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TLS-450PLUS Consoles

Troubleshooting Guide

VEEDER-ROOT™

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We warrant that this product shall be free from defects in material and workmanship and is compliant with all applicable performance standards and specifications for which it has been certified, for a period of one (1) year from the date of installation when proof of the date of installation is provided or fifteen (15) months from the date of manufacture when proof of date of installation is not provided. We warrant that the lithium batteries (excluding EVR BATTERY PACK) shall be free from defects in material and workmanship for a period of three (3) months from date of invoice. We will repair or replace the product if the product is returned to us; transportation prepaid by user, within the warranty period, and is determined by us to be defective. **LAMPS AND FUSES ARE NOT COVERED UNDER THIS WARRANTY.**

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1 Introduction

This manual contains troubleshooting information for the TLS-450PLUS console. Most of the components discussed in this manual are to be replaced if faulty. The intent of this manual is to help you identify replaceable parts and assemblies and to provide accepted troubleshooting methods where applicable. Information on individual plug-in modules is covered in manuals accompanying those components and/or systems.

Related Manuals

Troubleshooting of a TLS-450PLUS console requires knowledge of the system site prep and installation as well as setup and operation of all installed options. Refer to the Tech Docs CD-ROM (V-R P/N 331650-001) for all relevant manuals:

577013-934	TLS-450 & TLS-450PLUS Consoles Site Prep Certification Manual
577013-950	TLS-450/TLS-450PLUS/TLS4 Console Serial Interface Manual
577014-048	TLS-450 to TLS-450PLUS Console Upgrade Instructions
577014-072	TLS-450PLUS Operator's Quick Help
577014-073	TLS-450PLUS Console Site Prep And Installation Manual
577014-074	TLS-350 to TLS-450PLUS Console Upgrade Instructions
577014-076	TLS-450PLUS Console Board and Software Replacement/Upgrade Manual
577014-077	TLS-450PLUS Console Module Replacement Instructions
577014-078	TLS-450PLUS Console Hardware Replacement Guide
577013-344	PLLD Troubleshooting Manual
577013-401	TLS Consoles Point-of-Sale (POS) Application Guide

Contractor Certification Requirements

Veeder-Root requires the following minimum training certifications for contractors who will install and setup the equipment discussed in this manual:

Service Technician Certification (Previously known as Level 2/3): Contractors holding valid Technician Certifications are approved to perform installation checkout, startup, programming and operations training, system tests, troubleshooting and servicing for all Veeder-Root Series Tank Monitoring Systems, including Line Leak Detection.

TLS-3xx Technician Certification: Contractors holding valid TLS-350 Technician Certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root TLS-300 or TLS-350 Series Tank Monitoring Systems, including Line Leak Detection and associated accessories.

TLS-4xx Technician Certification: Contractors holding valid TLS-450 Technician Certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root TLS-450 Series Tank Monitoring Systems, including Line Leak Detection and associated accessories.

In-Station Diagnostics (ISD-PMC) Technician Certification: ISD PMC Contractors holding a valid ISD/PMC Certification are approved to perform (ISD/PMC) installation checkout, startup, programming, and operations training. This training also includes troubleshooting and service techniques for the Veeder-Root In-Station Diagnostics system. A current Veeder-Root Technician Certification is a prerequisite for the ISD/PMC course.

All service personal on site must comply with all recommended safety practices identified by OSHA and your employer.

Review and comply with all the safety warnings in the manuals listed in this document above and any other Federal, State or Local requirements.

Warranty Registrations may only be submitted by selected Distributors.

Safety Precautions

The following safety symbols may be used throughout this manual to alert you to important safety hazards and precautions

 **EXPLOSIVE** Fuels and their vapors are extremely explosive if ignited.	 **FLAMMABLE** Fuels and their vapors are extremely flammable.
 **ELECTRICITY** High voltage exists in, and is supplied to, the device. A potential shock hazard exists.	 **TURN POWER OFF** Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.
⚠WARNING **WARNING** indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.	**NOTICE** **NOTICE** is used to address practices not related to physical injury.
 **READ ALL RELATED MANUALS** Knowledge of all related procedures before you begin work is important. Read and understand all manuals thoroughly. If you do not understand a procedure, ask someone who does..	 **STATIC SENSITIVE COMPONENTS** Wear grounded anti-static wrist strap before handling the printed circuit board and mounted components

Safety Warnings

⚠ WARNING



This system operates near highly combustible fuel storage tanks.

FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.

To ensure proper installation, operation, and continued safe use of this product:

1. **Read and follow all instructions in this manual, including all safety warnings.**
2. **Have equipment installed by a contractor trained in its proper installation and in compliance with all applicable codes including: the National Electrical Codes; federal, state, and local codes; and other applicable safety codes.**
3. **Before working on this console, turn off, tag and lockout power to the console.**
4. **Substitution of components may impair intrinsic safety.**
5. **Do not modify or use service parts other than those provided by Veeder-Root.**

2 System Description

System Parts Identification

The following figures identify the components and printed circuit boards of the TLS-450PLUS console.

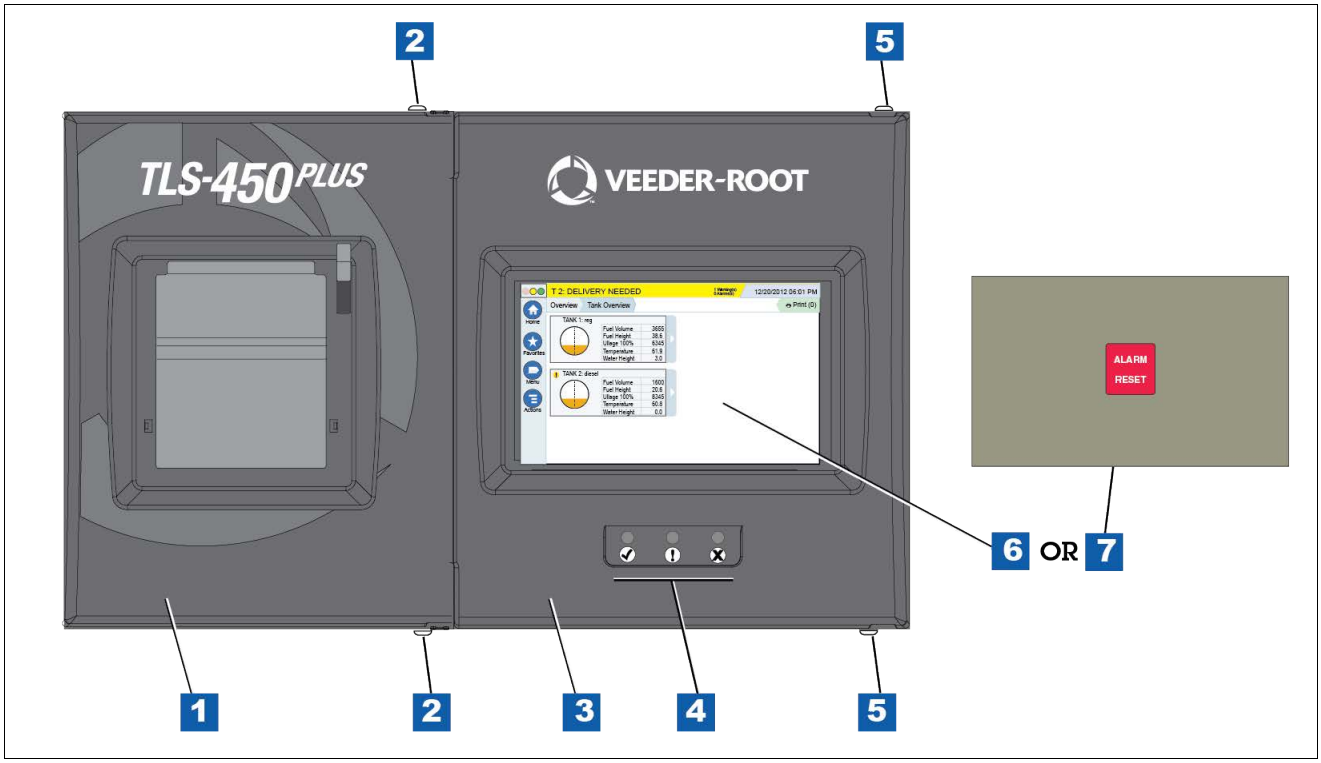


Figure 2-1. Console Front Panel

Legend For Figure 2-1			
Item	**Description**	**Item**	**Description**
1	Left door (showing optional printer))	6	Optional Graphical User Interface (GUI) touch display
2/5	T-15 Torx screws, remove to open doors and access system components	7	Acknowledge (ACK) Switch panel
3	Right door		
4	LED Status indicators: ✓ System Normal (Green); ✘ Warning (Yellow); ! Alarm (Red)		

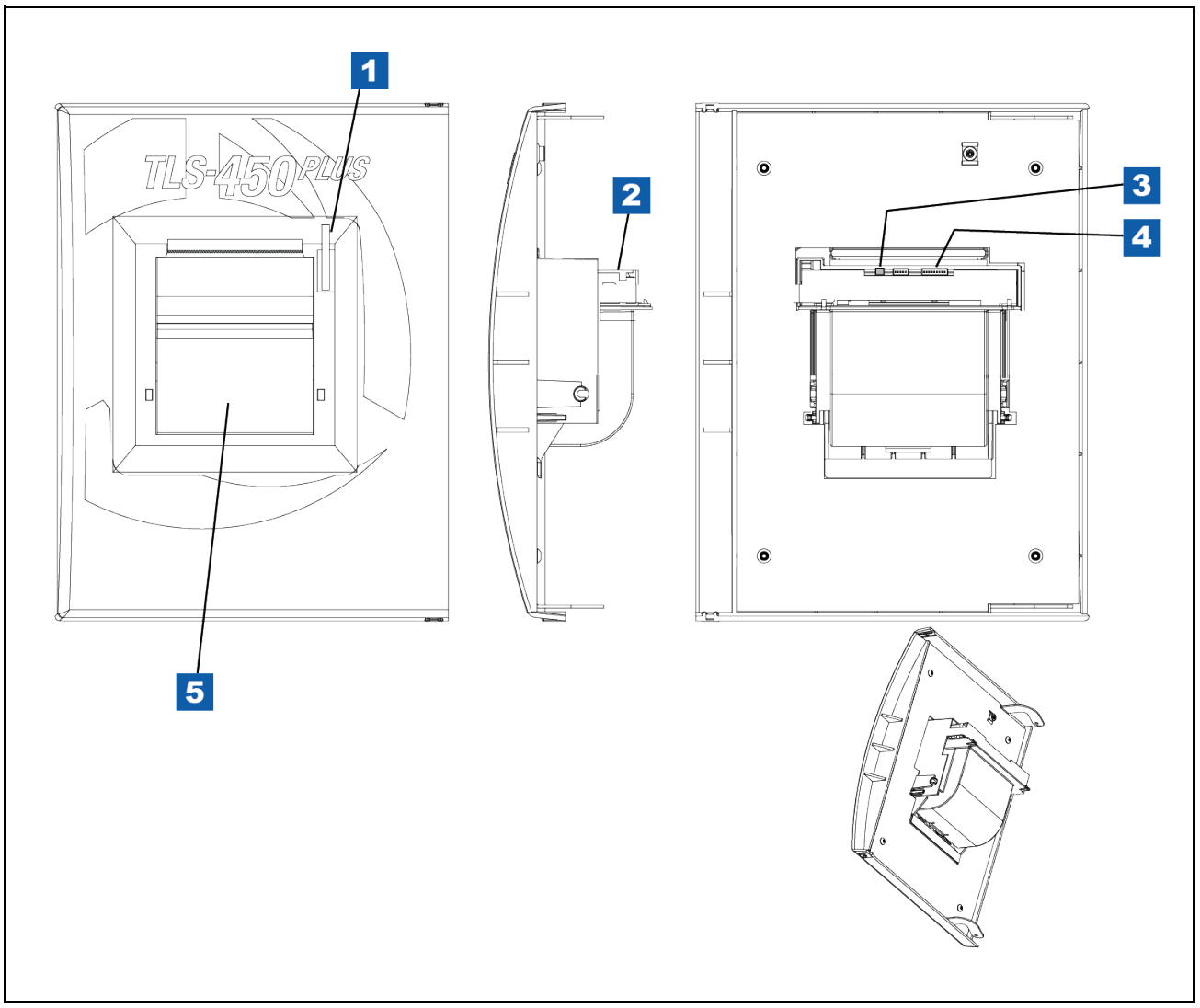


Figure 2-2. Printer Door Assembly

Legend For Figure 2-2			
Item	**Description**	**Item**	**Description**
1	Paper roll release lever	4	Connector for data input cable to USB1 on CPU board
2	Printer assembly	5	Paper cover
3	Connector for power input cable to J1 on Power Supply board		

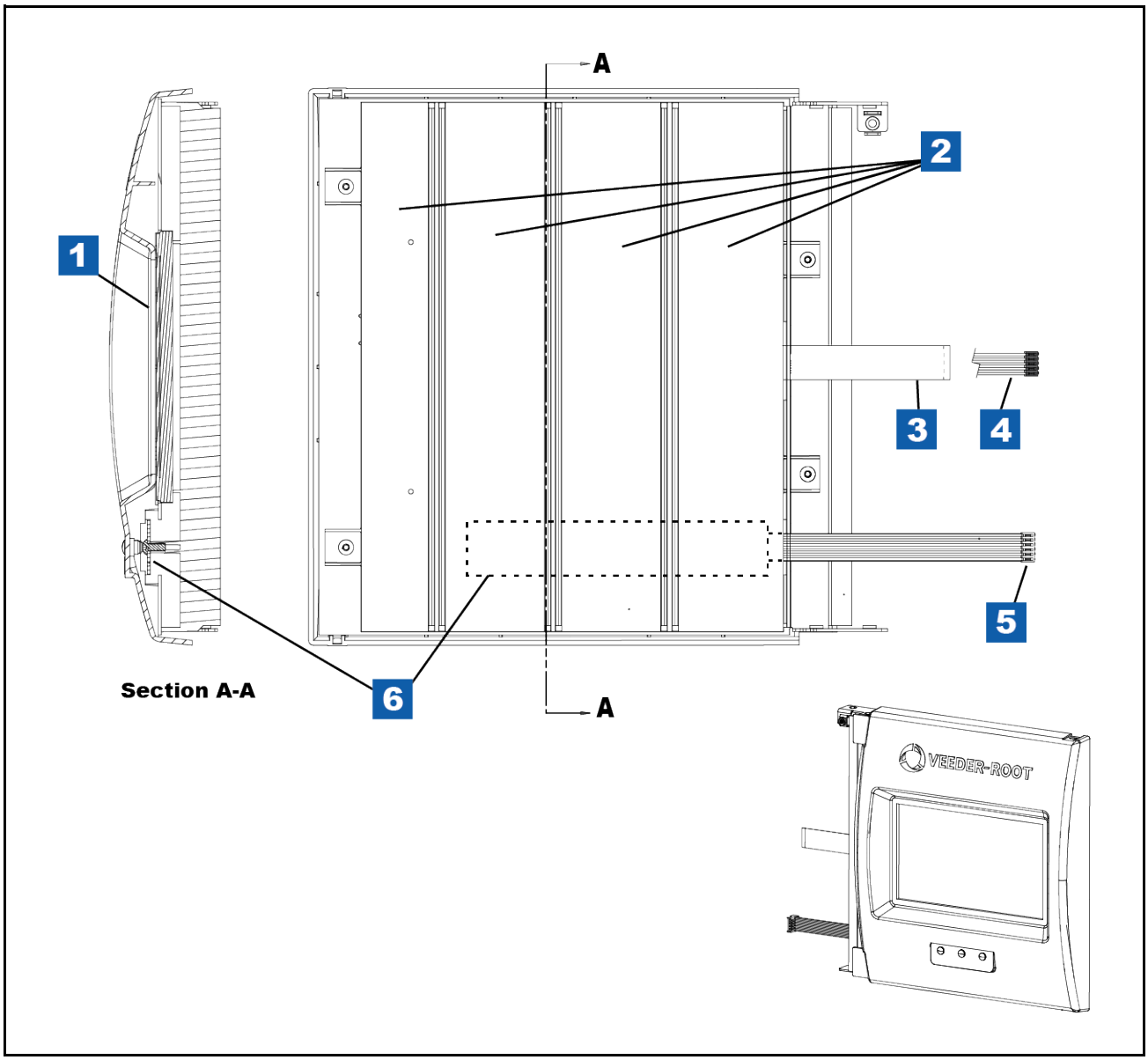


Figure 2-3. Display Door Assembly

Legend For Figure 2-3			
Item	**Description**	**Item**	**Description**
1	Touch screen display assembly	4	Cable to Ack Switch Panel connector on CPU board (item 16 in Figure 2-14)
2	Input Module Connection Labels	5	Cable to LED Backlight connector on CPU board (item 11 in Figure 2-14)
3	Cable to Data Display connector on CPU board (item 6 in Figure 2-14). Data Display is an option.	6	Front panel sysem status LED board assembly

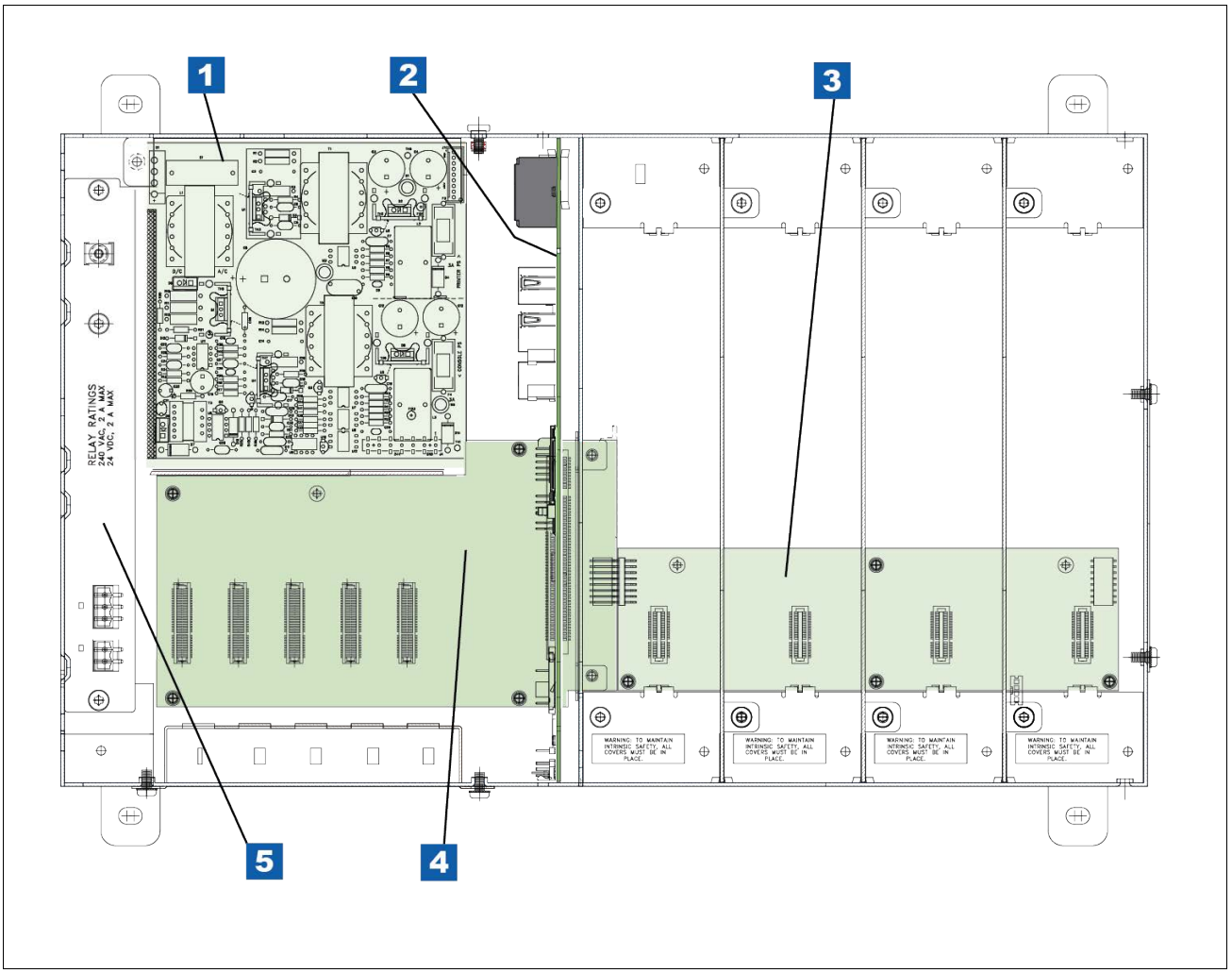


Figure 2-4. Console Board Locations (with Power Supply Protective Cover Removed)

Legend For Figure 2-4			
Item	**Description**	**Item**	**Description**
1	Power Supply board (access cover removed)	4	Comm Backplane board
2	CPU board	5	AC Input board assembly (access cover removed)
3	I/O Backplane board		

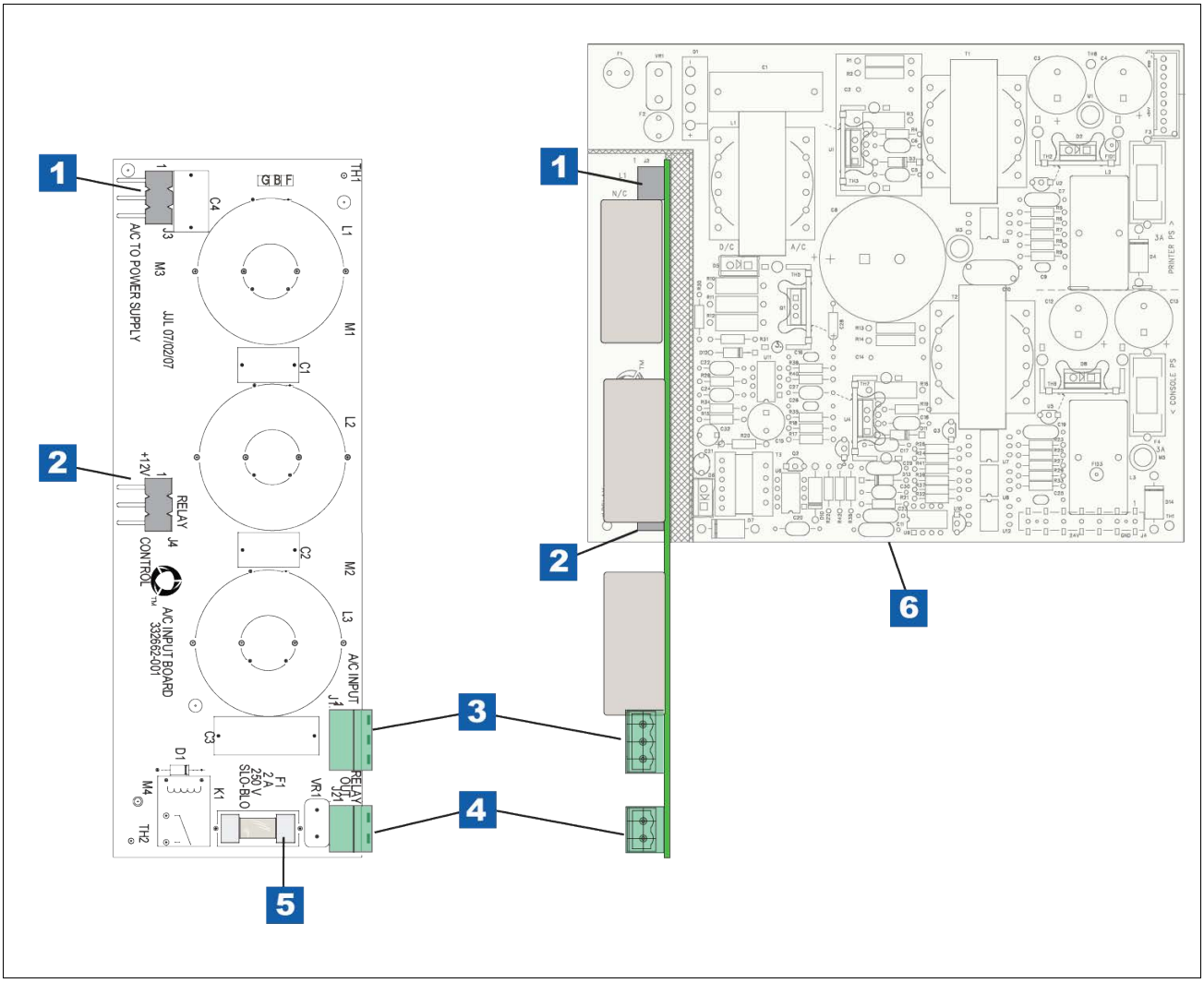


Figure 2-5. AC Input Board

Legend For Figure 2-5			
Item	**Description**	**Item**	**Description**
1	Console AC Input plugs into J2 on Power Supply board	5	Relay output fuse, 2A 250V Slo-Blo
2	Output relay control plugs into J3 on Power Supply board	6	AC Input board plugs into Power Supply board as shown
3	AC input power connector		
4	Output relay control connector		

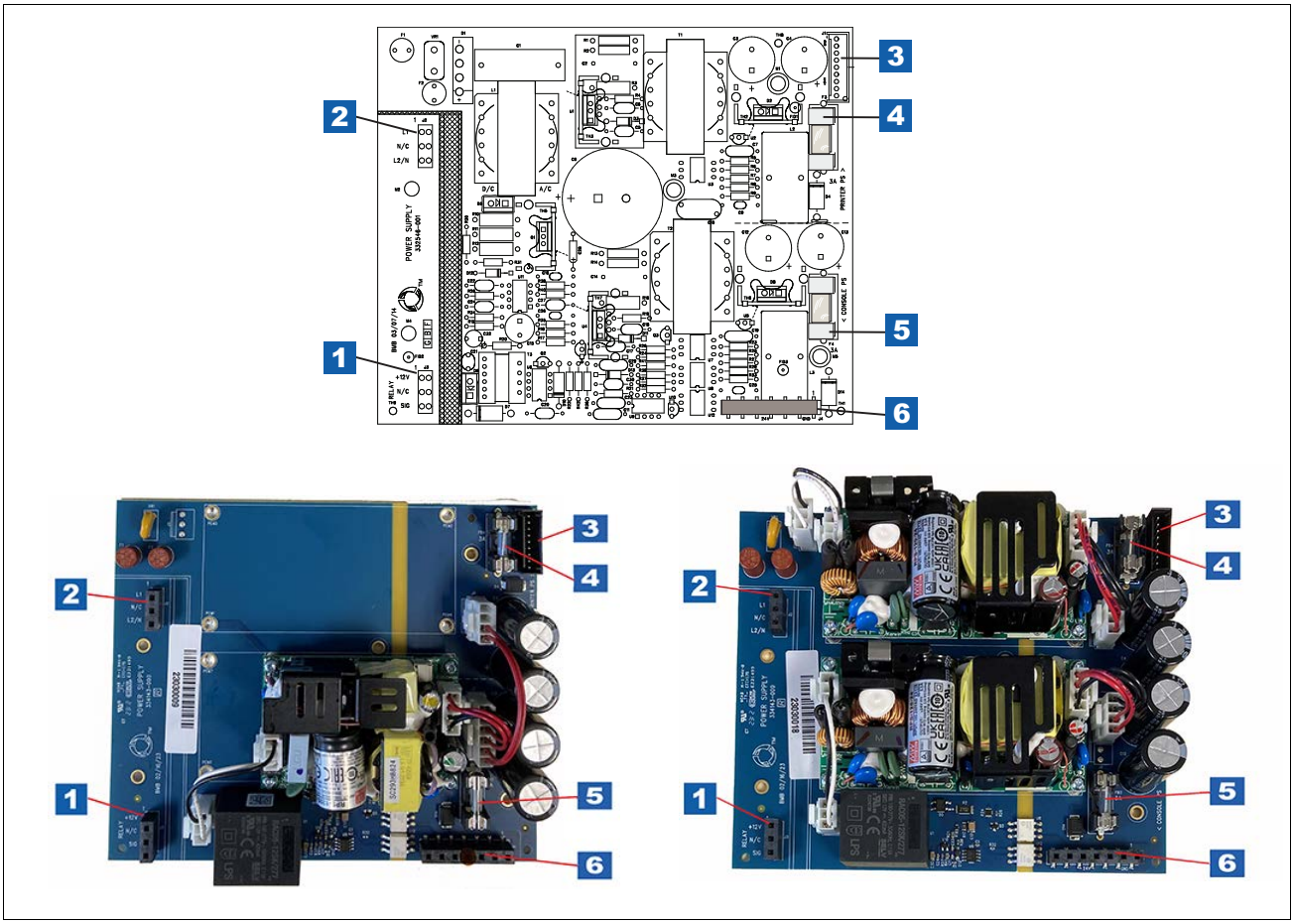
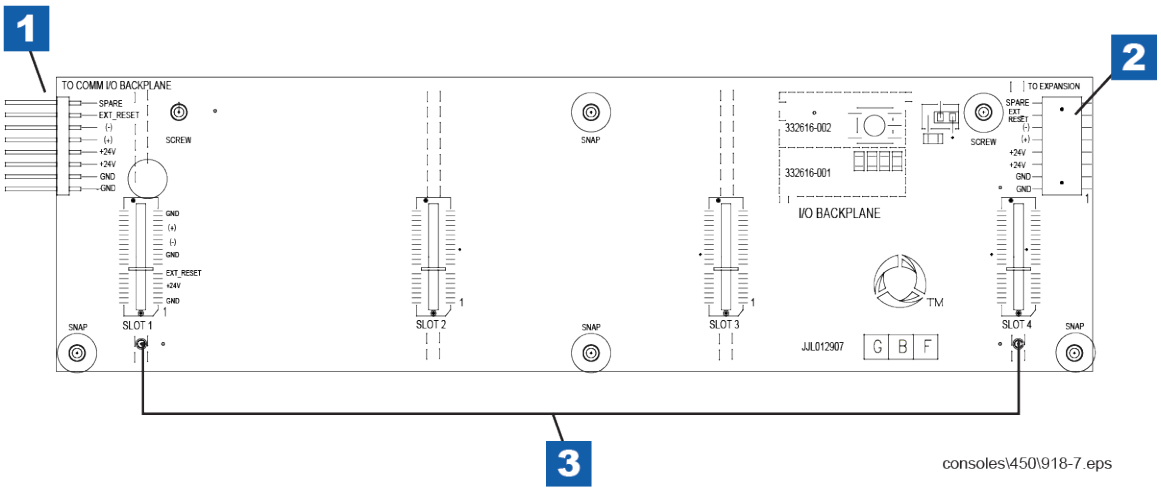


Figure 2-6. Power Supply Board Configurations

Legend For Figure 2-6			
Item	**Description**	**Item**	**Description**
1	Low voltage relay control connector (Relay connector on AC input board connects here)	4	Printer power supply fuse, 3A Slo-Blo
2	AC Input power connector (Line AC input connector on AC input board connects here)	5	Console power supply fuse, 3A Slo-Blo
3	Printer power connector J1	6	Power output connector (connects to Comm Backplane board)



LEGEND			
Item	**Description**	**Item**	**Description**
1	J1 connects to J4 on Comm Backplane board (see permissible Modules in the diagram below)	3	4 - J3 connectors for USM, I/O, MDIM or LVDIM-Modules (see permissible Modules in the diagram below)
2	J2 connects to J1 Expansion board (Expansion board is optional)		

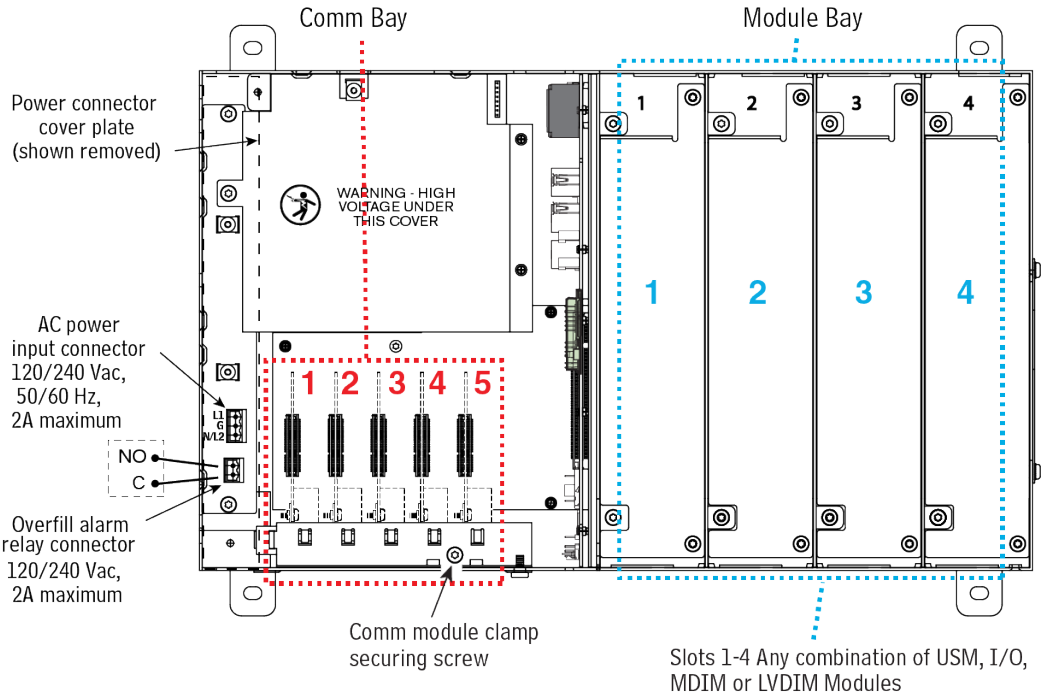


Figure 2-7. I/O Backplane Board

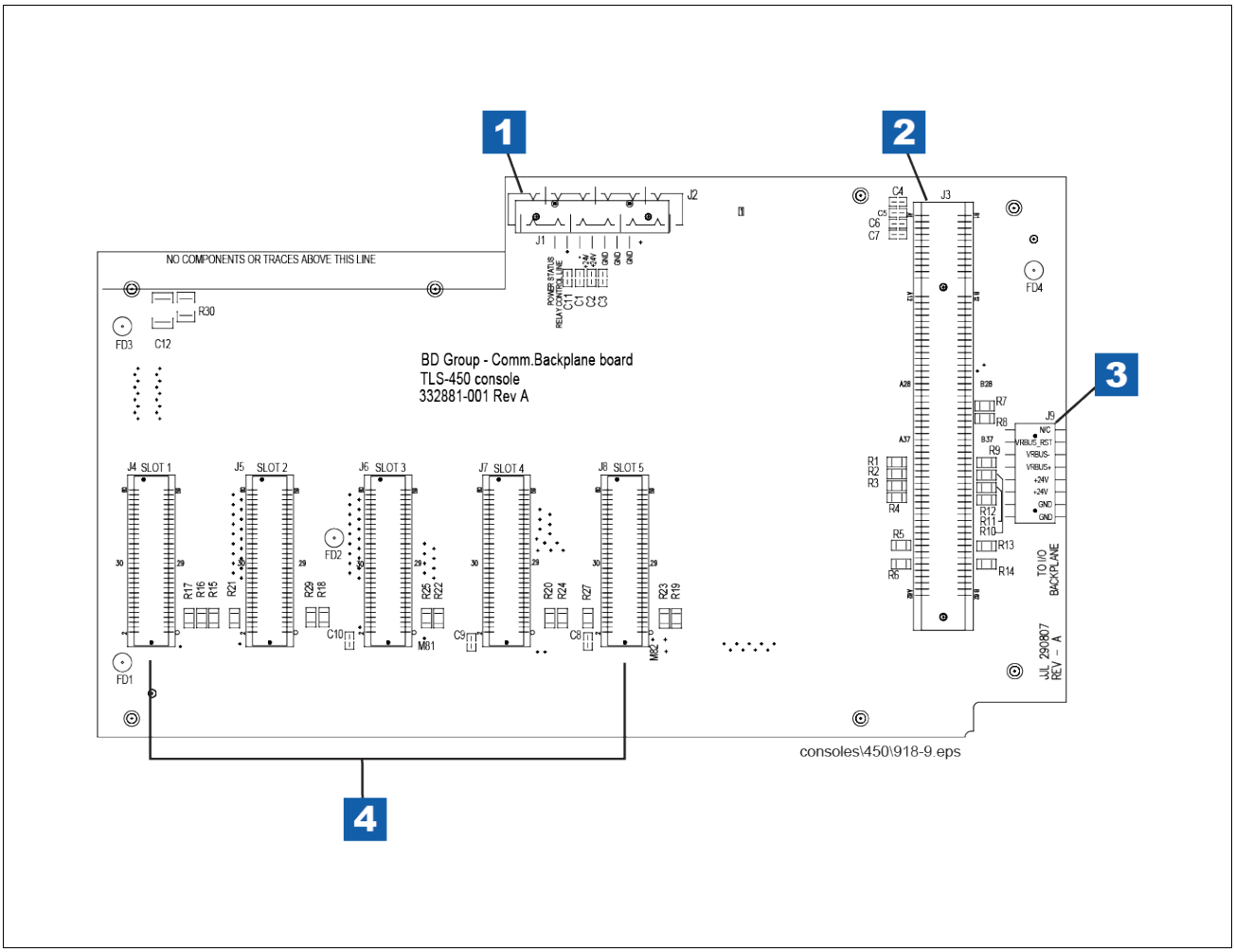


Figure 2-8. Comm Backplane Board

Legend For Figure 2-8			
Item	**Description**	**Item**	**Description**
1	J2 connector connects to J4 on Power Supply board	4	J4 - J8 connectors for optional Comm modules (Comm modules keyed for certain slots) See Figure 2-10 for user selectable Comm Modules. See Table 2-2 for permissible slots/ports for user selectable Comm Modules See Figure 2-9 for fixed Comm Modules.
2	J3 connector for CPU board		
3	J9 connector connects to J1 connector on I/O Backplane board		

COMM MODULES

Table 2-1 lists Comm Modules for the TLS-450PLUS designed and manufactured by Veeder-Root.

Table 2-1. Communication Bay Modules

Part No.	Item
332818-001	SiteFax/Modem Single Port Module
333460-001	Ethernet Module (Factory Installed Slot 4 Only)
333477-001	USB module (Factory installed Slot 5 Only)
332866-001	RS-232 Single Port Module (also used for EDIM or Satellite S-SAT or Satellite H-JBox Modules apps.)
332868-001	RS-232 Dual Port Module (also used for EDIM or Satellite S-SAT or Satellite H-JBox Modules apps.)
332867-001	RS-485 Single Port Module
332869-001	RS-485 Dual Port Module
333807-002	Tri-Comm Module
333140-001	CDIM Module
333651-001	IFSF LON Module

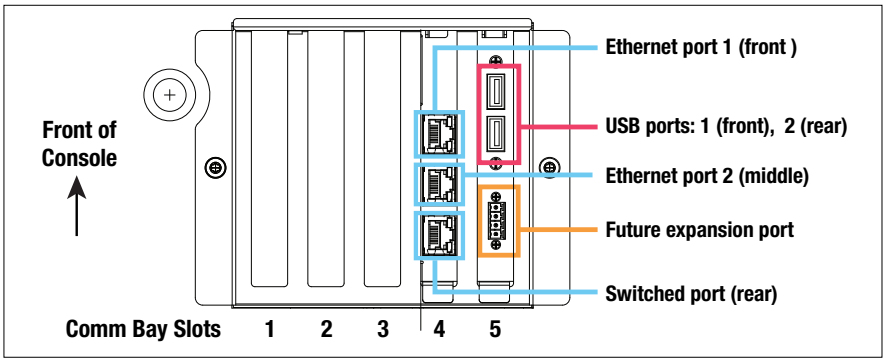


Figure 2-9. TLS-450PLUS Console - Fixed Comm Modules

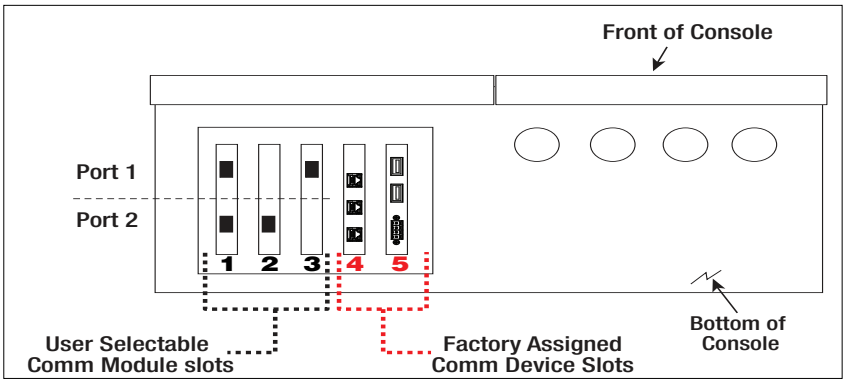


Figure 2-10. TLS-450PLUS Console - Selectable Comm Modules

COMM MODULE PORT CONFIGURATIONS

NOTICE **To avoid attaching a Comm Module cable to a non-configurable (NC) port, identify the configurable (C) ports of any Comm Module being installed. Also verify the Comm cable port connections to Comm Modules in slots 4 and 5. Record all Comm port connections for use at setup.**

User-selectable Comm Port configurations will depend on features ordered. Slots 1-3 (Figure 2-10) can be used for any combination of Comm Modules found in Table 2-2 as appropriate.

Table 2-2. Configurable (C) / Non-Configurable (NC) Ports for Selectable Comm Modules (Comm Bay Slots 1 - 3 Only)

Comm Module	Comm Type	Comm Slot 1			Comm Slot 2			Comm Slot 3		
		Module Port			Module Port			Module Port		
		1	2	3	1	2	3	1	2	3
RS-232 Single Port (also EDIM, Satellite S-SAT and Satellite H-JBox apps.)	Serial	NC	C	NC	NC	C	NC	NC	C	NC
RS-232 Dual Port (also EDIM, Satellite S-SAT and Satellite H-JBox apps.)		C	C	NC	C	C	NC			
RS-485 Single Port		NC	C	NC	NC	C	NC	NC	C	NC
RS-485 Dual Port		C	C	NC	C	C	NC			
RS-232/RS-485 Dual Port		C (RS-232)	C (RS-485)	NC	C (RS-232)	C (RS-485)	NC			
Tri-Comm		C* (RS-232) (RS-485)	C (RS-485)	C (Mini USB inquiry only)	C* (RS-232) (RS-485)	C (RS-485)	C (Mini USB inquiry only)	NC	C (RS-485)	NC
SiteFax / Modem		NC	C	NC	NC	C	NC	NC	C	NC
CDIM	DIM	C	NC	NC	C	NC	NC			
IFSF LON		C	NC	NC	C	NC	NC	C	NC	NC

= An unclearable alarm will be posted if this Comm Module is in Slot 3.

* = Configurable by jumpers - see Figure 2-11 and Table 2-3.

TRI-COMM MODULE

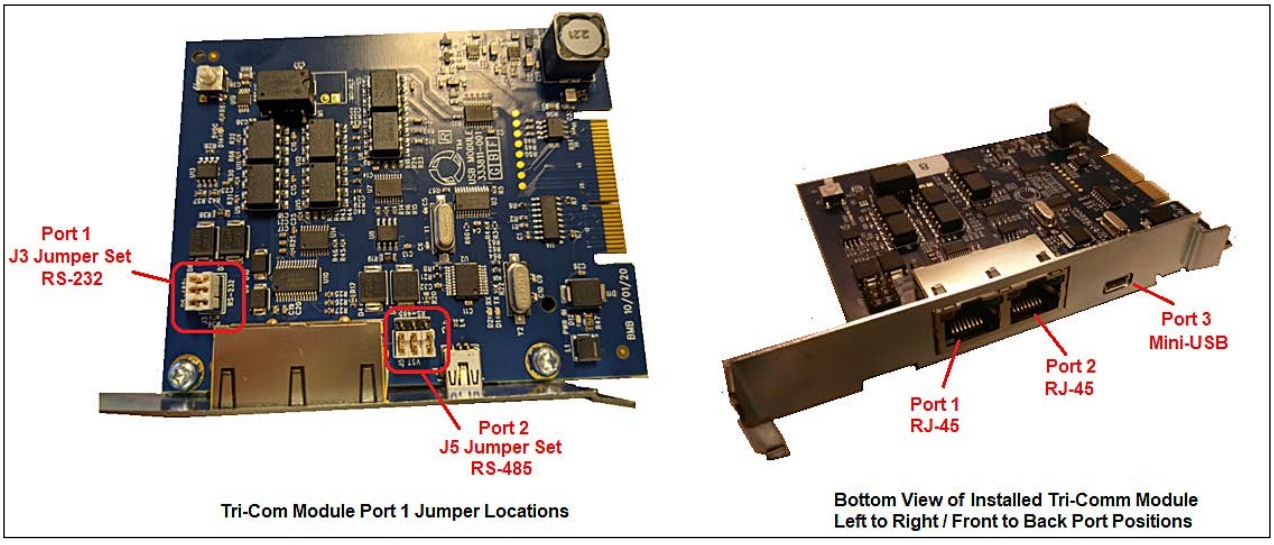


Figure 2-11. Tri-Comm Module

If using a Tri-Comm Module (slots 1 or 2 only), refer to Figure 2-12 for Tri-Comm Module locations and Table 2-3 for Tri-Comm Module port configurations.

Table 2-3. Tri-Comm Module Port Configuration

Item	Port 1		Port 2	Port 3
Communication Type	RS-232 or RS-485 (Dependent upon jumper positioning)		RS-485 (Only)	Mini USB/Inquiry Only
Connector Type	RJ-45	RJ-45	RJ-45	Mini USB
Cable Pin Outs	RS-232 • Pin 1 – DCD • Pin 2 – RXD • Pin 3 – TXD • Pin 4 – DTR • Pin 5 – GND • Pin 6 – DSR • Pin 7 – RTS • Pin 8 – CTS	RS-485 • Pin 2 – RS-485B • Pin 3 – RS-485A • Pin 5 – GND	Jumper Pins in VST position (default): • Pin 5 – GND • Pin 6 – RS-485 A • Pin 7 – RS-485 B Jumper Pins in RS-485 position: • Pin 2 - RS-485 A • Pin 3 - RS-485 B • Pin 5 - GND	----------
Data Bit **Parity** **Stop Bit** **Data Rate**	Configurable		Configurable	Fixed at: • 8 Data Bits, • No Parity, • 1 Stop Bit. • Data Rate (configurable)

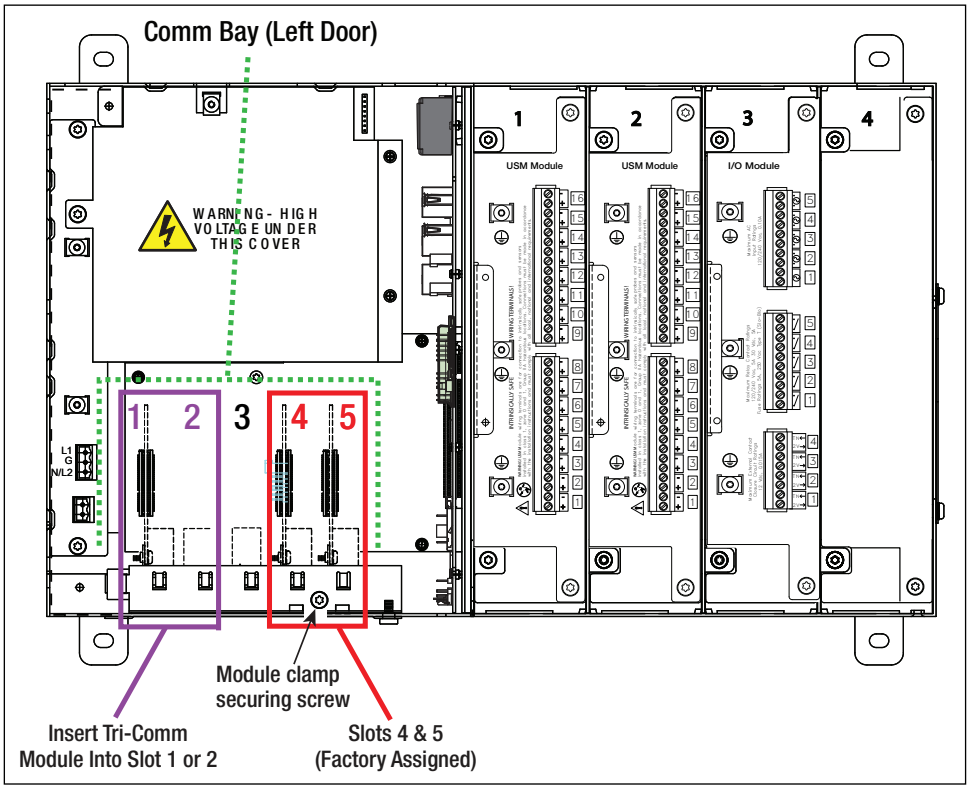


Figure 2-12. Example Tri-Comm Module Installation in Slot 1

CONNECTING A LAPTOP TO THE TLS-450PLUS

Connect your laptop to one of the TLS-450PLUS Comm port using one of the methods shown in the in Figure 2-13 below.

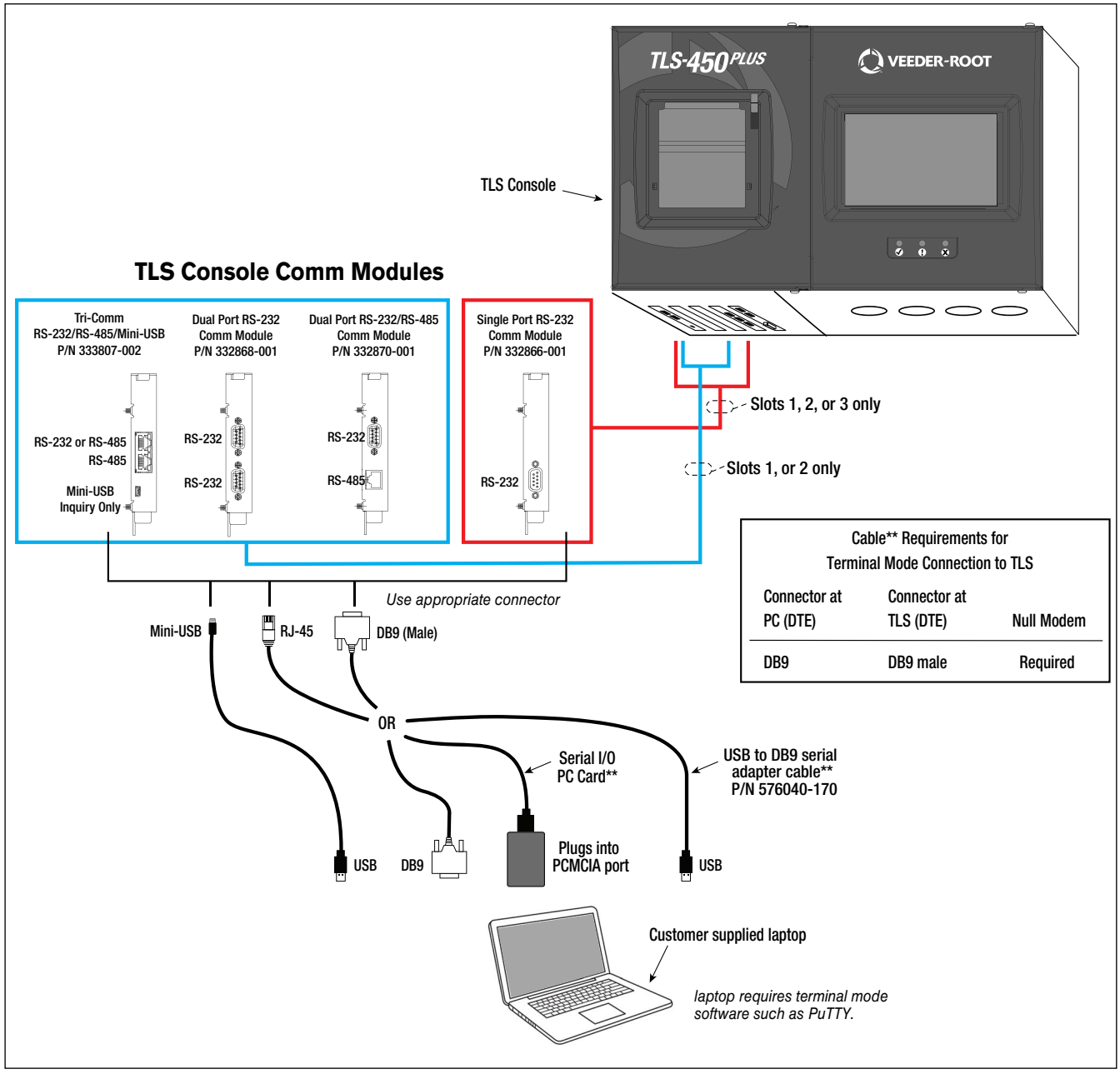


Figure 2-13. Connecting Laptop to TLS-450PLUS for Serial Communication

If using a USB to DB9 Serial adapter cable (P/N 576040-170), or equivalent, you will need to follow the instructions shipped with the adapter cable.

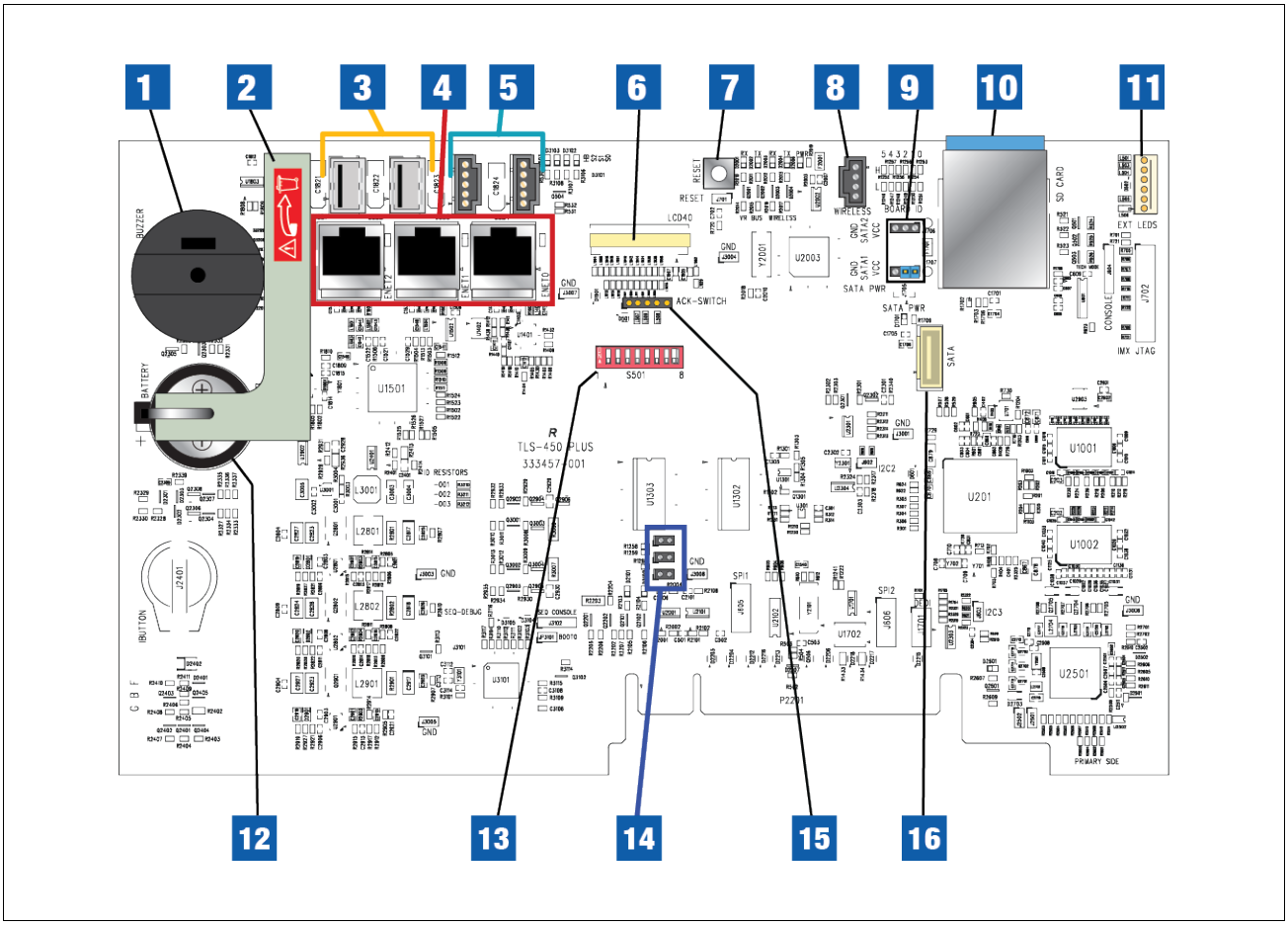


Figure 2-14. CPU Board

LEGEND			
Item	**Description**	**Item**	**Description**
1	Console beeper	9	SATA Type Jumpers (J1704 & J1708)
2	Battery isolator strip - to be removed prior to startup	10	SD Card (in metal enclosure)
3	USB Type A connectors (2)	11	LED Backlight cable connector (optional display)
4	Ethernet (RJ-45) connectors (3)	12	Backup Battery
5	USB (0.1” pitch header) connectors (2)	13	Configuration DIP switches
6	Display cable connector (optional display)	14	SD card/SATA selection jumpers (J1201, J1202 & J1203)
7	Reset button	15	Acknowledge Switch panel cable connector
8	USB module - wireless cable connector	16	SD/SATA board connector

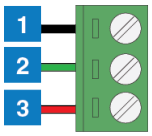
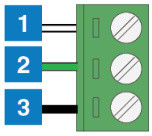
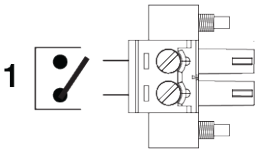
About Screen

The About Screen displays the console's software version and information on installed features. From the Home screen touch **Menu>Overview>About** to view the About screen.

Console Power And Relay Wiring Inputs

Table 2-4 below details TLS-450PLUS power and relay wiring connections and requirements.

Table 2-4. TLS-450PLUS Wiring Inputs

Connector	Description
Input Power	AC power supply:100 to 249Vac, 50/60Hz, 2A maximum **240 Vac input:** 1 - N/L2 (black), 2 - Ground (green), 3 - L1 (red)  **120 Vac Input:** 1 - N/L2 (white), 2 - Ground (green), 3 - L1 (black) 
HV Relay Output	1 relay output: 120/240 Vac, 5A; 30 Vdc, 5A; Fuse ratings 5A, 250 Vac Type T (Slo-Blo) 

Configuration DIP Switch Settings

Verify the Configuration DIP switches (see item 13 in Figure 2-14) are set as shown below:

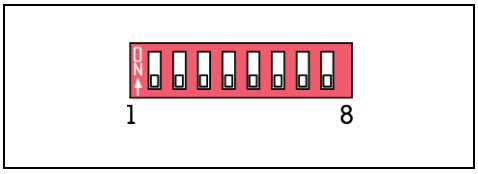


Figure 2-15. Configuration DIP Switch Settings

Basic Troubleshooting Procedures

To ensure proper and safe troubleshooting and repair procedures for the TLS-450PLUS consoles, the following steps should be taken in the order they appear, prior to servicing the system:

1. Review and thoroughly understand the “Safety Warnings” on page 1-2 of this manual.
2. Review the “System Parts Identification” on page 2-1 to locate components.
3. Review “Console Power And Relay Wiring Inputs” to ensure the AC Input board is wired correctly.
4. Review “Configuration DIP Switch Settings” section to ensure the configuration DIP switches are set correctly.
5. Perform a “Intrinsic Safety Check” on page 2-15. If the system fails the Intrinsic Safety Check, turn the AC Power circuit breaker at the service panel to the OFF position, disconnect and cap the AC wires in the monitor, and disconnect and cap all probe and sensor field wires in the probe and sensor junction boxes.
6. Perform the “Visual Inspection of Console Interior” on page 2-16.
7. Refer to the appropriate section of this manual (or another manual, see “Related Manuals” on page 1-1) to troubleshoot a faulty component of the system.

Intrinsic Safety Check



Turn off, tag and lockout power to the console before starting this intrinsic safety check.

Definition of Intrinsic Safety Circuit and System- *An intrinsically safe circuit is one in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions. An intrinsically safe system is an assembly of interconnected intrinsically safe apparatus, associated apparatus, and interconnecting cables in that those parts of the system that may be used in hazardous (classified) locations are intrinsically safe circuits.

*Excerpt from latest National Electrical Code Handbook.

⚠ WARNING





FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.

Explosion could occur if other wires share conduits or troughs with TLS console intrinsically safe probe, sensor, and thermistor wiring. Conduits and wiring troughs from the console’s probes, sensors, and thermistors must not contain any other wires and must enter the console through their designated preformed knockouts.

Improper system operation could result in inaccurate inventory control or undetected potential environmental and health hazards if probe-and sensor-to-monitor wiring runs exceed 1,000 feet. Probe-and sensor-to-monitor wiring runs over 1,000 feet are not UL approved for this application.

To avoid electrical shock resulting in personal injury, death, equipment damage or damage to the environment, switch OFF and tag the AC power circuit breaker at the service panel while inspecting, removing, or installing wiring and components.

1. Verify that the TLS console is installed indoors in an accessible location.

2. Verify that the TLS console barrier ground wire to earth ground in the power panel is a #12 AWG (or larger diameter) conductor.
3. Verify that TLS console has chassis ground at AC Input Power connector (see item 3, Figure 2-5).
4. Verify that power conduit and sensor and probe conduits enter TLS console only through preformed, designated knock-outs.
5. Verify that probe and sensor wiring and conduit meet Veeder-Root requirements (ref. manual P/N 577014-073).
6. If the system fails the intrinsic safety check, disconnect and cap the AC wires in the monitor, and disconnect and cap all probe and sensor field wires in the probe and sensor junction boxes.

   IMPORTANT! Do not apply power to the system until its installation has been checked and found to be in accordance with the instructions outlined in the Veeder-Root TLS-450PLUS Series Site Prep and Installation manual (P/N 577014-073); the National Electrical Code; federal, state, and local codes; and other applicable safety codes.

Visual Inspection of Console Interior

It is recommended that whenever troubleshooting, repairing, or replacing components, a visual inspection of the overall condition of the system be made.



Turn off, tag and lockout power to the console before starting this inspection.

1. Inspect for signs of corrosion inside the console.
2. Check for broken or frayed insulation on all wires and be sure that the wires are secure at their terminals.
3. Check all PC boards for cracks.
4. Check to see that there is no loose or missing hardware for components (transformers, PC boards, brackets, etc.).
5. Check to ensure that the boot disk (SD Card or SATA drive) is properly installed.
6. Check to see that all interconnecting cable connectors are firmly seated. Check connector ends for cracks and flat cables for breaks.
7. Check fuse continuity and fuseholder contacts for corrosion.
8. Replace all covers after inspection.
9. Check touch screen display for signs of damage.
10. Check the mounting of the equipment to be sure all components were mounted properly and in accordance with instructions contained in the Site Prep and Installation manual.
11. Verify that no unapproved modifications to equipment have been made, no unapproved parts are being used, and previous repairs and modifications bring the unit to original factory condition.
12. All deficiencies should be corrected and damaged components replaced before continuing with procedures.

3 Fuses

The TLS-450PLUS console uses replaceable fuses on several boards and modules. Under no circumstances substitute a different rating or fuse type during service.

Power Supply Fuses

Table 3-1. Power Supply/AC Input board fuses

Fuse	Circuit	Fuse Location	Fuse Size/Type	V-R Part No.
F3	Printer +24V power supply	Fuseholder - Power Supply board	3A/250V Slo-Blo (5 x 20 mm)	576010-942
F4	Console +24V power supply	Fuseholder - Power Supply board	3A/250V Slo-Blo (5 x 20 mm)	576010-942
F1	Relay output	Fuseholder - A/C Input board	2A/250V Slo-Blo (5 x 20 mm)	576010-784

Module Fuses

Table 3-2. I/O Module Fuses

Fuse	Circuit	Fuse Location	Fuse Size/Type	V-R Part No.
F1-F5	F1 - F5 Relay outputs	Fuse holders - I/O module	5A/250V Slo-Blo (5 x 20 mm)	576010-973

4 Diagnostics

The Diagnostic main screen gives you access (depending on installed features) to the site's current and historical tank and line test results. Also from Diagnostic screens, you can manually run tank tests, PLLD line tests and view technical data from monitored devices. Touch the Help button at the top of each diagnostic screen to view more information on each screen's contents.

From the Home Screen, touch **Menu>Diagnostics** to access the Diagnostics Main screen. To access specific diagnostic information for the TLS-450PLUS, touch the desired diagnostic button. An overview of each diagnostic component is discussed in the paragraphs below.

AccuChart

The AccuChart diagnostics contain information on the current and historical tank calibration test results.

AVAILABLE DIAGNOSTIC SCREENS

- **Calibration Feedback** - This screen contains alarms and warnings that are only issued during the automatic AccuChart calibration process.?
- **Data Sufficiency** - This screen lets you view an histogram of the data collected at different levels of the tank for the tank's calibration.
- **Delivery Instructions** - This screen contains instructions to help you achieve better calibration data over the range of the tank
- **Error Plot** - This screen lets you view an error plot comparison of two charts using the same data from one tank.
- **Histogram** - This screen lets you view an histogram comparison of two charts using the same data from one tank.
- **Time Ordered Sales** - This report lists all tank sales volume calibrating records applied to two selectable tank charts, over a selectable range, with variances displayed for each chart in adjoining columns.

BIR

The BIR diagnostics contain information on sales, deliveries and inventory levels to allow for reconciliation.

AVAILABLE DIAGNOSTIC SCREENS

- **Reconciliation** - This screen reports metered sales, variance and suggested reasons for the variance for the selected product.
- **Status** - This screen contains a list of causes for Reconciliation events.

LPR Sensor

The LPR (Line Pressure) Sensor diagnostics contain reports on the activity and condition of Line Pressure Sensors.

AVAILABLE LINE PRESSURE SENSOR DIAGNOSTIC REPORTS

- General (general diagnostic information)
- Communication (communication diagnostic information)
- Constants (constants diagnostic information)
- Channel (channel data)

Mag Sensor

The Mag Sensor diagnostics contain reports on the activity and condition of Mag Sensors.

AVAILABLE MAG SENSOR DIAGNOSTIC REPORTS

- General (general diagnostic information)
- Communication (communication diagnostic information)
- Constants (constants diagnostic information)
- Channel (channel data)

Meter

The Meter diagnostics contain information on meter events and enables mapping of a tank to meter.

AVAILABLE DIAGNOSTIC SCREENS

- **Manual Mapping** - The Manual Mapping diagnostic screen will help you assign meters to tanks with small volume dispensing events and to identify post-blend metering. This screen displays active events as they are reported by the POS terminal.
- **Meter Events** - The Meter Events screen lists up to one page of time-ordered meter start/stop events.
- **Tank Map** - This screen displays the meter-to-tank map. This is the screen you want to use to verify meter mapping, or to view if the site should go unmapped, suspending BIR.

Miscellaneous

The Miscellaneous diagnostics contain information on power up and power down events.

AVAILABLE ?MISCELLANEOUS DIAGNOSTIC REPORTS AND SCREENS

- **Power Reset History Report** - (Power up and power down timestamps).

Module

The Module diagnostics contain information/diagnostics about modules.

AVAILABLE DIAGNOSTIC SCREENS

- **Comm** - This screen contains a report of data transmission and reception results for installed communication modules.?
- **Device Assignments** - This screens contains modules, their connected devices and the device's primary and secondary assignments.
- **Device Dir** - This screen lists the console's installed modules and their connected devices.
- **Firmware Upgrade** - This screen lists TLS software available for remote download.
- **HW Configuration** - This screen lists console's module locations and hardware/software details.

PLLD

The PLLD diagnostics provide access to the PLLD Manual Test interface and all PLLD diagnostic reports. ?Each report has quick access to the PLLD setup screen. ?

Current or active reports will not be visible for PLLD Lines that are not configured or inactive. Historic reports will be available for PLLD lines even if they are not configured or if they are inactive, as long as they have data to display.

AVAILABLE ?PLLD DIAGNOSTIC REPORTS AND SCREENS

- 0.1 gph (0.38 lph) Auto-Confirm Report ?(0.1 gph auto-confirm data)
- 0.1 gph (0.38 lph) Tests Report (0.1 gph diagnostics test results)
- 0.2 gph (0.76 lph) Auto-Confirm Report ?(0.2 gph auto-confirm data)
- 0.2 gph (0.76 lph) Tests Report ?(0.2 gph diagnostics test results)
- 3.0 gph (11.3 lph) Tests Report (3.0 gph diagnostics test results)
- Mid-Range Tests Report (mid-range Diagnostics Test Results)
- No-Vent Abort Tests Report (No-Vent Test Aborts Information)
- PLLD Status Report (general status and diagnostic information about PLLD)
- PLLD Manual Test (start or stop PLLD tests manually for one or all lines)
- Pressure Offset Monitor (pressure offset history interface for a pressure offset test)?

Probe

The Probe diagnostics contain information/diagnostics about probes. Section 8 of this manual is devoted to probe troubleshooting.

AVAILABLE PROBE DIAGNOSTIC REPORTS AND SCREENS

- **Density Offset** - (current density probe readings and fields to enter tank density and temperature information).
- **Density Offset History** - (density offset history records).
- **Overview**- (general information about each probe).

Relays and Inputs

The Relays and Inputs diagnostics contain information/diagnostics about relays and inputs.

AVAILABLE DIAGNOSTIC SCREENS?

- **External Inputs**- View diagnostic information on external Inputs.
- **Relays** - Test all configured relays (except PLLD relays). Two types of relay tests are available:
  - Sequential Test - This test sets selected relays to INACTIVE for two seconds and then sets them to ACTIVE for two seconds. When the test is complete the relays are automatically reset to their original state.
  - Relay Inspection Test - This test sets selected relays to a selectable state, ACTIVE or INACTIVE, until the test is complete. When you finish the test the relays are automatically reset to their original state.

Sensors

The Sensor diagnostics contain reports on the activity and condition of Liquid, Vapor, Groundwater, 2-wire CL and 3-wire CL sensors. ? Section 9 of this manual is devoted to sensor troubleshooting.

AVAILABLE SENSOR DIAGNOSTIC REPORTS

- Liquid (diagnostic information about each Liquid Sensor)
- Vapor (diagnostic information about each Vapor Sensor)
- Groundwater (diagnostic information about each Groundwater Sensor)
- 2-Wire CL (diagnostic information about each 2-wire CL sensor)
- 3-Wire CL (diagnostic information about each 3-wire CL sensor)

Tank

The Tank diagnostics contains information related to tank inventory volumes and tank charts.

AVAILABLE TANK DIAGNOSTIC REPORTS

- 30 Second Inventory Samples Report (diagnostic information about 30 second inventory samples)

Tank Test

The Tank Test diagnostics contain information on all environmental tank tests. ?Each report has quick access to the appropriate tank test setup screen. ?Manual tank leak tests are run from this diagnostic.

CSLD and/or SLD tabs will be displayed only if these features are supported and at least one tank has the respective feature enabled. Current or active reports will not be visible for tanks that are not configured or inactive. Historic reports will be available for tanks even if they are not configured or if they are inactive.

Section 11 of this manual is devoted to CSLD/SLD troubleshooting.

AVAILABLE TANK TEST DIAGNOSTIC REPORTS

- CSLD Monthly Report (CSLD state changes)
- CSLD Rate Table Report (CSLD rate table)
- CSLD Rate Test Report (CSLD rate test results)
- CSLD Test Status Report (current CSLD test status)
- SLD History Report (all SLD test results)
- SLD In-Progress Reports (SLD active tests)
- SLD Last Test Report (most recently completed SLD tests)
- SLD Manual Test Report (manually start or stop an SLD test)

5 Warning and Alarm Messages

The TLS-450PLUS console constantly monitors the entire system for warning and alarm conditions including fuel leaks, inventory limit excesses, and equipment problems. When an alarm occurs, a message displays the device identifier followed by the alarm label.

Device Identifiers

Device Type	Short Device Identifier	Long Device Identifier	Full Device Identifier
Air Flow Meter	Af	AfMeter	Air Flow Meter
Atmospheric Sensor	At	AtmSns	Atmospheric Sensor
Automatic Event	Ae	------	------
Contact	Cn	------	------
Comm Device	Co	Comm	Comm Device
Dispenser	d	Disp	Dispenser
EDIM,CDIM,LDIM	E	DIM	EDIM,CDIM,LDIM
External Input	I	ExtInp	External Input
Fueling Position	Fp	FPos	Fueling Position
Ground Water Sensor	G	GrndWtr	Ground Water Sensor
Hose	h	Hose	Hose
Hydrocarbon Sensor	Hy	HydcSns	Hydrocarbon Sensor
Line	Ln	Line	Line
Line Pressure Sensor (PLLD)	Pl	LPSensr	Line P Sensor
Liquid Sensor	L	Liquid	Liquid Sensor
Mag Sensor	MS	MAG	Mag Sensor
Meter	m	Meter	Meter
MDIM	M	MDIM	MDIM
Module	Mo	Module	Module
PLLD Line	Q	Line	PLLD Line
Probe	Pb	Probe	Probe
Product	F	Product	Product
Pump	Pm	Pump	Pump
Pump Sense Input	S	PumpSns	Pump Sense Input

Device Type	Short Device Identifier	Long Device Identifier	Full Device Identifier
Relay	R	Relay	Relay
Siphon Set	Si	Siphon	Siphon Set
Tank	T	Tank	Tank
Type A (2-Wire CL) Sensor	C	Type A	Type A Sensor
Type B (3-Wire CL) Sensor	H	Type B	Type B Sensor
Vacuum Sensor	Vs	VacSns	Vacuum Sensor
Ullage Pressure Sensor	Pv	UVPSns	Ullage Press Sensor
Vapor Sensor	V	Vapor	Vapor Sensor

Displayed Alarm Messages

A complete list of displayed TLS console alarm messages and a possible cause/action for the alarms are listed in the tables below.

Actual alarms displayed by a particular system depend upon the options installed.

Table 5-1. System Alarms

Alarm	Cause	Action
BIR Daily Close Pending	Tanks are not idle. Dispense or delivery is in progress.	BIR is waiting for an idle period to close the shift report.
BIR Shift Close Pending	Tanks are not idle. Dispense or delivery is in progress.	BIR is waiting for an idle period to close the shift report.
BIR Status Warning	Condition that impacts reconciliation variance identified.	Clears when condition that caused alarm clears; Clears after specified time out; User clears alarm.
System Self Test Error	Contact Technical Support.	Contact Technical Support.
Version Upgrade Available	A new version of the TLS software is available for remote download	Download, Reject or Postpone the software upgrade

Table 5-2. Tank Alarms

Alarm	Cause	Action
AccuChart Calibration Warning	Insufficient data collection rate - Warning will be posted on days that record fewer than 8 transactions.	More dispensing needs to occur.
	Noisy data - Warning will be posted after a calibration is generated, and the RMS Error of the data exceeds a maximum threshold.	Verify Meter Map.
	Data too regionally concentrated - Warning will be posted when there is a severe imbalance in the amount of data collected above and below the mid-height of the tank.	Schedule more deliveries if insufficient data in top half of tank. Schedule fewer deliveries if insufficient data in bottom half of tank.
	Initial tank parameters suspicious - Warning will be posted after a calibration is attempted, but optimization is incomplete.	Manually verify tank diameter, capacity and end shape.
	Station too busy - Warning will be posted on days that record fewer than 2 calibration records.	Temporarily halt dispensing to introduce more idle periods.
	Insufficient Data Collected - Warning will be posted if data sufficiency is too low on the day before end of calibration period.	Extend the calibration period before it expires. Alternatively let the calibration expire and then restart calibration.
Annual Leak Test Fail Alarm	System failed an annual in-tank leak test.	Rerun in-tank leak test. If second test fails, call for service.
Annual Test Needed Alarm	System failed to perform an annual test (0.1 gph [0.38 lph]) in the programmed number of days.	Schedule a 0.1 gph (0.38 lph) test.
Annual Test Needed Warning	System failed to perform an annual test (0.1 gph [0.38 lph]) in the programmed number of days.	Schedule a 0.1 gph (0.38 lph) test.
Cold Temperature Warning	Probe temperature drops below -4°F (-15.6°C).	Probe returns to normal operation after probe temperature rises above 0°F (-17.8°C).
CSLD Rate Increase Warning	An excessive amount of fluid leaked into the tank during a test period.	Call for service following the procedures established for your site.
Delivery Needed Warning	Product level dropped below programmed limit.	Call for a delivery.
Density Warning	The tank density is either greater than the tank density low limit plus 1.00 KG/M^3 (0.062 LBS/FT^3), or is less than the tank density high limit minus 1.00 KG/M^3 (0.062 LBS/FT^3).	Verify fluid density. Retest when product density is within the tank density low and high limits.

Table 5-2. Tank Alarms

Alarm	Cause	Action
Fuel Quality Alarm	Water/phase separation may be present in tank.	Test fuel at bottom of tank to ensure water/phase separation is not present.
Gross Leak Test Fail Alarm	In-tank leak (3.0 gph [11.3 lph]) test failed.	Rerun in-tank leak test. If second test fails, call for service.
High Product Alarm	Product level in tank rose above programmed limit.	Do not allow additional delivery until product is dispensed below preset limit.
High Water Alarm	Water detected in tank exceeds programmed alarm limit.	Remove water from tank.
High Water Warning	Water detected in tank exceeds programmed warning limit.	Remove water from tank.
Invalid Fuel Level Alarm	Product level is too low, causing the fuel and water floats to be too close together.	Call for a delivery.
Leak Alarm	A static in-tank leak test failed.Rerun in-tank leak test.	Rerun in-tank leak test.
Leak Test Active	In-tank leak test is underway.	Do not dispense fuel from this tank until message disappears.
Low Product Alarm	Tank level dropped below the programmed limit.	Call for a delivery.
Maximum Product Alarm	Product level rose above the programmed limit.	Stop delivery. Do not allow additional delivery until product drops below preset limit.
Missing Delivery Ticket Warning	Delivery Ticket information has not been entered at the console.	Enter Delivery Ticket information.
No CSLD Idle Time Warning	System has not had enough idle time over previous 24 hours to run a statistical leak detection test.	Stop dispensing fuel from this tank until CSLD test is complete.
Overfill Alarm	Fuel level has exceeded a programmed limit. Potential overflow of tank may occur.	Stop delivery. Check for spillage.
Periodic Leak Test Fail Alarm	In-tank leak (0.2 gph [0.76 lph]) test failed. Dispensing halts if programmed to do so.	Rerun in-tank leak test. If second test fails, call for service.
Periodic Test Needed Alarm	A periodic in-tank leak (0.2 gph [0.76 lph]) test has not been successfully completed within the programmed number of days.	Schedule a 0.2 gph (0.76 lph) test.
Periodic Test Needed Warning	A periodic in-tank leak (0.2 gph [0.76 lph]) test has not been successfully completed within the programmed number of days.	Schedule a 0.2 gph (0.76 lph) test.
Probe Out Alarm	Hardware failure - probe or interconnecting wiring to console.	Call for service following the procedures established for your site.
Setup Data Warning	Device setup data problem.	Recheck device setup parameters.

Table 5-2. Tank Alarms

Alarm	Cause	Action
Siphon Break Active Warning	Siphon break valve has shut down manifold for tank test.	Clears when tank test completes.
Sudden Loss Alarm	System detects loss of fuel during an idle period.	Check for gross leak.
Tank/Line Gross Leak Alarm	In-tank gross leak test failed. A static in-tank leak test failed	Call for service following the procedures established for your site.

Table 5-3. Liquid Sensor Alarms

Alarm	Cause	Action
Fuel Alarm	Fuel is present in the area being monitored by the sensor.	Call for service following the procedures established for your site.
High Liquid Alarm	**Dispenser Pan/Containment Sump Sensor** Liquid reached 8" (203mm)on the dispenser pan sensor or 10" (254mm) on the containment sump sensor.	Immediately follow the alarm reporting procedures established for your site.
	Dual Float Differentiating Hydrostatic Sensor A sensor in a brine-filled interstice detects an increase in the brine level increase. Liquid is entering the riser pipe, or in a high groundwater area, an outer wall rupture has occurred.	Call for service following the procedures established for your site.
Liquid Warning	Liquid reached 1 inch (25.4 mm) on the dispenser pan or containment sump sensor.	Immediately follow the alarm reporting procedures established for your site.
Low Liquid Alarm	The sensor in a brine-filled interstice detects a decrease in the brine level. A hole is in the tank's inner wall, or in low groundwater areas, a hole is in the outer wall.	Call for service following the procedures established for your site.
Out Alarm	The sensor setup was performed incorrectly or a sensor is disconnected or is not functioning properly.	Call for service following the procedures established for your site.
Setup Data Warning	Device setup data problem.	Recheck device setup parameters.
Short Alarm	A short has occurred in the sensor wiring or in the sensor.	Call for service following the procedures established for your site.
Water Alarm	Sensor has detected water.	Call for service following the procedures established for your site.
Water Out Alarm	Water level is below the float switch making the sensor ineffective.	Call for service following the procedures established for your site.

Table 5-4. Vapor Sensor Alarms

Alarm	Cause	Action
Fuel Alarm	Fuel is present in the area being monitored by the sensor.	Call for service following the procedures established for your site.
Out Alarm	The sensor setup was performed incorrectly or a sensor is disconnected or is not functioning properly.	Call for service following the procedures established for your site.
Setup Data Warning	Device setup data problem.	Recheck device setup parameters.
Short Alarm	A short has occurred in the sensor wiring or in the sensor.	Call for service following the procedures established for your site.
Water Alarm	The vapor sensor is immersed in water and is incapable of detecting fuel vapors.	Call for service following the procedures established for your site.

Table 5-5. External Input Alarms

Alarm	Cause	Action
Generator Off	Backup generator shut down, in-tank leak testing resumed.	None
Generator On	Backup generator switched on, in-tank leak testing halted.	None
Input Alarm	External device changed from programmed condition.	Check the operation of the external device.
Input Normal	(Not displayed, printed out only) External device returned to preset condition.	None
Input Out Alarm	No longer receiving data from input. Hardware or setup problem.	Call for service following the procedures established for your site.
Setup Data Warning	Device setup data problem.	Recheck device setup parameters.

Table 5-6. Groundwater Sensor Alarms

Alarm	Cause	Action
Fuel Alarm	Fuel is present in the area being monitored by the sensor.	Call for service following the procedures established for your site.
Out Alarm	The sensor setup was performed incorrectly or a sensor is disconnected or is not functioning properly.	Call for service following the procedures established for your site.
Setup Data Warning	Device setup data problem.	Recheck device setup parameters.

Table 5-6. Groundwater Sensor Alarms

Alarm	Cause	Action
Short Alarm	A short has occurred in the sensor wiring or in the sensor.	Call for service following the procedures established for your site.
Water Out Alarm	Water level is below the float switch making the groundwater sensor ineffective.	Call for service following the procedures established for your site.

Table 5-7. Type A Sensor Alarms

Alarm	Cause	Action
Fuel Alarm	Fuel is present in the area being monitored by the sensor.	Call for service following the procedures established for your site.
Out Alarm	The sensor setup was performed incorrectly or a sensor is disconnected or is not functioning properly.	Call for service following the procedures established for your site.
Short Alarm	A short has occurred in the sensor wiring or in the sensor.	Call for service following the procedures established for your site.
Setup Data Warning	Device setup data problem.	Recheck device setup parameters.
Water Alarm	Water is present in the area being monitored by the sensor.	Call for service following the procedures established for your site.

Table 5-8. Type B Sensor Alarms

Alarm	Cause	Action
Fuel Alarm	Fuel is present in the area being monitored by the sensor.	Call for service following the procedures established for your site.
High Liquid Alarm	The sensor detects a high liquid level.	Call for service following the procedures established for your site.
Liquid Warning	Liquid reached 1 inch (25.4 mm) on the dispenser pan or containment sump sensors.	Immediately follow the alarm reporting procedures established for your site.
Out Alarm	The sensor setup was performed incorrectly or a sensor is disconnected or is not functioning properly.	Call for service following the procedures established for your site.
Setup Data Warning	Device setup data problem.	Recheck device setup parameters.
Short Alarm	A short has occurred in the sensor wiring or in the sensor.	Call for service following the procedures established for your site.

Table 5-9. Relay Alarms

Alarm	Cause	Action
Out Alarm	Console has lost communication with the relay.	Call for service following the procedures established for your site.
Setup Data Warning	Device setup data problem.	Recheck device setup parameters.

Table 5-10. Pressure Line Leak Alarms

Alarm	Cause	Action
Annual Test Fail Alarm	0.1 gph (0.38 lph) line test failure. Dispensing halts, if programmed to do so.	Consult PLLD Alarm Quick Help Guide and PLLD diagnostic screens.
Annual Test Needed Alarm	System failed to perform an annual test (0.1 gph [0.38 lph]) in the programmed number of days.	Schedule a 0.1 gph (0.38 lph) test.
Annual Test Needed Warning	System failed to perform an annual test (0.1 gph [0.38 lph]) in the programmed number of days.	Schedule a 0.1 gph (0.38 lph) test.
Continuous Handle On Alarm	Handle signal has been active for a programmed number of hours.	Call for service following the procedures established for your site.
Fuel Out Alarm	Tank product level below 10-inch (25.4 cm) level - cannot pump when active.	Schedule a delivery.
Gross Test Fail Alarm	3 gph (11.3 lph) line test failure. Dispensing halts, if programmed to do so, while the alarm is active.	Consult PLLD Alarm Quick Help Guide and PLLD diagnostic screens.
Line Equipment Alarm	A problem with the pressure measurement equipment has been detected.	Call for service following the procedures established for your site.
Low Pressure Alarm	Low pump dispense pressure is detected during a dispense. Dispensing halts if programmed to do so.	The next handle up will restart the pump.
Periodic Test Fail Alarm	0.2 gph (0.76 lph) test failure. Dispensing halts, if programmed to do so.	Consult PLLD Alarm Quick Help Guide and PLLD diagnostic screens.
Periodic Test Needed Alarm	A periodic in-tank leak (0.2 gph [0.76 lph]) test has not been successfully completed within the programmed number of days.	Schedule a 0.2 gph (0.76 lph) test.
Periodic Test Needed Warning	A periodic in-tank leak (0.2 gph [0.76 lph]) test has not been successfully completed within the programmed number of days.	Schedule a 0.2 gph (0.76 lph) test.
Setup Data Warning	The default line length was not changed to reflect the actual line length.	Enter the correct line length(s).
Sensor Open Alarm	Pressure sensor reading is less than -8 psi (-51.2 kPa). Only tested while the pump is running. Dispensing halts if programmed to do so.	3 gph (11.3 lph) test must pass to clear the alarm. Call for service following the procedures established for your site.

Table 5-10. Pressure Line Leak Alarms

Alarm	Cause	Action
Shutdown Alarm	System shut down line because of failed line leak test, or an alarm assigned to disable the line is active.	Identify offending alarm, and refer to PLLD alarms for corrective action.

Table 5-11. Mag Sensor Alarms

Alarm	Cause	Action
Communication Alarm	Hardware failure - sensor or interconnecting wiring to console.	Call for service following the procedures established for your site.
Fault Alarm	Monitored parameter exceeded preset threshold.	Call for service following the procedures established for your site.
Fuel Alarm	Monitored parameter exceeded preset threshold.	Call for service following the procedures established for your site.
Fuel Warning	Monitored parameter exceeded preset threshold.	Call for service following the procedures established for your site.
High Liquid Alarm	Monitored parameter exceeded preset threshold.	Call for service following the procedures established for your site.
High Liquid Warning	Monitored parameter exceeded preset threshold.	Call for service following the procedures established for your site.
Install Alarm	Sensor not installed in correct position.	Call for service following the procedures established for your site.
Low Liquid Alarm	Monitored parameter exceeded preset threshold.	Call for service following the procedures established for your site.
Low Liquid Warning	Monitored parameter exceeded preset threshold.	Call for service following the procedures established for your site.
Relay Active	Monitored parameter exceeded preset threshold.	Call for service following the procedures established for your site.
Setup Data Warning	Device setup data problem.	Recheck device setup parameters.
Temperature Warning	Ambient temperature exceeded sensor's operating range (-40 to +122°F [-40 to +50°C]).	Warning removed when temperature returns to within sensor's operating range.
Water Alarm	Monitored parameter exceeded preset threshold.	Call for service following the procedures established for your site.
Water Warning	Monitored parameter exceeded preset threshold.	Call for service following the procedures established for your site.

Table 5-12. Line Pressure Sensor Alarms

Alarm	Cause	Action
Communication Alarm	Console has lost communication with the relay.	Call for service following the procedures established for your site.
Setup Data Warning	Device setup data problem.	Recheck device setup parameters.

Table 5-13. Printer Alarms

Alarm	Cause	Action
Printer Error	Printer feed roller release is open.	Push the release lever to the up position.
Printer out of Paper	Paper roll is empty.	Replace the paper roll with Veeder-Root part number 514100-456 only.

Table 5-14. Pump Alarms

Alarm	Cause	Action
Pump Out Alarm	Hardware failure or setup data warning on dependent device (Relay or External Input) prevents this device from working.	Call for service following the procedures established for your site.
Setup Data Warning	Device setup data problem.	Recheck device setup parameters.

Table 5-15. Line Alarms

Alarm	Cause	Action
Line Out Alarm	Hardware failure or setup data warning on dependent device (Pump) prevents this device from working.	Call for service following the procedures established for your site.
Line Setup Data Warning	Device setup data problem.	Recheck device setup parameters.

Table 5-16. Communication Alarms

Alarm	Cause	Action
Setup Data Alarm	Hardware failure or setup data warning on dependent device (Pump) prevents this device from working.	Call for service following the procedures established for your site.
Setup Data Warning	Device setup data problem.	Recheck device setup parameters.

Table 5-17. Contact Alarms

Alarm	Cause	Action
Autodial Failed Alarm	System failed to connect to a remote receiver after 'n' tries.	Verify the address book settings for the contact are correct (i.e., modem device number, phone number to dial), verify the receiving device (fax or modem) is operational. Contact technical support for assistance.
Autodial Setup Data Warning	Device setup data problem	Recheck device setup parameters.
Email Failed	The console did not successfully send email when configured to email.	Verify the address book settings for the contact are correct (email address of recipient), verify network connectivity is available (Ethernet card is installed). Contact technical support for assistance.
Fax Failed	The console did not successfully send fax when configured to fax.	Verify the address book settings for the contact are correct (fax address of recipient), verify modem is configured. Contact technical support for assistance.

Table 5-18. Auto Events Alarms

Alarm	Cause	Action
Setup Data Warning	Device setup data problem	Recheck device setup parameters.

Table 5-19. Product Alarms

Alarm	Cause	Action
Product Setup Warning	Setup is incomplete or in error.	Meter Data Present not setup. Temperature Compensation not setup. BIR Alarm Threshold and/or Alarm Offset values incorrect.
Product Threshold Alarm	Periodic variance exceeds threshold.	The periodic variance of a product exceeded the BIR calculated threshold.

Table 5-20. DIM Alarms

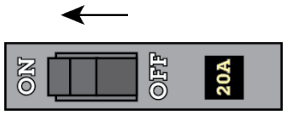
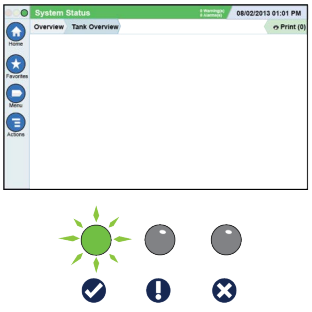
Alarm	Cause	Action
Communication Failure Alarm	DIM module has stopped communicating with the external equipment or the cable adaptor box.	Reconnect the external equipment or adaptor box to the TLS.
Disabled DIM	DIM module has stopped communicating with central processing unit of the console.	Verify DIM firmware is correct. Replace DIM module.
Setup Data Warning	Device setup data problem	Recheck device setup parameters.

6 Console Troubleshooting

Boot-Up LED Sequence

A normal TLS-450PLUS boot-up sequence can be followed observing the front panel status LEDs as described in Table 6-1.

Table 6-1. Front Panel LED Normal Boot-Up Sequence

Boot-Up Sequence	Visual Sequence	System Task
1. Console powered On at the breaker.		
2. All three LEDs On.		Console is loading U-Boot.
3. The Green LED is On, the rest are Off.		U-Boot is loading the Operating System (OS).
4. All three LEDs On.		Linux is loaded and starts the drivers for USB, Ethernet, etc.
5. The Green LED is On, the rest are Off.		Linux is running and the system is being initialized.
6. Green LED On Steady and the designated Home screen displays (when equipped with a touch screen display.		The console completes the boot-up sequence, starts the applications and brings up the GUI, or is ready for use.

TLS-450PLUS Troubleshooting Guide

Table 6-2. TLS-450PLUS Troubleshooting

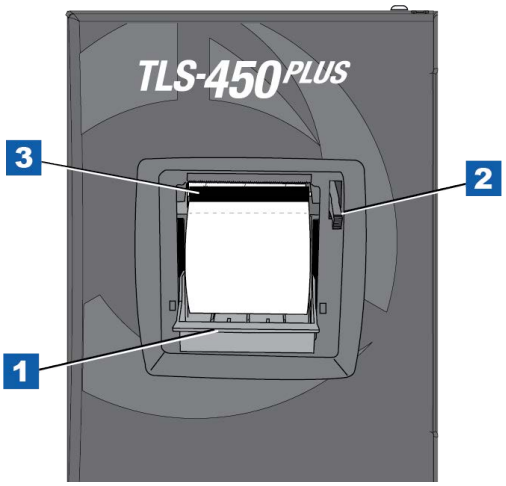
Symptom	Cause	Corrective Action
Blank printout from integral printer	Wrong paper type - not thermal paper.	Replace with thermal paper roll (Veeder-Root Part No. 514100-328).
	Printer paper in backwards.	Install paper properly. Swing down the printer cover (1) and push the paper feed release lever (2) down. Remove the roll of paper. Insert the roll into the paper tray with the end of the paper tail facing you from the bottom of the roll. Pull the tail out and push the tail under the black paper feed roller until it exits above the feed roller (3). Push lever (2) up. Touch the print button Print (0) to advance the paper a few lines and verify the paper is feeding correctly. Close the printer cover. 
	Paper roll release lever not closed.	Close lever.
	Defective printer.	Replace printer door.
Characters “Overprint”	Paper jam.	Remove paper jam and replace paper.
	Paper roll release lever not closed.	Close lever.
	Defective printer.	Replace printer door.
Missing characters on printout	Defective printer.	Replace printer door.

Table 6-2. TLS-450PLUS Troubleshooting

Symptom	Cause	Corrective Action
No display reading	No AC power to monitor.	Verify power circuit breaker is switched ON Ensure power cable is properly secured to AC Input Power connector (item 3, Figure 2-5).
	AC fuse blown.	Check fuses on AC Input module and Power Supply board.
	Defective power supply.	Replace Power Supply board.
	Defective display board.	Replace display door.
Printer will not print or feed paper	Printer Error Alarm - Printer Traction lever in down position.	Raise printer traction lever to up position.
	Printer out of paper.	Load thermal paper (Veeder-Root Part No. 514100-328).
	Loose printer cable.	Check connections between printer and CPU board.
	Defective printer.	Replace printer door.
	Defective printer communication module.	
System will not communicate via fax.	Incorrect or defective interconnect cable.	Check cable between TLS and telephone jack.
	Problem with telephone line.	Call phone company.
	Incorrect modem baud rate, parity, data bits, or stop bit settings.	Set all to agree with host device. Recheck device setup parameters.
	Defective modem card.	Replace modem.
System will not communicate via RS-232 Module	Incorrect cable.	Use null cable when connecting to terminal/ computer. Use straight cable when connected to external modem.
	Incorrect modem baud rate, parity, data bits, or stop bit settings.	Set all to agree with host device. Recheck device setup parameters.
	Defective RS-232 Module.	Replace module.
	Defective host terminal or modem.	See manufacturer's troubleshooting manual.

Table 6-2. TLS-450PLUS Troubleshooting

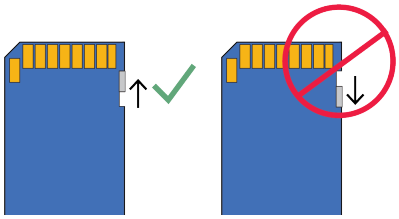
Symptom	Cause	Corrective Action
Boot Sequence Stalled	Boot device jumper(s) in wrong position(s).	Verify jumper positions. For SD card: on J1203, off J1201 and J1202. For SATA drive: on J1201 and J1202, off J1203.
	The console cannot read the SD Card, is not able to read the RAM, or the SD Card is missing.	1. Open the console's printer and display cover following as described in Step 1 of "Removing The Ack Switch Panel/Display (Right) Door And CPU Board" on page 7-3. 2. Confirm SD is present (Item 10 in Figure 2-14 on page 2-13) - if not, order SD card. If present continue to next step. 3. Remove the SD Card by pushing in on the SD Card then quickly releasing it letting it spring free of its enclosure's latch so you can slide it out. While you have the SD Card out, check the position of the write protect slide on the side of the SD Card, making sure it is in the position shown below and then reinsert it in its enclosure until it clicks into the enclosure's latch: 
Console Does Not Power On	AC Power Input connector (Item 3, Figure 2-5) is loose.	Verify AC Power Input connector is fully seated in its connector.
	The wires in the power input plug are pinched underneath the terminal's screws.	Verify each of the wires is correctly seated in each of the plug's terminal clamps. If the clamps are not opened all the way when inserting the wires into the plug, the wires can be inserted behind the clamps preventing proper contact.
	Wires to the power input plug are attached to the wrong power input terminals.	Verify correct wiring.
	Fuse missing or blown.	Check F4 fuse (Item 5 in Figure 2-6).
	Power supply board bad.	Replace Power supply board.
	AC input board bad.	Replace AC input board.
	CPU board bad.	Replace CPU board.
	Comm backplane board bad.	Replace Comm backplane board.
	I/O backplane board bad.	Replace I/O backplane board.

Table 6-2. TLS-450PLUS Troubleshooting

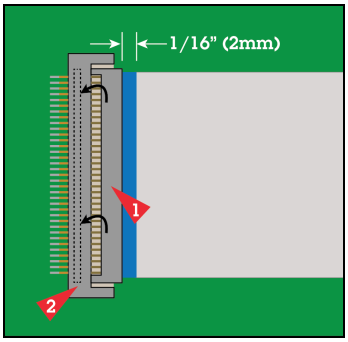
Symptom	Cause	Corrective Action
Display Dark After Boot-Up	Bad Display cable, loose Display cable.	1. Open the printer door. 2. Verify the Display ribbon cable (Item 3 in Figure 2-3 on page 2-3) is securely seated in its CPU board connector and that the locking latch (1 pointer) is down against the cable. If inserted fully, the blue end of the cable will be no more than 1/16" (2mm) out of the connector as shown below:  3. If the cable appears loose or out of the connector, rotate the locking member of the cable connector (1 pointer) up 90° from the connector's fixed base (2 pointer). Reseat the cable end into the connector as far as it will go and then push the locking member down onto the connector snapping it in place.
	Bad SD card.	Replace SD card.
	Bad CPU board.	Replace CPU board.
Acknowledge (Ack) Switch Not Working Properly	The Ack cable plug is loose or not plugged in Ack connector.	Reseat cable connector.
	Ack cable is broken.	Replace the Ack assembly.
	Ack cable connector incorrectly installed.	Verify all pins of Ack cable plug are seated in the Ack switch connector, J502.
	Bad SD card.	Replace SD card.
	Bad CPU board.	Replace CPU board.
RS-232 Communication Not Working	Serial settings are incorrect for data transfer such as Baud Rate, Parity Setting, Data Bit, and Flow Control.	Verify serial communication settings to make sure settings are correct for data transfer.
	Bad cable connecting TLS-450PLUS to serial device.	Verify if cable is bad.
	Polarity of wiring is wrong.	Verify wiring polarity.
	Bad RS-232 comm module.	Replace RS-232 comm module.
	Bad comm backplane.	Replace comm backplane.

Table 6-2. TLS-450PLUS Troubleshooting

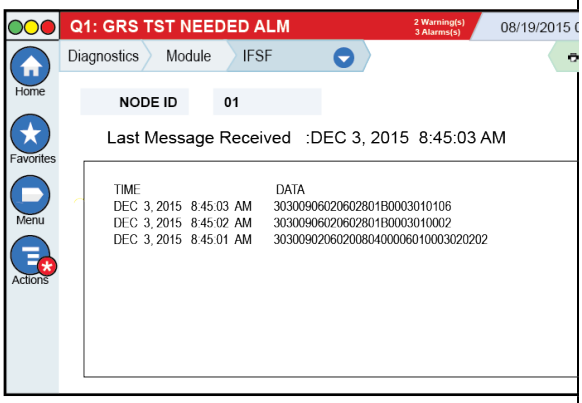
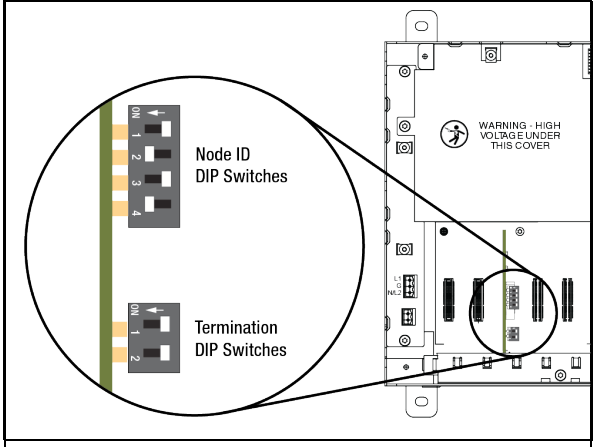
Symptom	Cause	Corrective Action
RS-485 Communication Not Working	Serial settings are incorrect for data transfer such as Baud Rate, Parity Setting, Data Bit, and Flow Control.	Verify serial communication settings to make sure settings are correct for data transfer.
	Bad cable connecting TLS-450PLUS to serial device.	Verify if cable is bad.
	Polarity of wiring is wrong.	Verify wiring polarity.
	Bad RS-485 comm module.	Replace RS-485 comm module.
	Bad comm backplane.	Replace comm backplane.
IFSF Communication Not Working	Verify LON Card selected for device field on IFSF Communication Setup screen.	Not selected - Correct device selection
		Selected - Go to next cause.
	No Communication	Verify Node ID and IFSF messages displayed in Diagnostic Module IFSF screen: On the front panel screen touch Menu>Diagnostics>Module>IFSF:. This screen allows you to view messages for the Node ID so you can validate IFSF communications. The messages (Data) are listed in descending order with the latest message at the top (see example below).  No messages have been received - Go to next cause Messages have been received - Done

Table 6-2. TLS-450PLUS Troubleshooting

<table>
<tr><th>Symptom</th><th>Cause</th><th>Corrective Action</th></tr>
<tr><td rowspan="2">IFSF Communication Not Working - (cont'd.)</td><td>Node ID Setting Incorrect</td><td>Get the correct Node ID setting from the site's LON administrator and verify that the correct Node ID has been entered:
1. Shut off power to the console.
2. Remove the two T15 Torx screws securing the left door of the console (item 2 in Figure 2-1 on page 2-1) and open the left door.
3. Locate the Node ID and Termination DIP switches on the IFSF LON module (comm slots 1,2, or 3):


4. The Termination DIP switches are set in the NO TERMINATION or all the way to the right in the image above).
5. The Node ID DIP switches are set to a value supplied by the Site IFSF LON Administrator. LON Node Address is subnet 9, Node X, where X is selected using DIP switches 1-4 using the legend below:
<table>
<tr><th></th><th colspan="16">Node Address</th></tr>
<tr><th>DIP SW</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th></tr>
<tr><td>1</td><td></td><td>L</td><td></td><td>L</td><td></td><td>L</td><td></td><td>L</td><td></td><td>L</td><td></td><td>L</td><td></td><td>L</td><td></td><td>L</td></tr>
<tr><td>2</td><td></td><td></td><td>L</td><td>L</td><td></td><td></td><td>L</td><td>L</td><td></td><td></td><td>L</td><td>L</td><td></td><td></td><td>L</td><td>L</td></tr>
<tr><td>3</td><td></td><td></td><td></td><td></td><td>L</td><td>L</td><td>L</td><td>L</td><td></td><td></td><td></td><td></td><td>L</td><td>L</td><td>L</td><td>L</td></tr>
<tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>L</td><td>L</td><td>L</td><td>L</td><td>L</td><td>L</td><td>L</td><td>L</td></tr>
</table>
L (Slide to Left) = ON, Blank = Slide to Right
Note: The Node ID DIP switches shown in the example illustration above are set to Node 11.
6. Close the console door and reapply power.
7. IFSF communication still not working - go to next cause.</td></tr>
<tr><td>Intermittent communication</td><td>Verify Termination DIP switches are set for No Termination. Follow the procedure in cause above to access Termination DIP switches and verify both DIP switches are all the way to the right (No Termination). Verify Termination in site's Primary Junction Box. IFSF communication still not working - go to next cause.</td></tr>
</table>

Table 6-2. TLS-450PLUS Troubleshooting

Symptom	Cause	Corrective Action
IFSF Communication Not Working - (cont'd.)	Bad cable connecting ATG to LON network	Verify the external input plug is pushed all the way into the connector on the IFSF module. Verify if wires are loose or broken. If necessary, replace cable. The IFSF cable's plug will have to be assembled in the field as shown below:

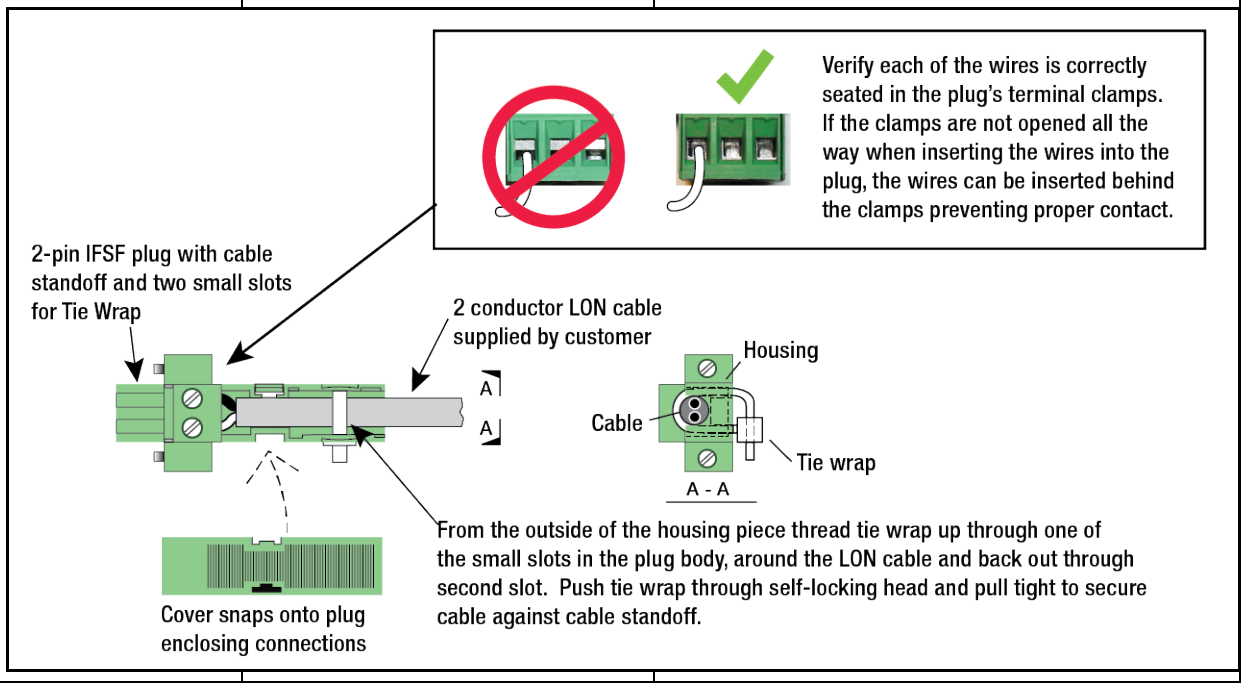


Table 6-2. TLS-450PLUS Troubleshooting

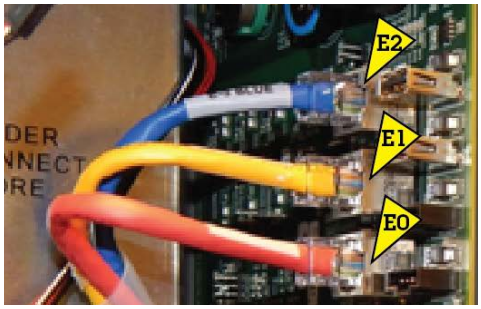
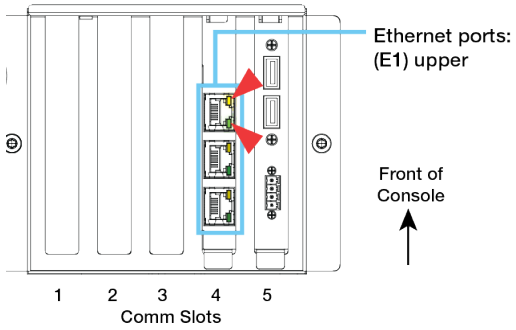
Symptom	Cause	Corrective Action
No Connection To Ethernet Port	Cable is plugged into the wrong port.	Verify Ethernet cables are plugged into correct port(s) on the bottom of the console (ref. Slot 4 in Figure 2-9 on page 2-9).
	Cable is not properly connected to CPU board.	Open Printer door. Verify that the Slot 4 Ethernet Interface module cables are properly connected to the CPU board connectors: 
	Ethernet communication settings, such as, IP Address type, IP Address, etc.	1. Verify Ethernet communication settings are correct. 2. Check if Ethernet port's Link and Activities LEDs are flashing:  3. Try to communicate to the maintenance IP address: 169.254.21.12
	Bad cable.	Verify if cable is bad.
	Defective Ethernet signal source.	Verify Ethernet signal source, e.g. hub or switch.
	Bad Ethernet comm module.	Replace Ethernet Interface module.
	Bad CPU board.	Replace CPU board.

Table 6-2. TLS-450PLUS Troubleshooting

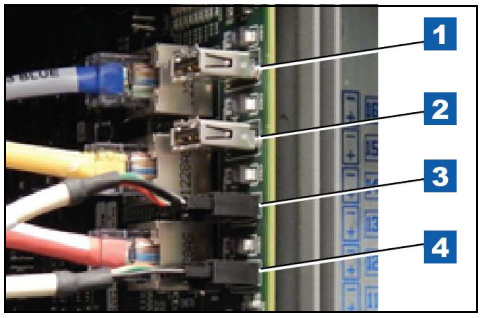
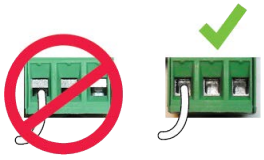
Symptom	Cause	Corrective Action
USB communication not working	Cable(s) not properly plugged into port on USB module.	Verify cables are plugged into moduled properly (ref. Slot 5 in Figure 2-9).
	Cable(s) not properly plugged into connectors on CPU board.	Open Printer door. Verify that the Slot 5 USB module cables are properly connected to the CPU board USB connectors 3 and 4: 
Probe Connected To TLS-450PLUS But No Probe Address Under Devices Menu	Probe wires were connected while the console was ON.	Re-boot console.
	Probe wiring installed incorrectly.	1. Open the Display door. 2. Polarity is required for this device. Locate the questionable probe's input wiring connections at the USM connector (Figure 2-7 on page 2-7). Verify the two wires are connected with white to + terminal and black to – terminal. 3. Verify each of the wires is correctly seated in each of the plug's terminal clamps. If the clamps are not opened all the way when inserting the wires into the plug, the wires can be inserted behind the clamps preventing proper contact: 
	Probe input in USM or bad probe.	Verify by connecting probe to a different input on the USM module. See Section 9 (Probe Troubleshooting).
	Bad USM module.	Replace USM module.

Table 6-2. TLS-450PLUS Troubleshooting

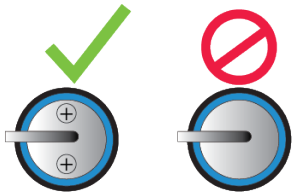
Symptom	Cause	Corrective Action
Incorrect Time Displayed After Console Power Loss	Battery Isolator strip not removed.	Remove and discard the battery isolator strip (see Item 2 in Figure 2-14 on page 2-13).
	Battery is installed in backwards with ' +' side of battery facing down in holder.	Remove the battery by gently lifting the retaining clip over the battery as you slide it to the right. Reinstall the battery with the '+' side up, by sliding it from right to left under the retaining clip until it snaps securely into the holder: 
	Bad battery.	Replace battery.

Table 6-2. TLS-450PLUS Troubleshooting

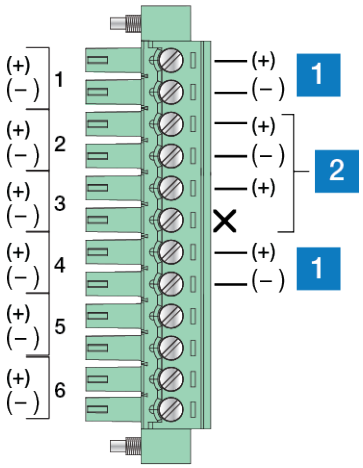
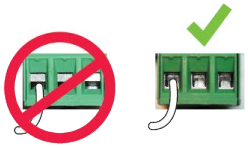
Symptom	Cause	Corrective Action
Sensor Connected To TLS-450PLUS But No Sensor Address Under Devices Menu	Sensor wires were connected while the console was ON.	Re-boot console.
	Sensor wiring installed incorrectly.	1. Open the Display door. 2. Polarity may be required for this device. Locate the questionable sensor's input wiring connections at the USM connector. If polarity required, verify the two wires are connected with white to + terminal and black to – terminal. (item 1 in diagram below) If three wire sensor, verify the three wires are connected as shown below (item 2 in diagram below):  3. Verify each of the wires is correctly seated in each of the plug's terminal clamps. If the clamps are not opened all the way when inserting the wires into the plug, the wires can be inserted behind the clamps preventing proper contact: 
	Sensor input in USM or bad sensor.	Verify by connecting sensor to different input on USM module.
	Bad USM module.	Replace USM module.

Table 6-2. TLS-450PLUS Troubleshooting

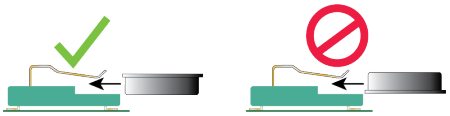
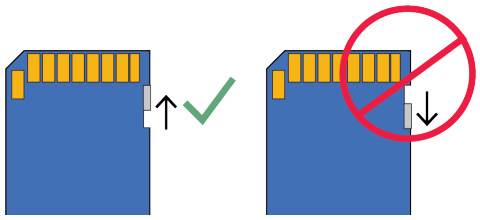
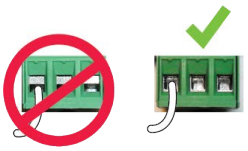
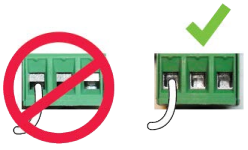
Symptom	Cause	Corrective Action
"Could Not Validate IButton" or "Media Address Error" **Displays On GUI of existing TLS-450PLUS consoles with iButton**	Features iButton is not seated properly in its holder.	Check that iButton (Item 12 in) on the CPU board is installed correctly aFigure 2-14 on page 2-13s shown below:  With flange end up, slide the iButton under the clip until it snaps securely into the holder.
	Features iButton is not programmed.	Replace iButton with one that has been programmed with the required features.
	Bad Cyclic Redundancy (CRC) check sum error.	Replace CPU board.
"Could Not Validate IButton" or "Media Address Error" **Displays On GUI of newer TLS-450PLUS consoles w/o iButton**	Software error.	Replace CPU board.
Cannot Save Setup Data, "Data Retrieved" Error Message In Status Bar	SD Card in write protect mode.	Remove the SD Card (item 10 in Figure 2-14 on page 2-13) by pushing in on the Card then quickly releasing it letting it spring free of its enclosure's latch so you can slide it out. While you have the Card out, check the position of the write protect slide on the side of the Card, making sure it is in the position shown below and then reinsert it in its enclosure until it clicks into the enclosure's latch. 

Table 6-2. TLS-450PLUS Troubleshooting

Symptom	Cause	Corrective Action
Relay Will Not Change State	Setup problem - relay is not enabled.	Verify relay is enabled in the GUI. Are relays setup on TLS-450PLUS?
	Connector is not pushed all the way in.	Verify the relay plug is pushed all the way into the connector (Item 4 in Figure 2-5 on page 2-5). Verify each of the wires is correctly seated in the plug's terminal clamps. If the clamps are not opened all the way when inserting the wires into the plug, the wires can be inserted behind the clamps preventing proper contact: 
	Incorrect input wiring from external device.	Verify external wiring into the relay input connector.
	Fuse missing or blown.	Install or replace fuse(s) with the correct type as indicated in Section 3.
	AC input board bad.	Replace AC input board.
	Power supply board bad.	Replace Power supply board.
	CPU board bad.	Replace CPU board.
	Comm backplane board bad.	Replace Comm backplane board.
External Input Does Not Recognize External Contact Closure	Setup problem - external input is not enabled.	Verify external input is enabled in the GUI. Verify proper alarm setup for relay trigger in the GUI.
	Incorrect external wiring to external input connector.	Verify the external input plug is pushed all the way into the connector on the I/O module. Verify each of the wires is correctly seated in the plug's terminal clamps. If the clamps are not opened all the way when inserting the wires into the plug, the wires can be inserted behind the clamps preventing proper contact: 
	I/O module bad.	Replace I/O module.
	CPU board bad.	Replace CPU board.

7 Component Removal

This sections contains instructions for removing/replacing the TLS-450PLUS console Ack Switch/Display door, CPU board, AC Input Filter, Power Supply board, Printer door, SD card, Features iButton, Backup Battery, and the SATA drive.

Safety Warnings

⚠ WARNING



This console contains high voltages which can be lethal. It is also connected to low power devices that must be kept intrinsically safe.

FAILURE TO COMPLY WITH THE FOLLOWING WARNINGS AND SAFETY PRECAUTIONS COULD CAUSE DAMAGE TO PROPERTY, ENVIRONMENT, RESULTING IN SERIOUS INJURY OR DEATH.

1. **Turn off and tag power at the circuit breaker. Do not connect the console AC power supply wires at the breaker until all devices are connected.**
2. **Attach conduit from the power panel to the console's Power Area knockouts only.**
3. **Comply with all applicable codes including: the National Electrical Code; federal, state, and local codes; and other applicable safety codes.**

Connecting power wires to a live circuit can cause electrical shock that may result in serious injury or death.

Routing conduit for power wires into the intrinsically safe compartment can result in fire or explosion resulting in serious injury or death.

Precautions Against Static Electricity

Before removing electronic components from their anti-static bags read the following static electricity precautions.

1. Before handling any components, discharge your body's static electric charge by touching a grounded surface.
2. Do not remove parts from their anti-static bags until you are ready to install them.
3. Do not lay parts on the anti-static bags! Only the insides are anti-static.
4. When handling parts, hold them by their edges and their metal mounting brackets.

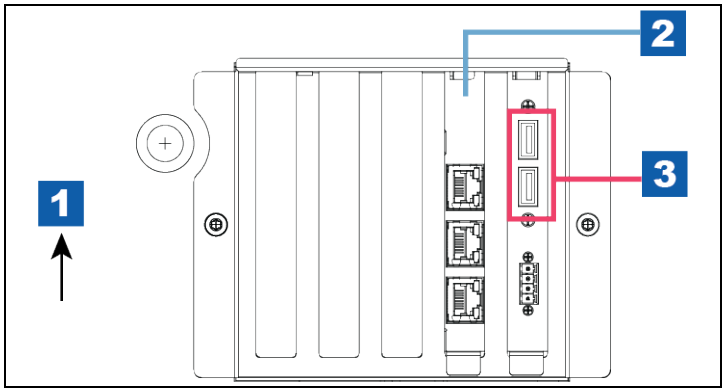


5. Avoid touching components or edge connectors that plug into slots and wear the anti-static wrist strap (Part No. 576010-908) included in your component replacement kit.
6. Never slide parts over any surface.
7. Avoid plastic, vinyl, and Styrofoam in your work area.

Before Turning Off Power

Before powering off the console perform a system backup:

1. Beneath the left side of the 450 Plus console, locate the USB Module and insert the V-R Backup thumb drive, minimum 4 GB, (P/N 332970-004) into one of the external USB ports on the USB module, P/N 333477-001 (see item 3 in Figure 7-1).



LEGEND FOR NUMBERED BOXES IN Figure 7-1

1. Front of console
2. Ethernet Interface Module
3. USB Ports on USB Module

Figure 7-1. USB Board - USB Ports

2. From the Home Screen touch **Menu > Software Upgrade > DB Backup** to view the Database Backup Screen (see Figure 7-2). Touch the down arrow in the Destination field to select the Backup thumb drive inserted in Step 1, then follow the on-screen instructions to backup TLS-450PLUS console data.

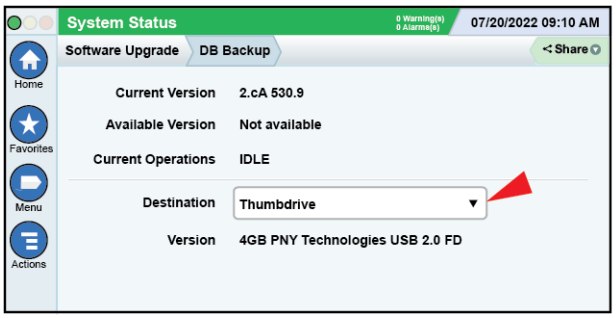


Figure 7-2. DB Backup Screen

Removing The Ack Switch Panel/Display (Right) Door And CPU Board

⚠WARNING **Turn off, tag and lockout the breaker that supplies power to the console..**

To remove just the Acknowledge Switch Panel door (or optional Display door), complete Steps 1 - 6 in this section. To remove the CPU board, complete all Steps (1-10) in this section.

1. Remove the both left and right door screws and swing doors open to the left (see items 2/5 in Figure 2-1).
2. For the Ack Switch panel door remove the Ack Switch Panel cable plug from its CPU board connector (item 16 in Figure 2-14 on page 2-13).

   For the optional Display door, remove the Display cable (pointer 1 in Figure 7-3) from the CPU board connector. Rotate the locking member of the cable's Display connector (1a pointer) up 90° from the connector's fixed base and slide cable end out.
3. Remove the LED Back light cable (pointer 2) from CPU board connector (see Figure 7-3).

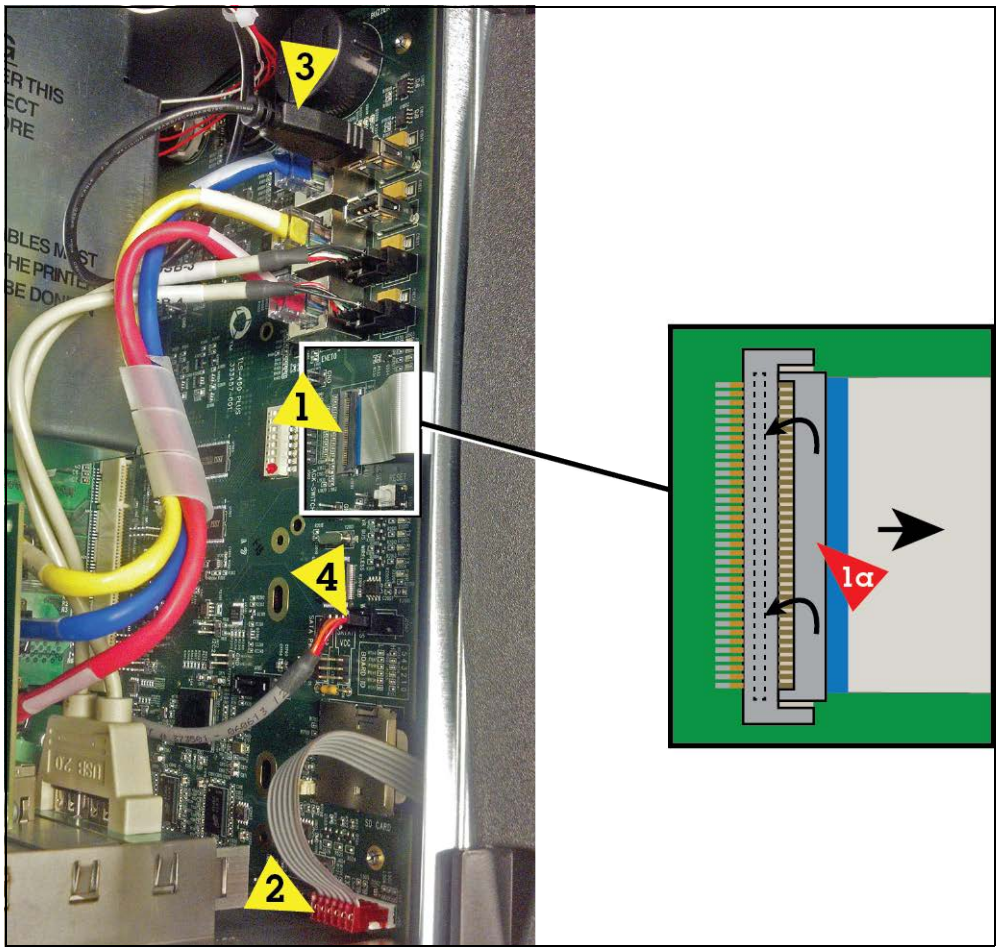


Figure 7-3. Remove Optional Printer and Display Cables from CPU Board

4. Remove the Ground wire at the top of the door (see Figure 7-4).

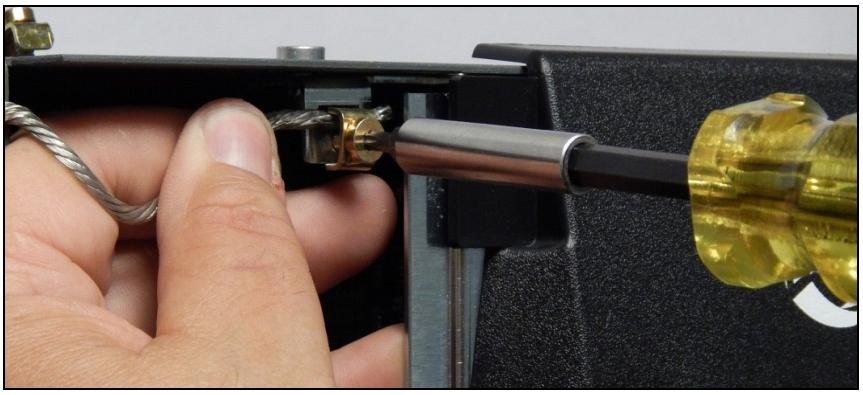


Figure 7-4. Remove Ground Wire From Ack Switch/Display Door

5. Remove the TLS-450PLUS Ack Switch Panel/Display door by removing the top and bottom hinge shoulder screws (see Figure 7-5).

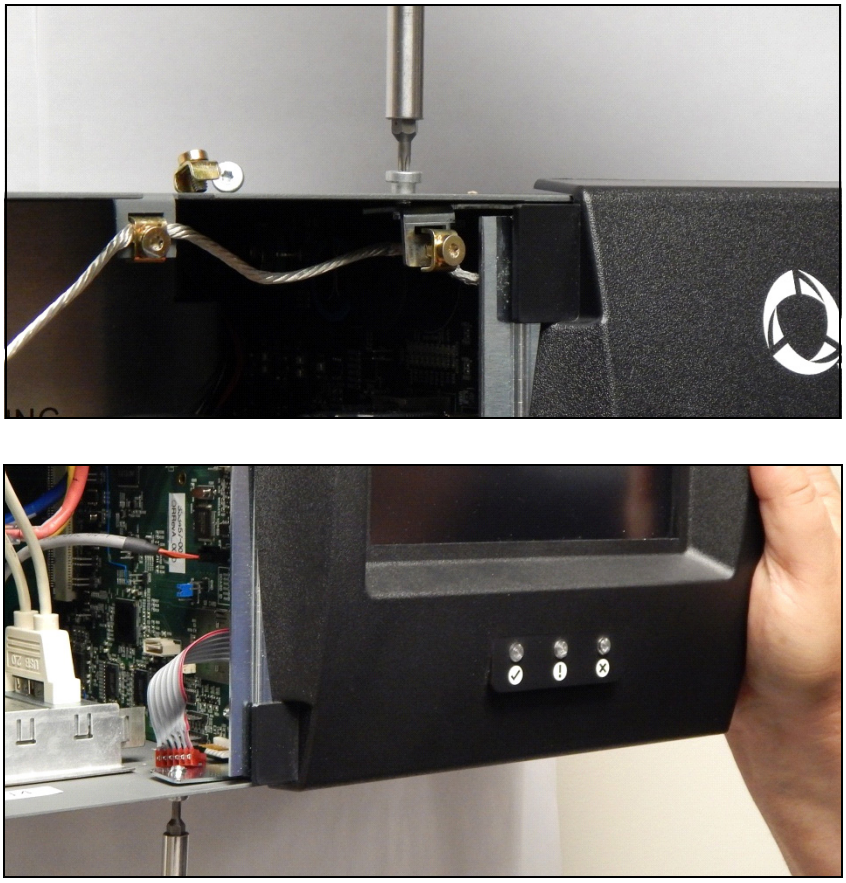


Figure 7-5. Remove Top and Bottom Optional Display Door Hinge Screws

6. Remove the USB module cables from the CPU board (two USB cables - top pointers; Wireless cable - bottom pointer) (see Figure 7-6).



Figure 7-6. Remove USB Module Cables from CPU Board

7. Remove the three Ethernet Module cables E2 (blue), E1 (yellow) and E0 (red) from the CPU board (see Figure 7-7).

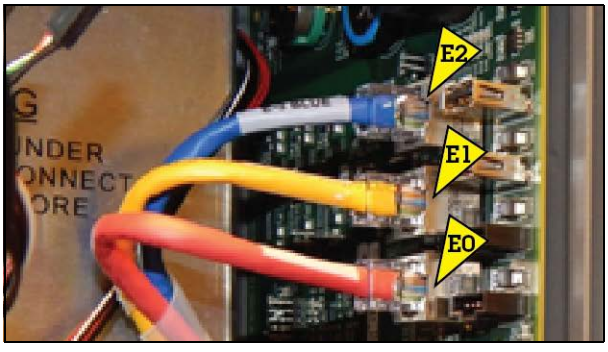


Figure 7-7. Remove Ethernet Module Cables from CPU Board

8. Remove the Printer cable (Pointer 3 Figure 7-3) and the Wireless cable (pointer 4 in Figure 7-3) from the CPU board connector.

9. Locate the three retention snap pins along the front edge of the CPU board. Position your forefinger beneath one of the pins and press up releasing the CPU board from the snap pin. Repeat at each of the remaining two retention pins.
10. Tilt the board a little away from the bulkhead and grasping the edge of the board pull out firmly to remove the board from its backplane board connector. Once the CPU board is free from the connector, slowly remove the board from the console.

Removing The AC Input Filter And Power Supply Board

1. Perform all of the Steps in the section entitled “Before Turning Off Power” on page 7-2.
2. Open the console doors as described in Step 1 of the section entitled “Removing The Ack Switch Panel/ Display (Right) Door And CPU Board” on page 7-3.
3. Remove the two T15 screws from the AC Channel cover and put the cover and screws aside (see Figure 7-8).



Figure 7-8. Remove AC Channel Cover

Legend For Figure 7-8			
Item	**Description**	**Item**	**Description**
1	AC Channel cover.	2	T15 screws (2).

4. Remove the three T15 screws in the AC Input Filter (item 1 in Figure 7-9).
5. Lift the Power Supply shield up to disengage the two retention snap pins in its right side flange and remove it from the console (item 2 in Figure 7-11).
6. Grasp the AC Input Filter handle (see item 3 in Figure 7-9) and slowly pull up and away from the Power Supply board until the two AC Input Filter plugs disconnect from the Power Supply board connectors. Lift the AC Input Filter out of the console. Remove the two T-15 screws that secure the AC Input board to the AC input board bracket. Place fingers under the AC Input board near each of the two retention pins and lift the board up until it is free of the pins.

   To replace the AC Input Filter reverse the above steps. To remove the Power Supply Board continue to Step 7.

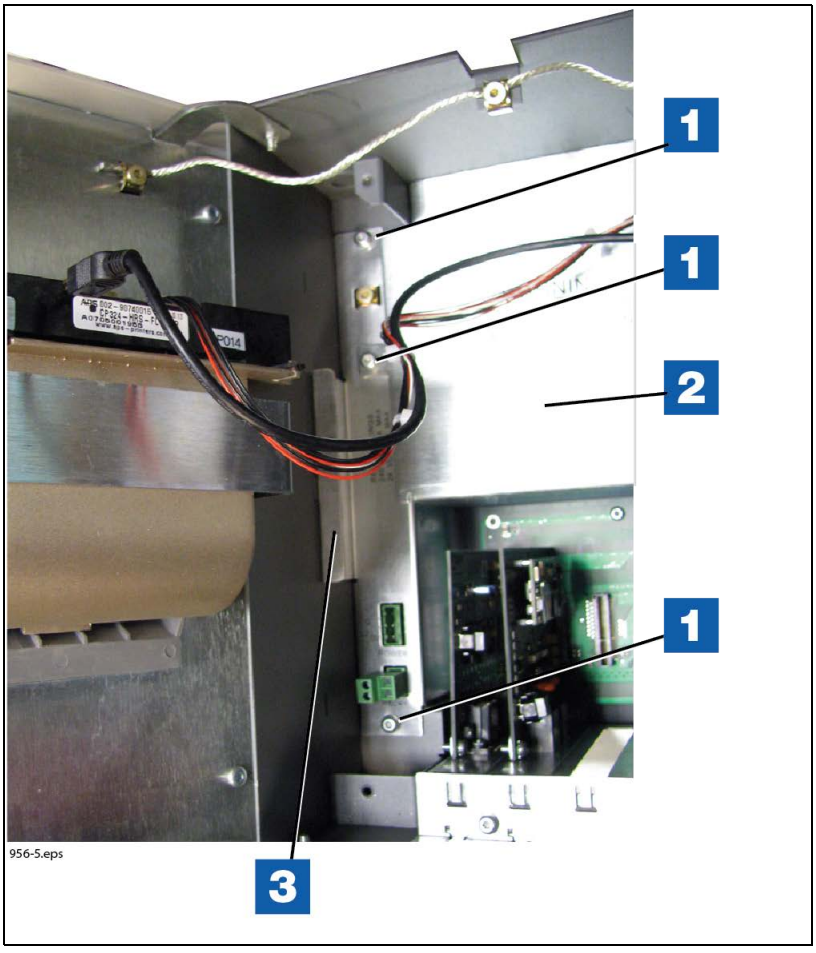


Figure 7-9. Removing AC Input Filter

Legend For Figure 7-9			
Item	**Description**	**Item**	**Description**
1	T15 screws (the middle one secures the Power Supply shield to the AC Input Filter bracket)	3	AC Input Filter handle
2	Power Supply shield		

7. Remove the two T15 screws (item 1 in Figure 7-10) that secure the Power Supply board to the console housing.
8. Place a finger under the edges of the Power Supply board near the upper right and lower left edges of the board and lift the board up until it is free of the three snap pins (item 2 in Figure 7-10).

⚠WARNING **Shock hazard. Do not touch underside of Power Supply board beneath the capacitors (identified by item 3 in Figure 7-10).**

9. Disconnect the printer power cable from the Power Supply board connector J1.
10. Lift the board out of the console by its edges since there is still undischarged high voltage in the item 3 capacitors.

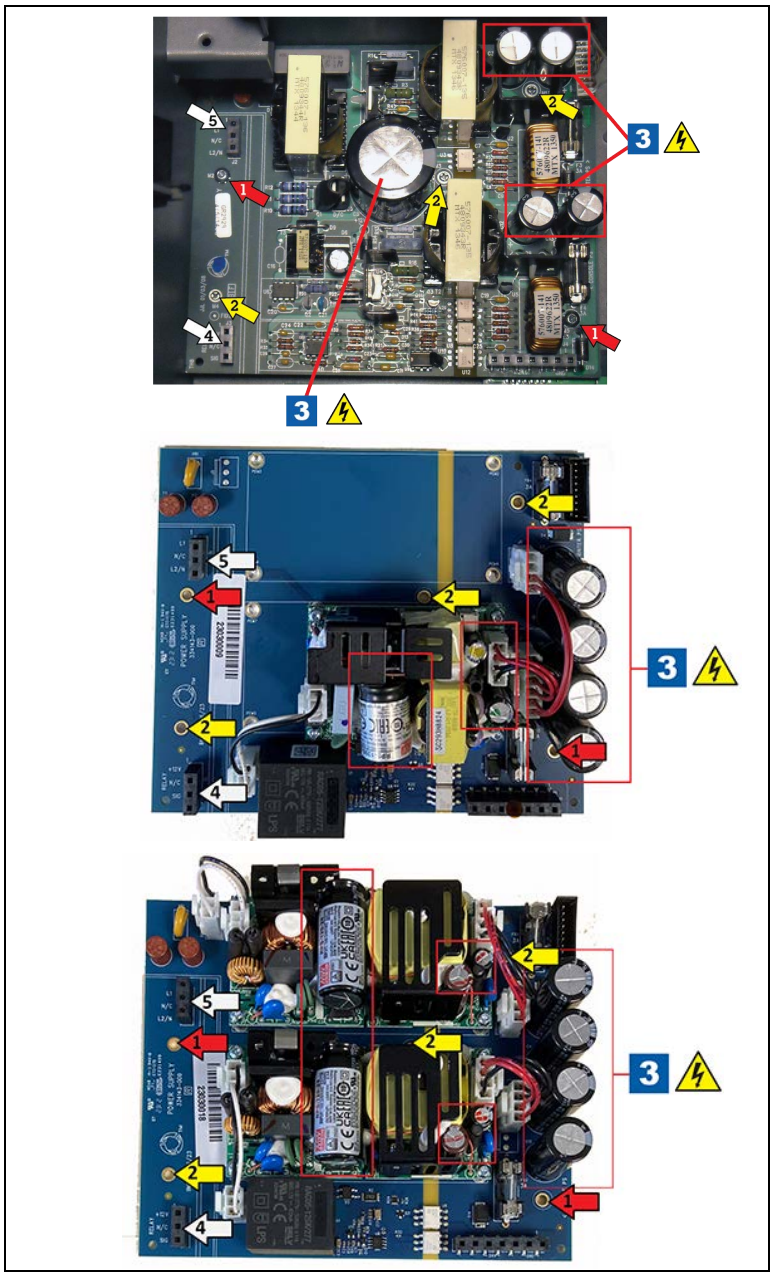


Figure 7-10. Removing One of the Three Possible Power Supply Boards

Legend For Figure 7-10			
Item	**Description**	**Item**	**Description**
1	Power Supply Board T15 securing screws	3	Power Supply Board capacitor warning. **WARNING! The five capacitors identified by pointer 3, can hold a high charge, do not touch underside of board where these caps are soldered to board.**
2	Power Supply Board retention snap pins		

11. Get the new Power Supply board and lower it into the console.
12. Attach the printer power supply cable to its connector (J1) on the upper right corner of the replacement Power Supply board.
13. Line up the three holes in the Power Supply board (see item 2 in Figure 7-10) with the three retention pins in the back of the console housing and push the board down until the pins snap into position.
14. Install the two T15 screws (item 1 in Figure 7-10) and tighten them.
15. Notice that there are two male connectors on the bottom of the AC Input Filter board that plug into two female connectors on the Power Supply board. With the handle (item 3 of Figure 7-9) of the AC Input Filter against the left side of the console housing, line up the two AC Input Filter bottom connectors over the two female connectors (items 4 and 5 in Figure 7-10) on the Power Supply board and push down on the AC Input Filter until the connectors are firmly seated.
16. Place the Power Supply shield (item 2 in Figure 7-9) over the Power Supply board and lower it down onto its two retention pins (see item 2 in Figure 7-11) and snap it into place.
17. Install the three T15 screws in the AC Input Filter (see item 1 in Figure 7-9).
18. Replace the AC Channel cover and install the two T15 screws (see Figure 7-8).

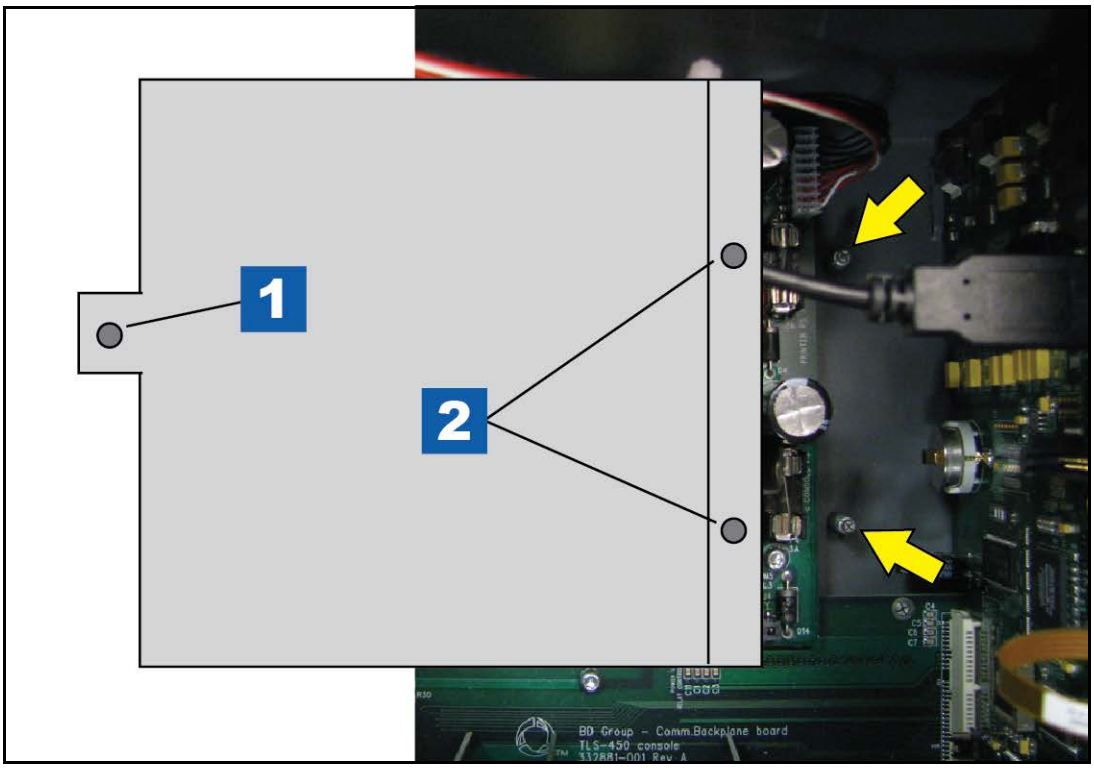


Figure 7-11. Replacing Power Supply Shield Over Power Supply Board

Legend For Figure 7-11			
Item	**Description**	**Item**	**Description**
1	T15 screws	2	Board retention snap pins

Removing The Printer/Blank (Left) Door

1. Perform all of the Steps in the section entitled “Before Turning Off Power” on page 7-2.
2. Open the console doors as described in Step 1 of the section entitled “Removing The Ack Switch Panel/ Display (Right) Door And CPU Board” on page 7-3.
3. If a printer is installed, remove the printer’s USB cable (pointer 3 in Figure 7-3) from the top USB connector (USB 1).
4. Loosen the T15 ground clamp screw securing the ground wire at the top of the Printer door and slide it free of the clamp (see Figure 7-12).

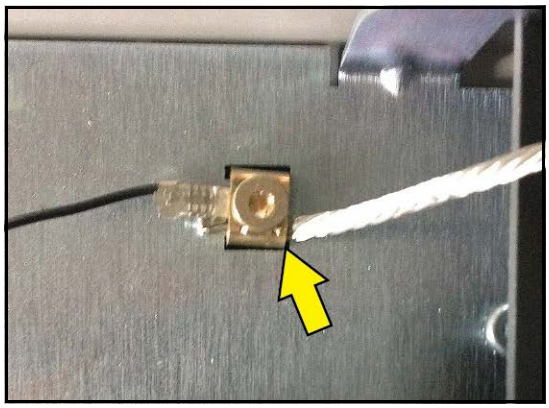


Figure 7-12. Removing Printer Door Ground Wire

5. If a printer is installed, unplug the Printer power cable plug from the Power Supply board connector. (see Figure 7-13).

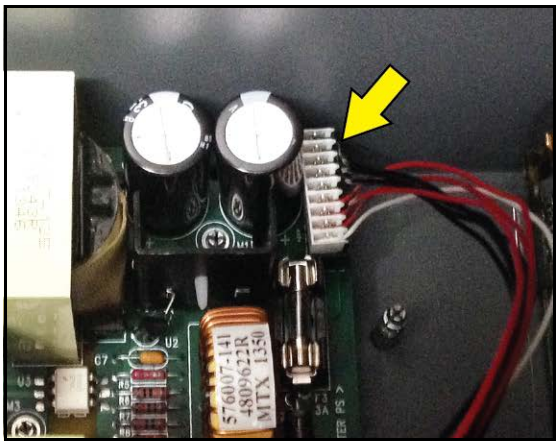


Figure 7-13. Removing Printer Door Ground Wire

6. Remove the TLS-450PLUS Printer door by removing the top and bottom hinge shoulder T15 screws (similar to the Ack Switch Panel/Display Door shoulder screws Figure 7-5).

Removing The Backup Battery

1. Perform all of the Steps in the section entitled “Before Turning Off Power” on page 7-2.
2. Open the right and left console doors as described in Step 1 of the section entitled “Removing The Ack Switch Panel/Display (Right) Door And CPU Board” on page 7-3.
3. Locate the backup battery at the top of the CPU board (see pointer 2 in Figure 7-14).

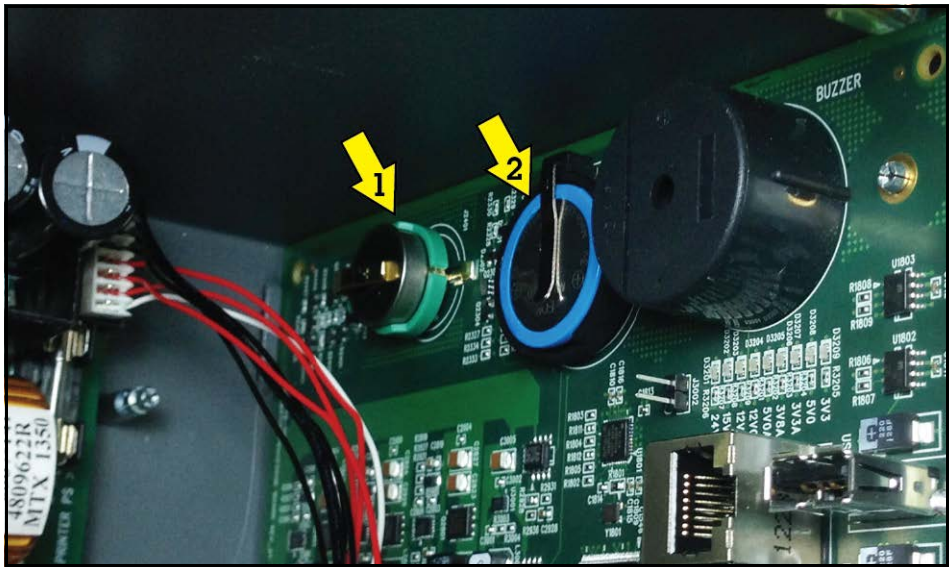
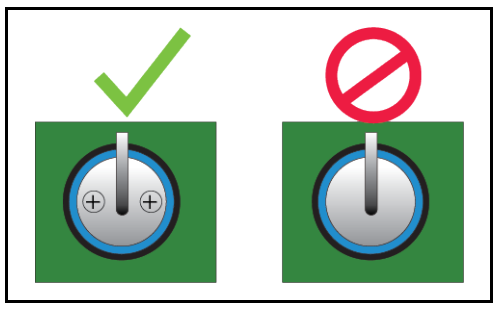


Figure 7-14. Locating Features iButton and Backup Battery

Legend For Figure 7-14			
Item	**Description**	**Item**	**Description**
1	Features iButton (Note: this part has been removed from newer TLS-450PLUS consoles.)	2	Backup Battery

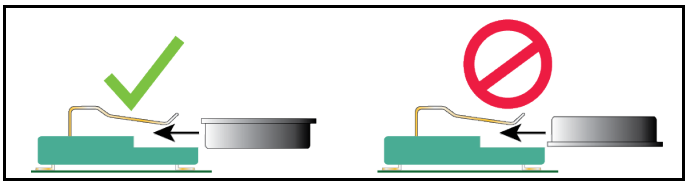
4. Remove the battery by gently lifting the retaining clip over the battery as you slide it down out of its holder. Reinstall the battery with the ‘+’ side up, by sliding it up under the retaining clip until it snaps securely into the holder:



Removing The Features iButton

NOTICE **This Section is only applicable to existing consoles with the iButton. The Features iButton has been removed from newer TLS-450PLUS consoles.**

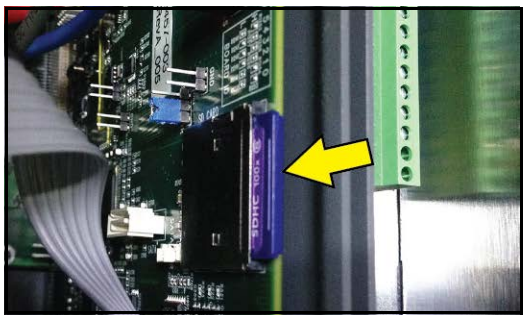
1. Perform all of the Steps in the section entitled “Before Turning Off Power” on page 7-2.
2. Open the console doors as described in Step 1 of the section entitled “Removing The Ack Switch Panel/ Display (Right) Door And CPU Board” on page 7-3.
3. Perform all of the steps in the section entitled “Removing The Ack Switch Panel/Display (Right) Door And CPU Board” on page 7-3.
4. Holding the CPU board by its edges, place it on a clean surface. Locate the Features iButton at the top of the CPU board (see pointer 1 in Figure 7-14).
5. Remove the iButton by gently lifting the retaining clip over the iButton as you slide it out of its holder.
6. When inserting the iButton make sure the flanged side is up as it is slid into its holder:



7. Replacing the CPU board and perform a Features Update procedure (Menu>Software Upgrade>Upgrade Features) to install any new software.

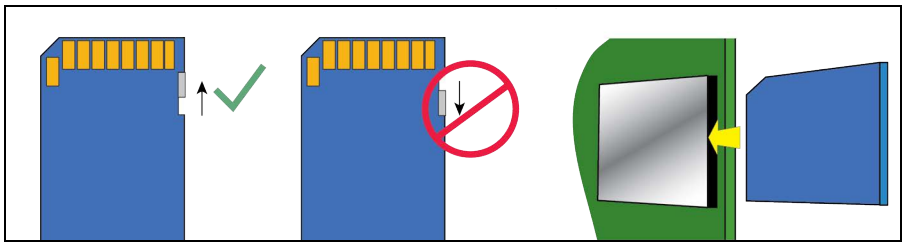
Removing The SD Card

1. Perform all of the Steps in the section entitled “Before Turning Off Power” on page 7-2.
2. Open the console doors as described in Step 1 of the section entitled “Removing The Ack Switch Panel/ Display (Right) Door And CPU Board” on page 7-3.
3. Locate the SD card on the lower front edge of the CPU board:



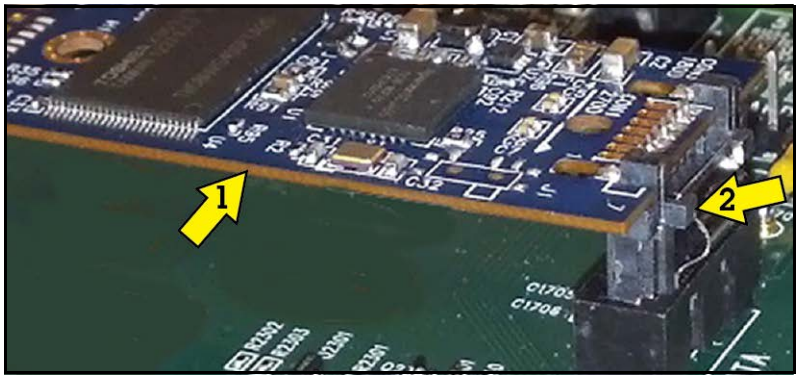
4. Remove the SD Card by pushing in on card then quickly releasing it, letting it spring free of its enclosure’s latch then slide it out.
5. Perform a database restore procedure (Menu>Software Upgrade>DB Restore) to reload system data into a new SD card.

6. Before replacing the SD Card, always check the position of the write protect slide on the side of the SD Card, making sure it is in the position shown below and then reinsert it in its enclosure until it clicks into the enclosure's latch:



Removing The SATA Drive

1. Perform all of the Steps in the section entitled "Before Turning Off Power" on page 7-2.
2. Open the console doors as described in Step 1 of the section entitled "Removing The Ack Switch Panel/ Display (Right) Door And CPU Board" on page 7-3.
3. Locate the small SATA drive board in the middle of the CPU board (pointer 1 below):



4. Wearing a static avoidance wrist strap grounded to the console, push in on the small button (pointer 2 above) to release the plug latch and lift the small SATA drive board from the connector.



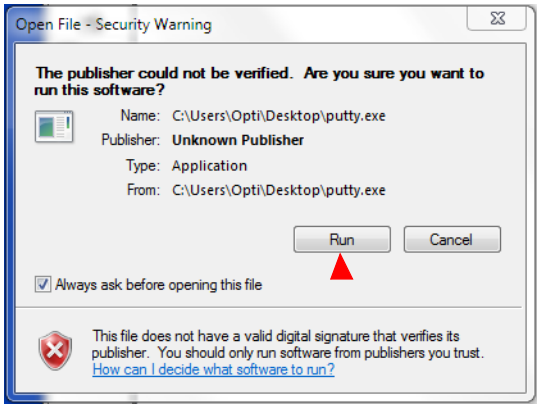
5. Handle the SATA drive by its edges and avoid touching components on the board. To reinstall push the SATA drive board plug into the CPU connector until the plug latch snaps into place.
6. Perform a database restore procedure (Menu>Software Upgrade>DB Restore) to reload system data into a new SATA drive.

8 Console Diagnostics Using The TLSTECH Diagnostic Tool

Remote users can connect to the TLS-450PLUS via a Secure Shell (SSH) Protocol to run the TLSTECH diagnostics program discussed in this section. One popular SSH tool is Putty.

Downloading and Using Putty

1. The Putty program can be downloaded from the following website:
   http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html
2. Doubleclick on the putty.exe icon you downloaded earlier to open the program
3. Click on **Run**.



1. Make the selections on the Putty Configuration dialog box as shown below and ignore the Category field selections. In the 'Host Name for IP Address' field, enter the IP address of the TLS-450PLUS console, 169.254.21.12 (see Figure 8-15). Click the **Open** button to save settings and open the TLSTECH login screen.

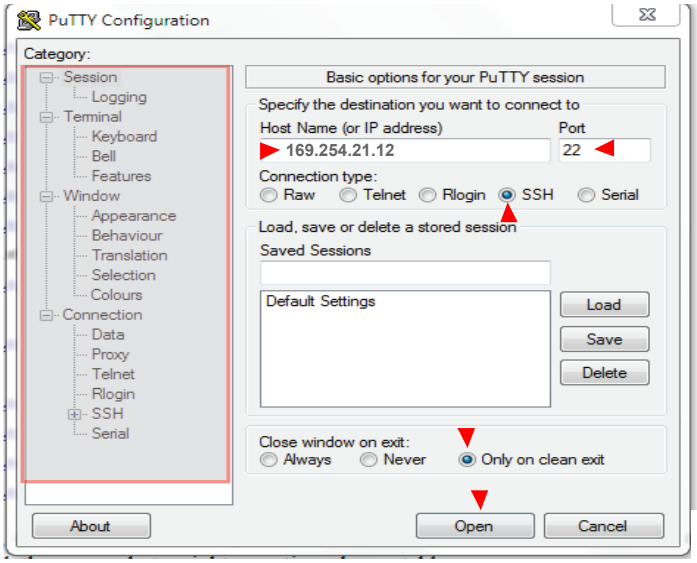
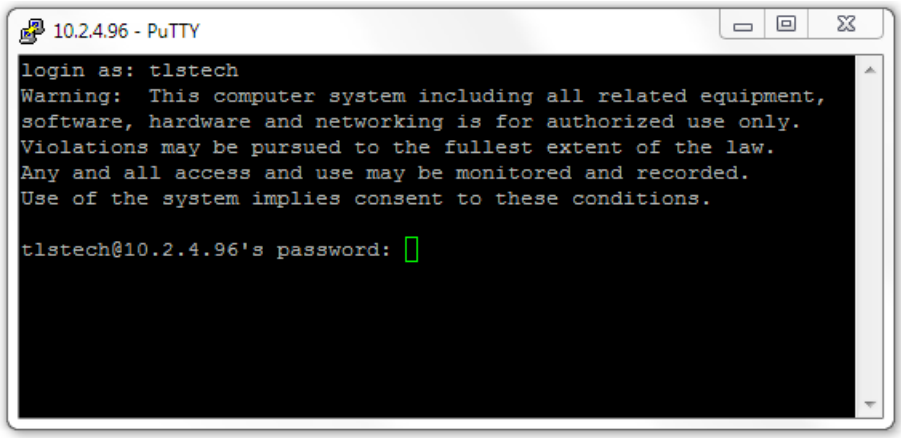
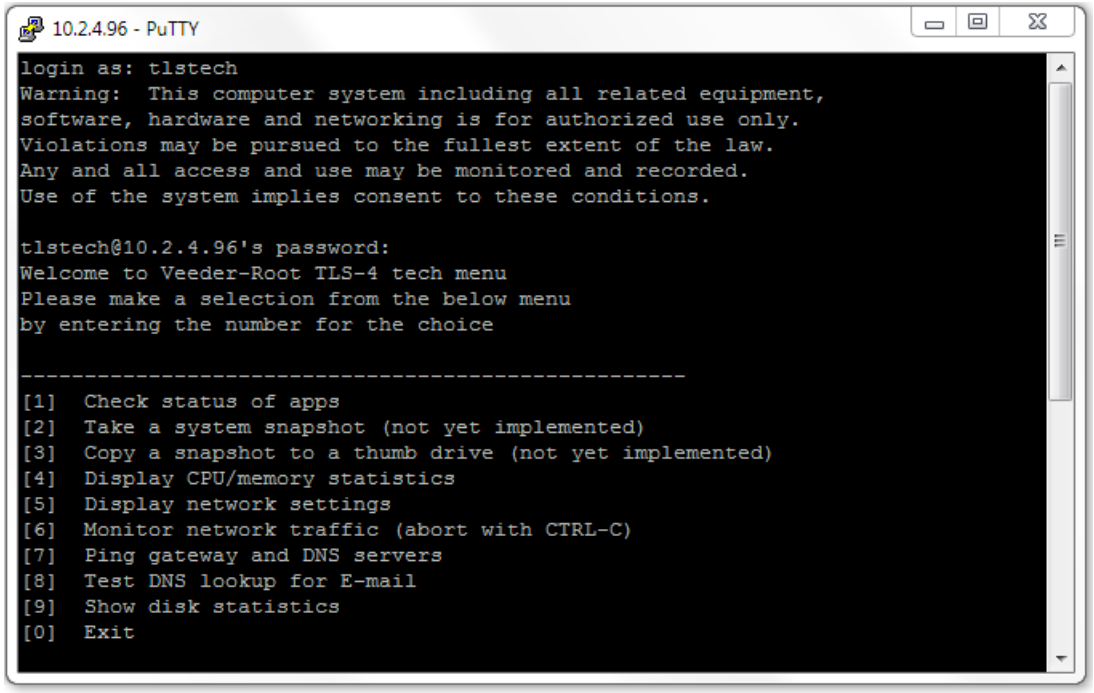


Figure 8-15. Putty Configuration Screen

2. When the login screen appears, login as **tlstech**:



3. Enter the password as follows:
   - For 450PLUS Consoles with software versions up to 6K the password is **tlstech**
   - For 450PLUS Consoles with software versions 6K and later the password is **4XXtrouble**



4. When the TLSTECH menu appears, enter the number of a desired choice then press **Enter** to view that result. To exit the program, press 0 then press Enter.

TLSTECH Menu Examples

The TLSTECH menu is shown below and examples of each menu item are shown below.

[1] Check status of apps

[2] Take a system snapshot (not yet implemented)

[3] Copy a snapshot to a thumb drive (not yet implemented)

[4] Display CPU/memory statistics

[5] Display network settings

[6] Monitor network traffic (abort with CTRL-C)

[7] Ping gateway and DNS servers

[8] Test DNS lookup for E-mail

[9] Show disk statistics

[0] Exit

MENU SELECTION 1

Checking status of apps

```
1674    mysql    mysqld
2275    exim     sendmail
6033    tlsuser  SOAPServer
6023    tlsuser  TLS-450PLUSGUI
2366    tlsuser  CommServices
2353    tlsuser  CoreServer
2343    tlsuser   CommandProcesso
2333     tlsuser  DeviceServer
2273     tlsuser  WatchDog
2236     tlsuser  MaintServer
1686     root     httpd
21676    daemon   \_ httpd
29299    daemon   \_ httpd
26014    daemon   \_ httpd
```

MENU SELECTION 4

Display system statistics

```
Linux 2.6.35.3-433-g0fae922+ (TLS-450PLUS)     08/08/13       _armv7l_       (1 CPU)

08/08/13 09:35:26
avg-cpu:   %user     %nice   %system   %iowait    %steal    %idle
           13.75      0.00     15.95      0.18      0.00    70.13

 09:35:26 up 6 days, 33 min,  1 user,  load average: 2.78, 2.81, 2.77

                     total       used       free     shared    buffers     cached
Mem:                505792     357612     148180          0      39600     197288
-/+ buffers/cache:             120724     385068
Swap:                    0          0          0
```

MENU SELECTION 5

Displaying network settings

Kernel Interface table

eth0 Link encap:Ethernet HWaddr 00:50:83:f0:04:99

inet addr:10.2.1.71 Bcast:10.2.1.255 Mask:255.255.255.0

inet6 addr: fe80::250:83ff:fef0:499/64 Scope:Link

UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1

RX packets:1833262 errors:0 dropped:0 overruns:0 frame:0

TX packets:440681 errors:0 dropped:0 overruns:0 carrier:0

collisions:0 txqueuelen:1000

RX bytes:142122262 (135.5 MiB) TX bytes:357490031 (340.9 MiB)

Base address:0x2000

eth0:9 Link encap:Ethernet HWaddr 00:50:83:f0:04:99

...

MENU SELECTION 6

Monitoring network traffic (CTRL-C to abort)

Every 2.0s: /bin/netstat -s | grep -A 7 '^Ip:'

Thu Aug 8 09:36:30 2013

Ip:

13598624 total packets received

112 with invalid addresses

0 forwarded

0 incoming packets discarded

13598512 incoming packets delivered

13266813 requests sent out

2 dropped because of missing route

MENU SELECTION 7

Pinging gateway and DNS servers

Pinging gateway

PING 10.20.95.1 (10.20.95.1): 56 data bytes

64 bytes from 10.20.95.1: icmp_seq=0 ttl=255 time=0.760 ms

64 bytes from 10.20.95.1: icmp_seq=1 ttl=255 time=1.114 ms

64 bytes from 10.20.95.1: icmp_seq=2 ttl=255 time=0.606 ms

--- 10.20.95.1 ping statistics ---

3 packets transmitted, 3 packets received, 0% packet loss

round-trip min/avg/max/stddev = 0.606/0.827/1.114/0.213 ms

Pinging name servers

PING 10.20.77.5 (10.20.77.5): 56 data bytes

64 bytes from 10.20.77.5: icmp_seq=0 ttl=127 time=0.532 ms

64 bytes from 10.20.77.5: icmp_seq=1 ttl=127 time=0.404 ms

64 bytes from 10.20.77.5: icmp_seq=2 ttl=127 time=0.387 ms

--- 10.20.77.5 ping statistics ---

3 packets transmitted, 3 packets received, 0% packet loss

round-trip min/avg/max/stddev = 0.387/0.441/0.532/0.065 ms

PING 10.28.54.15 (10.28.54.15): 56 data bytes

64 bytes from 10.28.54.15: icmp_seq=0 ttl=124 time=39.489 ms

64 bytes from 10.28.54.15: icmp_seq=1 ttl=124 time=27.339 ms

64 bytes from 10.28.54.15: icmp_seq=2 ttl=124 time=27.159 ms

--- 10.28.54.15 ping statistics ---

3 packets transmitted, 3 packets received, 0% packet loss

round-trip min/avg/max/stddev = 27.159/31.329/39.489/5.770 ms

MENU SELECTION 8

Testing Internet e-mail MX lookup with configured DNS servers

Server: 10.20.77.5

Address: 10.20.77.5#53

Non-authoritative answer:

veeder.com mail exchanger = 10 mail.global.frontbridge.com.

Authoritative answers can be found from:

mail.global.frontbridge.com internet address = 216.32.180.190

mail.global.frontbridge.com internet address = 216.32.181.178

mail.global.frontbridge.com internet address = 65.55.88.22

mail.global.frontbridge.com internet address = 207.46.163.30

mail.global.frontbridge.com internet address = 213.199.154.190

mail.global.frontbridge.com internet address = 213.199.154.254

mail.global.frontbridge.com internet address = 213.199.180.150

mail.global.frontbridge.com internet address = 216.32.180.22

Server: 10.28.54.15

Address: 10.28.54.15#53

Non-authoritative answer:

veeder.com mail exchanger = 10 mail.global.frontbridge.com.

Authoritative answers can be found from:

mail.global.frontbridge.com internet address = 216.32.180.22

mail.global.frontbridge.com internet address = 216.32.180.190

mail.global.frontbridge.com internet address = 216.32.181.178

mail.global.frontbridge.com internet address = 65.55.88.22

mail.global.frontbridge.com internet address = 207.46.163.30

mail.global.frontbridge.com internet address = 213.199.154.190

mail.global.frontbridge.com internet address = 213.199.154.254

mail.global.frontbridge.com internet address = 213.199.180.150

MENU SELECTION 9

Showing disk related information

Disk devices:

NAME FSTYPE SIZE MOUNTPOINT

mmcblk0 3.8G

|-mmcblk0p1 1.9G /

`-mmcblk0p2 1.9G

Disk usage:

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
rootfs	rootfs	1.9G	1013M	742M	58%	/
/dev/root	ext3	1.9G	1013M	742M	58%	/
tmpfs	tmpfs	10M	4.0K	10M	1%	/dev
tmpfs	tmpfs	247M	228K	247M	1%	/tmp
tmpfs	tmpfs	247M	4.0K	247M	1%	/dev/shm
tmpfs	tmpfs	247M	0	247M	0%	/run

IO statistics:

03/08/14 08:26:42

Device:	tps	kB_read/s	kB_wrtn/s	kB_read	kB_wrtn
mmcblk0	0.80	28.91	7.16	141526	35052
mmcblk0p1	1.74	28.71	7.16	140521	35044

mmcblk0p20.030.140.006698

9 Probe Troubleshooting

This section contains basic probe problem diagnosis and suggested corrected actions for troubleshooting Magnetostrictive Probes (Table 9-1). Refer to TLS-450PLUS Site Prep and Installation Manual (Veeder-Root No. 577014-073) and the appropriate probe installation manual for more information about probe, conduit, and wiring installation.

NOTICE **Removing the probe from the tank while connected to the console will cause a "Sudden Loss Alarm" which must be cleared after the probe is reinstalled.**



Turn off, tag, and lockout power to the console before opening display door assembly!

Table 9-1. Mag Probe Troubleshooting

Alarm	Problem	Probable Cause	Corrective Procedure
N/A	Incorrect height/volume reading	Incorrect float size programmed	Reprogram actual installed float size
		Incorrect or missing setup data	Print out setup data and check for errors.
		Incorrect tank tilt value	Check tank tilt and correct if necessary.
		Probe wired to wrong probe channel on probe module	Verify probe is wired to correct channel.
		Probe not sitting on bottom of tank	Check and correct position of probe, if necessary.
		Fuel float stuck in riser tube.	Remove float from riser and install split-ring collar (P/N 576008-617) on probe shaft below riser tube to prevent recurrence of problem.
		Water or fuel float assembly missing or ring magnet defective.	Replace float assembly.
		Fuel float assembly installed upside down	Correct float assembly installation.
		Dirty probe shaft.	Clean probe shaft so that float moves freely up and down.
		Defective probe	Swap with probe from another tank. If problem follows probe, replace probe.
Water Warn/ High Water Alarm	Incorrect water height reading	Wrong or missing ballast	Install correct water float assembly.
		Water float sitting on debris at bottom of tank.	Check for debris on bottom of tank and clean if necessary.
Invalid Fuel Level	Invalid fuel height on warning display	Fuel level is too low and fuel float is sitting on the water float.	Call for delivery.
Low Product Alarm	Low or invalid product	Fuel is too low	Call for delivery.

Table 9-1. Mag Probe Troubleshooting

Alarm	Problem	Probable Cause	Corrective Procedure
N/A	Fuel level reading equals full tank volume even though fuel level is below full volume.	Fuel float stuck in riser.	Remove float from riser and install split-ring collar (P/N 576008-617) on probe shaft below riser tube to prevent a recurrence of the problem.
	Probe reading on console display disappears or appears intermittently.	Defective probe cable	Replace cable.
	Ghost Deliveries.	Splices in wiring	See Note 1.
		Defective field wiring	Check for open or shorted wires, or absence of epoxy seal kits around field connections. Refer to “Field Troubleshooting Probe-Out Alarms” procedure below for more details.
		Other control wires in probe conduit	See Note 1.
		Conduit not grounded properly	See Note 1.
		Non-metallic conduit present	See Note 1.
		Variable speed submersible pump in use	See Note 1.
		Defective barrier board	Replace barrier board.
		Defective probe	Replace probe.
	Fuel temperature reading is incorrect	Defective thermal sensor in probe.	Replace probe.
	Leak Test Invalid - Recent delivery	A delivery occurred during the leak detect test or within 8 hours prior to the console’s entering the leak detect mode.	Retest, waiting longer than 8 hours after last delivery.
	Leak Test Invalid - Tank level low	Fluid level is too low. Insufficient product in tank for satisfactory thermal compensation.	Fill tank to half full or more.
	Leak Test Invalid - First hour error	Consult factory.	Consult factory.
	Leak Test Invalid - Last hour error	Consult factory.	Consult factory.

Table 9-1. Mag Probe Troubleshooting

Alarm	Problem	Probable Cause	Corrective Procedure
N/A	Leak test invalid - temp out of range	Fuel temp reading is below 0°F or above 100°F.	Retest when product temperature is between 0 -100°F.
		Defective probe.	Replace probe.
	Temp change error - w/0.1 gph test	Temp of fuel changed by more than 1/10th degree per hour during the leak test.	Retest.
	Temp change error - w/0.2 gph test (Mag 2 probe only).	Temp of fuel changed by more than 2/10th degree per hour during the leak test.	Retest.
	Temp change error - zone change error	Temp of any covered thermistor changed more than 3/10th degree per hour during leak test.	Retest.
	Temp change error - head change error	Temp in head of probe changed more than 1/10th degree per hour during leak test.	Retest.
Fuel Quality Alarm - Tank has Ethanol-Blended Gasoline floats	Water/phase separation	Water/phase separation may be present in tank.	Test fuel at bottom of tank to ensure water/phase separation is not present.
Density Warning	Tank product density has exceeded preset limits.	The tank density is either greater than the tank density low limit plus 1.00 KG/M^3 (0.062 LBS/FT^3) , or is less than the tank density high limit minus 1.00 KG/M^3 (0.062 LBS/FT^3).	Verify fluid density. Retest when product density is within the tank density low and high limits.

NOTE 1. Refer to TLS-450PLUS *Site Prep and Installation Manual* (Veeder-Root No. 577014-073).

Field Troubleshooting Probe-Out Alarms

You must verify all locations utilizing shielded cable are wired correctly.



Turn off, tag, and lockout power to the console before opening display door assembly!

Verify that the drain wire of the shielded cable is connected to the console end only. If the drain wire is connected on both ends this creates a ground loop which can produce Probe-Out Alarms. Remove power from the console before disconnecting the probe cable from the probe.

Follow these steps in sequence to troubleshoot probe-out alarms.

All probes returned for a warranty claim must be accompanied with the documentation produced during the following troubleshooting procedures to document the failure.

For any of the following steps that produce a printout from the console, those printouts must be provided with any returned probe.

If no printer is available then you must record the information specified below:

1. From the Home screen touch **Menu>Reports>Alarms>Reports**

   - Print / record the active alarms

2. From the Home screen touch **Menu>Diagnostics>Probe>Overview**

3. Select the malfunctioning probe and view each of the diagnostics tab screens. Print out the contents of each tab screen report for the suspect probe.

4. The Probe distance from the console must be less than 1000 feet. If the distance is greater than this probe operation is not guaranteed.

5. Ensure the probe wiring conforms to the requirements detailed in the TLS-450PLUS Site Prep and Installation Manual (Veeder-Root No. 577014-073).

6. Verify the console is grounded correctly.

   - Is the ground wire at least a 12AWG conductor? Remove ground cable from the grounding lug inside the console, use an ohmmeter to measure resistance from the ground wire to a known good ground. The resistance reading should be less than 1ohm.

   - If resistance is greater than 1 ohm, the console is not properly grounded. Either repair the ground connection or contact the installation company to ensure proper grounding is established.

7. Verify the console is on a separate circuit breaker with no shared branch circuits.

8. Verify the polarity of the probe wiring is correct from the probe to the console. The probe cable black conductor must be connected to the probe module (-) Negative. The probe cable white conductor must be connected to the probe module (+) Plus. NOTE: If probe is wired backwards it will be recognized as a liquid sensor.

9. Disconnect the probe cable connector from the probe and inspect both the probe cable female pins and the male pins on the probe for corrosion. If corrosion or contamination is suspected clean with electrical cleaning solution and reconnect probe cable. Verify alarm condition is cleared.

10. Open probe junction box and inspect connections for the probe wires and the connecting field wiring. These connections must have Veeder-Root supplied epoxy packs on the splices. Corroded splices will create Probe Out alarms. If Veeder-Root supplied epoxy packs are present, inspect them to make sure there is no water inside the packs where the connections are made. Verify that the wire nuts and cable sheathing are immersed in epoxy. The epoxy should be "rock hard". If no epoxy packs were utilized, the Veeder-Root installation procedures were not followed. Refer to the appropriate installation manual for correct installation procedures.

11. Before proceeding, ensure that console power is Off. (If only one tank exists or the suspect probe cannot be installed in another tank at the site, proceed to step 13). Swap the non-working probe with a working one from another tank to determine if the problem follows the probe or stays with the tank. When swapping probes, disconnect the probe cable connector on the top of the probes and swap the probes between the tanks. Do not swap probes and cables at the same time. If the problem moves to the other tank, replace the probe. If the problem stays with the original tank after swapping probes, go to step 13. If the Probe Out clears and does not return on either tank wait 30 minutes to see if alarm returns. If it does not return, leave the probes in-place and wait for the customer to contact you if the problem reoccurs. If problem reoccurs within a reasonable period of time on the tank the suspect probe is now in, then replace the probe. If it returns on the original tank then follow the steps for troubleshooting wiring and connectors.

12. Replace the probe cable. If the problem persists, move the wires on the probe module from the non-working channel to a known working channel (if possible). If the probe works on the known working channel, replace the probe module. If the problem still exists on the known working channel, remove the probe from the tank and bring it to the console. Connect it directly to the console (you will need a spare probe cable). If the Probe-Out

Alarm clears with the probe wires connected directly to the console, then there is a problem with the field wiring.

13. Measure the resistance of the probe wiring from the probe end of the cable to its connections at the console. First disconnect the cable from the console and twist the two ends together. Then remove the connector from the probe canister. Measure the resistance across the two connector pins. The resistance should be low. It should equal (approximately) the cable manufacturer's single conductor resistance per foot times the length of the cable run times two:

    -14 AWG should measure 2.52 ohms/1000 feet

    -16 AWG should measure 4.02 ohms/1000 feet

    -18 AWG should measure 6.39 ohms/1000 feet

    If the resistance is higher than the cable manufacturer's specification, either the cable is defective or there are poor connections between the console and the probe. If the resistance is within the cable manufacturer's specification, measure the resistance between one of the connector pins and the field wiring conduit to verify it is not shorted (this resistance should be very high [megohms to infinity]). If the cable is good, reconnect the cable at the probe and the console.

14. Verify that the probe riser is not magnetized. This can be accomplished by using a metal paper clip on a string. Dangle the paper clip suspended by a string into the probe riser to determine of the riser pipe is magnetized. If the paper clip is attracted to one side of the riser pipe, replace the riser (this is rare, but it has occurred).

Minimum Detected Fluid Levels

Table 9-2. Mag Probe Minimum Detected Fluid Levels

Circuit Code	Mag Probe Type	Leak Detect	Name Plate Color	Water Detect	4" Ethanol-Blended Gasoline Floats		4" Floats		3" Floats		2" Floats	
					Min. Fuel Level	Min. Water Level	Min. Fuel Level	Min. Water Level	Min. Fuel Level	Min. Water Level	Min. Fuel Level	Min. Water Level
Mag Probes - Form Number 8473												
C000	Std., 2 float	0.10 gph	Black	Yes	—	—	8"	0.75"	—	—	9.5"	0.75"
C001	Std., 2 float	0.20 gph	Red	Yes	—	—	8"	0.75"	—	—	9.5"	0.75"
D000	Std., Inv. only, 2 flt	None	Green	Yes	—	—	8"	0.75"	—	—	9.5"	0.75"
D001	Alt., 1 float	0.10 gph	Black	No	—	—	5"	—	—	—	7"	—
D002	Alt., 1 float	0.20 gph	Red	No	—	—	5"	—	—	—	7"	—
D003	Alt., Inv. only	None	Green	No	—	—	5"	—	—	—	7"	—
Mag Probes - Form Numbers 8463 & 8493												
D004	2 float	0.10 gph	Black	Yes	7.000"	0.38"	3.04"	0.63"	3.04"	0.63"	3.23"	.867"
D005	2 float	0.20 gph	Red	Yes	7.000"	0.38"	3.04"	0.63"	3.04"	0.63"	3.23"	.867"
D006	Inv. only, 2 flt	None	Green	Yes	7.000"	0.38"	3.04"	0.63"	3.04"	0.63"	3.23"	.867"
D007	1 float	0.10 gph	Black	No	—	—	0.985"	—	0.985"	—	3"	—
D008	1 float	0.20 gph	Red	No	—	—	0.985"	—	0.985"	—	3"	—

Table 9-2. Mag Probe Minimum Detected Fluid Levels

Circuit Code	Mag Probe Type	Leak Detect	Name Plate Color	Water Detect	4" Ethanol-Blended Gasoline Floats		4" Floats		3" Floats		2" Floats	
					Min. Fuel Level	Min. Water Level	Min. Fuel Level	Min. Water Level	Min. Fuel Level	Min. Water Level	Min. Fuel Level	Min. Water Level
D009	Inv. only, 1 flt	None	Green	No	—	—	0.985"	—	0.985"	—	3"	—
Mag Probes - Form Number 8468												
D021	Inv. only 2 flt	None	Blue	Yes	—	—	3.04"	0.63"	3.04"	0.63"	3.23"	0.867"
D022	Inv. only, 2 flt	None	Blue	Yes	—	—	3.04"	0.63"	3.04"	0.63"	3.23"	0.867"
D023	Inv. only, 1 flt	None	Blue	No	—	—	0.985"	—	0.985"	—	3"	—
D024	Inv. only, 1 flt	None	Blue	No	—	—	0.985"	—	0.985"	—	3"	—
Density Mag Probes - Form Number 8860												
D041	Mag- D	0.10 gph	Black	Yes	—	—	—	—	—	—	8.0"	1.5"
D042	Mag- D	0.20 gph	Red	Yes	—	—	—	—	—	—	8.0"	1.5"
D043	Inv only, Mag- D	None	Green	Yes	—	—	—	—	—	—	8.0"	1.5"

Mag Probe Channel Counts in Common Liquids

Table 9-3 below shows the normal operating range of channel counts for magnetostrictive probes in common liquids (fuels).

Table 9-3. Mag Probe Channel Counts in Common Liquids

Probe Length	Channel	Normal Count Range*
All Probes	C00 (No Water)	0 - 1500
4 Foot Probe	C01-C10	700 - 17040
5 Foot Probe	C01-C10	700 - 21300
6 Foot Probe	C01-C10	700 - 25560
7 Foot Probe	C01-C10	700 - 29820
7 Foot, 6 Inch Probe	C01-C10	700 - 31950
8 Foot Probe	C01-C10	700 - 34080
9 Foot Probe	C01-C10	700 - 38340
10 Foot Probe	C01-C10	700 - 42600

*Channels C06 - C10 are only updated when necessary. Therefore the counts for C01 - C05 will normally be different from the counts for C06 - C10. Channel counts outside of this range indicate a defective probe – replace probe.

10 Sensor Troubleshooting

This section contains suggested corrective actions for troubleshooting sensor problems.



Turn off, tag, and lockout power to the console before opening display door assembly!

Sensor Alarm Will Not Clear

Liquid or fuel in containment area.

Sensor Out Alarms

Follow these steps in sequence to troubleshoot Sensor Out alarms.

1. Verify that the distance from the sensor to the TLS is less than 1000 feet.
2. Verify that the sensor wiring conforms to the requirements detailed in the Site Prep and Installation Manual (P/N 577014-073) and that it connects the console to the sensor.
3. Verify that the console grounding is correct. Make sure there are two grounds and that one is at least a 12 AWG (or larger diameter) conductor. Check that the grounding conductors are properly connected to a good ground source. Measure the resistance to ground, it should be less than one ohm.
4. Verify that the console is on a separate circuit breaker with no shared branch circuits.
5. Verify that the sensor connects to the proper connector position and that polarity (required for some sensors) is maintained from the sensor to the console. If necessary, refer to the Sensor Products Application Guide (P/N 577013-750) for correct sensor/console compatibility and sensor specifications.
6. View the diagnostic screen for the problem sensor and search for information that may help you determine the root cause of the sensor's problem.
7. Consider directly connecting the sensor to the console to confirm a faulty sensor.

Setup Data Warning

This alarm could be posted by one of three setup errors:

1. A label for the sensor was not entered during setup.
2. The wrong sensor type was selected during setup.
3. The sensor was not configured during setup but the console measures a resistive value and determines a device is connected.

Unstable Sensor Readings

Unstable sensor readings may be the result of intermittent signals or electro-magnetic interference (EMI). Some causes of unstable sensor readings are discussed below.

1. Shielded cable was not used between the sensor and the console, or if it was, it was not grounded correctly. See the Site Prep and Installation Manual (P/N 577014-073) for installation requirements.

2. Extra wires (not connected to the console) in the sensor conduit. They should be removed.
3. Damaged wiring insulation exposing bare conductors to moisture in the conduit. This condition may also appear as readings showing lower than normal or the same reading, regardless of the state of the sensor.
4. Moisture causing the sensor wiring to short to the conduit. This can become evident after rainy wet weather or flooding. Measuring the resistance with a standard volt-ohm meter may not identify a short due to moisture.
5. Connect the sensor directly to the console to determine if the reading is still unstable. If it stabilizes, the problem is between the console and the sensor. If fluctuation continues with the sensor connected directly to the console, change the sensor.

Cleaning Fuel Contaminated Discriminating Sensors

DISCRIMINATING SENSORS 794380-320, -322, -350, -352

Sensors exposed to gasoline should be removed from the pan or sump, dried off, and be allowed to recover in a well-ventilated area for up to 7 days. Note: recovery time will vary depending on the ambient temperature and how long the sensor was exposed to fuel. Sensors exposed to diesel fuel must be soaked in Coleman® fuel for 30 minutes and be allowed to recover in a well-ventilated area for up to 7 days.

DISCRIMINATING SOLID-STATE SENSOR - OPTICAL (P/N 794380-343, -344)

To clean contaminated optical sensors, dip the sensor into a small container of alcohol and briefly swirl it around to rinse it off.

Sensor Troubleshooting

COMM ALARMS

1. The console cannot reliably communicate with the sensor. This could be caused by a poor wiring connection, faulty sensor, faulty USM module, or an electrically noisy line.
2. Connect the sensor directly to the console to troubleshoot field wiring, noisy line issues. If unit is ok, check wiring connections, wire conductivity, etc., to isolate the problem.

MAG SENSOR

1. Verify threshold parameters entered during setup for this sensor are correct.
2. Following the alarm upgrade delay period, if enabled, any designated Fuel, Water, High Liquid, and Low Liquid ‘warnings’ will change to ‘alarms’ - even if the liquid in the containment area is only at the warning level.
3. For a Sensor Fault Alarm the console is reading the Mag Sensor, but the readings are unstable. The problem could be the sensor itself (float missing, bad probe, etc.) or electrical noise on the line (similar to effects on mag probes).
4. An Install Alarm is posted if the Mag Sensor is not firmly resting on the bottom of the monitored pan/sump. Check that the sensor is installed correctly.

11 CSLD Troubleshooting

CSLD collects information during each idle time to form a highly accurate leak detection database. Since the database is being constantly updated, leak test results are always current. Periodic leak tests are performed using the best data from up to the previous 28 days, and test results are continuously updated as new data is gathered. Invalid data is discarded and only the best data is used to ensure accurate leak test results and fewer false alarms. Test results are provided automatically every 24 hours at 8:00 a.m.

CSLD Tank Limitations

All applications of CSLD should conform to the following installation guidelines.

LEAK THRESHOLD

Leak Thresholds for maximum tank capacity of 58,752 gallons and monthly maximum throughput of 1, 538,015 gallons are shown below:

System	Threshold	PD	PFA
Single Tank	0.17	98.6%	<0.001%
Manifolded Tanks	0.16	98.5%	<0.001%

APPLICABILITY

Gasoline, diesel, aviation fuel, fuel oil #4, solvents, biodiesel blends B6-B20 meeting ASTM D7467, biodiesel B100 meeting ASTM D6571, ethanol and ethanol-gasoline blends.

TANK CAPACITY

Maximum of 58,752 gallons for the leak thresholds shown above. Maximum tank capacity listed is for single tanks and up to 3 tanks manifolded together. the minimum product level required to a test is 15% full.

THROUGHPUT

Monthly maximum of 1,538,015 gallons for leak thresholds shown above.

CSLD Block Diagrams

Figure 11-1 illustrates the CSLD decision process in block diagram form and Figure 11-2 diagrams the timing of events during a CSLD test.

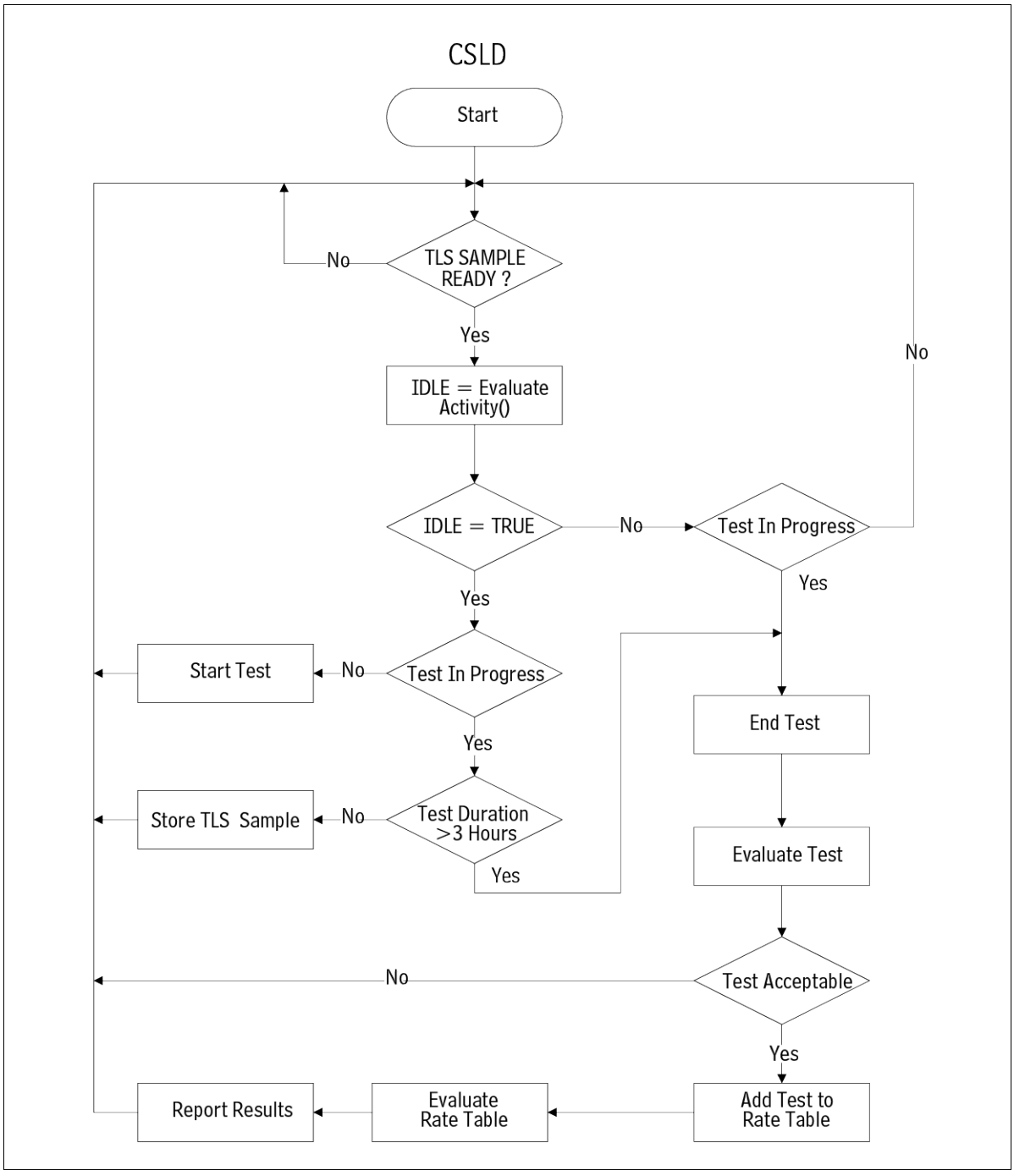


Figure 11-1. CSLD Decision Process Block Diagram

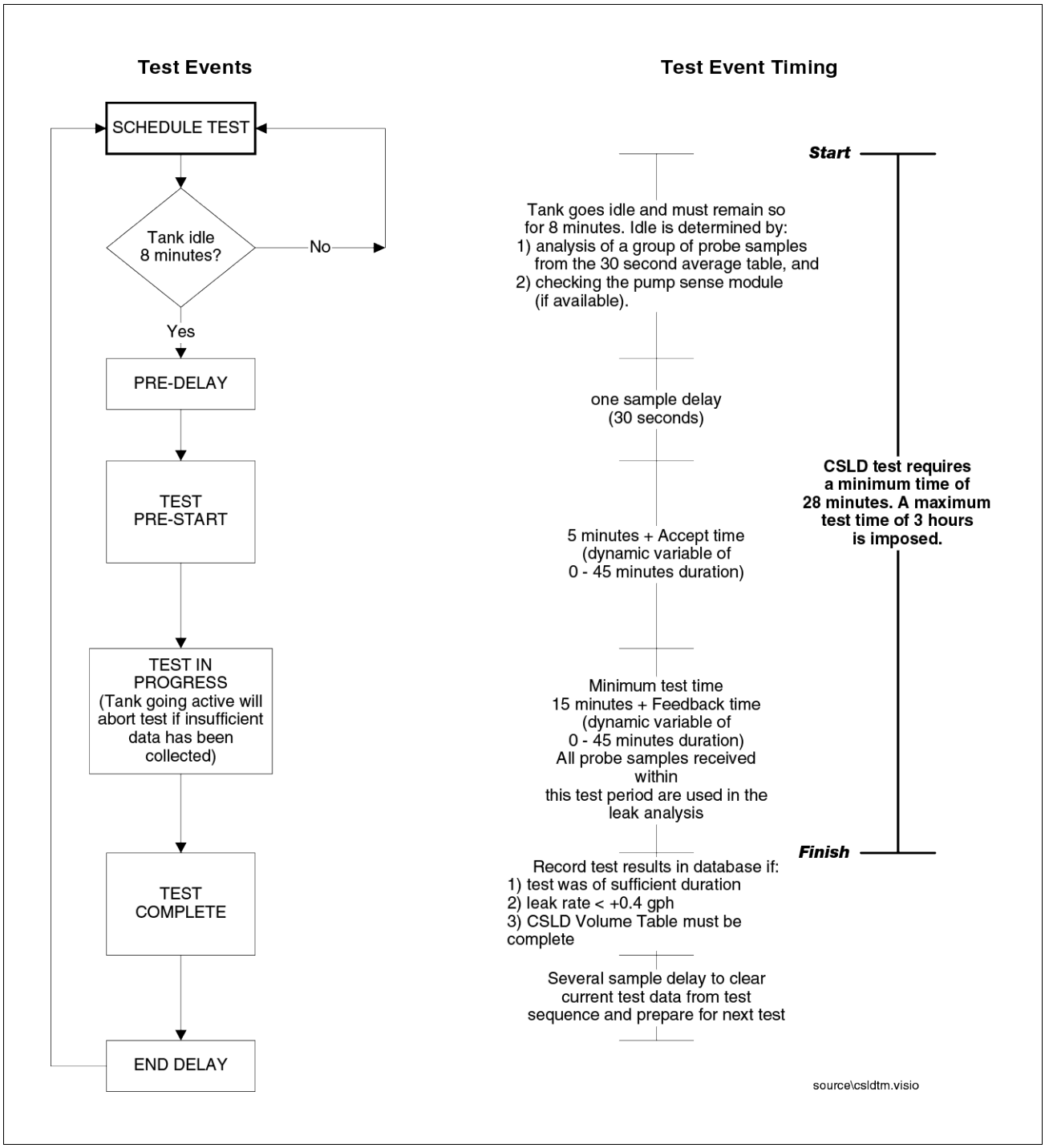


Figure 11-2. CSLD Leak Test Timing Sequence

CSLD Diagnostic Aids

Due to the complexity of CSLD, most information required to troubleshoot the product is accessible only using RS-232 commands via direct or modem connection. If you do not have a computer or data terminal to collect this data you will not be able to resolve CSLD alarms.

In order to troubleshoot CSLD problems you must retrieve the following reports via the RS-232 port or modem:

1. IA5100 - CSLD Rate Table (see Figure 11-3)

   This table contains the last 28 days of leak tests, or a maximum of 80 of the most recent tests.

2. IA5200 - CSLD Rate Test (see Figure 11-4)

   This report contains the CSLD summary of the evaluation of the raw test data collected in the Rate Table.

3. IA5300 - CSLD Volume Table (see Figure 11-5)

   This report contains volume samples collected once every hour. CSLD uses this data to determine the amount of dispensing that has occurred during the last 24 hours.

4. IA5400 - CSLD Moving Average Table (see Figure 11-6)

   This report contains averaged probe data collected every 30 seconds. CSLD uses this data to determine if the tank is idle or active, and to perform the leak test.

```
IA5100
MAR 14, 1996  8:12 AM


CSLD DIAGNOSTICS: RATE TABLE
T 1:SUPER
      TIME ST    LRT AVTMP TPTMP BDTMP  TMRT DSPNS   VOL INTVL    DEL ULLG EVAP

9602202227  0 -0.016  39.2  38.3  36.3  0.02   191  4281 174.5    2.7  168  0.000
9602210128  0  0.016  39.3  38.2  35.9  0.02   169  4281 174.5    5.7  168  0.000
9602210428  0 -0.022  39.4  38.2  35.6  0.03   162  4281  57.5    8.7  168  0.000
9602210636  1  0.106  39.5  38.3  35.8  0.02   213  4207  19.5   10.8  172  0.000
9602210718  1  0.118  39.5  38.4  35.9  0.00   215  4175  19.5   11.5  173  0.000
9602212259  3  0.007  40.2  39.0  37.1  0.02   460  3557 174.5   27.2  204  0.000
```

----- Partial set of entries shown ------

```
TIME      Test start time. (YYMMDDHHMM)

ST        Test qualification status at last evaluation.
          0 Test valid
          1 Test rejected - duration too short.
          2 Test rejected - start time too close to a delivery.
          3 Test rejected - excessive dispensing prior to test.
          4 Test rejected - excessive temperature change during test.
          6 Test rejected - leak rate outlier.

LRT       Leak rate in gph (negative number = a loss, no sign = a gain)

AVTMP     Average fuel temperature

TPTMP     Temperature of top thermistor in the tank.

BDTMP     Temperature of thermistor on the board.

TMRT      Rate of temperature change during the test.

DSPNS     Factor related to the amount of dispensing prior to the test.

VOL       Volume at the start of the test.

INTVL     Test Duration in minutes.

DEL       Time since the last delivery in hours.

ULLG      Amount of surface area of the tank that is not covered by fluid.

EVAP      If the Reid Vapor Pressure table has been entered, the evaporation rate will
          be here.
```

Figure 11-3. CSLD Rate Table Example

```
IA5200
MAR 14, 1996  8:12 AM


CSLD DIAGNOSTICS: RATE TEST

TK        DATE  LRATE INTVL ST  AVLRTE    VOL  C1  C3 FDBK ACPT  THPUT EVAP  RJT
 1  9603140346 -0.031  33.7  1   0.002   3525  74  15 38.3 28.9  31.63 0.000   0
 2  9603140342  0.000  32.2  1   0.004   3184  74  15 38.3 28.9  29.85 0.000   0
 3  9603140151  0.051  26.8  1   0.039   6165  49  16 10.1  8.8  43.67 0.000   0
 4  9603140646 -0.000  53.0  1  -0.003   1762  80  26 45.0 44.8  20.22 0.000   0
```

```
DATE      The date of the last rate table evaluation (YYDDMMHHMM)

LRATE     Compensated leak rate in gph (negative number = a loss, no sign = a gain)

INTVL     Total test duration, sum of all acceptable tests, in hours.

ST        Status:
          0 NO TEST - no evaluation.
          1 PASS
          2 FAIL
          3 NOT USED.
          4 INVALID - obsolete.
          5 NO DATA:COUNT - not enough tests available to evaluate. There must be
            at least 2 acceptable tests.
          6 NO DATA:INTERVAL - not enough total test time to evaluate (< 6 hours).
          7 NO DATA:RANGE -  tests did not range over a sufficient time period.
                         test time < 10 hours AND tests date range < 5 DAYS.
          8 WARNING INCREASE  - excessive positive leak rate.
          9 WARNING NEGATIVE_HOLD - 2 day waiting period before reporting a
            failure.

AVLRTE    Uncompensated Leak Rate, in gph (negative number = a loss, no sign = a gain)

VOL       Average volume of all acceptable tests.

C1        Total number of tests in the rate table.

C3        Number of acceptable tests.

FDBK      Feedback control variable, range 0 to 45 minutes.

ACPT      Accept control variable, range 0 to 45 minutes.

THPUT     Estimated monthly throughput in thousands of gallons.

EVAP      If the Reid Vapor Pressure table has been entered, the evaporation rate will
          be here.

RJT       Of the last 20 tests completed, this is the number of tests rejected due
          to excessive positive leak rate (>0.4 gph).
```

Figure 11-4. CSLD Rate Test Example

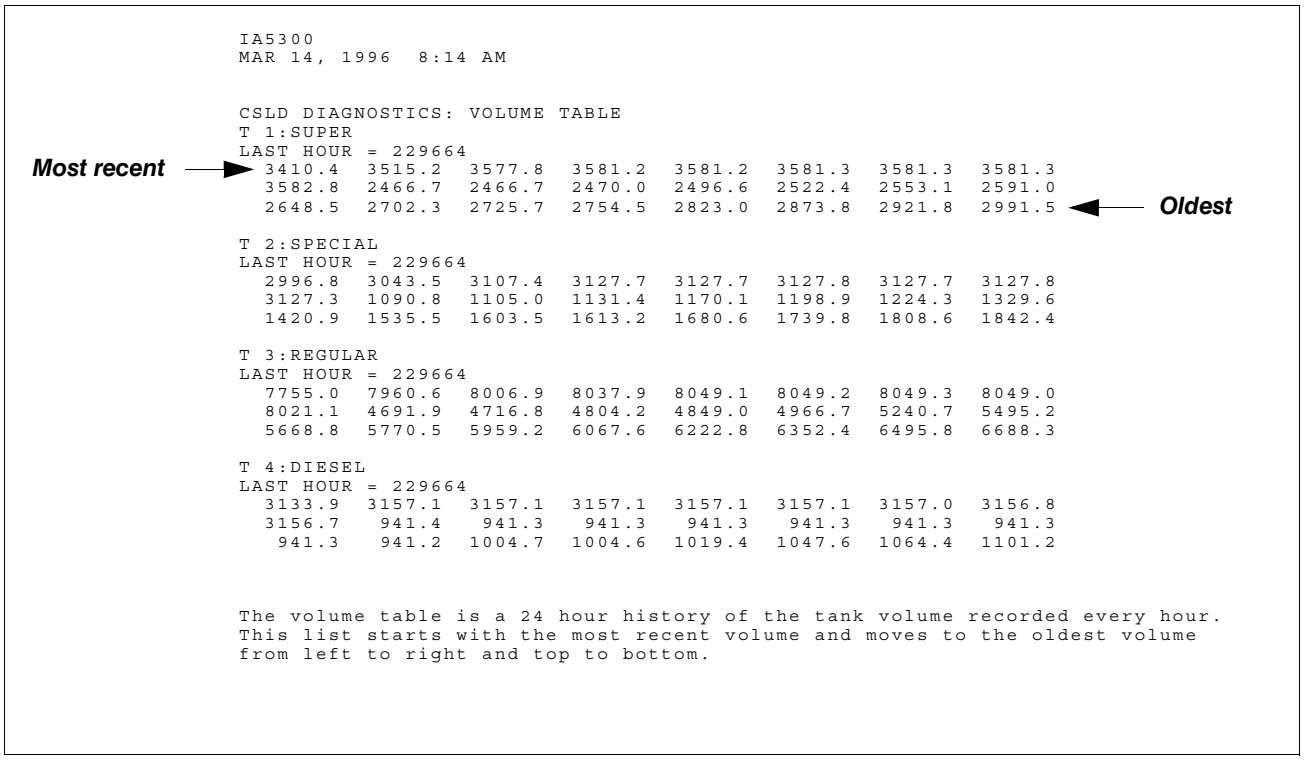


Figure 11-5. CSLD Volume Table Example

SMPLS = Samples
TLCVOL = Temp. compensated volume
HEIGHT = Product height
AVGTEMP = Avg. fuel temperature
TOPTEMP = Temp. of the highest thermistor in the probe
BDTEMP = Temp. of the probe circuit board (in canister)

* following ACTIVE = Pump sense available

```
IA5402
MAR 12, 1996 10:52 AM


CSLD DIAGNOSTICS: MOVING AVERAGE TABLE

T 2:SUPER
        TIME  SMPLS     TCVOL    HEIGHT   AVGTEMP   TOPTEMP    BDTEMP
960312103008     28   2118.16    29.547     45.52     44.01     39.31
960312103038     28   2118.16    29.547     45.52     44.01     39.31
960312103108     28   2118.14    29.547     45.52     44.01     39.31
960312103138     27   2118.16    29.547     45.53     44.02     39.32
960312103208     24   2118.17    29.547     45.53     44.02     39.32
960312103238     28   2118.19    29.547     45.52     44.02     39.32
960312103308     28   2118.13    29.547     45.52     44.02     39.32
960312103338     28   2118.13    29.547     45.52     44.02     39.33
960312103408     28   2118.16    29.547     45.52     44.03     39.33
960312103438     28   2118.13    29.547     45.52     44.03     39.33
960312103508     28   2118.17    29.547     45.52     44.03     39.33
960312103538     27   2118.16    29.547     45.52     44.04     39.34
960312103608     22   2118.21    29.547     45.52     44.04     39.34
960312103638     19   2118.16    29.547     45.52     44.04     39.34
960312103708     28   2118.23    29.548     45.52     44.05     39.34
960312103738     28   2118.19    29.547     45.52     44.05     39.34
960312103808     29   2118.17    29.547     45.52     44.06     39.35
960312103838     21   2118.13    29.547     45.52     44.06     39.35
960312103908     29   2118.21    29.547     45.52     44.06     39.35
960312103938     28   2118.12    29.546     45.53     44.06     39.36
960312104008     28   2118.11    29.546     45.53     44.06     39.36
960312104038     28   2118.21    29.547     45.53     44.06     39.37
960312104108     29   2118.14    29.547     45.53     44.06     39.37
960312104138     27   2118.05    29.546     45.53     44.06     39.38
960312104208     29   2115.86    29.524     45.53     44.06     39.38
960312104238     28   2112.55    29.490     45.53     44.05     39.39
960312104308     28   2109.43    29.459     45.53     44.05     39.39
960312104338     28   2106.14    29.426     45.53     44.05     39.40
960312104408     28   2102.58    29.390     45.53     44.05     39.40
960312104438     27   2099.08    29.354     45.53     44.05     39.40
960312104508     28   2095.64    29.320     45.53     44.05     39.41
960312104538     29   2092.37    29.287     45.53     44.04     39.41
960312104608     22   2091.61    29.279     45.53     44.04     39.41
960312104638     28   2091.66    29.279     45.53     44.04     39.42
960312104708     27   2091.64    29.279     45.53     44.04     39.42
960312104738     28   2091.66    29.280     45.53     44.05     39.43
960312104808     28   2091.65    29.279     45.53     44.05     39.43
960312104838     28   2091.60    29.279     45.53     44.05     39.43
960312104908     28   2091.61    29.279     45.53     44.05     39.44
960312105008     23   2091.60    29.279     45.53     44.04     39.44
960312105038     29   2091.67    29.280     45.53     44.04     39.44
960312105108     29   2091.70    29.280     45.53     44.04     39.45
960312105138     21   2091.63    29.279     45.53     44.04     39.45
960312105208     28   2091.74    29.280     45.53     44.04     39.45
960312105238     29   2091.63    29.279     45.53     44.04     39.45
960312105308     29   2091.64    29.279     45.53     44.04     39.46
MOVING AVERAGE:   2091.64

DISPENSE STATE: ACTIVE *  330.710632
```

Figure 11-6. CSLD Moving Average Table Example

Tank Setup Check Before Troubleshooting

All in-tank setup data must be correct for CSLD to work properly. Setup data, such as manifolded status, pump sense tank assignment, and temperature coefficient of thermal expansion entries, should be verified before attempting troubleshooting procedures.

CSLD Alarms

Each of the three CSLD alarms, CSLD Rate Incr Warn, No CSLD Idle Time, and Periodic Leak Test Fail is discussed below. In addition, there is one CSLD status message, No Results Available, which is also discussed.

ALARM: CSLD RATE INCR WARN

A CSLD Rate Increase Warning indicates fluid is entering the tank during the leak test. This warning indicates a higher than acceptable positive increase in product calculated from the CSLD Rate Table. The threshold amounts are listed below.

Single tank configuration:

PD - 95% = -0.17 gph

PD - 99% = -0.16 gph

Manifolded Tank configuration:

PD - 95% = -0.16 gph

PD - 99% = -0.15 gph

From the Home Screen, touch the DIAG button, the Tank Test button and then the CSLD Rate Table tab to view the CLSD Rate Table results.

SOME POSSIBLE Causes of positive rate increases

1. Incorrect temperature coefficient entered during setup. Verify that the temperature coefficient of thermal expansion is set correctly according to the TLS Setup specifications listing for various product grades.
2. Manifold Tank Siphon Bar Leakage

   Rate increases can occur in siphon manifolded tanks due to a leaking siphon system. Since the siphon piping is normally full of fuel this can become a source of rate increases. If the siphon does not hold, product will drain back slowly into the tanks during idle periods. The fuel from the siphon piping will increase the volume in the tank which will cause a CSLD rate increase warning. Test and repair the siphon system per the manufacturer's recommendations.
3. Leaks In Submersible Pumps
   - Around the packer O-ring.
   - At the threads of the two-inch pipe coming from the turbine motor.
   - The gasket between the turbine motor and mounting flange.
   - At any seal which would allow the column of fuel being held in the pump by the check valve to leak back slowly into the tank.
4. Manifolded tanks are programmed incorrectly in In-Tank setup.

   Tanks in a manifolded set must be programmed as a set, and you must select **CSLD** as the Leak Test Frequency for each of the tanks.
5. Defective Line Check Valves

   Fluid from the line piping leaking back into the tank through a defective Line Check Valve may cause a rate increase. Verify that the line piping holds pressure after pumping stops.
6. Thermal Expansion In The Lines

   When the product temperature in the tank is lower than the ground temperature, product in the line will expand after dispensing. After pumping ceases the line check valve or pump check valve will maintain pressure in the line. As the ground warms the product in the line expands. This expansion causes a corresponding pressure increase in the line therefore the pressure relief valve opens. The relief valve, relieves this increased pressure by allowing fuel to flow back into the tank. The flow from the line back into the tank can be a source of rate increase warnings. Typically thermal expansion's impact on CSLD is short lived. However, in extreme cases thermal expansion can be a source of CSLD rate increase warnings. If thermal expansion is suspected as the source of CSLD rate increase warnings you should inspect the site layout to determine if it is susceptible to ex-

treme thermal expansion due to site specific conditions (i.e. shallow line depth combined with extreme temperatures, etc.).

7. Stage II Vapor Recovery System Related Problems
   - Condensed vapors and liquid drawn into the vapor recovery system can leak back into the tank causing increases.
   - Check with the manufacturer of the vapor recovery system about possible solutions such as the addition of a vapor pot to collect these condensed vapors.
   - Have the Stage II vapor recovery system inspected and tested.
   - Verify that liquid product in the vapor lines cannot drain directly back into the tank. A liquid trap can be installed. The product that collects in the trap can be siphoned back to the tank via the pump siphon system. This will prevent the introduction of liquid into the tank during idle periods.
8. Water Leaking into the Tank
   - Water can leak into the tank and cause rate increase warnings.
   - Check the water level in the tank.
   - Monitor the tank for increasing water levels.
   - Check the alarm history for prior water level alarms.

ALARM: NO CSLD IDLE TIME

The system has not detected an idle period in the last 24 hours. All tanks must have at the very least some short idle periods each day. CSLD needs to find an idle time to clear this alarm. This alarm will automatically clear when the system detects that at least one idle period has occurred (this does not require that a CSLD record get stored in the rate table).

Frequent or continuous NO CSLD IDLE TIME messages are an indication of a problem. Possible reasons for this message:

1. Very large leaks may look like a product dispense. If this occurs the system will post a NO CSLD IDLE TIME alarm since it appears that product is being continually dispensed from the tank. Stop all activities and run a Static Leak Test.
2. Very high activity. Tank capacity or throughput specifications are exceeding CSLD specifications.
3. Line leak detection is running the product pump during normally idle periods.Veeder-Root line leak equipment is designed to coordinate line testing and CSLD to prevent this disturbance however in some cases conflicts may arise.
4. The site may be having problems determining an idle period due to site specific equipment disturbing the tank level (e.g. vapor recovery equipment).
5. The pump is running continuously. Check for a defective product dispenser or pump relay that is keeping the pump turned On.
6. A defective probe will sometimes make the tank level appear as though it is changing continuously when it is actually stable. This can be determined by examining the CSLD Moving Average Table (IA5400 Command). This table displays the tank data at 30 second intervals. Increases and decreases of typically around 1 or 2 gallons when the tank is idle are indications that the probe may be the problem. Also verify the amount of samples the TLS is receiving from the probe -there should be at least 7 and as many as 31.

ALARM: PERIODIC LEAK TEST FAIL

This message is posted when CSLD data indicates a high probability that a tank is leaking. The threshold for this determination is shown below,

Single Tanks:

PD - 95% = -0.17 gph

PD - 99% = -0.16 gph

Manifolded Tanks:

PD - 95% = -0.16 gph

PD - 99% = -0.15 gph

Review the CSLD Rate Table leak rates (Leak Rate). If the rates are not consistent (-0.83, +0.06,-0.90, -0.62, etc.) most likely the tank is not leaking.

Possible reasons for this message:

1. Tank is leaking.
2. CSLD is not recognizing the start of a busy period soon enough. These conditions are caused by small and/or slow dispenses, as in the case of operation with blenders. The solution would be to install a Pump Sense Module.
3. An external device is periodically turning On the pump power. This usually results in large negative leak rates. A Pump Sense Module will solve this problem.
4. Coefficient of expansion programmed incorrectly.
5. Tank is manifolded but programmed incorrectly.
6. Excessive compensation. Check in the IA5200 report for excessive compensation by comparing the compensated value (LRATE) to the uncompensated value (AVLRTE). The most likely cause of excessive compensation is bad probe temperature readings.
7. Stuck floats. Install a collar on the probe shaft to prevent floats from entering riser.
8. Floats damaged or installed incorrectly.
9. A stuck relay is causing the pump to run continuously. This causes the fluid to heat up around the pump producing temperature compensation errors.
10. Excessive evaporation due to an air leak into the tank may be the cause of a periodic leak test failure. Check vapor recovery system, pressure vent cap, all tank sump areas and riser caps, delivery sump plunger valve, etc.

STATUS MESSAGE: NO RESULTS AVAILABLE

This message may print when the CSLD Test Results are printed or accessed via the RS-232 command. This message indicates that CSLD has not collected sufficient test data to determine whether or not the tank is leaking, and is normal until 7 -10 days AFTER a CSLD startup. The program must be allowed to build a suitable database to calculate reliable results. At highly active sites some tanks may provide results before others. The busier tanks will take longer to produce the initial results.

Possible reasons for this message:

1. Not enough time after startup to generate results.
2. Console is being shut Off on a regular basis.
3. Tank too busy.

4. Defective probe.
5. Not enough idle time (see message above).
6. Tests are being rejected because the test results indicate a rate increase >+0.4 gph.

Static Leak Test

If after troubleshooting the Periodic Leak Test Fail Alarm an equipment problem has not been identified, perform a static leak test. Be sure that the product pump cannot come on during the test and that the level in the tank is within the normal operating range (i.e., the results of the static test may not be meaningful if the tank is nearly empty). If the static test verifies the CSLD result follow the procedures as established by the site owner. If the static test passes, contact Technical Support for assistance.

When to Manually Clear the CSLD Rate Table

You should manually clear the CSLD Rate Table if data, known to be inaccurate, had been stored in the table and the source of the inaccurate data was subsequently removed (e.g., after making tank plumbing repairs).

The CSLD Rate Table can be cleared by touching the Clear Table button on the CSLD Rate Table tab screen, or via the RS-232 command shown below.

NOTICE **IMPORTANT! DO NOT CLEAR THE CSLD RATE TABLE UNLESS IT IS ABSOLUTELY NECESSARY. DATA CLEARED FROM THIS TABLE CAN NOT BE RECOVERED!**

```
Function Code:     054
Function Type:     Delete CSLD Rate Table
Command Format:
Display:           <SOH>S054TT149
Computer:          <SOH>s054TT149
NOTE:
     1. TT - Tank number (command valid for single tank only).
     2. 149 - Verification code.
Typical Response Message Display:
<SOH>
S05402149
JAN 1, 1997 8:03 AM
T2:PRODUCT 2       CSLD RECORDS DELETED
<ETX>
typical Response Message Computer:
       <SOH>s054TTYYMMDDHHMM&&CCCC<EXT>
NOTE:
       1.       YYMMDDHHmm   -  Current time of day
       2.               TT   -  Tank number
       3.               &&   -  Data termination flag
       4.             CCCC   -  Message checksum.
```

Contacting Tech Support

If the CSLD problem cannot be resolved, retrieve the following data via the RS-232 port or SiteFax modem and contact Technical Support:

1. <Control-A> IA5100 CSLD RATE TABLE
2. <Control-A> IA5200 CSLD RATE TEST
3. <Control-A> IA5300 CSLD VOLUME TABLE
4. <Control-A> IA5400 CSLD MOVING AVERAGE TABLE
5. <Control-A> I10100 SYSTEM STATUS REPORT
6. <Control-A> IN0600 GET DEVICE ASSIGNMENTS
7. <Control-A> I11100 PRIORITY ALARM HISTORY
8. <Control-A> I11200 NON-PRIORITY ALARM HISTORY
9. <Control-A> I20100 INVENTORY REPORT
10. <Control-A> I20200 DELIVERY REPORT
11. <Control-A> I20600 TANK ALARM HISTORY REPORT
12. <Control-A> I25100 CSLD RESULTS
13. <Control-A> I60900 SET TANK THERMAL EXPANSION COEFFICIENT
14. <Control-A> I61200 SET TANK MANIFOLDED PARTNERS

Is tank assigned to a pump sense input or assigned to a line leak device?

If assigned to a pump sense collect the following reports:

1. <Control-A> I77100 PUMP SENSE CONFIGURATION REPORT
2. <Control-A> I77200 PUMP SENSOR TANK ASSIGNMENT REPORT
3. <Control-A> I77300 PUMP SENSOR DISPENSE MODE REPORT
4. <Control-A> IB7100 PUMP SENSOR DIAGNOSTIC REPORT

OR - if assigned to PLLD collect the following report:

1. <Control-A> I78000 PRESSURE LINE LEAK GENERAL SETUP INQUIRY

Actual CSLD Test Problems Analyzed

CSLD PROBLEM 1 - TANK 1 CSLD FAIL

Report I25101 confirmed the failure. Reports IA5201, and IA5100 were then collected for analysis.

```
I25101
CSLD TEST RESULTS
TANK        PRODUCT     RESULT
1           SUPER       PER: JUL 26, 1996 FAIL
```

DIAGNOSTICS

```
JUL 26, 1996 10:44 AM
IA5101
CSLD DIAGNOSTICS: RATE TABLE
T1: SUPER
```

TIME	ST	LRT	AVTMP	TPTMP	BDTMP	TMRT	DISPNS	VOL	INTVL	DEL	ULLG	EVAP	
9606280418	1	0.105	66.1	75.3	84.8	-0.05	750	2837	35.5	51.9	263	0.000	
9606290312	3	0.059	69.3	76.4	86.3	-0.09	488	3542	127.5	5.0	227	0.000	
9606281743	1	0.095	68.8	77.0	86.8	-0.08	731	2802	36.0	19.5	265	0.000	
9606300041	3	-0.212	74.0	78.6	87.7	-0.15	432	4432	49.5	5.5	179	0.000	
9606300246	1	0.098	73.8	78.7	87.8	-0.13	441	4381	33.0	7.6	182	0.000	
9606300353	3	0.097	73.6	78.8	87.8	-0.12	438	4366	52.5	8.7	183	0.000	
9606300519	1	0.079	73.5	78.8	87.8	-0.11	434	4352	36.0	10.1	184	0.000	
9606300657	3	0.055	73.4	78.9	87.8	-0.11	4180	4316	53.5	11.8	186	0.000	
9607010127	3	0.070	72.4	79.9	89.5	-0.10	633	3464	39.5	30.3	231	0.000	
9607010240	3	0.047	72.3	79.9	89.6	-0.10	600	3458	44.0	31.5	231	0.000	
9607020111	1	0.050	71.4	79.5	90.2	-0.05	490	4492	32.0	16.5	176	0.000	
9607020303	1	0.067	71.3	79.6	90.2	-0.05	474	4467	26.0	18.4	178	0.000	
9607021054	1	0.092	70.7	80.2	89.7	-0.05	519	4196	25.5	26.2	193	0.000	
9607021900	1	0.105	70.9	80.5	89.8	-0.07	568	3837	35.0	34.3	212	0.000	
9607030105	3	0.069	71.0	80.7	89.8	-0.08	616	3580	41.5	40.4	225	0.000	
9607030222	3	0.002	70.9	80.7	89.7	-0.06	532	3571	113.0	41.7	226	0.000	
9607040407	1	-0.175	69.5	78.0	88.6	0.08	377	4297	34.0	0.9	187	0.000	
9607041719	3	0.092	69.7	79.8	88.0	-0.05	679	3574	42.0	14.1	226	0.000	
9607042049	3	0.052	69.8	79.8	88.3	-0.02	674	3448	43.5	17.6	232	0.000	
9607042330	3	0.010	69.8	79.8	88.3	-0.04	566	3423	113.5	20.3	233	0.000	
9607050208	3	0.042	69.7	79.8	88.3	-0.05	558	3403	39.5	23.0	234	0.000	
9607050323	3	0.002	69.7	79.7	88.2	-0.03	484	3398	99.5	24.2	235	0.000	
9607052355	3	0.062	72.6	79.8	88.6	-0.06	534	4442	78.5	11.8	179	0.000	
9607060152	3	0.040	72.5	79.9	88.7	-0.05	492	4416	146.0	13.8	180	0.000	
9607061838	3	0.095	72.0	80.8	89.1	-0.07	560	3832	37.0	30.5	212	0.000	
9607062238	1	-0.195	72.2	72.6	89.0	0.09	121	5631	28.5	0.0	97	0.000	
9607070235	1	0.022	72.5	74.8	89.4	0.01	208	5511	35.0	4.0	108	0.000	
9607070414	3	-0.454	72.6	75.3	89.4	0.00	209	5502	42.5	5.6	108	0.000	
9607080224	3	-0.004	72.5	80.9	90.7	-0.05	614	4585	104.0	27.8	171	0.000	
9607080756	3	0.042	72.5	81.2	90.5	-0.05	650	4427	41.5	33.3	180	0.000	***Start of bad data***
9607080923	0	-0.257	71.9	72.0	87.0	0.07	17	6027	147.0	34.8	0	0.000	
9607081224	0	-0.341	72.1	73.1	88.5	0.07	14	6026	146.5	3.0	0	0.000	
9607081524	0	-0.557	72.4	74.0	89.0	0.12	13	6025	146.5	6.0	0	0.000	

9607081825	0	-0.356	72.7	75.1	89.4	0.07	10	6024	146.0	9.0	0	0.000
9607082126	0	-0.306	72.9	76.1	89.7	0.06	7	6023	145.5	12.0	0	0.000
9607090027	0	-0.296	73.1	76.7	89.8	0.05	6	6022	145.0	15.0	0	0.000
9607090329	0	-0.359	73.2	77.3	89.7	0.09	5	6021	144.0	18.0	0	0.000
9607090630	0	-0.429	73.6	78.4	89.4	0.09	4	6020	143.0	21.0	0	0.000
9607090931	6	-0.737	73.9	79.5	89.2	0.16	5	6018	142.5	24.0	0	0.000
9607091233	0	-0.448	74.3	80.4	89.0	0.10	6	6017	141.5	27.0	0	0.000
9607091534	0	-0.187	74.5	80.8	88.9	0.05	5	6016	141.0	30.0	0	0.000
9607091835	0	-0.393	74.7	81.1	88.8	0.08	5	6015	140.0	33.1	0	0.000
9607092137	0	-0.080	75.1	81.5	88.7	0.02	5	6013	139.0	36.1	0	0.000
9607100038	0	-0.034	75.1	81.5	88.5	-0.00	4	6013	138.5	39.1	0	0.000
9607100339	0	-0.223	75.1	81.4	88.2	0.02	4	6013	137.5	42.1	0	0.000
9607100640	0	0.054	75.2	81.5	87.8	0.00	3	6013	137.0	45.1	0	0.000
9607100942	0	-0.178	75.2	81.5	87.4	0.05	2	6013	136.0	48.1	0	0.000
9607101243	0	-0.555	75.5	81.5	87.2	0.13	3	6012	135.5	51.1	0	0.000
9607101544	0	-0.093	75.9	81.6	87.2	0.04	3	6010	135.0	54.1	0	0.000
9607101845	0	-0.018	76.0	81.4	87.4	0.02	3	6010	134.5	57.1	0	0.000
9607102146	0	-0.248	76.1	81.4	87.5	0.04	3	6009	134.0	60.1	0	0.000
9607110047	6	0.270	76.1	81.3	87.5	-0.06	2	6009	133.5	63.2	0	0.000
9607110348	0	-0.115	76.0	81.2	87.4	0.04	2	6009	133.0	66.2	0	0.000
9607110649	0	0.113	76.1	81.1	87.1	-0.04	2	6009	44.5	69.2	0	0.000
9607120336	3	-0.149	71.5	80.3	87.4	-0.05	1440	3214	75.5	15.9	244	0.000
9607130348	3	-0.211	70.8	79.3	86.5	-0.02	587	3965	99.0	4.8	205	0.000
9607132344	3	0.054	70.9	79.9	87.5	-0.05	638	3110	51.5	24.7	249	0.000
9607140246	2	0.133	70.1	75.1	86.5	0.04	182	5030	128.5	0.1	144	0.000
9607150252	3	0.054	70.7	79.4	86.0	-0.03	638	4088	45.0	24.2	199	0.000
9607170151	1	0.019	72.8	79.6	86.3	-0.07	795	3756	29.0	36.7	216	0.000
9607170329	3	0.061	72.8	86.4	87.5	-0.07	732	3736	40.5	38.3	217	0.000
9607170752	1	0.055	72.8	79.8	86.5	-0.07	697	3593	18.5	42.7	224	0.000
9607172000	1	0.059	72.5	80.2	86.1	-0.05	614	3045	30.5	54.8	252	0.000
9607180638	1	0.029	72.8	80.4	84.7	-0.04	607	2665	18.0	65.5	271	0.000
9607190226	1	0.073	72.4	79.5	84.2	-0.02	700	3614	28.0	14.0	223	0.000
9607200059	3	0.024	73.1	79.5	84.8	-0.09	980	2230	38.0	36.6	294	0.000
9607200246	3	0.006	73.0	79.5	84.7	-0.08	882	2203	93.0	38.4	295	0.000
9607210433	3	0.033	71.6	78.6	84.6	-0.01	510	4222	48.0	17.4	191	0.000
9607210613	1	0.027	71.6	78.6	84.5	-0.02	493	4218	32.0	19.1	191	0.000
9607220129	1	0.074	72.4	78.9	83.3	-0.08	637	3403	16.0	38.3	234	0.000
9607220323	3	-0.011	72.3	78.9	83.1	-0.04	563	3380	54.5	40.2	235	0.000
9607220828	1	0.107	72.4	78.8	82.6	-0.07	604	3219	16.0	45.3	243	0.000
9607232310	1	0.045	72.7	78.4	83.9	-0.06	644	3525	21.0	32.6	228	0.000
9607240105	1	0.066	72.7	78.4	84.0	-0.06	620	3471	21.5	34.5	230	0.000
9607250248	1	0.094	72.0	78.5	85.1	-0.05	654	3301	20.5	18.4	239	0.000
9607250641	1	0.003	72.1	78.6	84.9	-0.04	620	3219	17.5	22.3	243	0.000
9607260126	3	0.009	72.3	78.9	85.3	-0.07	793	2153	78.5	41.0	298	0.000
9607260336	3	-0.024	72.2	78.9	85.2	-0.06	732	2145	63.0	43.2	298	0.000

End of bad data

IA5201

CSLD DIAGNOSTICS: RATE TEST

TK	DATE	LRATE	INTVL	ST	AVLRTE	VOL	C1	C3	FDBK	ACPT	THPUT	DFMUL	RJT
1	9607260947	-0.308	49.8	2	-0.259	6016	79	22	43.9	43.4	5.24	-0.40	0

ANALYSIS OF RATE TABLE (IA51)

LRT

Looking in the leak rate column (LRT) the test results start off looking reasonable, if anything they tend to be positive. Leak rates suddenly change on the 8th and are consistently negative. There is another transition on the 13th where the leak rates return to the pattern observed prior to the 8th - slightly positive.

ST

the status table indicates that the tests between the 8th and 13th are the only ones contributing to the overall leak rate. This is indicated by a status code of 0. The reason CSLD is favoring these tests will be explained below.

DATE

The DATE field indicated that tests are being performed on a regular basis, several tests a day.

CSLD will complete a test after 3 hours and start a new test if the tank remains idle. The tests between the 8th and the 13th are being performed continuously, one test every 3 hours. This is inconsistent with the tests outside this date range.

INTVL

This is the length of a test in minutes. With the exception of the period between the 8th and 13th, test lengths are much less than 140 minutes. this indicates the site is a 24-hour site because tests are halted by dispensing, not the 3-hour CSLD limit. Test intervals are less than 3 hours because CSLD eliminates the first part of a test. The amount of time eliminated varies with the feedback variables.

Together, the interval and date information indicates that the tank was IDLE during the 8th and 13th period.

In reference to all the test in the rate table, these tests also have the longest interval time, one of the reasons CSLD is favoring these tests. All the tests with status code 1 were rejected due to short intervals.

DSPNS

The dispense factor is an indication of the amount of dispensing that occurred during the last 24 hours. It is not as simple as the amount of gallons dispensed during the last 24 hours because the hourly volumes are weighted in such a way that the most recent dispensing value contributes more to the dispense factor than dispensing volume that has occurred 23 hours ago. But it can be used as a relative indication of tank activity. The dispense factor for the above data set shows a typical value of 600. But the dispense factor during the 8th and 13th period drops rapidly to single digit values. This is another indication that there was no dispensing during this period.

CSLD prefers tests with low dispense factors, another reason why CSLD is favoring these tests. All the tests rejected with error code 3 were rejected because of high dispense factors.

VOL

The volume parameter indicates the volume at the start of the test. The volume during the trouble period started at 6027 and slowly dropped to 6009 gallons. Note that none of the volumes exceeded 6027.

EVAP

If the Reid Vapor Pressure table has been entered, the evaporation rate is displayed here.

DEL

The time since last delivery is in hour units. There was no indication of a delivery during the problem period. All tests rejected with error code 2 started within 2 hours of a delivery.

ULLG

The ullage factor is the surface area of the walls of the tank that is NOT covered in fluid. It is used for leak rate compensation. This parameter normally provides little diagnostic value, but it actually solves the problem. An ullage factor of zero indicates the tank is completely full, i.e., fluid height is equal to or greater than the tank's diameter.

ANALYSIS OF RATE TEST (IA52)

The average leak rate (AVLRTE) is -0.259. The average leak rate is uncompensated so excessive compensation is not an issue. This leak rate is not excessively high so blender/pump sense issues are probably not involved.

The tank label is SUPER so most likely it is not manifolded.

The DATE is recent so results are up to date.

The maximum number of tests is 80 and because C1 = 79 there are more than enough tests.

SOLUTION

The float was stuck in the riser. A collar was installed on the probe to prevent recurrences of this problem.

CSLD PROBLEM 2 - MANIFOLDED TANKS 1 AND 2 ARE FAILING

Reports I201, I51, IA52, and I752 were collected for analysis.

DIAGNOSTICS

```
I20100
STATION HEADER INFO
MAY 21, 2000 10:29 AM
TANK  PRODUCT          VOLUME  TLC VOLUME   ULLAGE   HEIGHT   WATER    TEMP
1    REGULAR            2311        2303     3705    39.21     0.0    65.2
2    REGULAR Secondary  3276        3266     4746    41.07     1.6    64.1
3    MIDGRADE           4378        4365     5774    42.81     0.0    64.4
4    PREMIUM            2547        2548     7605    28.68     1.3    59.7

IA5200
JUN 11, 2000 12:00 PM
CSLD DIAGNOSTICS: RATE TEST
TK       DATE    LRATE  INTVL  ST   AVLRTE  VOL   C1  C3  FDBK  ACPT  THPUT   EVAP    RJT
1  9608220320  -0.834   28.4   2  -0.809   7909  58  30  20.3  21.7   32.37  0.000    0
2  9608220320  -0.834   28.4   2  -0.809   7909  58  30  20.3  21.7   29.56  0.000    0
3  9608220445  -0.008   25.8   1   0.005   4400  67  18  30.   21.7   21.23  0.000    0
4  9608220402   0.005   22.3   1   0.005   1893  80  13  45.0  44.8   24.45  0.000    0

I75200
JUN 11, 2000 10:30 AM
LINE LEAK TANK ASSIGNMENT
LINE      LABEL                TAN
   1      PREMIUM                4
   2      MIDGRADE               3
   3      REGULAR                1
```

Line 1 should be labelled Regular and assigned to tank 1
Correct as is
Line 3 should be labelled Premium and assigned to tank 4

I510

AUG 22, 1996 11:58 AM

CSLD DIAGNOSTICS: RATE TABLE

T1: REGULAR

Large and inconsistent negative leak rates.

TIME	ST	LRT	AVTMP	TPTMP	BDTMP	TMRT	DISPNS	VOL	INTVL	DEL	ULLG	EVAP
9607250359	1	-0.802	72.3	73.7	76.0	-0.09	594	5214	20.0	36.3	602	0.000
9607260145	3	-0.186	73.5	74.3	76.2	-0.15	451	9019	25.0	0.6	443	0.000
9607260309	0	-0.661	73.3	74.3	76.2	-0.12	438	9005	28.5	2.0	444	0.000
9607270309	0	-0.666	72.4	73.5	76.2	-0.04	602	11409	29.5	3.4	331	0.000
9607270411	0	-0.409	72.4	73.6	76.2	-0.04	552	11407	55.5	4.4	331	0.000
9607280030	0	-1.027	72.2	73.9	76.2	-0.05	503	9725	39.5	24.8	413	0.000
9607280318	0	-1.064	72.1	73.9	76.2	-0.05	448	9688	74.5	27.6	414	0.000
9607280511	0	-0.634	72.1	73.8	76.2	-0.04	410	9671	57.0	29.5	415	0.000
9607290118	1	-0.544	71.9	73.9	76.3	-0.07	478	8065	25.0	49.6	483	0.000
9607290408	0	-0.932	71.8	73.8	76.3	-0.05	434	8032	33.0	52.4	485	0.000
9607300100	0	-1.121	71.7	73.6	76.2	-0.07	601	5827	84.5	73.3	577	0.000
9607300258	0	-0.873	71.5	73.6	76.2	-0.07	551	5815	119.0	75.3	577	0.000
9607310325	2	-0.621	70.3	72.7	76.0	0.02	468	10592	29.5	1.8	373	0.000
9607310427	0	-0.388	70.4	72.8	76.0	0.01	431	10589	43.0	2.8	373	0.000
9608010046	6	-0.081	70.3	71.8	75.6	0.00	509	11824	138.5	2.1	309	0.000
9608010451	1	-0.521	70.3	72.4	75.5	0.00	481	11804	22.5	6.2	310	0.000
9608020130	3	-0.839	70.6	73.1	75.4	-0.04	689	9208	107.5	26.9	436	0.000
9608020349	0	-0.597	70.5	73.1	75.3	-0.04	663	9202	48.5	29.2	436	0.000
9608020510	1	-1.061	70.5	73.1	75.3	-0.03	639	9191	17.0	30.5	437	0.000
9608030035	1	-0.775	70.8	72.9	75.1	-0.06	783	6543	15.0	49.9	546	0.000
9608030351	3	-0.951	70.7	72.9	75.1	-0.06	680	6448	68.0	53.2	551	0.000
9608040234	3	-0.839	72.8	73.7	75.1	-0.08	988	8570	55.5	12.4	463	0.000
9608040425	1	-0.046	72.7	73.9	75.1	-0.05	944	8567	16.0	14.3	462	0.000
9608040649	1	-0.144	72.6	73.7	75.1	-0.07	842	8514	21.0	16.6	465	0.000
9608050051	0	-0.228	72.3	73.4	75.2	-0.07	531	6661	81.5	34.7	541	0.000
9608050309	1	0.030	72.2	73.6	75.2	-0.09	509	6659	20.0	37.0	541	0.000
9608060123	0	-0.344	71.9	73.3	75.3	-0.10	617	4366	107.5	59.2	639	0.000
9608070046	3	-0.942	77.8	77.3	76.4	-0.20	684	9861	48.0	7.2	404	0.000
9608070312	1	-0.955	77.4	77.0	76.5	-0.17	647	9823	26.0	9.6	406	0.000
9608080356	0	-0.960	75.5	75.9	76.9	-0.10	654	7168	76.5	34.4	520	0.000
9608090121	0	-1.035	74.6	75.4	77.2	-0.11	614	4957	47.0	55.6	613	0.000
9608090315	1	-1.435	74.5	75.4	77.2	-0.10	599	4930	22.5	57.7	614	0.000
9608090410	0	-1.226	74.4	75.4	77.3	-0.09	577	4923	31.0	58.6	614	0.000
9608100145	1	-0.738	73.3	75.0	77.4	-0.06	713	7261	24.0	19.6	517	0.000
9608110220	1	0.132	72.5	74.0	77.4	0.00	420	11645	22.0	1.4	317	0.000
9608110445	0	-0.218	72.6	74.7	77.5	-0.01	372	11634	53.0	3.8	318	0.000
9608110616	0	-0.628	72.6	74.7	77.5	-0.01	362	11624	42.5	5.3	319	0.000
9608120303	2	-0.779	72.7	73.3	77.3	-0.02	302	12240	31.5	0.7	282	0.000
9608120409	2	-0.574	72.7	73.5	77.3	-0.03	293	12233	43.5	1.8	283	0.000
9608130138	0	-0.874	72.8	74.8	77.2	-0.04	580	10045	88.0	23.3	398	0.000
9608130342	1	-0.777	72.7	74.9	77.2	-0.04	560	10035	21.5	25.4	398	0.000
9608130520	1	-1.054	72.7	74.9	77.2	-0.04	547	10016	21.5	27.0	399	0.000
9608140210	0	-1.442	72.7	74.9	77.1	-0.05	565	8025	36.5	47.8	486	0.000
9608140328	0	-1.245	72.6	74.9	77.1	-0.05	523	8010	47.0	49.1	486	0.000
9608150117	3	-0.758	72.6	74.7	77.0	-0.08	690	5501	100.5	70.9	590	0.000
9608160325	2	-0.843	72.1	74.1	76.9	0.00	415	10443	53.0	1.7	380	0.000
9608160455	0	-0.594	72.1	74.3	77.0	0.00	398	10438	30.5	3.2	380	0.000
9608170055	0	-0.427	72.2	74.7	77.0	-0.06	630	8255	29.5	23.3	475	0.000
9608170403	0	-0.704	72.2	74.7	77.0	-0.04	551	8193	112.0	26.4	478	0.000
9608180200	0	-1.037	72.2	74.6	76.9	-0.06	504	6338	78.5	48.3	555	0.000

```
9608180357  0 -0.853   72.1  74.6   76.9   -0.05     486    6329   46.5    50.3     555  0.000
9608180523  0 -1.071   72.0  74.6   76.9   -0.05     452    6316   72.0    51.7     556  0.000
9608190359  2 -1.182   72.0  74.1   76.8    0.00     358    9680   62.0     1.7     414  0.000
9608200135  1 -0.385   72.2  74.6   76.8   -0.05     618    7471   22.5    23.3     508  0.000
9608220158  0 -1.139   71.6  74.5   76.7   -0.09     564    3210   41.5    71.6     694  0.000
9608220320  0 -1.284   71.5  74.5   76.7   -0.08     520    3194   40.0    73.0     695  0.000


CSLD DIAGNOSTICS: RATE TABLE
T2: REGULAR SECONDARY
      TIME  ST   LRT    AVTMP   TPTMP   BDTMP    TMRT    DISPNS    VOL     INTVL    DEL     ULLG     EVAP
RATE TABLE EMPTY
```

The secondary tank in manifolded sets <u>will</u> have empty rate tables!

Analysis of Rate Table (IA51)

Rate table shows large negative rates and the rates are inconsistent. This is an indication that CSLD is not detecting dispensing soon enough. If the leak test had stopped after dispensing began, the result would have been a negative rate.

The solution for this type of problem is pump sensing. BUT this site has pump sensing with line leak devices. The problem in this example was that the pump wiring to the line leak devices was correct, but the line leak tank assignments were incorrect.

Solution

Reassign Tanks 4 and 1 to their installed line leak devices (in this example, Line 1 [Reg] to Tank 1, Line 2 is correctly assigned to Tank 3, but Line 3 [Premium] should be assigned to Tank 4).

CSLD PROBLEM 3 - INCREASE RATE WARNING FOR MANIFOLDED TANKS 2 AND 3

Reports IA52 and IA53 were collected for analysis.

Diagnostics

```
IA5200
MAR 12, 1996  1:54 PM


CSLD DIAGNOSTICS: RATE TEST

TK        DATE  LRATE INTVL ST  AVLRTE    VOL  C1  C3 FDBK ACPT THPUT DFMUL RJT
 1  9603121226 -0.033  28.6  1  -0.009   3877  80  20 45.0 44.8  1.42 -0.08   0
 2  9603120523  0.138  36.8  1   0.165   8647  53  31 14.6 15.0  3.26  0.16   5
 3  9603120523  0.138  36.8  1   0.165   8647  53  31 14.6 15.0  3.26  0.16   5


CSLD DIAGNOSTICS: RATE TABLE
T 2:REGULAR
      TIME ST    LRT AVTMP TPTMP BDTMP  TMRT DSPNS   VOL INTVL    DEL ULLG  EVAP

9602130541  1  0.181  42.2  41.7  40.1 -0.01   265 10628  20.5   23.9  304 0.000
9602140033  3  0.320  42.1  41.6  40.3 -0.00   457  9331  59.5   42.7  366 0.000
9602140318  1  0.285  42.1  41.6  40.4 -0.00   420  9304  21.5   45.5  366 0.000
9602140406  0  0.178  42.1  41.6  40.4 -0.00   386  9292 100.0   46.3  366 0.000
```

Indicates number of tests rejected because leak rates > +0.4 gph.

Large positive rates.

```
9602150326  0  0.144  42.1  41.6  40.9 -0.00   382  7994  76.0   69.6  415 0.000
9602160140  0  0.354  42.0  41.6  41.2  0.00   440  6451  86.5   91.8  469 0.000
9602160333  0  0.281  42.0  41.6  41.2  0.00   422  6446  30.0   93.7  469 0.000
9602160506  1  0.260  42.0  41.7  41.2  0.00   404  6434   9.0   95.3  469 0.000
9602160541  0  0.084  42.0  41.7  41.2  0.00   388  6428  44.5   95.9  469 0.000
9602170444  0  0.353  42.1  41.5  41.4  0.00   416  4840  77.0  118.9  526 0.000
9602190128  0  0.307  42.8  42.6  41.8 -0.01   287 11416 101.0   33.9  267 0.000
9602190335  0  0.072  42.8  42.6  41.8 -0.01   259 11411 123.0   36.0  267 0.000
9602200211  0  0.046  42.7  42.4  41.9 -0.00   357 10165 125.0   58.6  328 0.000
9602210256  0  0.169  42.7  42.3  41.9 -0.00   366  8726 132.0   83.3  383 0.000
9602210534  0  0.260  42.7  42.3  41.8 -0.00   351  8721  53.0   86.0  383 0.000
9602220139  3  0.153  42.6  42.2  41.9 -0.00   499  7285  63.0  106.1  444 0.000
9602220308  3  0.180  42.6  42.2  41.9 -0.00   479  7280  43.5  107.6  444 0.000

CSLD DIAGNOSTICS: RATE TABLE
T 3:REGULAR
      TIME ST    LRT AVTMP TPTMP BDTMP  TMRT DSPNS   VOL INTVL    DEL ULLG THPT

RATE TABLE EMPTY


IA5300
IA5300
MAR 12, 1996  1:54 PM
```

T2 is not tracking T3 which indicates siphon is broken.

```
CSLD DIAGNOSTICS: VOLUME TABLE
T 2:REGULAR
LAST HOUR = 229621
3768.9  3844.8  3893.5  3938.7  3979.9  4002.5  4002.5  4003.3
4003.4  4003.4  4003.3  4003.5  4003.1  4003.0  4003.5  4001.6
4003.8  4024.6  4061.8  4109.2  4162.8  4253.6  4344.8  4346.6

T 3:REGULAR
LAST HOUR = 229621
3473.6  3457.0  3487.6  3511.8  3537.1  3573.3  3609.7  3644.7
3649.7  3653.7  3655.9  3664.3  3670.7  3688.0  3746.6  3756.3
3796.1  3831.2  3850.6  3914.6  3941.3  3923.1  3908.1  3999.2
```

Volume is not moving.

Volume is moving.

Analysis

The hourly volume table shows that the manifolded tanks are not always tracking. Compare the periods underlined in the volume table below (Tank 2 volume only moved 1.3 gals while Tank 3 volume moves 222.8 gals). This large difference indicates that the siphon is breaking. Fluid leaking into the tank from the siphon is causing the increase rate warning.

Solution

Repair siphon.

CSLD PROBLEM 4 - NO CSLD IDLE TIME

Report IA5402 was collected for analysis during an idle period (no dispensing/deliveries).

Diagnostics

IA5402

JUN 24, 1996 2:30 PM

CSLD DIAGNOSTICS: MOVING AVERAGE TABLE

T 2: MIDGRADE

Excessive differences may indicate a defective probe.

TIME	SMPLS	TLCVOL	HEIGHT	AVGTEMP	TOPTEMP	BDTEMP
960624140631	31	6521.67	53.299	78.76	81.10	86.64
960624140701	31	6521.77	53.298	78.72	80.99	86.54
960624140731	31	6521.85	53.297	78.67	80.88	86.44
960624140801	31	6522.22	53.298	78.61	80.75	86.34
960624140831	31	6522.67	53.298	78.53	80.62	86.23
960624140901	31	6523.02	53.298	78.46	80.49	86.11
960624140931	31	6523.44	53.299	78.38	80.35	85.94
960624141001	31	6523.48	53.297	78.30	80.17	85.81
960624141031	31	6523.90	53.297	78.22	80.04	85.67
960624141101	31	6524.77	53.301	78.15	79.93	85.84
960624141131	31	6524.58	53.298	78.11	79.84	85.41
960624141201	31	6525.14	53.301	78.09	79.77	85.28
960624141231	31	6524.94	53.299	78.08	79.71	85.15
960624141301	31	6524.97	53.299	78.06	79.66	85.03
960624141331	30	6525.22	53.300	78.04	79.62	84.91
960624141401	32	6525.17	53.299	78.02	79.57	84.79
960624141431	30	6525.26	53.299	77.98	79.51	84.68
960624141501	32	6525.63	53.299	77.93	79.24	84.52
960624141531	31	6526.39	53.302	77.68	79.33	84.40
960624141601	31	6526.71	53.303	77.80	79.26	84.29
960624141631	31	6526.88	53.302	77.74	79.20	84.17
960624141701	31	6527.34	53.304	77.72	79.17	84.07
960624141731	31	6527.60	53.306	77.73	79.17	83.97
960624141801	31	6527.49	53.308	77.81	79.27	83.89
960624141831	30	6527.37	53.311	77.93	79.43	83.85
960624141901	32	6526.21	53.307	78.05	79.62	83.82
960624141931	31	6526.36	53.311	78.16	79.78	83.81
960624142001	31	6525.02	53.305	78.23	79.94	83.81
960624142031	31	6525.20	53.307	78.26	80.00	83.81
960624142101	31	6524.84	53.304	78.25	80.01	83.80
960624142131	30	6523.02	53.304	78.25	80.00	83.80
960624142201	32	6526.39	53.314	78.23	80.04	83.79
960624142231	31	6526.65	53.319	78.35	80.19	83.81
960624142301	31	6525.05	53.315	78.57	80.45	83.86
960624142331	30	6523.43	53.319	78.84	80.78	83.94
960624142401	29	6521.88	53.310	79.11	81.12	84.05
960624142431	31	6519.58	53.303	79.34	81.44	84.17
960624142501	31	6519.59	53.308	79.53	81.69	84.35
960624142531	30	6518.62	53.304	79.60	81.84	84.47
960624142601	32	6518.72	53.305	79.59	81.90	84.58
960624142631	30	6519.02	53.305	79.53	81.89	84.67
960624142701	31	6519.54	53.305	79.43	81.78	84.73
960624142731	31	6520.18	53.307	79.35	81.70	84.78
960624142801	31	6520.59	53.308	79.31	81.66	84.83
960624142831	31	6519.95	53.305	79.33	81.68	84.88
960624142901	30	6519.45	53.304	79.41	81.79	84.95

MOVING AVERAGE: 6523.52

DISPENSE STATE: ACTIVE * 177.531143

Analysis

The moving average table shows erratic probe readings. Fluid is rising and falling by several gallons.

Solution

Replace probe.

CSLD PROBLEM 5 - TANK 1 IS FAILING

Reports I251, I201, IA52, IA51, and I609 were collected for analysis.

Diagnostics

```
I25100
JUN 26, 1996 2:37
STATION
HEADER
INFO
PHONE

CSLD TEST RESULTS
TANK   PRODUCT            RESULT
1      UNLEADED           PER: JUN 24, 1996 FAIL
2      UNLEADED PLUS      PER: JUN 26, 1996 PASS
3      SUPER UNLEADED     PER: JUN 26, 1996 PASS
4      KEROSENE           PER: JUN 26, 1996 PASS
5      DIESEL             PER: JUN 26, 1996 PASS


I20100
STATION HEADER INFO
JUN 26, 1996 2:36 PM
TANK   PRODUCT         VOLUME  TLC VOLUME   ULLAGE   HEIGHT   WATER    TEMP
1      UNLEADED          8627         8617     3000   63.42    0.0    76.9
2      UNLEADED PLUS     9286         9278     2341   67.92    0.0    72.2
3      SUPER UNLEADED    8315         8309     3312   61.38    0.0    70.6
4      KEROSENE          5399         5395      598   60.21    0.0    70.9
5      DIESEL            2989         2987     2940   46.27    0.0    70.1

IA5200
JUN 26, 1996 2:37 PM
CSLD DIAGNOSTICS: RATE TEST
TK       DATE    LRATE  INTVL ST   AVLRTE  VOL   C1  C3   FDBK   ACPT   THPUT    EVAP   RJT
1  9606240446  -0.270   10.3   2 -0.217   6406  21  20   0.0    0.0     44.32  0.000    1
```

2	9606260806	-0.159	25.1	1	-0.140	8959	67	16	30.4	32.6	77.32	0.000	0
3	9606260928	-0.039	31.3	1	-0.026	9277	80	18	45.0	44.8	87.45	0.000	0
4	9606261351	0.020	102.1	1	0.031	5404	63	41	25.9	24.3	43.32	0.000	0
5	9606261122	-0.010	41.4	1	0.001	3495	80	21	45.0	44.8	27.45	0.000	0

IA5100

CSLD DIAGNOSTICS: RATE TABLE (excerpt)

Inconsistent rates - not temperature compensating correctly.

T1: UNLEADED

TIME	ST	LRT	AVTMP	TPTMP	BDTMP	TMRT	DISPNS	VOL	INTVL	DEL	ULLG	EVAP
9605270507	0	-0.140	65.9	70.0	73.7	0.00	1271	8521	31.5	24.7	322	0.000
9605290214	0	-0.343	66.0	70.1	72.9	-0.10	1945	4983	17.0	38.9	471	0.000
9605290334	0	-0.172	65.9	70.0	72.8	-0.09	1820	4937	44.0	40.3	473	0.000
9605290444	0	-0.135	65.8	70.0	72.6	-0.11	1770	4911	40.5	41.4	474	0.000
9606020430	0	0.050	70.6	72.2	76.0	-0.07	1660	7254	20.0	16.1	378	0.000
9606020510	0	-0.301	70.5	72.2	76.1	-0.12	1591	7247	31.5	16.8	378	0.000
9606020637	0	-0.193	70.4	72.1	75.8	-0.10	1539	7215	18.0	18.3	380	0.000
9606030317	0	-0.408	69.2	71.8	73.1	-0.13	1584	4802	16.5	38.9	479	0.000
9606030346	0	-0.336	69.1	71.8	73.1	-0.14	1517	4799	21.5	39.4	479	0.000
9606030441	0	-0.249	69.0	71.7	73.1	-0.09	1474	4779	27.5	40.3	480	0.000
9606100451	0	-0.114	68.0	71.2	72.5	-0.12	1411	4303	28.5	41.1	500	0.000
9606110421	0	-0.136	67.8	70.6	72.8	-0.05	1956	7132	28.5	22.5	383	0.000
9606110505	0	-0.049	67.8	70.6	72.9	-0.05	1907	7105	23.0	23.2	384	0.000
9606120357	0	0.148	68.8	70.8	72.7	-0.05	1253	6644	17.0	4.7	403	0.000
9606120601	0	0.133	68.7	70.6	72.2	-0.06	1247	6535	18.5	6.7	408	0.000
9606130439	0	-0.293	73.0	73.4	75.2	-0.14	745	8532	44.0	5.8	321	0.000
9606130608	0	0.324	72.9	73.3	74.8	-0.12	763	8464	16.0	7.3	324	0.000
9606170258	0	-0.254	73.1	75.4	80.0	-0.12	1511	4677	21.5	38.7	484	0.000
9606170334	0	-0.424	73.0	75.5	80.2	-0.16	1373	4672	112.0	39.3	484	0.000
9606180420	6	-1.046	78.9	79.2	82.8	-0.26	1222	6206	49.0	10.3	421	0.000
9606240446	0	-0.350	75.2	79.0	84.5	-0.20	1659	3399	41.0	33.0	539	0.000

IA5100

CSLD DIAGNOSTICS: RATE TABLE (excerpt)

T2: UNLEADED PLUS

TIME	ST	LRT	AVTMP	TPTMP	BDTMP	TMRT	DISPNS	VOL	INTVL	DEL	ULLG	EVAP
9606100818	1	-0.134	67.2	69.2	71.5	-0.04	116	10194	21.5	2.3	231	0.000
9606110159	3	-0.081	67.4	70.1	72.3	-0.02	492	9489	69.5	19.9	273	0.000
9606110346	3	-0.081	67.3	70.2	72.3	-0.01	460	9479	90.0	21.7	274	0.000
9606120140	3	-0.075	67.5	70.3	71.8	-0.03	484	8763	70.0	43.6	310	0.000
9606120329	3	-0.083	67.5	70.4	71.9	-0.02	445	8759	75.0	45.4	310	0.000
9606120614	3	-0.044	67.4	70.5	71.8	-0.02	395	8747	57.5	48.1	311	0.000
9606130250	0	-0.103	68.9	70.6	73.6	-0.04	245	9650	146.5	3.8	264	0.000
9606140214	3	-0.111	68.6	71.2	75.3	-0.02	404	8974	145.5	27.1	300	0.000
9606140515	0	-0.117	68.5	71.4	75.8	-0.02	369	8974	66.5	30.1	300	0.000
9606150445	1	-0.051	68.5	71.6	76.7	-0.03	543	8049	27.5	53.6	343	0.000
9606150557	3	-0.108	68.5	71.8	76.7	-0.02	506	8035	120.0	54.8	344	0.000
9606160322	3	-0.251	70.7	73.0	78.6	-0.04	415	9276	113.5	14.8	284	0.000
9606160601	3	-0.233	70.5	73.1	79.0	-0.04	399	9271	52.0	17.4	285	0.000
9606170504	1	-0.142	70.2	73.4	78.9	-0.04	326	8731	29.0	40.4	312	0.000
9606180317	3	-0.131	70.0	73.8	79.6	-0.02	395	8055	76.0	62.6	343	0.000
9606190158	3	-0.146	69.9	73.9	78.7	-0.03	434	7315	138.5	85.3	375	0.000
9606190524	3	-0.136	69.8	74.1	79.4	-0.03	398	7310	52.5	88.7	375	0.000
9606191045	1	-0.062	69.7	74.1	77.5	-0.05	354	7207	28.0	94.1	380	0.000

```
9606200101  3 -0.183   70.4   74.1   79.3   -0.07     412    7715   48.5   12.6     358  0.000
9606200241  3 -0.187   70.3   74.2   79.5   -0.05     382    7711   53.5   14.3     358  0.000
9606200429  0 -0.175   70.3   74.3   79.6   -0.04     354    7708   70.5   16.0     358  0.000
```

Wrong values.

```
I60900
JUN 26, 1996 2:39 PM
TANK     PRODUCT LABEL
1        UNLEADED              0.000070
2        UNLEADED PLUS         0.000070
3        SUPER UNLEADED        0.000070
4        KEROSENE              0.000050
5        DIESEL                0.000045
6                              0.000000
7                              0.000000
8                              0.000000
```

Analysis of Rate Table (IA5100)

The test results show that tank 2 is also close to failing. Examining the leak rates for both tanks shows negative rates. the TMRT parameter is showing a negative temperature rate. This means that the fuel is contracting during the test.

ANALYSIS OF THERMAL EXPANSION COEFFICIENT REPORT (I60900)

Checking the thermal temperature coefficient of expansion value for the tanks reveals that these values were programmed incorrectly (1 extra zero was entered for each value e.g., 0.000070 instead of 0.00070). CSLD was not able to correct for temperature change when computing the leak rate.

Solution

Correctly reprogram the coefficient of thermal expansion for each tank.

CSLD PROBLEM 6 - CSLD PERIODIC FAILURE TANK 1

Diagnostics

```
200
Station Header 1
Station Header 2
Station Header 3
Station Header 4

JUN 17, 1998  8:31 AM

TANK  PRODUCT              GALLONS  INCHES   WATER  DEG F   ULLAGE

  1   UNLEADED SOUTH          5288   48.27     0.8   63.4     4528
  2   UNLEADED NORTH          5332   48.59     0.0   63.8     4484
  3   POWER PREMIUM           7168   62.35     0.0   66.4     2648
  4   POWER PLUS              6150   54.60     0.0   65.2     3666
```

Identical names suggest tanks are manifolded.

When tank levels are close tanks may be manifolded.

```
I25100
JUN 17, 1998  8:32 AM

Station Header 1
Station Header 2
Station Header 3
Station Header 4

CSLD TEST RESULTS
TANK PRODUCT                RESULT
  1  UNLEADED SOUTH         PER: JUN 17, 1998 FAIL
  2  UNLEADED NORTH         PER: JUN 17, 1998 PASS
  3  POWER PREMIUM          PER: JUN 17, 1998 PASS
  4  POWER PLUS             PER: JUN 17, 1998 PASS
```

Tanks programmed as manifolded would have a common result.

```
IA5200
JUN 17, 1998  8:32 AM


CSLD DIAGNOSTICS: RATE TEST

TK        DATE  LRATE INTVL ST  AVLRTE    VOL  C1  C3 FDBK ACPT THPUT DFMUL RJT
 1  9806170430 -0.492  14.7  2  -0.504   6123  26  20  0.0  0.0  7.13  0.61   0
 2  9806170254  0.025  14.8  1   0.015   6238  22  19  0.0  0.0  6.89  0.67   9
 3  9806170557  0.033  22.3  1   0.025   6289  75  19 39.4 29.8  4.01  0.14   0
 4  9806170527  0.033  26.6  1   0.018   6010  44  21  4.5  4.2  6.74  0.08   1
```

Positive tests rejected, these occurred when T1 was filing this tank.

```
I61200
JUN 17, 1998  8:33 AM

TANK MANIFOLDED PARTNERS

TANK   PRODUCT LABEL          MANIFOLDED TANKS
 1     UNLEADED SOUTH           NONE
 2     UNLEADED NORTH           NONE
 3     POWER PREMIUM            NONE
 4     POWER PLUS               NONE
```

Tanks not programmed as manifolded.

IA5100
JUN 17, 1998 8:32 AM

Inconsistent large leak rates. T1 is filling T2 while test is running.

CSLD DIAGNOSTICS: RATE TABLE
T 1:UNLEADED SOUTH

TIME	ST	LRT	AVTMP	TPTMP	BDTMP	TMRT	DSPNS	VOL	INTVL	DEL	ULLG	THPT
9806060245	3	-0.307	63.0	66.4	69.8	-0.08	1562	4297	57.5	31.7	419	6.7
9806060527	0	-0.452	62.9	66.3	69.5	0.12	1457	4263	16.0	34.4	420	6.4
9806070032	2	0.073	60.5	64.8	69.5	0.03	649	6411	34.5	1.1	325	7.4
9806070211	0	-0.185	60.5	65.0	69.4	0.02	601	6379	111.5	2.8	327	7.0
9806070414	0	-0.459	60.5	65.2	69.3	0.11	601	6378	24.0	4.8	327	7.0
9806080228	2	0.081	59.9	60.2	69.7	0.07	225	8870	54.5	0.7	190	6.9
9806100232	3	-0.978	60.8	64.4	69.9	0.04	1680	3968	17.5	48.7	434	7.2
9806100303	3	-1.977	60.8	64.4	69.9	-0.05	1612	3966	28.5	49.2	434	7.2
9806110337	0	-0.706	63.0	64.9	70.2	-0.03	916	6092	27.0	13.2	339	7.1

CSLD DIAGNOSTICS: RATE TABLE
T 2:UNLEADED NORTH

TIME	ST	LRT	AVTMP	TPTMP	BDTMP	TMRT	DSPNS	VOL	INTVL	DEL	ULLG	THPT
9806060147	6	-0.747	63.4	67.8	71.8	-0.02	1620	4335	47.5	30.7	417	7.0
9806060245	0	-0.008	63.4	67.7	71.7	-0.02	1555	4333	58.0	31.7	417	6.7
9806060527	0	-0.420	63.3	67.4	71.2	-0.01	1452	4299	16.5	34.4	419	6.4
9806070032	2	-0.061	60.9	66.0	71.3	0.07	647	6442	35.5	0.7	324	6.9
9806070211	0	0.109	61.0	66.1	71.2	0.04	599	6406	112.0	2.4	325	6.6
9806070414	0	0.021	61.1	66.1	71.1	-0.00	599	6403	25.0	4.4	326	6.5
9806080248	2	0.046	62.1	62.6	71.2	0.01	187	8886	35.5	0.6	188	6.4
9806080434	0	-0.303	62.1	63.1	71.2	-0.02	202	8854	29.5	2.4	191	6.3
9806090040	0	-0.323	62.0	66.1	71.4	-0.01	1470	6594	23.0	22.5	317	6.7
9806090425	0	-0.427	62.0	66.2	71.2	-0.02	1329	6571	20.5	26.2	318	6.5

IA5400
JUN 17, 1998 8:33 AM

This tank is filling T2.

CSLD DIAGNOSTICS: MOVING AVERAGE TABLE

T 1:UNLEADED SOUTH

TIME	SMPLS	TLCVOL	HEIGHT	AVGTEMP	TOPTEMP	BDTEMP
980617081037	23	5322.01	48.612	63.50	66.17	71.45
980617081107	23	5321.05	48.605	63.51	66.18	71.45
980617081137	22	5320.19	48.599	63.51	66.19	71.45
980617081207	23	5319.40	48.593	63.51	66.19	71.45
980617081237	23	5318.47	48.587	63.51	66.18	71.45
980617081307	24	5317.38	48.579	63.52	66.18	71.45
980617081337	25	5316.16	48.570	63.51	66.19	71.45
980617081407	16	5315.18	48.562	63.51	66.19	71.45

980617081437	20	5313.85	48.552	63.50	66.19	71.45
980617081507	16	5312.97	48.546	63.50	66.19	71.45
980617081537	15	5311.84	48.538	63.50	66.18	71.44
980617081607	10	5310.87	48.531	63.50	66.17	71.44
980617081637	15	5309.86	48.523	63.51	66.15	71.44
980617081707	23	5308.98	48.517	63.51	66.15	71.44
980617081737	24	5307.90	48.509	63.51	66.15	71.44
980617081807	23	5306.60	48.500	63.51	66.16	71.44
980617081837	24	5305.09	48.489	63.51	66.17	71.44
980617081907	22	5303.46	48.477	63.51	66.19	71.44
980617081937	19	5301.98	48.466	63.51	66.19	71.44
980617082007	13	5300.33	48.454	63.51	66.19	71.44
980617082037	19	5298.60	48.441	63.50	66.19	71.43
980617082107	23	5297.30	48.431	63.50	66.20	71.44
980617082137	23	5295.99	48.422	63.51	66.21	71.44
980617082207	22	5294.84	48.414	63.51	66.20	71.44
980617082237	24	5293.70	48.406	63.52	66.19	71.44
980617082307	13	5292.71	48.399	63.53	66.19	71.44
980617082337	23	5291.84	48.392	63.53	66.19	71.44
980617082407	22	5291.12	48.387	63.53	66.19	71.44
980617082437	23	5290.39	48.381	63.52	66.18	71.44
980617082507	24	5289.71	48.376	63.53	66.18	71.44
980617082537	22	5288.92	48.370	63.52	66.20	71.44
980617082607	12	5287.66	48.361	63.52	66.19	71.44
980617082637	24	5286.69	48.354	63.52	66.19	71.44
980617082707	23	5285.51	48.346	63.52	66.19	71.44
980617082737	24	5284.08	48.335	63.52	66.19	71.43
980617082807	23	5282.60	48.324	63.52	66.19	71.43
980617082837	24	5281.25	48.314	63.51	66.20	71.43
980617082907	13	5280.05	48.305	63.51	66.20	71.43
980617082937	13	5278.94	48.297	63.51	66.20	71.43
980617083007	23	5277.81	48.289	63.50	66.21	71.43
980617083037	23	5276.85	48.282	63.51	66.21	71.43
980617083107	24	5275.94	48.275	63.51	66.21	71.43
980617083137	23	5275.23	48.270	63.52	66.21	71.43
980617083207	21	5274.56	48.266	63.54	66.20	71.43
980617083237	15	5273.92	48.262	63.55	66.20	71.43
980617083307	23	5273.35	48.258	63.55	66.20	71.43

MOVING AVERAGE: 5284.02

T2's volume increases as T1 fills it.

DISPENSE STATE: ACTIVE * 762.432312
T 2:UNLEADED NORTH

TIME	SMPLS	TLCVOL	HEIGHT	AVGTEMP	TOPTEMP	BDTEMP
980617081037	24	5358.36	48.889	63.88	67.13	72.66
980617081107	23	5359.32	48.896	63.89	67.15	72.66
980617081137	22	5360.10	48.901	63.88	67.15	72.66
980617081207	23	5357.81	48.885	63.88	67.15	72.67
980617081237	23	5353.93	48.856	63.87	67.16	72.67
980617081307	24	5350.46	48.830	63.87	67.17	72.67
980617081337	23	5349.34	48.822	63.87	67.17	72.67
980617081407	16	5347.34	48.808	63.87	67.15	72.67
980617081437	20	5348.24	48.814	63.88	67.15	72.67
980617081507	16	5349.11	48.821	63.89	67.15	72.67
980617081537	15	5348.68	48.818	63.88	67.14	72.67
980617081607	10	5347.10	48.806	63.88	67.13	72.67
980617081637	15	5347.82	48.811	63.88	67.12	72.67

```
980617081707     23   5345.59    48.795     63.87     67.13     72.67
980617081737     24   5340.45    48.757     63.86     67.14     72.67
980617081807     23   5332.53    48.699     63.85     67.14     72.67
980617081837     23   5327.48    48.662     63.85     67.13     72.67
980617081907     22   5323.96    48.636     63.85     67.13     72.67
980617081937     18   5321.93    48.621     63.85     67.13     72.67
980617082007     14   5323.43    48.632     63.85     67.12     72.67
980617082037     19   5325.39    48.647     63.86     67.13     72.66
980617082107     23   5326.68    48.656     63.86     67.14     72.66
980617082137     22   5327.94    48.666     63.87     67.14     72.67
980617082207     23   5329.04    48.674     63.87     67.14     72.67
980617082237     24   5330.24    48.682     63.86     67.14     72.68
980617082307     12   5331.09    48.688     63.86     67.13     72.68
980617082337     24   5332.11    48.696     63.86     67.12     72.68
980617082407     22   5332.77    48.701     63.86     67.12     72.68
980617082507     23   5329.52    48.677     63.85     67.15     72.68
980617082537     22   5324.32    48.639     63.85     67.16     72.68
980617082607     12   5321.19    48.616     63.86     67.16     72.68
980617082637     24   5319.28    48.602     63.87     67.16     72.68
980617082707     23   5315.00    48.571     63.86     67.16     72.68
980617082737     24   5309.65    48.531     63.86     67.15     72.68
980617082807     23   5309.97    48.534     63.87     67.15     72.68
980617082837     23   5311.16    48.543     63.87     67.14     72.69
980617082907     13   5311.96    48.549     63.87     67.14     72.69
980617082937     12   5313.25    48.558     63.87     67.14     72.68
980617083007     24   5314.42    48.567     63.87     67.13     72.68
980617083037     23   5315.37    48.574     63.87     67.14     72.68
980617083107     24   5316.16    48.579     63.87     67.14     72.69
980617083137     22   5316.99    48.585     63.86     67.14     72.69
980617083207     21   5317.58    48.590     63.86     67.14     72.69
980617083237     15   5316.19    48.580     63.87     67.14     72.69
980617083307     23   5312.81    48.555     63.86     67.13     72.69
980617083337     20   5311.06    48.542     63.86     67.13     72.69
MOVING AVERAGE:   5311.55

DISPENSE STATE: ACTIVE    957.217224
```

Analysis

Tanks 1 and 2 are siphon manifolded, but they are incorrectly programmed in the console as single tanks.

Solution

Reprogram tanks 1 and 2 as manifolded and delete the rate table.

CSLD PROBLEM 7 - NO CSLD RESULTS

Diagnostics

```
I20100
MAY 14, 1998 11:44 AM

Station id 1
Station id 2
Station id 3
Station id 4

IN-TANK INVENTORY

TANK PRODUCT             VOLUME TLC VOLUME   ULLAGE   HEIGHT    WATER     TEMP
  1  REGULAR UNLEADED      6912         0     3115    62.50     0.00    73.39
  2  PLUS UNLEADED         1845         0     8182    22.99     0.00    74.96
  3  PREMIUM UNLEADED      3761         0     6266    38.52     0.00    73.95


IA5200
MAY 14, 1998 11:45 AM

CSLD DIAGNOSTICS: RATE TEST

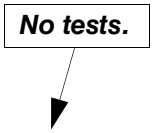
TK      DATE  LRATE INTVL ST  AVLRTE    VOL  C1  C3 FDBK ACPT THPUT DFMUL RJT
1 7001010000  0.000   0.0  5   0.000      0   0   0  0.0  0.0  0.00  0.80   0
2 7001010000  0.000   0.0  5   0.000      0   0   0  0.0  0.0  0.00  0.80   0
3 7001010000  0.000   0.0  5   0.000      0   0   0  0.0  0.0  0.00  0.80   0

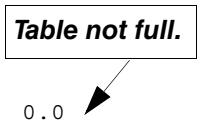

IA5300
MAY 14, 1998 11:45 AM


CSLD DIAGNOSTICS: VOLUME TABLE
T 1:REGULAR UNLEADED
LAST HOUR = 248651
  6876.8  6949.6  6985.7  7110.7  7191.0  7282.3  7354.8     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

T 2:PLUS UNLEADED
LAST HOUR = 248651
  1825.8  1846.9  1868.8  1900.3  1936.7  1936.7  1947.3     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

T 3:PREMIUM UNLEADED
LAST HOUR = 248651
```





```
  3737.9  3773.5  3797.8  3817.8  3883.3  3904.5  3904.7     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
     0.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0
```

Analysis

The volume table IA53 gets cleared when a gap in time between probe samples is detected. The site operators were turning the console's power Off every evening. This caused a gap between probe readings which cleared the volume table. CSLD does not perform any tests until the volume table is full (24 hours).

Solution

Keep power turned On to the console.

CSLD PROBLEM 8 - CSLD FAILURE TANK 1

Diagnostics

```
I25100
JUN 11, 1998 12:45 PM

Site Id 1
Site Id 2
Site Id 3
Site Id 4

CSLD TEST RESULTS
TANK PRODUCT                RESULT
  1  REGULAR                PER: JUN 11, 1998 FAIL
  2  PLUS                   PER: JUN 11, 1998 PASS
  3  PREMIUM                PER: JUN 11, 1998 PASS



200
Site Id 1
Site Id 2
Site Id 3
Site Id 4

JUN 11, 1998 12:45 PM

TANK  PRODUCT               GALLONS  INCHES   WATER  DEG F   ULLAGE

  1   REGULAR                  6439   57.38     1.0   52.3     3289

  2   PLUS                     6362   56.81     0.0   68.1     3366
  3   PREMIUM                  7916   69.05     0.0   67.3     1812


IA5200
```

JUN 11, 1998 12:45 PM

CSLD DIAGNOSTICS: RATE TEST

Comparing compensated LRATE to uncompensated AVLRATE shows excessive compensation.

TK	DATE	LRATE	INTVL	ST	AVLRTE	VOL	C1	C3	FDBK	ACPT	THPUT	DFMUL	RJT
1	9806110308	-0.309	13.0	2	0.040	6676	56	22	18.0	12.3	8.22	0.40	0
2	9806110404	-0.011	25.0	1	0.025	7865	80	16	45.0	44.0	2.28	0.02	0
3	9806110021	-0.011	26.6	1	0.012	7087	80	16	45.0	44.2	2.01	-0.00	0

I60900
JUN 11, 1998 12:46 PM

TANK THERMAL COEFFICIENT

OK

TANK	PRODUCT LABEL	
1	REGULAR	0.000700
2	PLUS	0.000700
3	PREMIUM	0.000700
4		0.000000

IA5101
JUN 11, 1998 12:46 PM

Abnormal temperatures.

Large jump in temp following delivery.

CSLD DIAGNOSTICS: RATE TABLE
T 1:REGULAR

TIME	ST	LRT	AVTMP	TPTMP	BDTMP	TMRT	DSPNS	VOL	INTVL	DEL	ULLG	THPT
9805230026	3	0.050	69.2	14.7	71.3	-0.02	2052	2976	24.5	34.7	452	8.2
9805230102	3	0.011	69.2	14.7	71.3	-0.03	1991	2972	30.0	35.3	452	8.0
9805230148	3	0.016	69.1	14.7	71.2	-0.02	1915	2964	38.5	36.0	452	7.9
9805230239	3	0.006	69.1	14.7	71.2	-0.02	1841	2953	69.5	36.9	453	7.6
9805230441	3	0.021	69.0	14.7	71.2	-0.02	1729	2910	29.5	38.9	455	7.4
9805230557	3	0.017	69.0	14.7	71						457	7.3
9805240018	0	-0.018	55.4	14.7	72						455	8.1
9805240144	0	-0.041	55.3	14.7	72						456	7.9
9805240224	1	-0.069	55.2	14.7	71.9	-0.04	565	7454	19.0	6.6	257	7.9
9805240303	0	0.057	55.1	14.7	71.9	-0.05	584	7426	45.0	7.3	259	7.8
9805240454	0	-0.138	54.9	14.7	71.8	-0.00	594	7366	21.5	9.1	262	7.7
9805240552	0	-0.084	54.8	14.7	71.8	-0.01	593	7337	40.0	10.1	263	7.5
9805250213	3	-0.048	51.2	14.7	72.0	-0.03	1599	5019	32.5	30.5	366	7.8
9805250340	0	-0.026	51.3	14.7	71.9	-0.04	1481	4988	24.0	31.9	367	7.8
9805250526	1	0.178	51.8	14.7	71.7	-0.08	1468	4911	18.0	33.7	370	7.7
9805250617	0	0.343	70.5	14.7	71.5	-0.13	1424	4821	26.0	34.5	371	7.7
9805250655	1	0.296	70.4	14.7	71.4	-0.12	1446	4812	18.5	35.2	372	7.6
9805260040	1	0.183	55.6	14.7	71.8	-0.08	650	7598	17.5	5.2	250	7.9

Big swing in temperature even though there has been no delivery.

```
9805260118  1  0.124  55.5  14.7  71.7 -0.07   629  7580  16.5    5.8  251  7.9
9805260227  6  0.242  55.3  14.7  71.6 -0.08   604  7540  98.5    7.0  253  7.7
9805260417  0  0.277  55.1  14.7  71.4 -0.09   604  7538  23.5    8.8  253  7.7
9805270015  0  0.051  46.7  14.7  71.1 -0.04  1280  5711  38.5   28.8  338  7.6
9805270109  0  0.053  46.7  14.7  71.1 -0.05  1174  5704  65.0   29.7  338  7.5
9805270303  0  0.019  46.8  14.7  70.9 -0.05  1164  5656  34.0   31.6  340  7.5
9806020056  2 -0.004  55.7  14.7  70.5 -0.00   375  8102  28.0    1.4  222  7.9
9806020136  0  0.045  55.7  14.7  70.6 -0.00   370  8090  46.0    2.1  223  7.9
9806020234  0  0.050  55.6  14.7  70.5 -0.01   359  8086  63.5    3.1  223  7.9
9806020442  0  0.022  55.6  14.7  70.5 -0.00   351  8061  43.0    5.2  225  7.8
9806030030  3  0.026  46.5  14.7  71.0 -0.01  1487  5697 108.5   25.0  338  7.9
9806030231  1  0.028  46.6  14.7  71.0 -0.02  1487  5688  18.5   27.0  339  7.9
9806030308  0  0.014  46.7  14.7  70.9 -0.02  1454  5660  44.5   27.6  340  7.9
9806040208  3  0.039  67.7  14.7  70.3 -0.05  2093  2291  23.5   50.7  485  8.1
9806040317  3  0.016  67.7  14.7  70.1 -0.05  2012  2267  37.5   51.8  486  8.1
9806040426  3  0.014  67.7  14.7  70.0 -0.04  1856  2245  61.5   52.9  487  8.0
9806050031  0 -0.008  42.0  14.7  70.9 -0.05  1002  6740  34.5    9.5  294  8.2
9806050118  0  0.015  42.1  14.7  70.8 -0.05  1002  6726  24.0   10.3  295  8.2
9806050154  0  0.007  42.1  14.7  70.8 -0.04   983  6719  21.0   10.9  295  8.1


Template for A12 command

IA1200
JUN 11, 1998 12:47 PM
TANK  1  REGULAR               MAG    NUMBER OF SAMPLES =    20
WATER     HEIGHT0   HEIGHT1   HEIGHT2   HEIGHT3   HEIGHT4   HEIGHT5   HEIGHT6
HEIGHT7   HEIGHT8   HEIGHT9   TMP REF   TMP5      TMP4      TMP3      TMP2
TMP1      TMP0      TMP REF


Probe Standard Average Buffers

IA1200
JUN 11, 1998 12:47 PM
TANK  1  REGULAR               MAG    NUMBER OF SAMPLES =    20
 1477.000 19845.199 19845.150 19844.699 19845.350 19845.150 19847.199 19847.301
19847.051 19847.400 19847.350 42377.398 17287.949 42375.449 17287.301 42375.898
17286.199 19271.199 42375.051
TANK  2  PLUS                  MAG    NUMBER OF SAMPLES =    20
 1371.150 19443.000 19443.000 19443.000 19443.000 19442.850 19443.000 19443.000
19443.000 19442.949 19443.000 42508.199 17503.051 18755.250 19174.350 19427.551
19583.150 20000.600 42506.000
TANK  3  PREMIUM               MAG    NUMBER OF SAMPLES =    20
 1383.000 23473.699 23473.500 23473.699 23473.699 23473.500 23485.051 23484.699
23484.850 23485.150 23484.949 41917.949 17255.750 18685.750 19646.900 19714.150
19804.750 19917.900 41901.301
```

Bad probe thermistor values.

Analysis

From the IA52 command compare LRATE (-0.309) with AVLRTE (0.040). This shows that there is excessive compensation. The most likely cause for excessive compensation is a false probe temperature reading. Examining the IA12 command shows that there are two erroneous thermistor values.

Solution

Replace probe and delete rate table.

CSLD PROBLEM 9 - TANK 1 FAIL

Diagnostics

```
200
Site ID
Site ID
Site ID
Site ID

MAY 18, 2000  8:23

TANK  PRODUCT               GALLONS  INCHES   WATER  DEG F   ULLAGE

  1   UNLEADED                 4740   44.69     0.0   61.2     4896
  2   PLUS                     5740   63.65     0.0   61.9     1952
  3   PREMIUM                  2712   62.65     0.0   62.0     1010


CSLD TEST RESULTS
TANK PRODUCT                RESULT
  1  UNLEADED               PER: MAY 18, 2000 FAIL
  2  PLUS                   PER: MAY 18, 2000 PASS
  3  PREMIUM                PER: MAY 18, 2000 PASS

__       76687IA5200_
IA5200
MAY 18, 2000  8:23


CSLD DIAGNOSTICS: RATE TEST

TK        DATE  LRATE INTVL ST  AVLRTE    VOL  C1  C3 FDBK ACPT THPUT  EVAP RJT
 1  0005180427 -0.282  37.0  2   0.017   6709  70  17 33.8 33.8 127.1 0.000   0
 2  0005180735 -0.025  32.5  1   0.026   5558  80  19 45.0 44.8  17.6 0.000   0
 3  0005180531 -0.061  32.3  1  -0.000   2589  80  17 45.0 44.8   8.6 0.000   0
IA5101
MAY 18, 2000  8:25

CSLD DIAGNOSTICS: RATE TABLE
T 1:UNLEADED
      TIME ST    LRT AVTMP TPTMP BDTMP  TMRT DSPNS   VOL INTVL    DEL ULLG  EVAP

0004200431  0 -0.085  53.3  52.0  56.5  0.00     2  9682  50.0   48.5    0 0.000
0004202332  3  0.068  55.2  55.5  57.2 -0.03  3073  4904 129.5   14.8  372 0.000
0004210148  3 -0.044  55.1  55.4  57.2 -0.03  2712  4904 174.5   17.8  372 0.000
0004210448  3 -0.174  55.0  55.4  57.1 -0.02  2601  4904  54.0   20.8  372 0.000
0004222339  0 -0.023  52.3  54.1  55.8  0.02  1585  6548 129.5    8.7  301 0.000
0004230155  0  0.012  52.4  53.5  55.6  0.01  1398  6548 174.5   11.7  301 0.000
0004230456  0  0.027  52.4  52.6  55.4  0.01  1234  6548 168.5   14.8  301 0.000
0004232246  3  0.038  53.2  53.0  55.8 -0.00  2597  2936 129.5   31.8  459 0.000
```

Comparing compensated LRATE to uncompensated AVLRTE shows excessive compensation.

0004240105	3	0.005	53.2	53.1	55.8	-0.00	2292	2936	171.0	34.8	459	0.000
0004240407	3	-0.011	53.2	53.2	55.7	0.00	2109	2936	57.0	37.9	459	0.000
0004242334	0	0.052	56.6	56.0	56.5	-0.06	1649	5721	129.5	6.6	337	0.000
0004250156	0	-0.002	56.4	56.0	56.4	-0.05	1455	5721	168.0	9.6	337	0.000
0004250458	1	-0.047	56.3	56.0	56.2	-0.04	1395	5721	18.5	12.6	337	0.000
0004252306	2	-0.024	55.8	55.9	56.8	-0.02	382	8435	129.5	1.0	199	0.000
0004260131	0	-0.016	55.8	55.9	56.8	-0.01	337	8435	165.5	4.0	199	0.000
0004260432	0	0.050	55.7	55.8	56.8	-0.01	323	8435	50.5	7.0	199	0.000
0004262332	3	-0.036	55.8	56.0	57.5	-0.03	2846	4236	129.5	25.4	401	0.000
0004270158	3	0.024	55.8	55.9	57.5	-0.02	2511	4236	164.0	28.4	401	0.000
0004270459	1	-0.414	55.7	55.9	57.5	-0.02	2409	4236	27.0	31.5	401	0.000
0004272326	3	0.036	58.4	57.6	58.5	-0.08	2029	4975	129.5	6.3	369	0.000
0004280154	3	-0.039	58.2	57.6	58.4	-0.06	1790	4975	162.5	9.3	369	0.000
0004282311	0	0.061	59.1	57.1	59.4	-0.06	1659	6434	129.5	6.4	305	0.000
0004290140	0	-0.002	58.9	57.1	59.4	-0.06	1464	6434	161.0	9.4	305	0.000
0004290441	0	0.021	58.8	57.0	59.4	-0.05	1345	6434	98.0	12.4	305	0.000
0004292345	3	0.074	58.3	56.0	60.1	-0.10	3384	1251	129.5	31.0	551	0.000
0004300216	3	0.028	58.0	58.0	60.1	-0.09	2986	1251	159.0	34.0	551	0.000
0004300518	3	0.007	57.8	57.9	60.1	-0.07	2618	1251	110.5	37.0	551	0.000
0004302242	3	0.050	56.8	57.5	61.1	-0.02	2587	3949	129.5	12.9	413	0.000
0005010116	3	-0.022	56.7	57.9	61.1	-0.02	2283	3950	156.5	15.9	413	0.000
0005010417	3	-0.099	56.7	57.8	61.1	-0.02	2190	3950	39.0	18.9	413	0.000
0005012322	3	0.000	58.1	58.9	61.7	-0.03	2100	5699	129.5	12.1	338	0.000
0005020159	3	0.027	58.0	58.8	61.7	-0.03	1853	5699	153.5	15.1	338	0.000
0005022346	3	0.047	58.0	58.8	62.1	-0.08	2882	1445	129.5	36.5	539	0.000
0005030225	3	-0.014	57.8	58.9	62.0	-0.06	2652	1445	49.0	39.5	539	0.000
0005032325	3	0.061	57.2	57.9	62.8	-0.03	2922	4110	129.5	19.0	406	0.000
0005040206	3	0.034	57.2	58.3	62.9	-0				22.0	406	0.000
0005042339	3	0.032	63.4	-107.4	64.6	-0				7.8	301	0.000
0005050222	3	0.007	63.1	-105.1	64.7	-0.10	1791	6496	147.5	10.8	301	0.000
0005052345	3	0.053	61.8	61.2	65.9	-0.14	3175	1823	129.5	31.8	516	0.000
0005060230	3	0.007	61.4	60.5	65.9	-0.12	2801	1823	145.5	34.8	516	0.000
0005060531	3	-0.025	61.1	60.2	65.9	-0.11	2571	1823	51.5	37.9	516	0.000
0005062349	3	0.006	61.1	51.2	67.2	-0.06	3140	3581	129.5	14.1	429	0.000
0005070236	3	0.012	60.9	51.4	67.2	-0.06	2771	3581	143.5	17.1	429	0.000
0005070537	3	-0.040	60.7	51.0	67.3	-0.04	2547	3581	124.0	20.1	429	0.000
0005072237	0	-0.023	66.8	-107.5	68.8	-0.16	792	7014	129.5	2.5	275	0.000
0005080126	0	0.020	66.4	-107.4	69.0	-0.13	699	7014	141.5	5.5	276	0.000
0005080427	1	0.129	66.0	-107.3	69.1	-0.11	670	7014	30.5	8.5	276	0.000
0005082328	3	0.097	64.5	-107.3	70.3	-0.16	2854	2747	129.5	27.3	467	0.000
0005090218	3	0.051	64.1	-107.3	70.3	-0.14	2518	2747	140.5	30.3	467	0.000
0005092322	3	0.003	64.6	-83.9	71.2	-0.07	1982	5745	129.5	9.1	334	0.000
0005100213	0	0.036	64.4	41.9	71.2	-0.06	1749	5744	139.5	12.1	334	0.000
0005102331	3	0.039	63.7	30.1	71.2	-0.13	2855	1559	129.5	33.3	531	0.000
0005110222	3	0.036	63.4	35.6	71.0	-0.10	2520	1559	139.0	36.3	531	0.000
0005112319	3	0.048	62.5	-107.1	70.7	-0.04	2878	4154	129.5	15.0	404	0.000
0005120210	3	0.009	62.3	-72.8	70.7	-0.04	2540	4154	139.0	18.0	404	0.000
0005130136	2	0.030	69.8	-107.2	71.1	-0.24	824	6333	138.5	0.2	307	0.000
0005130437	0	0.077	69.1	-107.3	71.3	-0.17	723	6333	114.5	3.2	307	0.000
0005132347	3	0.028	67.1	-107.0	71.6	-0.22	3350	1342	129.5	22.2	545	0.000
0005140237	3	0.008	66.5	-107.2	71.4	-0.17	2956	1342	140.5	25.2	545	0.000
0005140537	3	0.038	66.0	-106.0	71.2	-				28.3	545	0.000
0005142248	3	-0.013	60.1	-79.5	70.7					14.9	438	0.000
0005150138	3	0.007	60.1	-72.9	70.6	-0.00	2724	3396	140.5	17.9	438	0.000
0005150438	3	-0.051	60.1	-72.7	70.4	-0.00	2507	3396	45.0	20.9	438	0.000
0005152328	0	0.054	64.5	-94.8	70.4	-0.07	1260	5499	129.5	5.7	345	0.000
0005160218	0	0.013	64.3	-107.2	70.3	-0.06	1112	5499	140.5	8.7	345	0.000
0005162319	3	0.052	64.1	-106.1	69.7	-0.14	2548	1734	129.5	29.5	521	0.000
0005170209	3	0.020	63.7	-98.6	69.6	-0.12	2444	1734	32.0	32.5	521	0.000
0005170352	2	0.007	60.2	60.5	69.1	0.08	615	9215	68.0	0.2	131	0.000
0005172312	3	0.034	61.5	35.6	68.9	-0.02	2757	5141	129.5	19.3	361	0.000
0005180202	3	-0.010	61.5	-91.1	68.8	-0.02	2433	5141	140.5	22.3	361	0.000

Intermittent bad values.

Intermittent bad values.

```
__I_I_  76687IA1000_
IA1000
MAY 18, 2000  8:27
TANK  1  UNLEADED              MAG    NUMBER OF SAMPLES =  9445
 1334.000 15481.000 15480.000 15480.000 15480.000 15482.000 15483.000 15485.000
15489.000 15494.000 15497.000 45689.000 20931.000 23464.000 23409.000 23962.000
24250.000 24810.000 45691.000
TANK  2  PLUS                  MAG    NUMBER OF SAMPLES =   523
 1309.000 22143.000 22143.000 22143.000 22143.000 22143.000 22145.000 22144.000
22145.000 22145.000 22146.000 45504.000 21342.000 22545.000 23465.000 24019.000
24086.000 24730.000 45503.000
TANK  3  PREMIUM               MAG    NUMBER OF SAMPLES =   462
 1312.000 21871.000 21871.000 21871.000 21871.000 21871.000 21871.000 21871.000
21872.000 21871.000 21871.000 44889.000 21445.000 22442.000 22975.000 23510.000
23695.000 24592.000 44892.000
```

Yet probe's temperature readings look good at this time!

Analysis

From the IA52 command compare LRATE (-0.282) with AVLRTE (0.017). This shows that there is excessive compensation. The most likely cause for excessive compensation is a false probe temperature reading. Examining the IA52 command did not show erroneous thermistor values. However, examining the IA51 command showed that the board temperature value was intermittently bad.

Solution

Replace probe and delete rate table.

CSLD PROBLEM 10 - TANK 8 FAILING

Diagnostics

```
I61200
MAY  7, 1999 10:10 AM

TANK MANIFOLDED PARTNERS

TANK   PRODUCT LABEL          MANIFOLDED TANKS
 1     DIESEL 1                   2, 3, 4, 5
 2     DIESEL 2                   1, 3, 4, 5
 3     DIESEL 3                   1, 2, 4, 5
 4     DIESEL 4                   1, 2, 3, 5
 5     DIESEL 5                   1, 2, 3, 4
 6     AUTO DIESEL               NONE
 7     SUPER                     NONE
 8     REGULAR 1                  9
 9     REGULAR 2                  8
 10                              NONE
 11                              NONE
 12                              NONE
```

Manifolded set.

```
IA5200
MAY  7, 1999 10:11 AM

CSLD DIAGNOSTICS: RATE TEST

TK        DATE  LRATE INTVL ST  AVLRTE    VOL  C1  C3 FDBK ACPT THPUT DFMUL RJT
 6  9905070326 -0.013  41.1  1   0.000   7740  80  22 45.0 44.8  0.86 -0.36   0
 7  9905070456  0.003  22.2  1   0.014   4823  58  23 20.3 16.9  0.87  0.18   1
 8  9905070428  0.246   6.8  8   0.241   8708  11  10  0.0  0.0  2.86  0.79  12
```

Positive rejects.

```
IA5100
MAY  7, 1999 10:11 AM
T 8:REGULAR 1
      TIME ST    LRT AVTMP TPTMP BDTMP  TMRT DSPNS   VOL INTVL    DEL ULLG THPT

9904120309  0  0.395  64.3  67.8  71.5 -0.02   980  8808  36.0   36.8  909  3.0
9904130447  0  0.213  64.8  68.5  72.3 -0.01   849  5892  23.0   62.7 1038  3.0
9904280337  0  0.226  67.1  68.9  70.0 -0.02   608  6015  63.5   75.2 1028  3.1
9904280451  0  0.244  67.1  68.9  70.1 -0.03   578  6013  36.5   76.4 1028  3.1
9904300319  0  0.198  64.8  68.5  72.3  0.05  1102 10406  26.5   15.5  835  3.1
9905030233  0  0.130  65.9  69.9  74.2  0.01  1124 12183  22.0   17.1  762  3.1
9905030302  6 -0.032  65.9  69.9  74.2  0.01   983 12183 117.5   17.8  762  3.1
9905040303  0  0.324  66.8  70.7  74.7 -0.00   902  9501  29.5   41.7  877  2.8
9905040453  0  0.178  66.8  70.6  74.6 -0.01   856  9453  46.5   43.3  879  2.8
9905050339  0  0.186  67.4  71.0  74.8 -0.00   697 11738  90.0    10.  785  2.8
9905070428  0  0.370  68.2  71.8  75.1 -0.02   719  7068  37.0   59.0  983  2.9
```

Positives

```
I61101
MAY  7, 1999 10:13 AM
```

```
      LEAK                TEST    <------START TEST TIME------>
      TEST   TEST   TEST   START
TANK  METHOD TYPE   HOURS  METHOD  YEAR  MONTH  DAY  OCCUR   HH:MM
----  -----  ----   -----  ------  ----  -----  ---  -----   -----
8     CSLD   PER.   AUTO   CSLD
9     NONE
```

Analysis

Tanks 8 and 9 were manifolded and programmed as manifolded. However, the leak test frequency selected for Tank 9 was not CSLD. The CSLD program was only using Tank 8's volume to perform the test. When Tank 9 was filling, Tank 8's LRATE was positive.

Solution

Set Tank 9's Leak Test Method to CSLD and delete tank 8 and 9 rate tables.

CSLD PROBLEM 11 - PERIODIC TEST FAIL TANK 2

Diagnostics

```
200
Site ID
Site ID
Site ID
NOV 16, 1999  1:06 PM

TANK  PRODUCT               GALLONS  INCHES   WATER  DEG F   ULLAGE

  1   REGULAR                  8543   61.99     0.0   77.4     3139
  2   PLUS                     3705   32.53     0.0   85.2     7977
  3   SUPREME                  6024   46.50     0.0   80.4     5658

__       76687IA5100_
IA5100
NOV 16, 1999  1:06 PM

CSLD DIAGNOSTICS: RATE TABLE
T 2:PLUS
      TIME ST    LRT AVTMP TPTMP BDTMP  TMRT DSPNS   VOL INTVL    DEL ULLG THPT

9910181409  3 -1.252  98.7  97.2  98.9  0.36   734   601  50.0   26.5  717  2.4
9910181537  6 -0.824  99.2  97.2  98.9  0.39   582   599 142.0   28.0  717  2.4
9910190355  1 -0.464  91.4  96.5  98.9  0.28   432  2783  14.0    9.1  572  2.4
9910192324  3 -0.132  96.6  96.9  98.9 -0.21   898  1474  52.5   28.6  646  2.4
9910200241  3 -0.152  96.0  96.6  98.9 -0.13   753  1445 143.5   31.9  648  2.4
CSLD DIAGNOSTICS: RATE TABLE
T 3:SUPREME
      TIME ST    LRT AVTMP TPTMP BDTMP  TMRT DSPNS   VOL INTVL    DEL ULLG THPT

9910190459  0 -0.166  85.9  88.1  88.8  0.02  1074  5434  52.5   10.2  456  6.9
9910200011  0 -0.131  85.7  88.0  88.9  0.03   925  5970  34.5    4.3  434  6.9
```

High 90s inconsistent with other tanks.

```
9910200121  0 -0.134  85.8  88.0  88.9  0.03   862  5958  47.0    5.4  434  6.9
9910200243  0 -0.102  85.8  88.1  88.9  0.03   797  5955 126.0    6.8  434  6.9

CSLD DIAGNOSTICS: RATE TABLE
T 1:REGULAR
      TIME ST    LRT AVTMP TPTMP BDTMP  TMRT DSPNS   VOL INTVL    DEL ULLG THPT

9910200045  0 -0.049  84.9  86.2  88.6  0.04   856  8970  47.0    4.6  301 10.7
9910200212  0 -0.022  85.0  86.3  88.6  0.02   755  8969 109.5    6.1  301 10.7
9910200451  0  0.115  85.1  86.5  88.6  0.00   753  8940  26.0    8.7  302 10.7
9910210348  3 -0.096  86.3  87.0  88.7  0.02  1455  8414  31.0   12.2  327 10.7
9910210459  0 -0.011  86.3  87.0  88.7  0.02  1394  8410  32.5   13.4  328 10.7
9910220344  0 -0.087  84.4  85.7  88.5  0.05   661  9773  43.5    6.4  257 10.7
```

Mid 80s

Analysis

It can be seen that the temperatures in Tank 2 are abnormally higher than in the other tanks. This problem was traced to a stuck relay. The pump was running continuously and heating up the fuel.

Solution

Replace the stuck relay for pump in Tank 2.

CSLD PROBLEM 12 - PERIODIC TEST FAIL ON TANK 1

Diagnostics

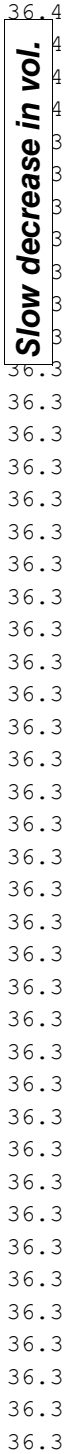
```
IA5400
NOV 20, 1998  7:31 AM

CSLD DIAGNOSTICS: MOVING AVERAGE TABLE
T 1:PREM
        TIME  SMPLS     TLCVOL   HEIGHT   AVGTEMP   TOPTEMP    BDTEMP
981120072142     30   3456.82   36.518     61.85     60.91     57.32
981120072212     31   3456.80   36.518     61.85     60.90     57.32
981120072242     30   3456.80   36.518     61.85     60.90     57.33
981120072312     30   3456.76   36.518     61.85     60.90     57.33
981120072342     30   3456.78   36.518     61.85     60.90     57.34
981120072412     31   3456.79   36.518     61.85     60.90     57.34
981120072442     30   3456.80   36.518     61.85     60.90     57.34
981120072512     30   3455.51   36.512     61.85     60.90     57.34
981120072542     31   3451.16   36.489     61.85     60.90     57.35
981120072612     30   3446.74   36.466     61.85     60.90     57.35
981120072642     31   3441.81   36.441     61.85     60.90     57.35
981120072712     30   3437.17   36.417     61.85     60.90     57.35
981120072742     30   3435.84   36.410     61.85     60.90     57.34
981120072812     31   3435.37   36.408     61.85     60.90     57.34
981120072842     30   3435.12   36.406     61.85     60.89     57.34
981120072912     31   3434.87   36.405     61.85     60.89     57.33
981120072942     30   3434.70   36.404     61.85     60.89     57.33
981120073012     30   3434.65   36.404     61.85     60.89     57.32
981120073042     31   3434.54   36.403     61.85     60.88     57.32
981120073112     30   3434.45   36.403     61.85     60.88     57.32
981120073142     31   3434.39   36.403     61.85     60.87     57.31
```

Dispensing

Slow decrease in vol.

981120073212	29	3434.29	36.402	61.85	60.87	57.31
981120073242	30	3434.18	36.402	61.85	60.86	57.30
981120073312	30	3434.04	36.401	61.85	60.86	57.30
981120073342	30	3433.96	36.400	61.85	60.85	57.30
981120073412	31	3433.91	36.400	61.85	60.85	57.30
981120073442	30	3433.88	36.400	61.85	60.85	57.30
981120073512	31	3433.84	36.400	61.85	60.84	57.30
981120073542	30	3433.85	36.400	61.85	60.84	57.31
981120073642	31	3433.81	36.400	61.85	60.83	57.31
981120073712	30	3433.82	36.400	61.85	60.83	57.32
981120073742	31	3433.77	36.399	61.85	60.83	57.32
981120073812	30	3433.69	36.399	61.85	60.83	57.32
981120073842	31	3433.63	36.399	61.85	60.82	57.33
981120073912	30	3433.62	36.399	61.85	60.82	57.33
981120073942	31	3433.56	36.398	61.85	60.83	57.33
981120074012	30	3433.63	36.399	61.85	60.83	57.33
981120074042	30	3433.58	36.398	61.85	60.83	57.33
981120074112	30	3433.60	36.399	61.85	60.83	57.33
981120074142	30	3433.60	36.399	61.85	60.84	57.33
981120074212	31	3433.57	36.398	61.85	60.84	57.33
981120074242	30	3433.55	36.398	61.85	60.84	57.33
981120074312	31	3433.54	36.398	61.85	60.85	57.33
981120074342	30	3433.50	36.398	61.85	60.85	57.34
981120074412	31	3433.43	36.398	61.85	60.85	57.34
981120074442	30	3433.48	36.398	61.85	60.86	57.34
981120074512	31	3433.47	36.398	61.85	60.86	57.34
981120074542	30	3433.44	36.398	61.85	60.86	57.34
981120074612	30	3433.46	36.398	61.85	60.87	57.35
981120074642	31	3433.49	36.398	61.85	60.87	57.35
981120074712	30	3433.50	36.398	61.85	60.87	57.35
981120074742	30	3433.46	36.398	61.85	60.88	57.35
981120074812	31	3433.47	36.398	61.85	60.88	57.35
981120074842	30	3433.41	36.398	61.85	60.88	57.36
981120074912	30	3433.44	36.398	61.85	60.88	57.36
981120074942	31	3433.41	36.398	61.85	60.88	57.36
981120075012	30	3433.36	36.397	61.85	60.88	57.36
981120075042	30	3433.35	36.397	61.85	60.88	57.37
981120075112	30	3433.41	36.398	61.85	60.88	57.37
981120075142	29	3433.41	36.398	61.85	60.88	57.37
981120075212	29	3433.39	36.397	61.85	60.88	57.37
981120075242	32	3433.37	36.397	61.85	60.88	57.38
981120075312	30	3433.41	36.398	61.85	60.88	57.38
981120075342	30	3433.39	36.397	61.85	60.88	57.38
981120075412	31	3433.40	36.398	61.85	60.88	57.38
981120075442	30	3433.37	36.397	61.85	60.88	57.38
981120075512	30	3433.34	36.397	61.85	60.89	57.38
981120075542	31	3433.35	36.397	61.85	60.88	57.39
981120075612	31	3433.38	36.397	61.85	60.88	57.39
981120075642	30	3433.31	36.397	61.85	60.88	57.39
981120075712	30	3433.31	36.397	61.85	60.88	57.40
981120075742	30	3433.29	36.397	61.85	60.88	57.40



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981120075812     31   3433.29    36.397     61.85     60.88     57.40
981120075842     30   3433.30    36.397     61.85     60.88     57.41
981120075912     30   3433.27    36.397     61.85     60.88     57.41
981120075942     30   3433.28    36.397     61.85     60.88     57.41
981120080012     30   3433.30    36.397     61.85     60.88     57.41
981120080042     30   3433.26    36.397     61.85     60.88     57.42
981120080112     31   3433.23    36.397     61.85     60.88     57.42
981120080142     30   3433.13    36.396     61.85     60.89     57.42
981120080212     31   3433.14    36.396     61.85     60.89     57.42
981120080242     30   3433.12    36.396     61.85     60.89     57.42
981120080312     30   3433.05    36.396     61.85     60.89     57.42
981120080342     31   3433.04    36.396     61.85     60.89     57.42
981120080412     30   3433.10    36.396     61.85     60.89     57.41
981120080442     31   3433.07    36.396     61.85     60.89     57.41
981120080512     30   3433.08    36.396     61.85     60.90     57.40
981120080542     30   3433.08    36.396     61.85     60.90     57.40
981120080612     30   3433.06    36.396     61.85     60.90     57.40
981120080642     31   3433.04    36.396     61.85     60.90     57.39
981120080712     31   3433.06    36.396     61.85     60.90     57.39
981120080742     30   3432.99    36.395     61.85     60.90     57.39
981120080812     30   3432.99    36.395     61.85     60.90     57.39
981120080842     31   3433.00    36.395     61.85     60.90     57.40
981120080912     30   3433.03    36.396     61.85     60.90     57.40
981120080942     31   3433.02    36.396     61.85     60.89     57.40
981120081012     30   3433.04    36.396     61.85     60.89     57.40
MOVING AVERAGE:   3433.07

DISPENSE STATE: IDLE      0.097659
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Analysis

Examining the IA54 table showed that following a dispense the level continued dropping for a long period of time. Inspecting the probe revealed that the floats had been installed upside down.

Solution

Reinstall floats correctly and delete rate table.

VEEDER-ROOT



Ver.: F.6, 05/05/2025