Manual No: **576013-818** • Revision: **K**

TLS-3XX Series Consoles

Troubleshooting Guide

VEEDER-ROOT

Notice

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DAMAGE CLAIMS

1. Thoroughly examine all components and units as soon as they are received. If damaged, write a complete and detailed description of the damage on the face of the freight bill. The carrier's agent *must* verify the inspection and sign the description.
2. Immediately notify the delivering carrier of damage or loss. This notification may be given either in person or by telephone. Written confirmation must be mailed within 48 hours. Railroads and motor carriers are reluctant to make adjustments for damaged merchandise unless inspected and reported promptly.
3. Risk of loss, or damage to merchandise remains with the buyer. It is the buyer's responsibility to file a claim with the carrier involved.

RETURN SHIPPING

For the parts return procedure, please follow the appropriate instructions in the "General Returned Goods Policy" and "Parts Return" pages in the "Policies and Literature" section of the Veeder-Root **North American Environmental Products** price list.

9 Probe Troubleshooting

10 Dispenser Interface Modules (DIMs)

11 CSLD Troubleshooting

12 BIR Troubleshooting

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1 Introduction

This manual contains troubleshooting information for the TLS-3XX Series Consoles. Most of the components discussed in this manual are replaceable and not repaired. The intent of this manual is to help you identify replaceable parts and assemblies, explain alarms and diagnostic displays, provide accepted troubleshooting guidelines for sensor, probe and DIM problems, and include actual examples illustrating methods for isolating CSLD and BIR problems.

Information on individual plug-in modules is covered in manuals accompanying those components and/or systems.

Related Manuals

Troubleshooting of a TLS 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:

576013-879	TLS-3XX Series Site Prep and Installation Manual
576013-623	TLS-3XX Series System Setup Manual
576013-610	TLS-3XX Series Operating Manual
576013-635	TLS-3XX Series RS-232 Serial Interface Manual
577013-750	Sensor Products Application Guide

Contractor Certification Requirements

This manual was written for **Level 3 or Level 4 certified** technicians who have completed system troubleshooting and service training.

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

Level 1 Contractors holding valid Level 1 Certification are approved to perform wiring and conduit routing, equipment mounting, probe and sensor installation, tank and line preparation, and line leak detector installation.

Level 2/3 Contractors holding valid Level 2 or 3 Certifications are approved to perform installation checkout, startup, programming and operations training, troubleshooting and servicing for all Veeder-Root Tank Monitoring Systems, including Line Leak Detection and associated accessories.

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.

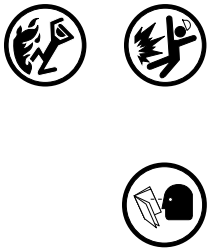
TURN POWER OFF
Live power to a device creates a potential shock hazard. Turn Off power to the device and associated accessories when servicing the unit.

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.

Safety Warnings

⚠ WARNING



This system operates near highly combustible fuel storage tanks.

Fire or explosion resulting in serious injury or death could result if the equipment is improperly installed or modified or is used in any way other than its intended use. Serious contamination of the environment may also occur.

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 Code; federal, state, and local codes; and other applicable safety codes.**
3. **Substitution of components may impair intrinsic safety.**
4. **Do not modify or use service parts other than those provided by Veeder-Root.**

Explanation of Software Version Numbering

Software version numbers for TLS Consoles are designated in five formats: 0xx, 1xx, 3xx, 4xx, and 5xx. These formats are assigned based on the console's having a CPU or ECPU board, its model designation, and its enabled features:

TLS-300 CONSOLES

- **424** software (up to 8 tanks and 8 Sensors)

TLS-350* CONSOLES HAVING FORM NUMBERS 08470XX-XXX

- **020** software (up to 8 tanks and 6 PLLD line leak transducers)
- **520** software (up to 8 tanks and 9 WPLLD line leak transducers)
- *Feature enhancements for this console will not be supported beyond V20 software.

TLS-350J* CONSOLES HAVING FORM NUMBERS 08470XX-XXX

- **020** software (up to 3 tanks and 3 PLLD line leak transducers)
- **520** software (up to 3 tanks and 3 WPLLD line leak transducers)
- *Feature enhancements for this console will not be supported beyond V20 software.

TLS-350 PLUS CONSOLES HAVING FORM NUMBERS 08482XX-XXX

- **124** software (up to 8 tanks and 6 PLLD or 9 WPLLD line leak transducers)

TLS-350R CONSOLES HAVING FORM NUMBERS 08482XX-XXX

- **124** software (up to 8 tanks, 6 PLLD or 9 WPLLD line leak transducers, and BIR on single tanks only)
- **324** software (up to 12 tanks, 6 PLLD or 9 WPLLD line leak transducers, and/or BIR on manifolded tanks).

Verifying Installed System Features

CONSOLE HAS AN OPTIONAL PRINTER:

If the console has a printer, you can determine which system features, such as Business Inventory Reconciliation (BIR), are available in your console as follows.

1. Press the MODE key until the front panel display reads:

   ```
   DIAG MODE
   PRESS <FUNCTION> TO CONT
   ```

2. Press the FUNCTION key until this message appears:

   ```
   SYSTEM DIAGNOSTIC
   PRESS <STEP> TO CONTINUE
   ```

3. Press the PRINT key and the printer prints:

   SOFTWARE REVISION LEVEL

   VERSION XXX.XX *(first 3 digits = software version e.g. 120. The second two are its rev level)*

   SOFTWARE# XXXXXX-XXX-X

   CREATED - YY:MM:SS:HH:MM

   S-MODULE# XXXXXX-XXX-X

4. After the S-Module part number prints, a list of your system's current features follows. Press the MODE key to return to the main screen:

   ```
   MMM DD, YYYY HH:MM:SM XM
   ALL FUNCTIONS NORMAL
   ```

5. Close and secure the left front door.

CONSOLE DOES NOT HAVE A PRINTER

If the console does not have a printer, you can determine which system features, such as BIR, are available in your console by knowing the part number of the S-Module (SEM) installed on the CPU or ECPU board (except CPU boards with 28-pin RAM chips [U4 & U5] - see Figure 2-5) and then looking that number up in Table 1-1 or Table 1-2 below.

1. Press the MODE key until the front panel display reads:

   DIAG MODE
   PRESS <FUNCTION> TO CONT

2. Press the FUNCTION key until this message appears:

   SYSTEM DIAGNOSTIC
   PRESS <STEP> TO CONTINUE

3. Press STEP until this message appears:

   SOFTWARE MODULE
   S-MODULE# XXXXXX-XXX-X

4. Match the first 9 digits of the S-Module number to the SEM part numbers in Table 1-1 or Table 1-2 below to verify what enhancements are enabled in your console.

Table 1-1.- TLS-350 Series Console SEM Modules & Features

SEM	Label ID	Available Features
330160-002	0-002	CS, MN
330160-003	0-003	FL
330160-005	0-005	CS, FL, MN
330160-010	0-010	P1C2C
330160-012	0-012	P1C2C, CS, MN
330160-013	0-013	P1C2C, FL
330160-015	0-015	P1C2C, CS, FL, MN
330160-020	0-020	TC
330160-022	0-022	TC, CS, MN
330160-023	0-023	TC, FL
330160-025	0-025	TC, CS, FL, MN
330160-030	0-030	TC, P1C2C

FEATURES LEGEND

BIR – BIR - Basic Inventory Reconciliation (TLS-350R)
CS – Continuous statistical leak detection
MN – CS for manifolded tanks
FL – Fuel management reorder
P1C2C – PLLD .1 gph & .2 gph continuous
TC – Tanker Loading Control
WP1D – WPLLD/PLLD .1 gph test on-demand
WP1D2C – WPLLD/PLLD .1 gph test on-demand, & and .2 gph test continuous

consoles\35fea

Table 1-1.- TLS-350 Series Console SEM Modules & Features

SEM	Label ID	Available Features
330160-032	0-032	TC, P1C2C, CS, MN
330160-033	0-033	TC, P1C2C, FL
330160-035	0-035	TC, P1C2C, CS, FL, MN
330160-050	0-050	WP1D
330160-052	0-052	WP1D, CS, MN
330160-053	0-053	WP1D, FL
330160-055	0-055	WP1D, CS, FL, MN
330160-060	0-060	WP1D2C
330160-062	0-062	WP1D2C, CS, MN
330160-063	0-063	WP1D2C, FL
330160-065	0-065	WP1D2C, CS, FL, MN
330160-070	0-070	TC, WP1D
330160-072	0-072	TC, WP1D, CS, MN
330160-073	0-073	TC, WP1D, FL
330160-075	0-075	TC, WP1D, CS, FL, MN
330160-080	0-080	TC, WP1D2C
330160-082	0-082	TC, WP1D2C, CS, MN
330160-083	0-083	TC, WP1D2C, FL
330160-085	0-085	TC, WP1D2C, CS, FL, MN
330160-100	0-100	BIR

Table 1-1.- TLS-350 Series Console SEM Modules & Features

SEM	Label ID	Available Features
330160-102	0-102	CS, MN, BIR
330160-103	0-103	FL, BIR
330160-105	0-105	CS, FL, MN, BIR
330160-110	0-110	P1C2C, BIR
330160-112	0-112	P1C2C, CS, MN, BIR
330160-113	0-113	P1C2C, FL, BIR
330160-115	0-115	P1C2C, CS, FL, MN, BIR
330160-120	0-120	TC, BIR
330160-122	0-122	TC, CS, MN, BIR
330160-123	0-123	TC, FL, BIR
330160-125	0-125	TC, CS, FL, MN, BIR
330160-130	0-130	TC, P1C2C, BIR
330160-132	0-132	TC, P1C2C, CS, MN, BIR
330160-133	0-133	TC, P1C2C, FL, BIR
330160-135	0-135	TC, P1C2C, CS, FL, MN, BIR
330160-150	0-150	WP1D, BIR
330160-152	0-152	WP1D, CS, MN, BIR
330160-153	0-153	WP1D, FL, BIR
330160-155	0-155	WP1D, CS, FL, MN, BIR
330160-160	0-160	WP1D2C, BIR

Table 1-1.- TLS-350 Series Console SEM Modules & Features

SEM	Label ID	Available Features
330160-162	0-162	WP1D2C, CS, MN, BIR
330160-163	0-1363	WP1D2C, FL, BIR
330160-165	0-165	WP1D2C, CS, FL, MN, BIR
330160-170	0-170	TC, WP1D, BIR
330160-172	0-172	TC, WP1D, CS, MN, BIR
330160-173	0-173	TC, WP1D, FL, BIR
330160-175	0-175	TC, WP1D, CS, FL, MN, BIR
330160-180	0-180	TC, WP1D2C, BIR

Table 1-2 TLS-300 Console SEM Modules and Features

SEM	Label ID	Available Features
330161-001	1-001	0.1 Leak Detection
330161-003	1-003	0.1 Leak Detection and CSLD
330161-020	1-020	Tanker Loading Control
330161-021	1-021	Tanker Loading Control and 0.1 Leak Detection

5. Press the MODE key to return to the main screen:

MMM DD, YYYY HH:MM:SM XM
ALL FUNCTIONS NORMAL

6. Close and secure the left front door.

2 System Description

System Parts Identification

The following figures identify the components of TLS-3XX Series Consoles. Plug-in modules are not shown.

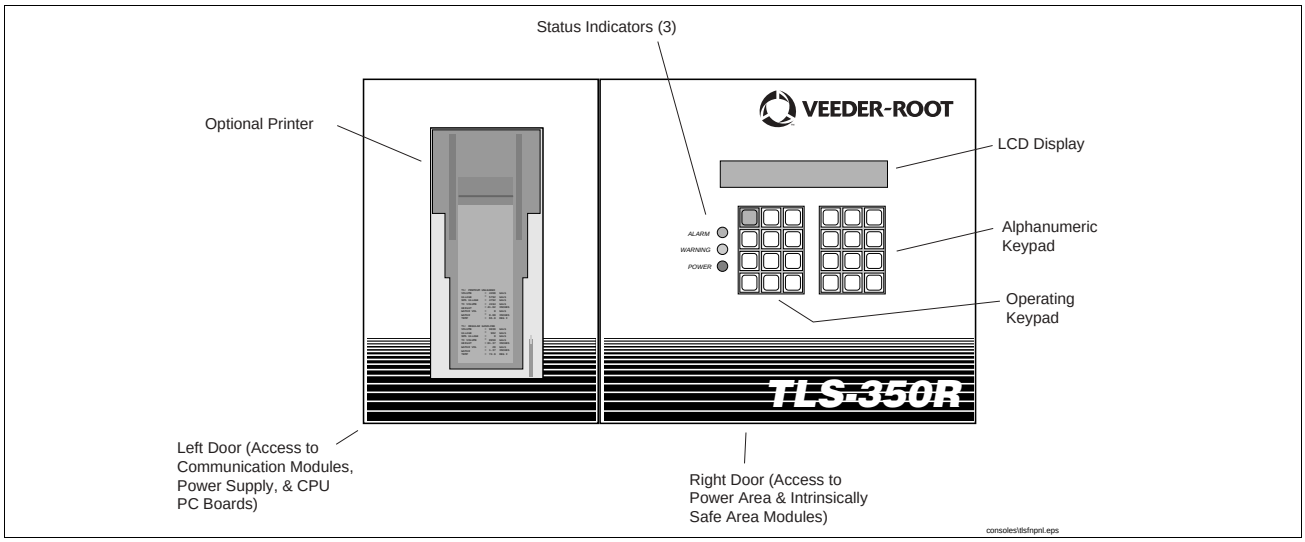


Figure 2-1. Console Front Panel (except for graphics, console doors are identical)

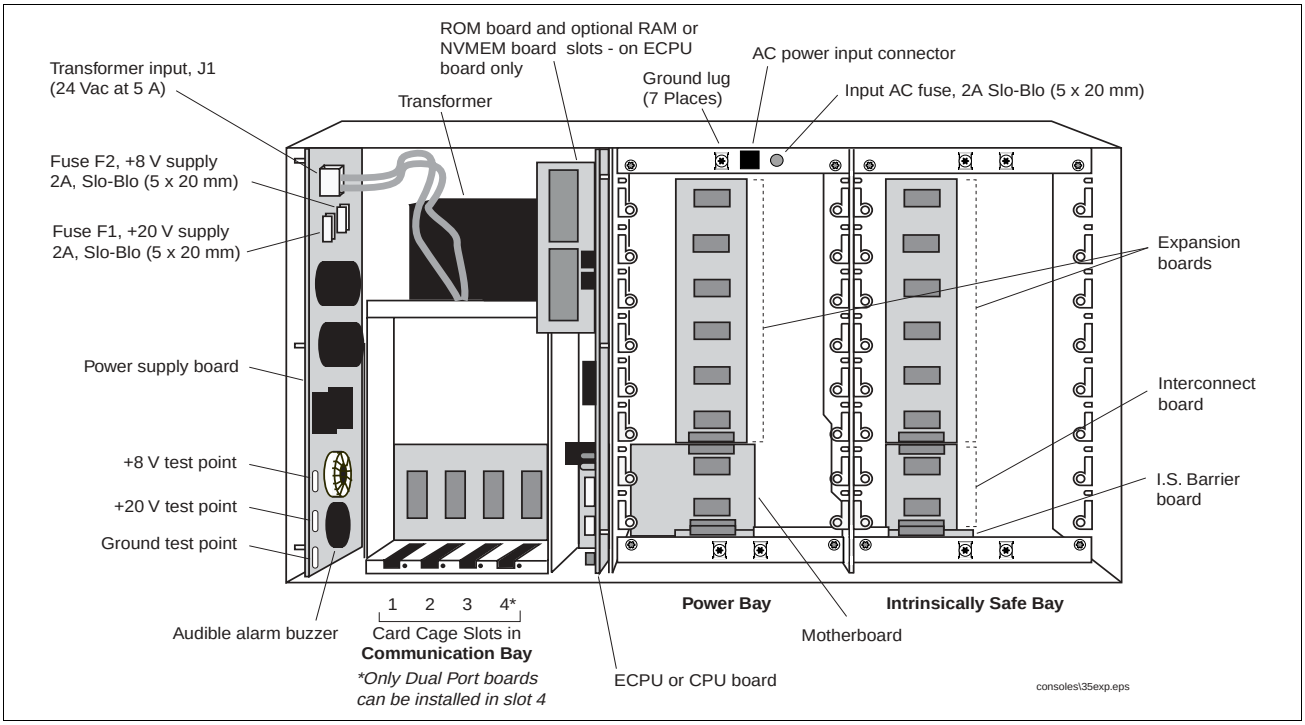


Figure 2-2. Communication Bay, Power Bay and Intrinsically Safe Bay Identification (TLS-350 Series Consoles)

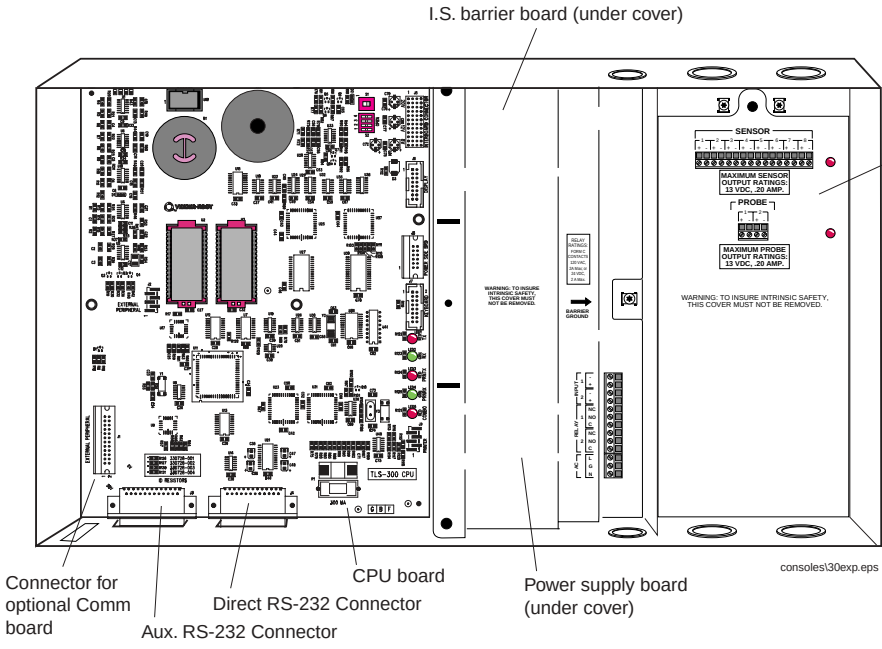


Figure 2-3. PC Board Identification (TLS-300 Series Consoles shown with doors removed)

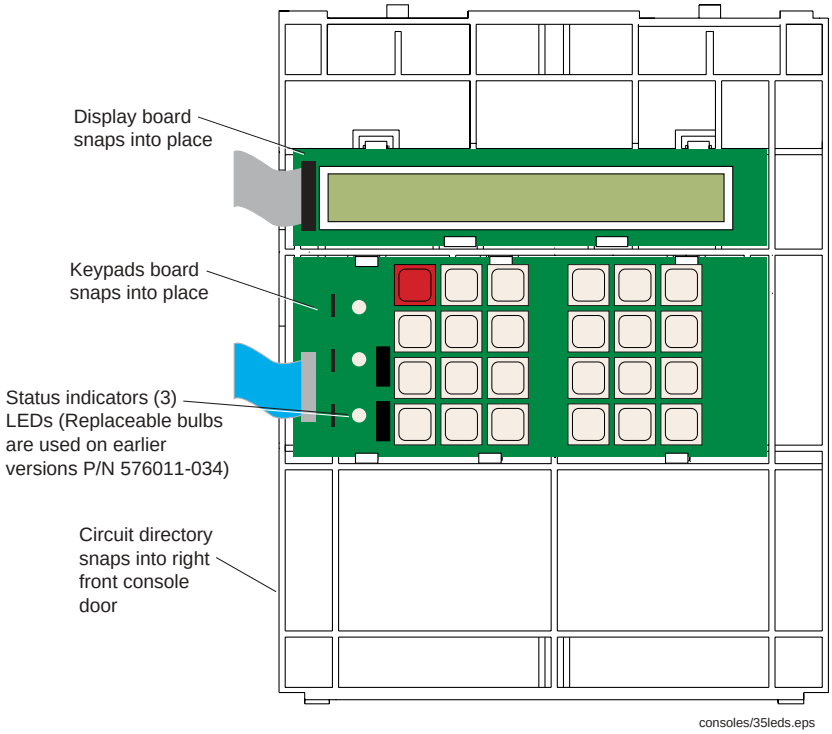


Figure 2-4. Console Display/Keyboard Board Components (behind right door)

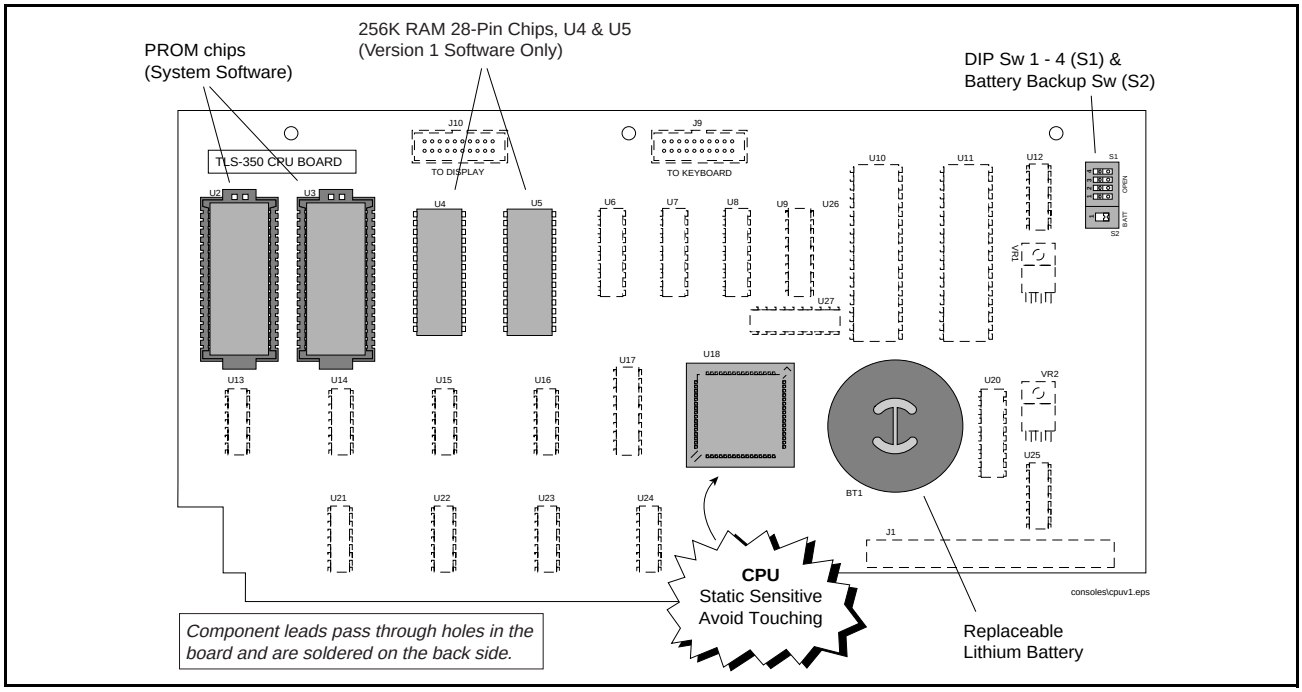


Figure 2-5. TLS-350 Consoles CPU board layout with through-hole components and 28-pin RAM chips (*This board is no longer in production*)

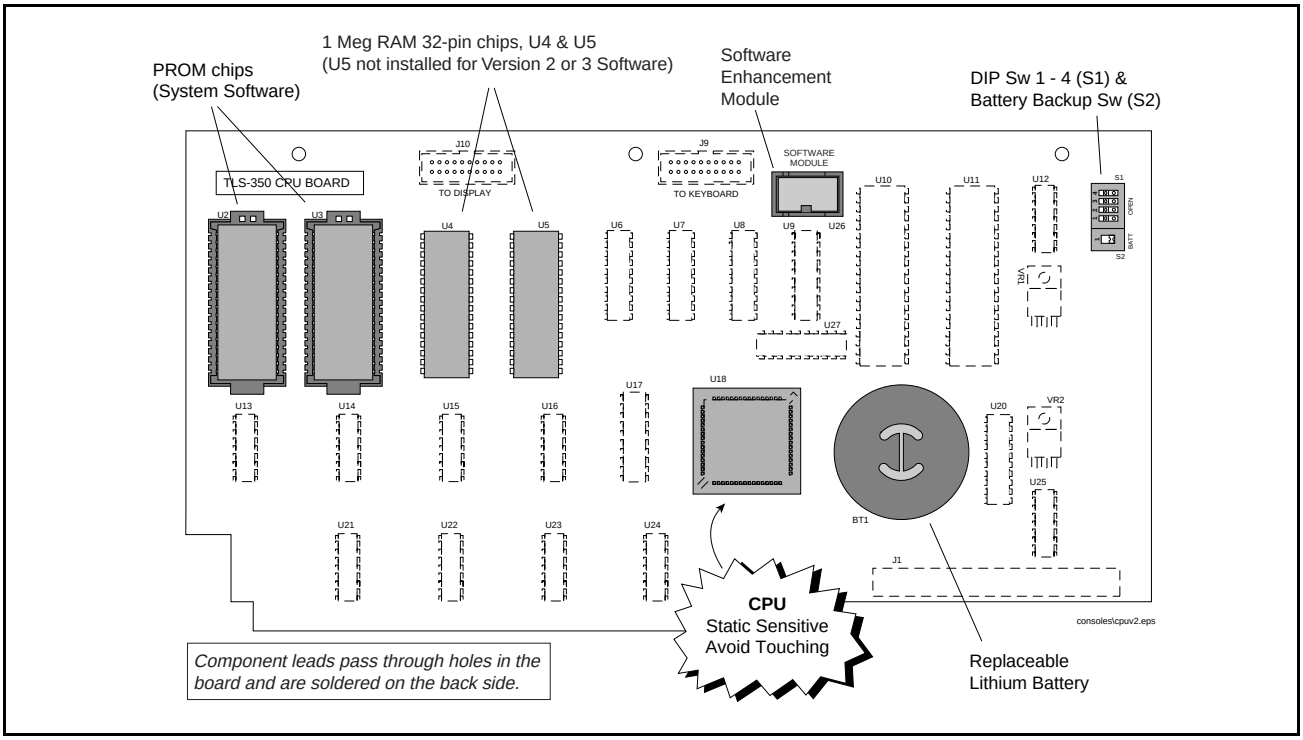


Figure 2-6. TLS-350 Consoles CPU board layout with through-hole components and 32-pin RAM chips (*This board is no longer in production*)

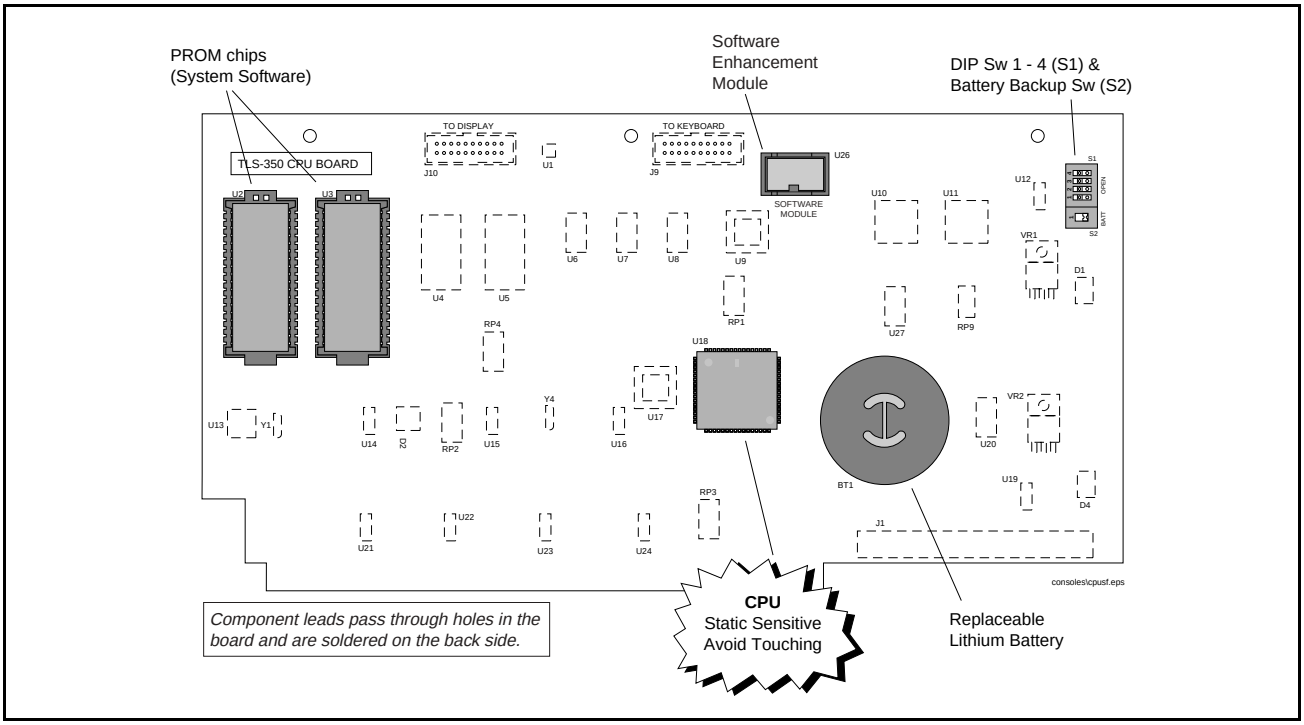


Figure 2-7. TLS-350 Consoles CPU board layout with surface-mount components (*This board is no longer in production*)

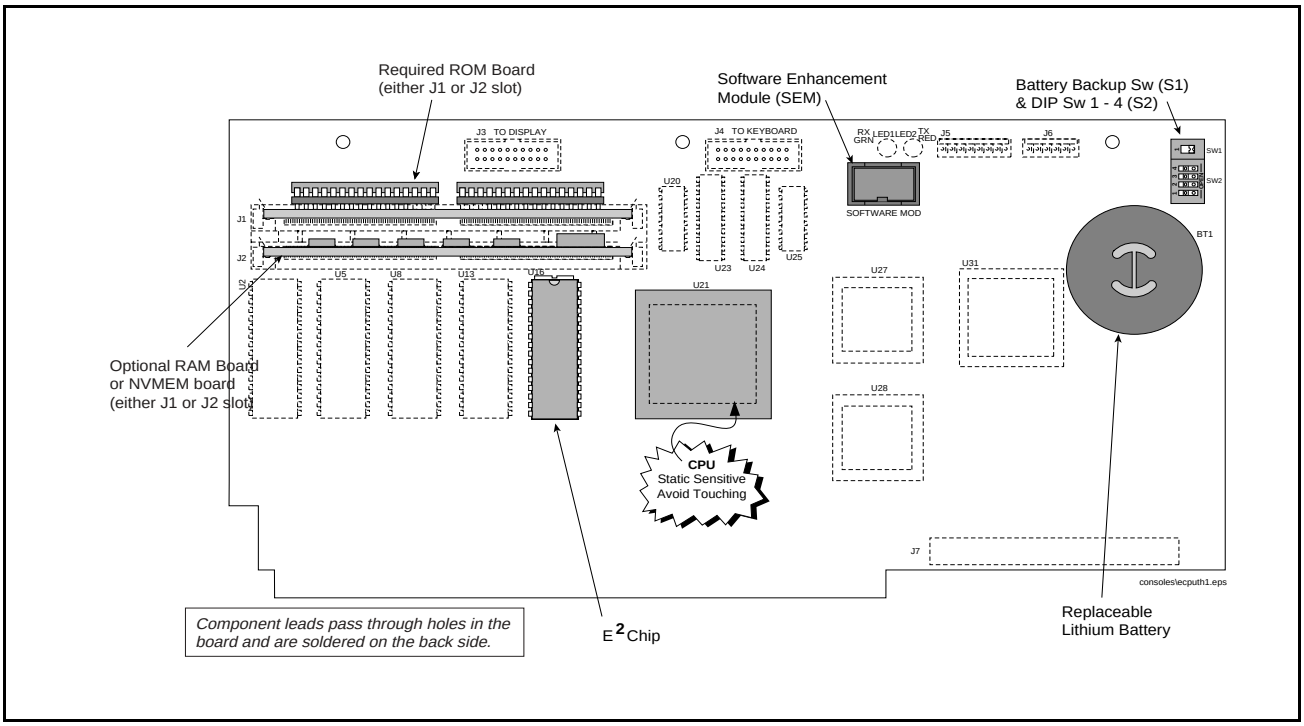


Figure 2-8. TLS-350 Consoles ECPU board layout with through-hole components (*This board is no longer in production*)

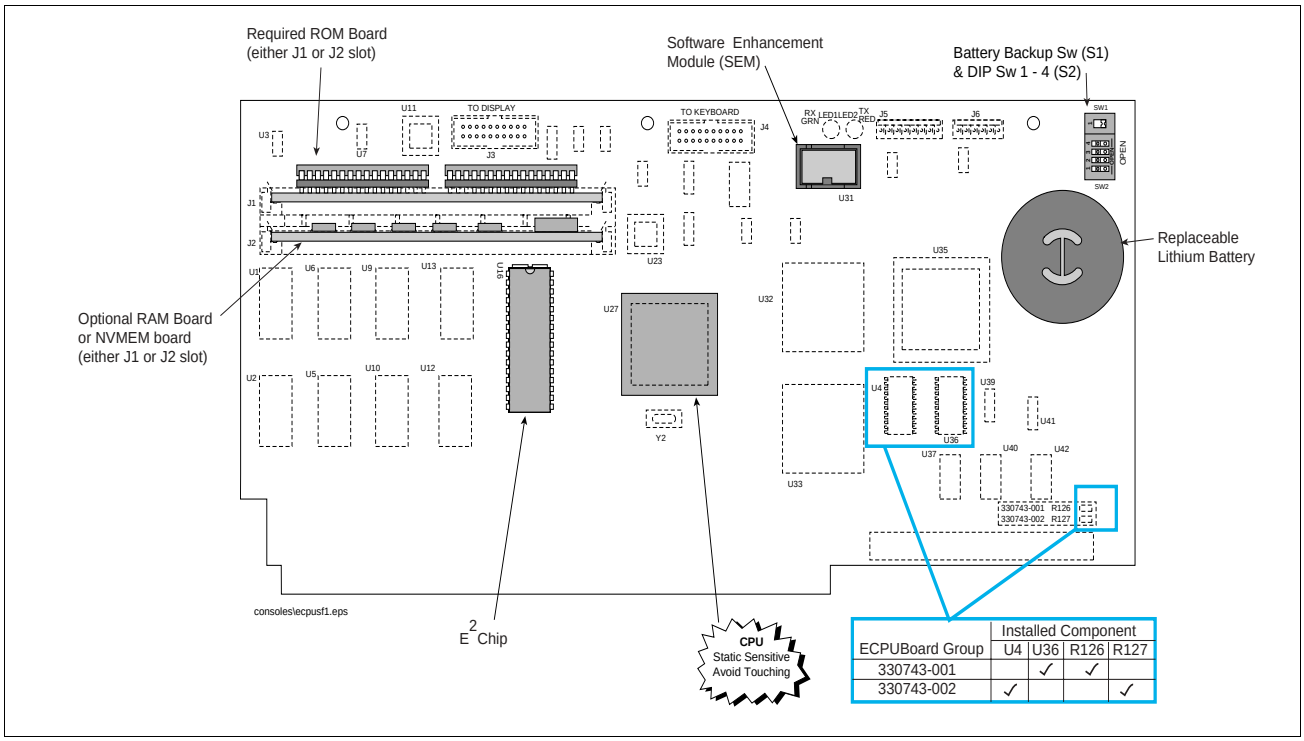


Figure 2-9. TLS-350 Consoles ECPU board layout

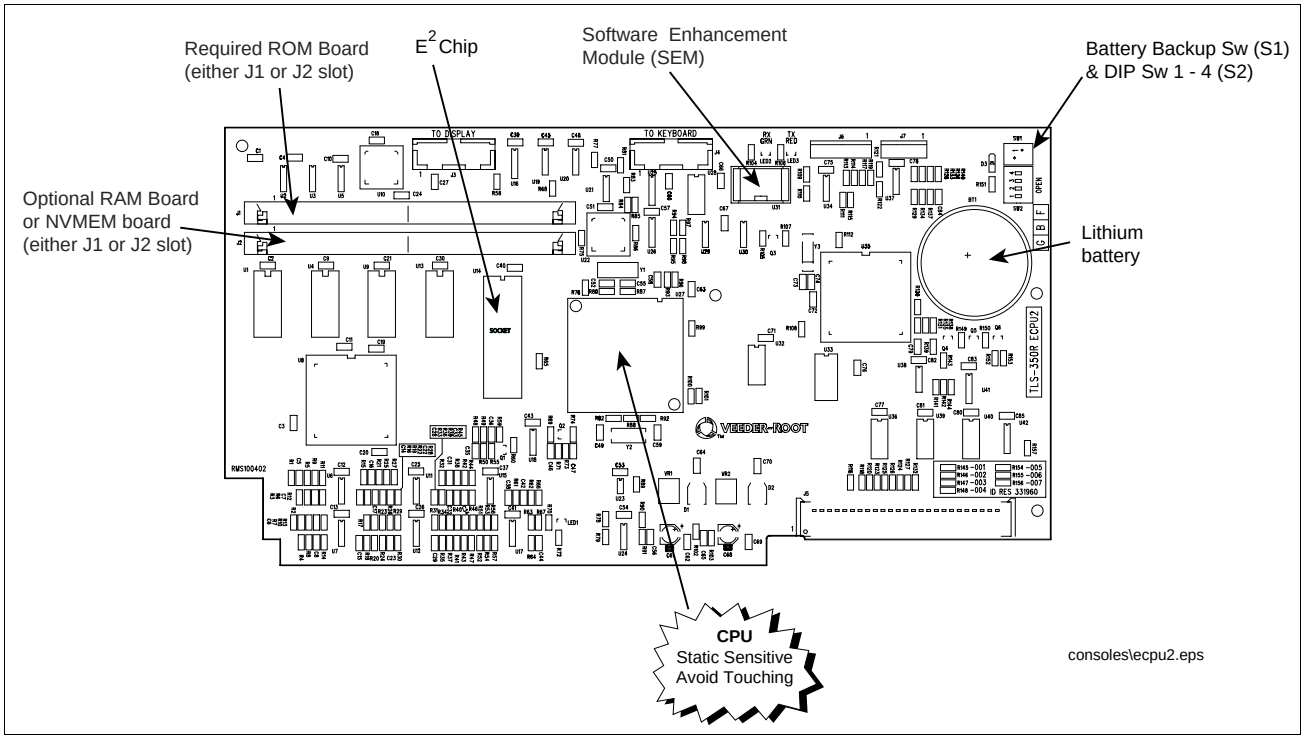
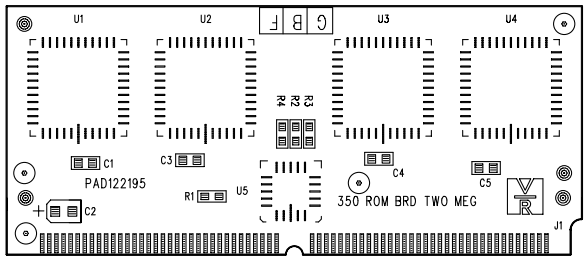
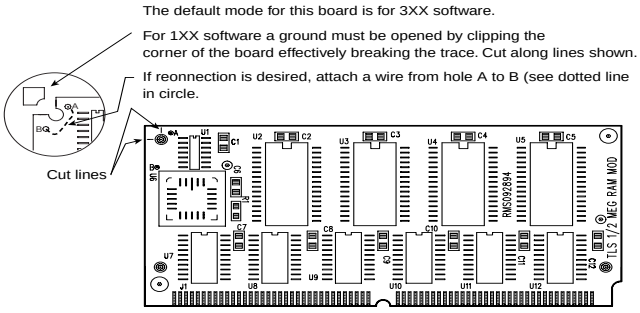


Figure 2-10. TLS-350 Consoles ECPU2 board layout



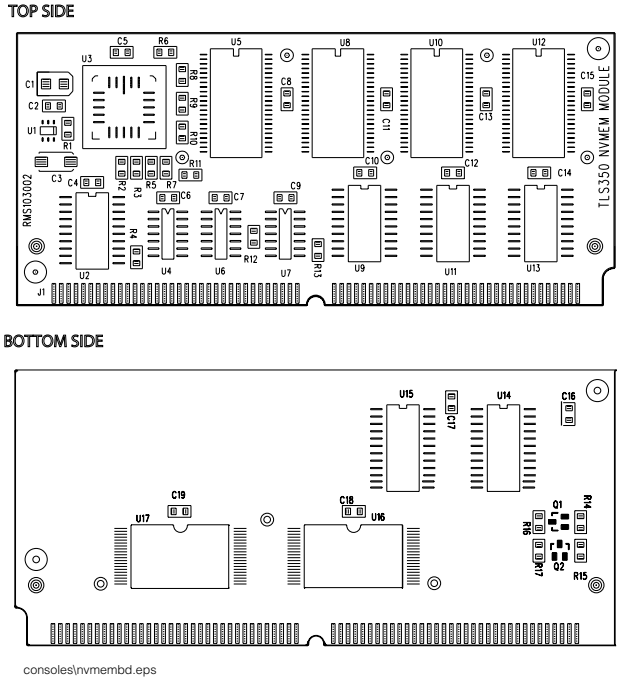
consoles\2megrombd.eps

Figure 2-11. TLS-350 Series Console - 2 Meg ROM Board



consoles\1-2megrambd.eps

Figure 2-12. TLS-350 Series Console - 1/2 Meg RAM Board



consoles\nvmembd.eps

Figure 2-13. TLS-350 Series Console - NVMEM Board

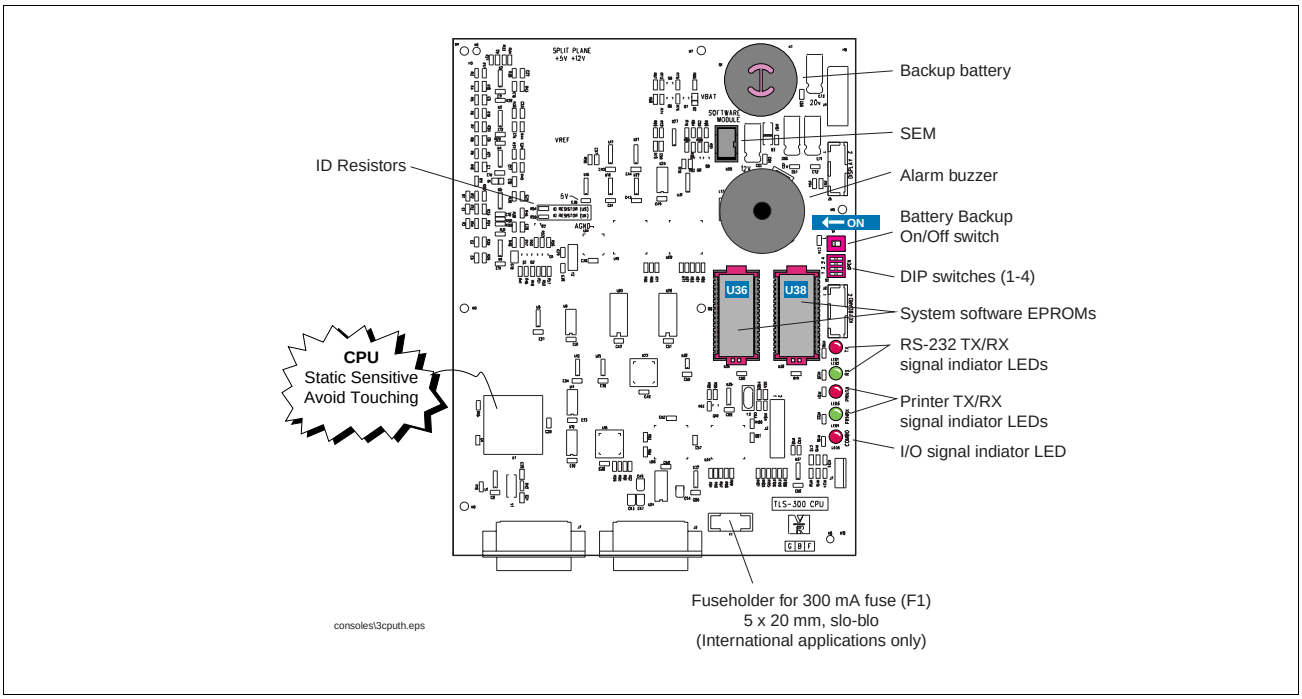


Figure 2-14. TLS-300 Series Console CPU board layout w/ through-hole components (*This board is no longer in production*)

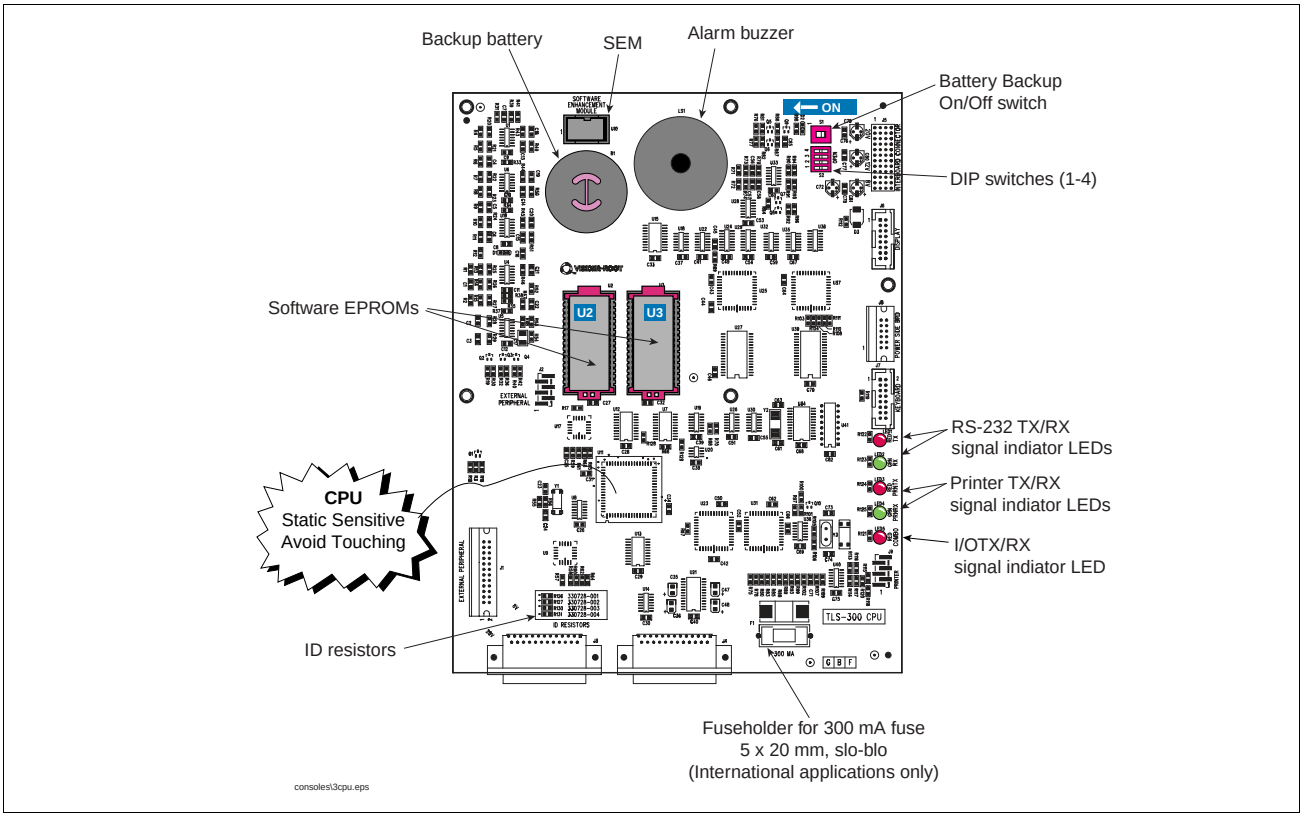


Figure 2-15. TLS-300 Series Console CPU board layout with surface-mount components

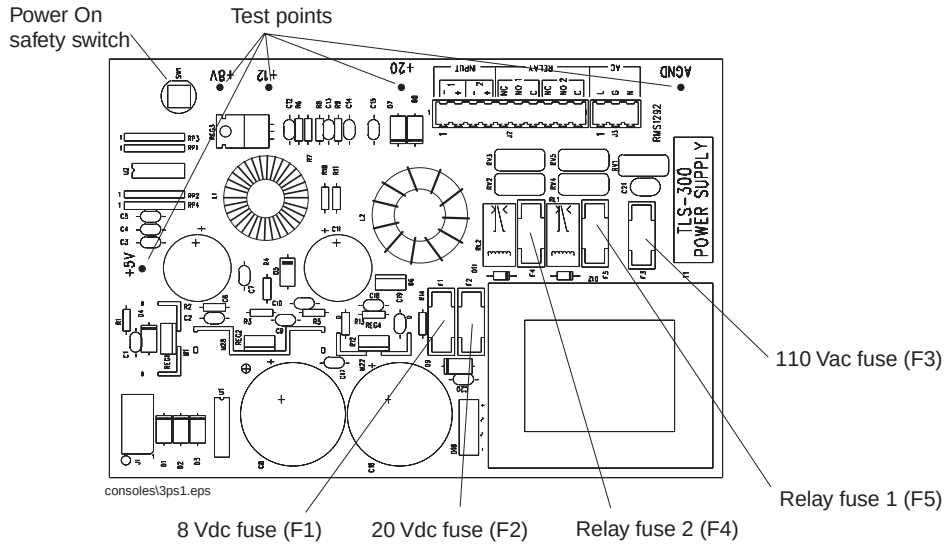


Figure 2-16. TLS-300 Series Console Power Supply Board (*This board is no longer in production*)

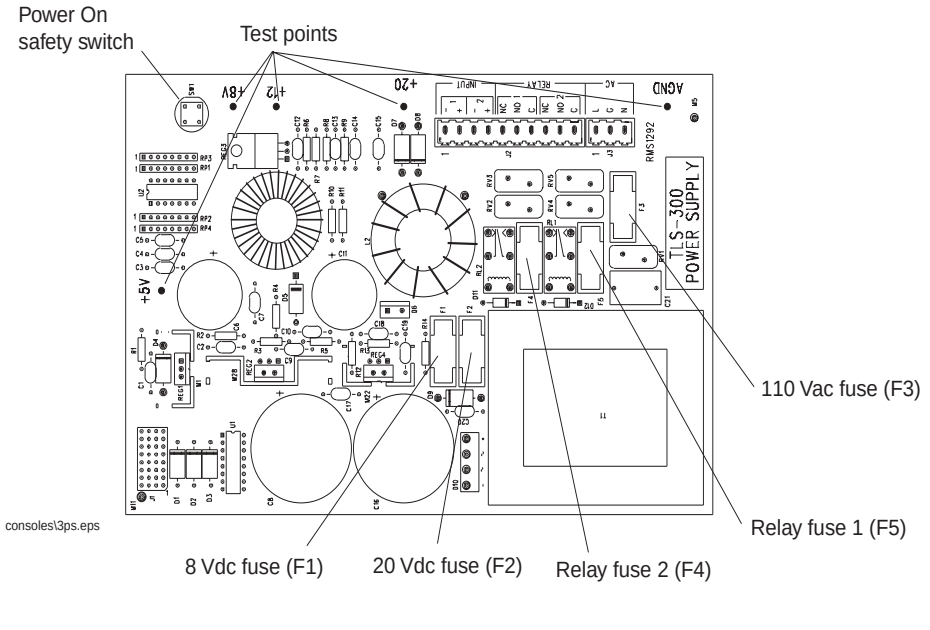


Figure 2-17. TLS-300 Series Console Power Supply Board

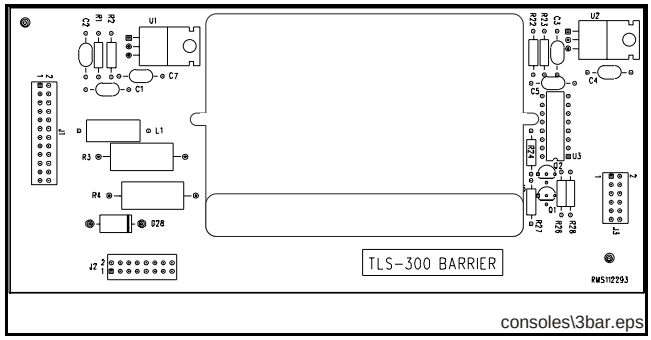


Figure 2-1. TLS-300 Series Console I.S. Barrier Board

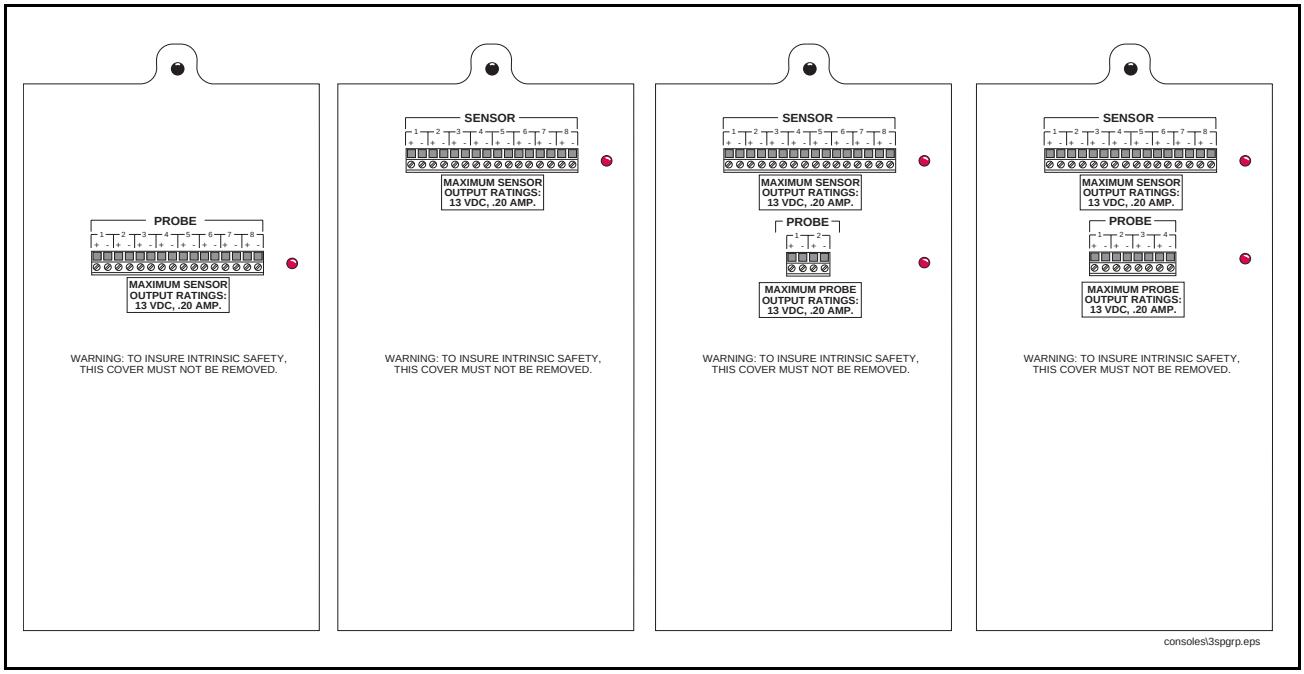


Figure 2-2. Example TLS-300 Series Console Sensor/Probe Interface Boards (8P/0S, 8S/0P, 8S/2P, and 8S/4P)

Basic Troubleshooting Procedures

To help ensure proper and safe troubleshooting and repair procedures for the TLS 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. Perform an "Basic Troubleshooting Procedures" on page 2-10. 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.
4. Perform the "Visual Inspection of Console Interior" on page 2-11.
5. Print out all system and tank setup parameters. IMPORTANT! Setup parameters can be lost during some service procedures. This printout will allow you to re-profile the system with the same parameters when service is complete.
6. 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.

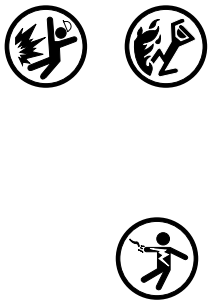
Intrinsic Safety Check

Be sure power is OFF 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



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 death, personal injury, or equipment damage, turn the AC power circuit breaker at the service panel to the OFF position 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 has #12 AWG (or larger diameter) conductor from barrier to earth ground in the power panel.
3. Verify that the TLS Console has a chassis ground connected.

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 576013-879).
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-3XX Series Site Prep and Installation manual; 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. Inspect the equipment, with the power Off, as follows:

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 see that all interconnecting cable connectors are firmly seated. Check connector ends for cracks and flat cable for breaks.
6. Check fuse continuity and fuseholder contacts for corrosion.
7. Check monitor for cracked display lens and damaged or missing buttons.
8. Check the mounting of the equipment to be sure all components were mounted properly and in accordance with instructions contained in the Site Preparation and Installation manual.
9. Verify that no unapproved modifications to equipment have been made, no unapproved parts are being used, and previous repairs and modification bring the unit to original factory condition
10. All deficiencies should be corrected and damaged components replaced before continuing with procedures.

Test Front Panel LEDs, Display, and Console Beeper

Apply power to the console. The display should read the start-up message and the green POWER LED should illuminate. Press the ALARM/TEST button to verify that the red ALARM and yellow WARNING LEDs illuminate and the console beeper switches On.

3 Software Version Feature List

Table 3-1 through Table 3-4 list the release dates of all system software versions and when major features were introduced or discontinued for TLS-3XX Series Consoles.

Table 3-1.- TLS-350 Series Software Versions 1 - 15

FEATURE	SYSTEM SOFTWARE VERSION (Release Date)													
	1 (3/92)	2 (8/92)	3 (12/92)	4 (4/93)	5 (8/93)	6 (1/94)	7 (8/94)	8 (1/95)	9 (8/95)	10 (10/95)	11 (7/96)	12 (10/96)	14 (2/97)	15 (10/97)
Cap 0 Probes	C0	C0	C0	C0	C0	C0,E1	C0,E1	C0,E1,E3	C0,E1,E3	C0	C0	C0	C0	C0
Cap 1 Probes	C0	C0	C0	C0	C0	C0,E1	C0,E1	C0,E1,E3	–	–	–	–	–	–
Mag 0, 1, 2 Probes	C0	C0	C0	C0	C0	C0,E1	C0,E1	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3
Mag 3 Probes	–	–	–	C0	C0	C0,E1	C0,E1	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3
Mag 4, 5, 6 Probes	–	–	–	–	–	–	C0,E1	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3
Mag 7 - 12 Probes	–	–	–	–	–	–	–	–	–	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3
Tank 9 - 16	–	C0	C0	C0	C0	C0,E1	C0,E1	E3	E3	E3	E3	E3	E3	E3
Remote Display	C0	C0	C0	C0	C0	C0,E1	C0,E1	C0,E1,E3	C0,E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3
Remote Printer[1]	–	C0	C0	C0	C0	C0,E1	C0,E1	C0,E1,E3	C0,E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3
VLLD	C0	C0	C0	C0	C0	C0,E1	C0,E1	C0,E1,E3	C0,E1,E3	C0,E1,E3	E1,E3	E1,E3	E1,E3	E1,E3
PLLD	–	–	–	–	–	–	C0,E1	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3
WPLLD	–	–	–	–	–	–	–	–	–	–	–	C0,E1,E3	C0,E1,E3	C0,E1,E3
CSLD	–	C0	C0	C0	C0	C0,E1	C0,E1	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3
CSLD (manifolded tanks)	–	–	–	–	–	C0,E1	C0,E1	C0,E1,E3	C0, E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0, E1,E3	C0,E1,E3
SiteFax	–	C0	C0	C0	C0	C0,E1	C0,E1	C0,E1,E3	C0, E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3
Fuel Manager	–	–	–	–	–	C0,E1	C0,E1	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3
BIR	–	–	–	–	–	E1	E1	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3
BIR (manifolded tanks)	–	–	–	–	–	–	–	–	–	E3	E3	E3	E3	E3
Inform/TLS-PC 32								C0,E1	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,E1,E3

Board Type/Software Version Requirement Legend:
– = Feature Not Available/Discontinued
C0 = CPU with 0XX Software
C5 = CPU with 5XX Software
E1= ECPU with 1XX Software
E3 = ECPU with 3XX Software

[1]Remote printer comm settings are: 1200 baud, 7 data bits, odd parity, & 1 stop bit.

Table 3-2. TLS-350 Series Software Version 16 and Following

FEATURE	SYSTEM SOFTWARE VERSION (Release Date) - Continued													
	16 (4/98)	17 (10/98)	18 (7/99)	19 (12/99)	20 (7/00)	21 (10/00)	22 (9/01)	23 (4/02)	24 (7/03)					
Cap 0 Probes	C0	C0	–	–	–	–	–	–	–					
Mag 0, 1, 2 Probes	C0,E1,E3	C0,E1,E3	C0,C5, E1,E3	C0,C5, E1,E3	C0,C5, E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
Mag 3 Probes	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,C5, E1,E3	C0,C5, E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
Mag 4, 5, 6 Probes	C0,E1,E3	C0, E1,E3	C0, E1,E3	C0,C5, E1,E3	C0,C5, E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
Mag 7 - 12 Probes	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,C5, E1,E3	C0,C5, E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
Tank 9 - 16	E3	E3	E3	E3	E3	E3	E3	E3	E3					
Remote Display	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
Remote Printer[1]	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
VLLD	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
PLLD	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0, E1,E3	C0, E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
WPLLD	C0,E1,E3	C0,E1,E3	C0,E1,E3	C5, E1,E3	C5, E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
CSLD	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,C5, E1,E3	C0,C5, E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
CSLD (manifolded tanks)	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,C5, E1,E3	C0,C5, E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
SiteFax	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,C5 E1,E3	C0,C5, E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
Fuel Manager	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,C5 E1,E3	C0,C5, E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
BIR	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
BIR (manifolded tanks)	E3	E3	E3	E3	E3	E3	E3	E1,E3	E1,E3					
BIR Variance Analysis	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
IFSF[2]	–	C0,E1,E3	C0,E1,E3	C0,C5 E1,E3	C0,C5, E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
330743-002 ECPU Board Group	–	–	–	–	C0,C5, E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
Inform/TLS-PC 32	C0,E1,E3	C0,E1,E3	C0,E1,E3	C0,C5, E1,E3	C0,C5, E1,E3	E1,E3	E1,E3	E1,E3	E1,E3					
Mag Sensor	–	–	–	–	–	–	–	–	E1,E3					

Board Type/Software Version Requirement Legend:
– = Feature Not Available/Discontinued
C0 = CPU with 0XX Software
C5 = CPU with 5XX Software
E1= ECPU with 1XX Software
E3 = ECPU with 3XX Software

[1]Remote printer comm settings are: 1200 baud, 7 data bits, odd parity, & 1 stop bit.

[2]Requires 346XXX-3XX software.

Table 3-3.- TLS-300 Series Software Versions 1 - 15

FEATURE	SYSTEM SOFTWARE VERSION (Release Date)													
	1 (3/92)	2 (8/92)	3 (12/92)	4 (4/93)	5 (8/93)	6 (1/94)	7 (8/94)	8 (1/95)	9 (8/95)	10 (10/95)	11 (7/96)	12 (10/96)	14 (2/97)	15 (10/97)
Cap 0 Probes	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0
Cap 1 Probes	C0	C0	C0	C0	C0	C0	C0	C0	–	–	–	–	–	–
Mag 0, 1, 2 Probes	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0
Mag 3 Probes	–	–	–	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0
Mag 4, 5, 6 Probes	–	–	–	–	–	–	C0	C0	C0	C0	C0	C0	C0	C0
Mag 7 - 12 Probes	–	–	–	–	–	–	–	–	–	C0	C0	C0	C0	C0
CSLD	–	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0
CSLD (manifolded tanks)	–	–	–	–	–	C0	C0	C0	C0	C0	C0	C0	C0	C0
SiteFax	–	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0	C0
Fuel Manager	–	–	–	–	–	C0	C0	C0	C0	C0	C0	C0	C0	C0
Inform/TLS-PC 32	–	–	–	–	–	–	–	C0	C0	C0	C0	C0	C0	C0

Board Type/Software Version Requirement Legend:
– = Feature Not Available/Discontinued
C0 = CPU with 0XX Software

Table 3-4.- TLS-300 Series Software Versions 16 and Following

FEATURE	SYSTEM SOFTWARE VERSION (Release Date) - Continued													
	16 (4/98)	17 (10/98)	18 (7/99)	19 (12/99)	20 (7/00)	21 (10/00)	22 (9/01)	23 (4/02)	24 (7/03)					
Cap 0 Probes	C0	C0	–	–	–	–	–	–	–					
Mag 0, 1, 2 Probes	C0	C0	C4	C4	C4	C4	C4	C4	C4					
Mag 3 Probes	C0	C0	C4	C4	C4	C4	C4	C4	C4					
Mag 4, 5, 6 Probes	C0	C0	C4	C4	C4	C4	C4	C4	C4					
Mag 7 - 12 Probes	C0	C0	C4	C4	C4	C4	C4	C4	C4					
CSLD	C0	C0	C4	C4	C4	C4	C4	C4	C4					
CSLD (manifolded tanks)	C0	C0	C4	C4	C4	C4	C4	C4	C4					
SiteFax	C0	C0	C4	C4	C4	C4	C4	C4	C4					
Fuel Manager	C0	C0	C4	C4	C4	C4	C4	C4	C4					
IFSF[1]	–	C0	C4	C4	C4	C4	C4	C4	C4					
Inform/TLS-PC 32	C0	C0	C4	C4	C4	C4	C4	C4	C4					

Board Type/Software Version Requirement Legend:
– = Feature Not Available/Discontinued
C0 = CPU with 0XX Software
C4 = CPU with 4XX Software

4 Fuses

TLS Consoles use fuses in the input power circuitry and on various Interface Modules. Under no circumstances should you substitute a different rating or fuse type during service.

TLS-300 Series Console Fuses

TLS-300 Series Console fuses for input ac power, dc voltages, and relays are shown in Table 4-1.

Table 4-1.- Console Fuses

Fuse	Circuit	Fuse Location	Fuse Size/Type	V-R Part No.
F1	+8 & +5 Vdc supply	Fuseholder on Power Supply board	2 A Slo-Blo (5 x 20 mm)	576010-784
F2	+20 & +12 Vdc supply	Fuseholder on Power Supply board	2 A Slo-Blo (5 x 20 mm)	576010-784
F3	110 Vac input power	Fuseholder on Power Supply board	2 A Slo-Blo (5 x 20 mm)	576010-784
F4	Relay fuse #2	Fuseholder on Power Supply board	2 A Slo-Blo (5 mm x 20 mm)	576010-784
F5	Relay fuse #1	Fuseholder on Power Supply board	2 A Slo-Blo (5 mm x 20 mm)	576010-784
F1	8 Vdc supply for external peripherals (UK only)	Fuse block on CPU board	300 mA (5 mm x 20 mm)	576010-855

TLS-350 Series Console AC Power Fuses

TLS-350 Console ac power fuses are shown in Table 4-2:

Table 4-2.- Console AC Power Fuses

Fuse	Fuse Location	Fuse Size/Type	V-R Part No.
F1	Fuseholder on AC Input board - top of Power Area Compartment	2A Slo-Blo (5 mm x 20 mm)	576010-784
F1	Fuse block on Power Supply Board left side of Communication Area	2A Slo-Blo (5 mm x 20 mm)	576010-784
F2	Fuse block on Power Supply Board left side of Communication Area	2A Slo-Blo (5 mm x 20 mm)	576010-784

TLS-350 Series Interface Module Fuses

TLS-350 Console Interface Module fuses are shown in Table 4-3

Table 4-3.- Interface Module Fuses

Interface Module	Fuse	Fuse Location	Fuse Size/Type	V-R Part No.
I/O Combination Module	F1 - F2	2 fuse blocks on board	2A Slo-Blo (5 mm x 20 mm)	576010-784
4 Relay Output Module	F1 - F4	4 fuse blocks on board	2A Slo-Blo (5 mm x 20 mm)	576010-784
Line Leak Interface Module	F1	Fuse block on board	2A Slo-Blo (5 mm x 20 mm)	576010-784
Pressure Line Leak Controller Module	F1 - F3	3 fuse blocks on board	2A Slo-Blo (5 mm x 20 mm)	576010-784
WPLLD Controller Module	F1 -F3	3 fuse blocks on board	2A Slo-Blo (5 mm x 20 mm)	576010-784
RS-232 (+8V)	HF1	Fuse block on board	300 mA (5 mm x 20 mm)	576010-855
Multiport	F1	Fuse block on board	300 mA (5 mm x 20 mm)	576010-855
TLS-350 EDIM (8V Link)	F1	Fuse block on board	300 mA (5 mm x 20 mm)	576010-855
Univ. CAB	F1	Soldered on board	125 mA Flatpak	576010-758
RS-232 CAB	F1	Soldered on board	500 mA Flatpak	577010-010
RS-485 CAB	F1	Soldered on board	500 mA Flatpak	577010-010
Tokheim 67 CAB	F1	Soldered on board	500 mA Flatpak	577010-010
Dispenser Controller	F1 - F4	4 fuse blocks on board	10A Slo-Blo (5 mm x 20 mm)	576010-955

5 Warning and Alarm Messages

Alarm Monitoring

The TLS Console constantly monitors the entire system for warning and alarm conditions including fuel leaks, inventory limit excesses, and equipment problems.

During normal operation when the system is functioning properly and no warning or alarm conditions exist, the "ALL FUNCTIONS NORMAL" message will appear in the system status (bottom) line of the display. If a warning or alarm condition is present, the type and location (tank or sensor number) of the warning or alarm will be indicated by a message on the system status line. If more than one condition exists, the display will alternately flash the appropriate System Status Messages.

Alarm Posting

Warning and alarm conditions detected while the TLS Console is in its normal operating mode are posted by a combination of an audible beep, warning and alarm lights on the front panel and a message on the display.

Displayed messages alert you to the source/number and type of alarm. In this example, the display's second line indicates that the fuel level in Tank #3 (T3) has dropped below the preset low level limit:

```
MMM DD, YYYY HH:MM XM
T3: LOW LIMIT ALARM
```

Abbreviations used to identify the sources of warnings and alarms are:

C (2-Wire C.L. sensor [type A])

D (Receiver [phone, fax, etc.])

E (EDIM or CDIM module)

F (Product)

G (Groundwater sensor)

H (3-Wire C.L. sensor [type B])

I (External input device)

L (Liquid sensor)

M (MDIM module)

P (Volumetric line leak detector)

Q (Pressure line leak detector)

R (Output relay)

S (Pump sense)

s (Smart Sensor)

T (Tank)

V (Vapor sensor)

W (Wireless pressurized line leak detector)

WHAT TO DO WHEN A WARNING OR ALARM OCCURS

Specific response instructions for each type of warning or alarm condition should be established and clearly posted by the person responsible for your site. (Be sure you are familiar with the warning and alarm response procedures established for your site.)

HOW TO SHUT OFF WARNING AND ALARM INDICATORS

1. Audible Alarm

   Push the ALARM/TEST button to silence the audible alarm.

2. Red Alarm and Yellow Warning Lights

   Warning and Alarm lights cannot be turned off until the cause of the warning or alarm has been corrected. Once the warning or alarm condition is eliminated, the light(s) will shut off automatically.

3. Warning and Alarm Display Messages

   Display Warning and Alarm Messages will appear on the display until the cause of the message(s) has been eliminated. When the cause(s) of the message(s) is eliminated, the "ALL FUNCTIONS NORMAL" message will appear on the display.

ALARM REPORTS

Consoles equipped with a printer will generate an alarm report when a warning or alarm condition is detected. This report will show the type and location of the warning or alarm and the date and time it occurred. An example alarm report is shown below:

```
VAPOR ALARM
SENSOR NUMBER 2
FUEL ALARM
WELL 2
MAR 15, 2000 2:01 AM
```

consoles\almprnt.eps

Displayed Alarm Messages

This section contains a complete list of displayed TLS Console alarm messages, the device category for which the alarm is posted (for device code definitions used in this list see inset at left), and a possible cause of the alarm.

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

CODE	DEVICE
D	Receiver
DIM	Dispenser Interface Module
F	Product
I	External Input Device
P	VLLD
Q	PLLD
s	Smart Sensor
Sensors	Deployed sensor(s)
System	System Alarm
T	Tank
W	WPLLD

consoles\dc.eps

Table 5-1. Alarms

Message	Device	Cause
ANN-LINE SELF FAIL	P	0.1 gph line self-test failure. (2 consecutive self-test failures.)
ANN-LINE TEST FAIL	P	0.1 gph line test failure.
ANN-PUMP SELF FAIL	P	0.1 gph pumpside self-test failure.
ANN-PUMP TEST FAIL	P	0.1 gph pumpside test failure.
ANN TST NEEDED ALM	P,Q,T,W	System failed to perform an annual test (0.1 gph) in the programmed number of days.
ANN TST NEEDED WRN	P,Q,T,W	System failed to perform an annual test (0.1 gph) in the programmed number of days.

Table 5-1. Alarms

Message	Device	Cause
ANNUAL LINE FAIL	Q,W	0.1 gph line test failure.
ANNUAL TEST FAIL	T	System failed an annual in-tank leak test.
AUTODIAL FAILURE	SYSTEM	System failed to connect to a remote receiver after “n” tries.
BATTERY IS OFF	SYSTEM	Battery switch is off. You will lose system programming if ac power to the console is interrupted.
BDIM TRANSACTION ALARM	E	No transactions received from the block DIM.
CLOCK IS INCORRECT	SYSTEM	System clock is not within ±10 seconds of last test.
CLOSE DAILY PENDING	SYSTEM	BIR is waiting for an idle period to close for a daily report.
CLOSE SHIFT PENDING	SYSTEM	BIR is waiting for an idle period to close for a daily or shift report.
COMMUNICATION ALARM	E,M	DIM module has stopped communicating with the external equipment or the cable adaptor box.
COMMUNICATION ALARM	s	Hardware failure - sensor or interconnecting wiring to console.
CSLD INCNR RATE WRN	T	A positive leak rate exceeded the threshold limit.
DELIVERY NEEDED	T	Product level dropped below programmed limit.
DISABLED DIM ALARM	E,M	DIM module has stopped communicating with central processing unit of the console.
EXTERNAL INPUT ALARM	I	External device changed from programmed condition.
EXTERN INPUT NORMAL	I	(Not displayed, printed out only) External device returned to preset condition.
FUEL ALARM	SENSOR	Fuel is present in the area being monitored by the sensor.
FUEL ALARM	s	Monitored parameter exceeded preset threshold.
FUEL WARNING	s	
FUEL OUT	P,Q,W	Tank product level below 10 inch level - cannot pump when active
GENERATOR OFF	I	Backup generator shut down, in-tank leak testing resumed.
GENERATOR ON	I	Backup generator switched on, in-tank leak testing halted.
GROSS LINE FAIL	Q,W	3.0 gph line test failure. Dispensing halts while the alarm is active.
GROSS TEST FAIL	T	In-tank leak test failed.
GRS LINE SELF FAIL	P	3.0 gph line self-test failure. (3 consecutive self-test failures.)

Table 5-1. Alarms

Message	Device	Cause
GRS LINE TEST FAIL	P	3.0 gph line test failure.
GRS PUMP SELF FAIL	P	3.0 gph pumpside self-test failure.
GRS PUMP TEST FAIL	P	3.0 gph pumpside test failure.
HANDLE ALARM	P,Q,W	Handle signal has been active 16 hours.
HIGH LIQUID ALARM	SENSOR	The sensor detects a high liquid level.
HIGH LIQUID ALARM	s	Monitored parameter exceeded preset threshold.
HIGH LIQUID WARNING	s	
HIGH PRODUCT ALARM	T	Product level in tank rose above programmed limit.
HIGH WATER ALARM	T	Water detected in tank exceeds programmed alarm limit.
HIGH WATER WARNING	T	Water detected in tank exceeds programmed warning limit.
INVALID FUEL LEVEL	T	Product level is too low, causing the fuel and water floats to be too close together.
INSTALL ALARM	s	Sensor not installed in correct position.
LEAK ALARM	T	A static in-tank leak test failed.
LINE LEAK SHUTDOWN	P	(VLLD) Line test or pumpside test failure.
LINE LEAK TEST FAIL	P	Line test or pumpside test failure.
LIQUID WARNING	SENSOR	The sensor detects a small amount of liquid.
LLD PRESSURE ALARM	P	Six consecutive attempts to run a test in which the pressure switch never opened (pump not running).
LLD PRESSURE WARN	P	Three consecutive attempts to run a test in which the pressure switch never opened (pump not running).
LLD SELF TEST FAIL	P	Line Leak Detector hardware failure.
LLD TEST FAULT-ANN	P	Line Leak Detector hardware failure.
LLD TEST FAULT-GRS	P	Line Leak Detector hardware failure.
LLD TEST FAULT-PER	P	Line Leak Detector hardware failure.
LN EQ FAULT	Q,W	A problem with the pressure measurement equipment has been detected.
LOW LIQUID ALARM	SENSOR	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.
LOW LIQUID ALARM	s	Monitored parameter exceeded preset threshold.
LOW LIQUID WARNING	s	
LOW PRESSURE ALARM	Q	Low pump dispense pressure is detected during a dispense. Dispensing halts if programmed to do so.

Table 5-1. Alarms

Message	Device	Cause
LOW PRODUCT ALARM	T	Tank level dropped below the programmed limit.
LOW TEMP WARNING	T	Probe temperature dropped below -4°F.
MAX PRODUCT ALARM	T	Product level rose above the programmed limit.
MISSING TICKET WARN	T	Missing ticketed delivery.
NO DIAL TONE ALARM	D	System failed to detect an operational line after 3 tries.
NO CSLD IDLE TIME	T	System has not had enough idle time over previous 24 hours to run a statistical leak detection test.
OVERFILL ALARM	T	Fuel level has exceeded a programmed limit. Potential overflow of tank may occur.
PAPER OUT	SYSTEM	Paper roll is empty.
PC(H8) REVISION WARN	SYSTEM	The CPU and the PC (H8) software versions are not compatible.
PER-LINE SELF FAIL	P	0.2 gph line self-test failure.
PER-LINE TEST FAIL	P	0.2 gph line test failure. (2 consecutive self-test failures.)
PER-PUMP SELF FAIL	P	0.2 gph pumpside self-test failure.
PER-PUMP TEST FAIL	P	0.2 gph pumpside test failure.
PER TST NEEDED ALM	P,Q,T,W	System failed to perform a periodic test (0.20 gph) in the programmed number of days.
PER TST NEEDED WRN	P,Q,T,W	System failed to perform a periodic test (0.20 gph) in the programmed number of days.
PERIOD FAIL	Q,T,W	0.2 gph test failure. Dispensing halts if programmed to do so.
PLLD OPEN ALARM	Q	PLLD transducer is disconnected or is not functioning properly.
PLLD SHUTDOWN ALARM	Q	A line disable occurred due to a 3.0 gph leak test failure or a programmed alarm.
PRINTER ERROR	SYSTEM	Printer feed roller release is open.
PROBE OUT	T	Hardware failure - interconnecting wiring to console, probe, or module problem.
PROD THRESHOLD ALM	F	The variance exceeded the BIR calculated threshold of an assigned product for the periodic report.
RELAY ACTIVE	s	Monitored parameter exceeded preset threshold.
REMOTE DISPLAY ERROR	SYSTEM	The Remote Display is not communicating properly
ROM REVISION WARNING	SYSTEM	Software revisions do not match. The software was replaced in the unit with the backup battery switch SW1 in the ON position.
SELF TEST INVALID	P	A self-test failed after a requested test has occurred.

Table 5-1. Alarms

Message	Device	Cause
SENSOR FAULT ALARM	s	Monitored parameter exceeded preset threshold.
SENSOR OPEN ALARM	SENSOR	The sensor setup was performed incorrectly or a sensor is disconnected or is not functioning properly.
SETUP DATA WARNING	SYSTEM	System setup problem or probe out on startup.
	P, Q, W	The default line length was not changed to reflect the actual line length.
	s	Programming error.
SHORT ALARM	SENSOR	A short has occurred in the sensor wiring or in the sensor.
SOFTWARE MODULE WARN	SYSTEM	The wrong software module is installed; or, the software module cannot be read or has an invalid checksum.
SUDDEN LOSS ALARM	T	System detects a loss of fuel: a) During a period when no pumping is occurring (with pump sense); or, b) During a static leak test. Clear this alarm by cycling pump on and off (a), or starting a static leak test (b).
SYSTEM SELF TEST ALM	SYSTEM	The backup battery switch was turned on before the system displayed the "BATTERY IS OFF" message.
TANK SIPHON BREAK	T	The siphon break valve has opened and a static leak test of one of the tanks in a manifolded pair is underway.
TANK TEST ACTIVE	T	In-tank leak test is underway.
TEMPERATURE WARNING	s	Ambient termperature exceeded sensor's operating range (-40 to +122°F [-40 to +50°C]).
TOO MANY TANKS	SYSTEM	The system detects more tank inputs than the system can accept. The maximum number of probes has been exceeded.
WATER ALARM	SENSOR	The sensor has detected water.
WATER ALARM	s	Monitored parameter exceeded preset threshold.
WATER OUT ALARM	SENSOR	The groundwater sensor is out of the water.
WATER WARNING	s	Monitored parameter exceeded preset threshold.
WPLLD COMM ALARM	W	Communication disrupted between the system and the WPLLD Comm Board.
WPLLD SHUTDOWN ALARM	W	System shut down line because of failed line leak test, or an alarm assigned to disable the line is active.

6 Diagnostic Mode

This section contains detailed diagrams, with notes, of all possible console's Diagnostic Mode Functions. Diagnostic functions display (and in certain cases, allow you to print) data useful in analyzing system performance and in troubleshooting.

You enter the DIAG MODE by pressing the MODE key until its display appears. Press the FUNCTION key to select any of the diagnostic functions within the mode, and the STEP key to view each of the Function's displays. Where you can enter changes to displayed data, you do so with the same front keys used enter to system programming selections (ENTER, CHANGE, etc.) See Figure 6-1 below for a legend of key symbols used in the Diag diagrams that follow.

In the upper right corner of each diagnostic function diagram you will notice an index of the Diagnostic Mode (Figure 6-2). This index lists the display sequence of all of the possible DIAG MODE functions. Your system will display only the diagnostic functions of installed and configured modules and options.

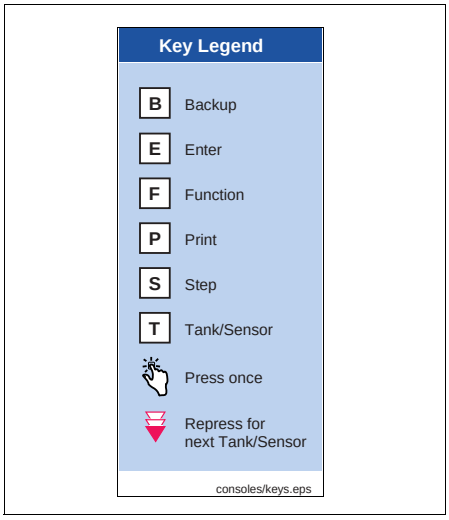


Figure 6-1. Index of Diagnostic Functions

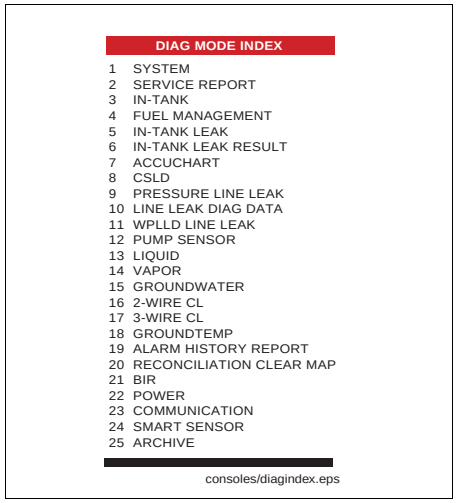


Figure 6-2. Key Symbols Used in Diagrams

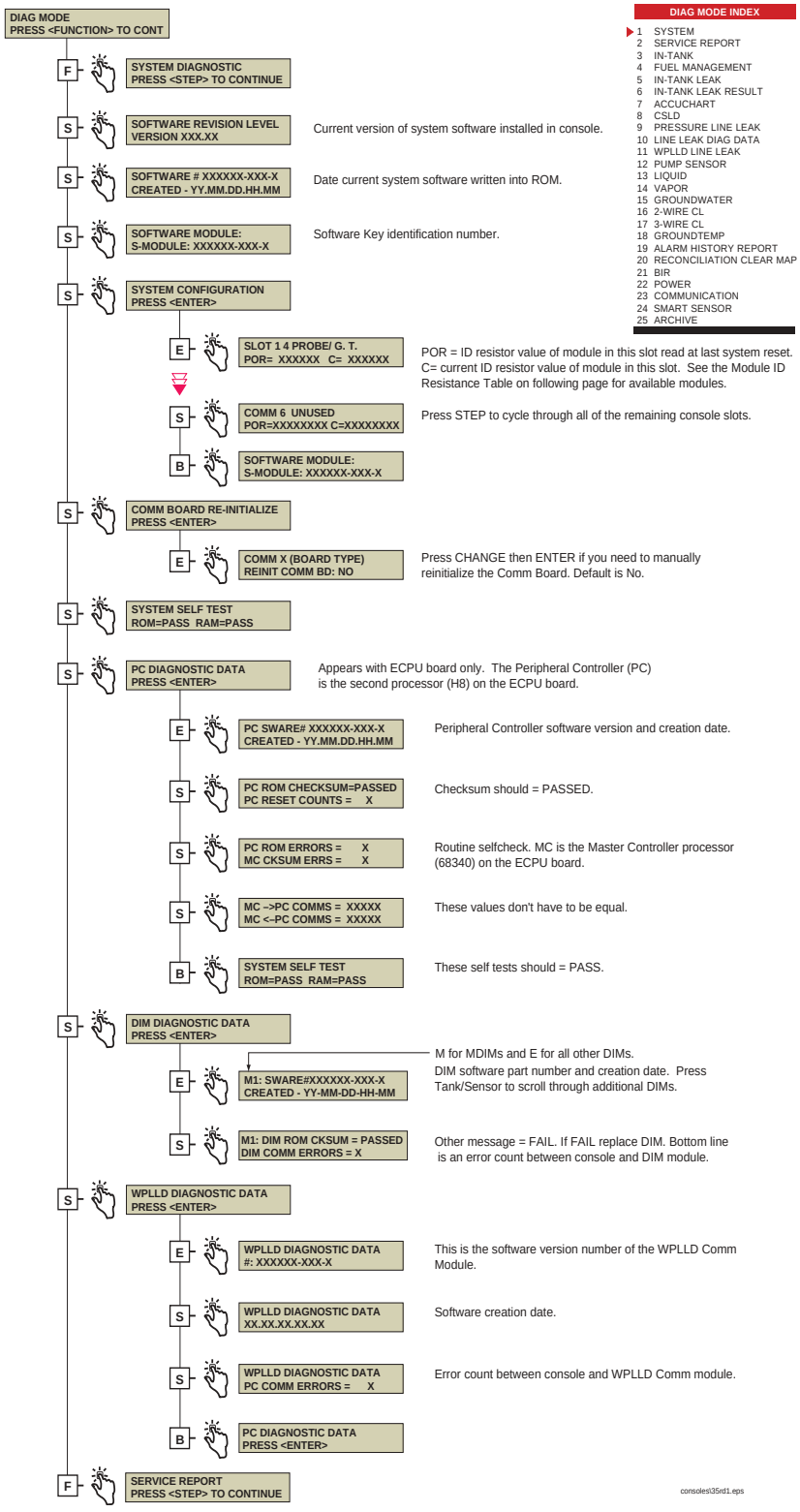


Figure 6-3. System Diagnostic Function Diagram

Table 6-1.- Console Modules - ID Resistances

Module	ID Resistance - Ohms
4 Probe	2K
PLLD Sensor	3.9K
I/O Combo	10K
Printer Interface	10K
4 Relay Output Interface	15K
RS232 Serial Interface	15K
Type B Sensor Interface	20K
1200 Baud Modem	20K
Remote Display Interface	27K
Universal Sensor	30.1K
Pump Sense	33K
Remote/Locol Printer Interface	33K
8-Input Smart Sensor	39.2K
SiteFax Modem (old)	40.2K
SiteFax Modem (new)	47K
VLLD Interface	47K
8 Probe	47K
European 232	56K
Type A Sensor Interface	68K
Mechanical Dim	68K
DCD Interface	68K
ISD Comm	82.5K
Dispenser Interface Module	100K
PLLD Controller	100K
Vapor Sensor	100K
Remote Only Printer Interface	160K
4 Probe w/Temp Interface	160K
WPLLD AC Interface	162K
Interstitial/Liquid Sensor Interface	200K
WPLLD Comm	200K
WPLLD Controller	200K

Table 6-1.- Console Modules - ID Resistances

Module	ID Resistance - Ohms
Groundwater Sensor	270K
SiteLink Comm	270K
Hughes JBox Comm	330K
3 Probe, 3 Sensor Interface (TLS-350J only)	332K
3 PLLD Sensor Interface (TLS-350J only)	402K
Serial Satellite Comm	475K

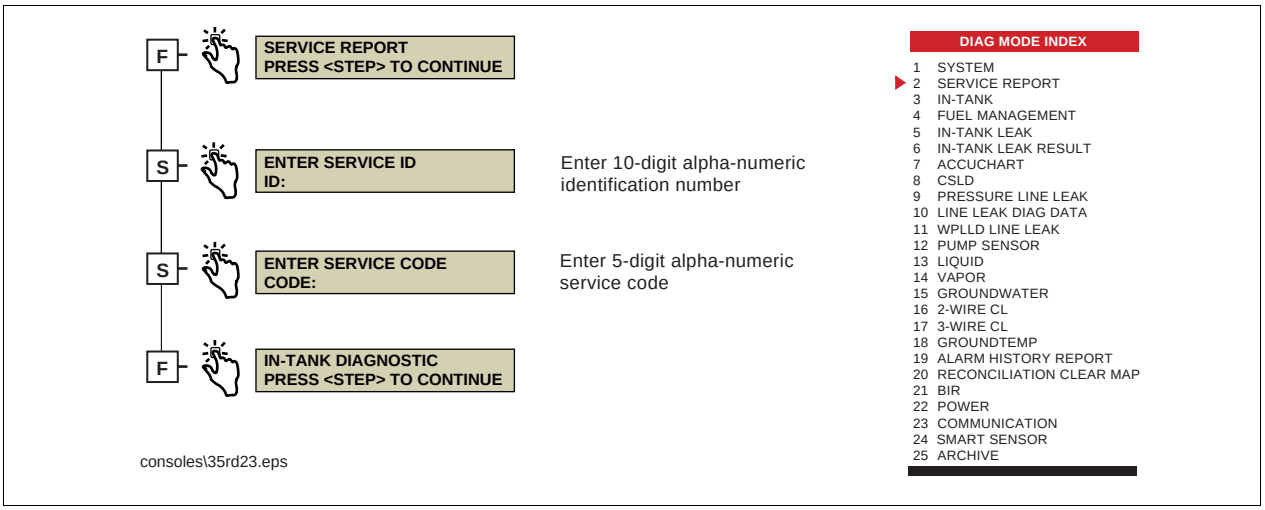


Figure 6-4. Service Report Function Diagram

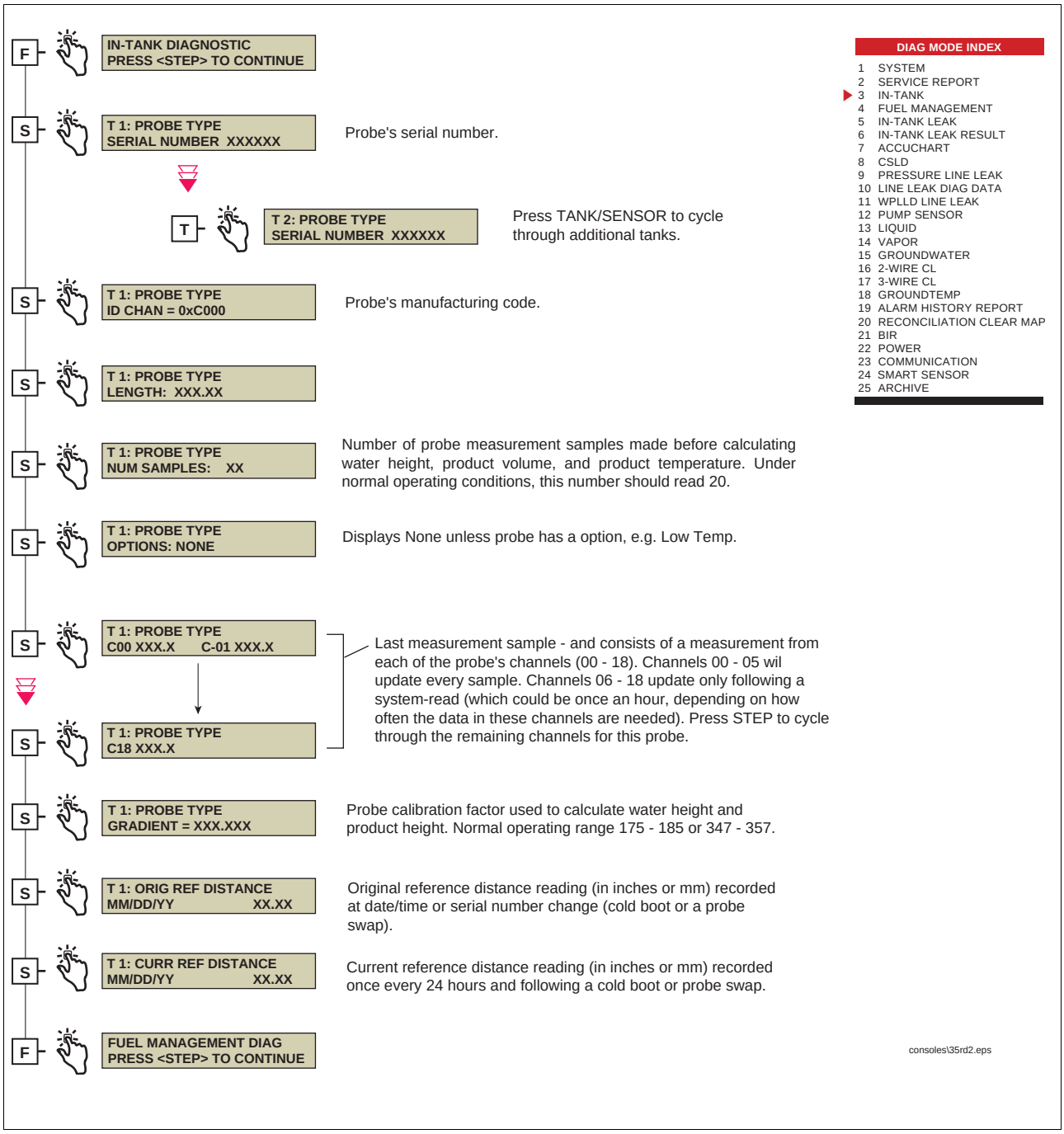


Figure 6-5. In-Tank Diagnostic Function Diagram

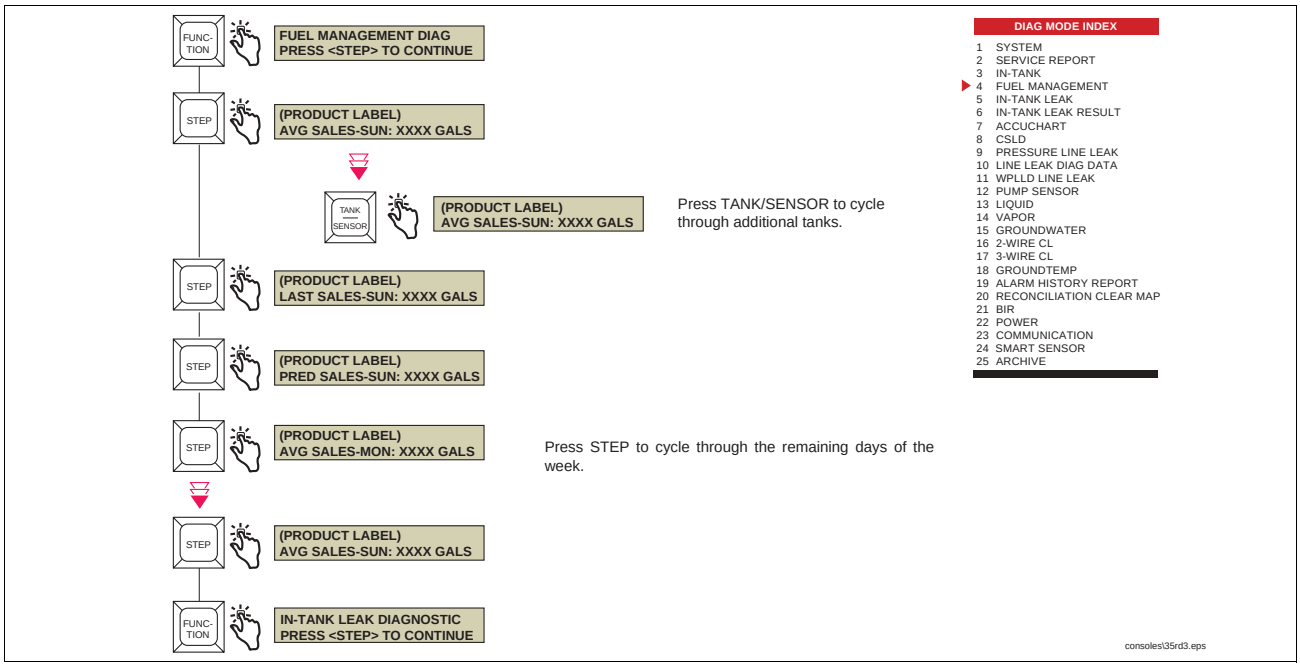


Figure 6-6. Fuel Management Diagnostic

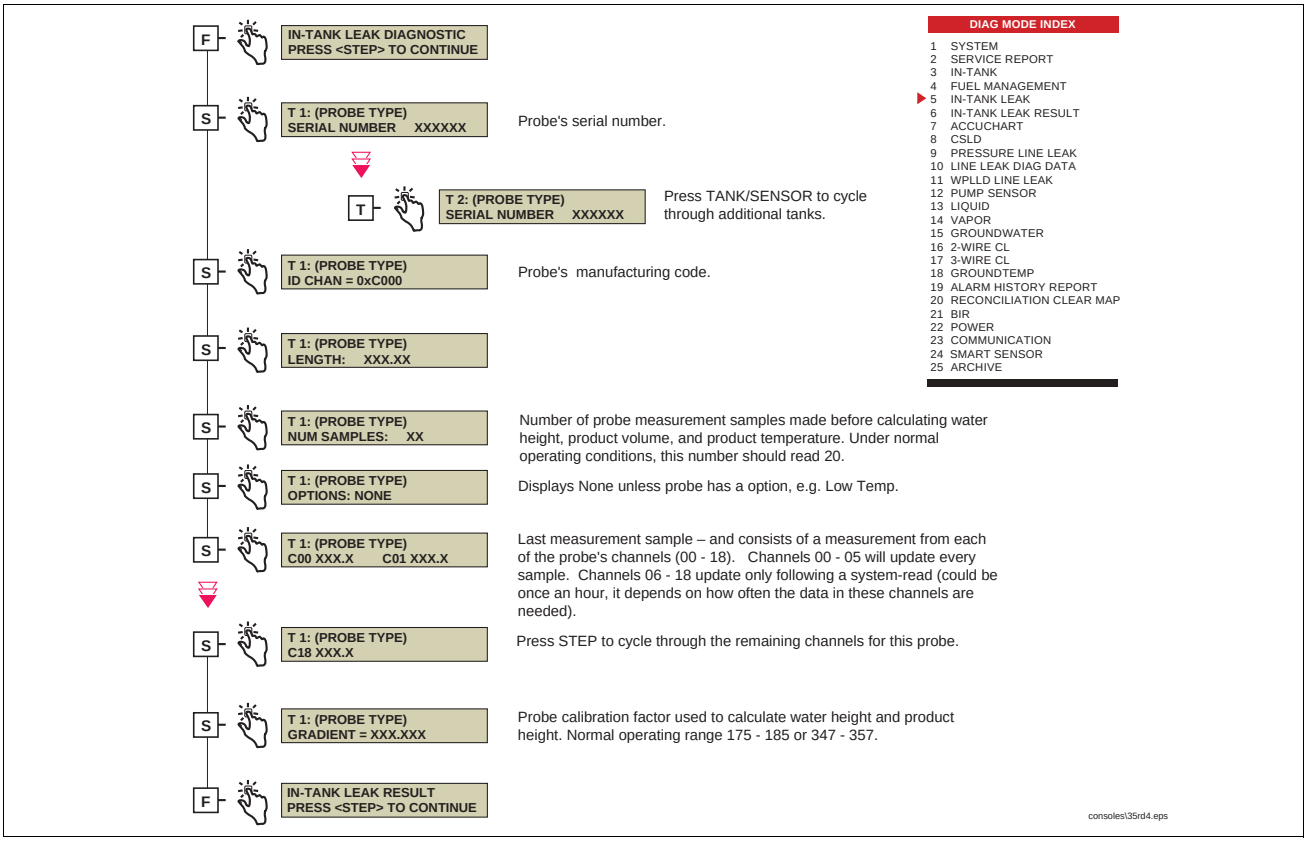


Figure 6-7. In-Tank Leak Diagnostic Function Diagram

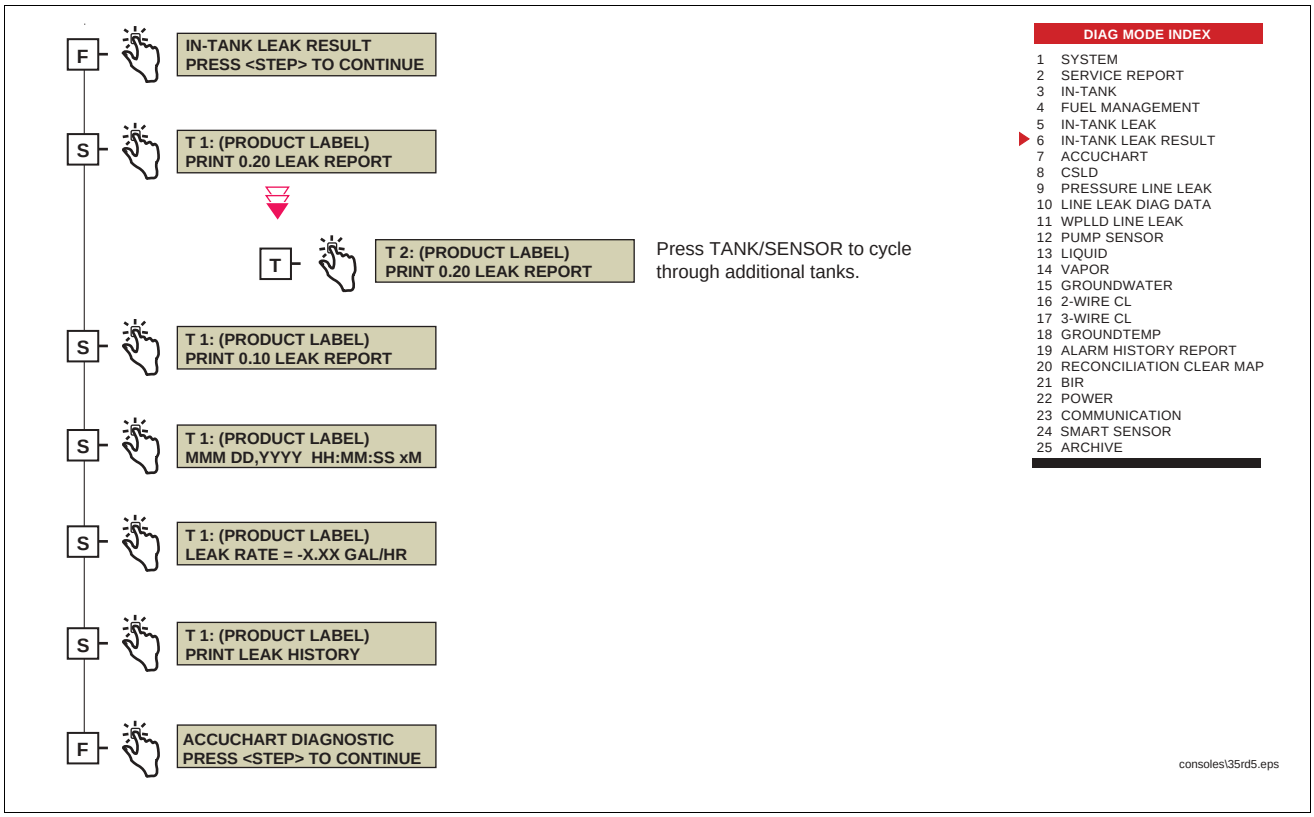
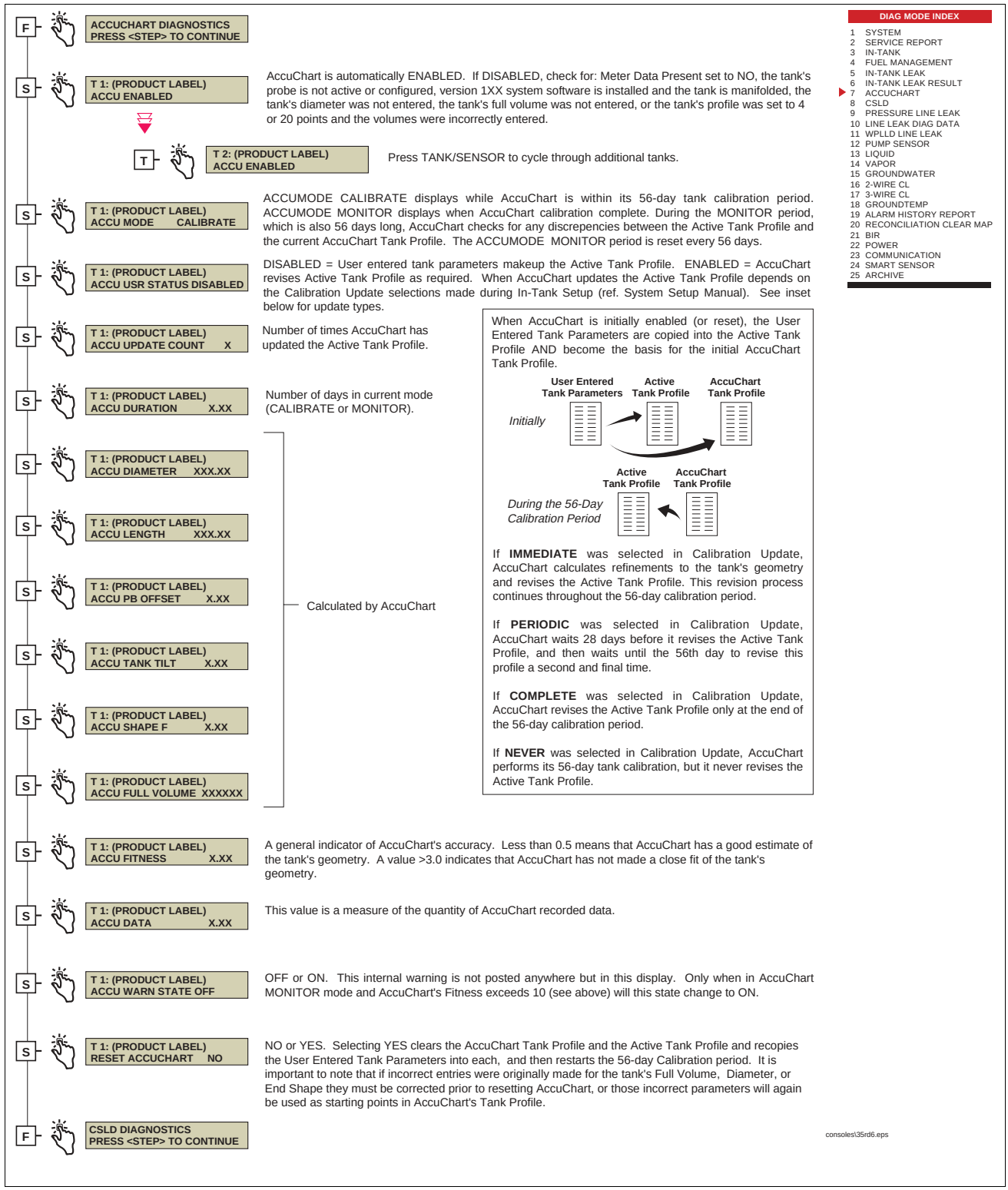


Figure 6-8. In-Tank Leak Result Diagnostic Function Diagram



DIAG MODE INDEX

Figure 6-9. AccuChart Diagnostic Function Diagram

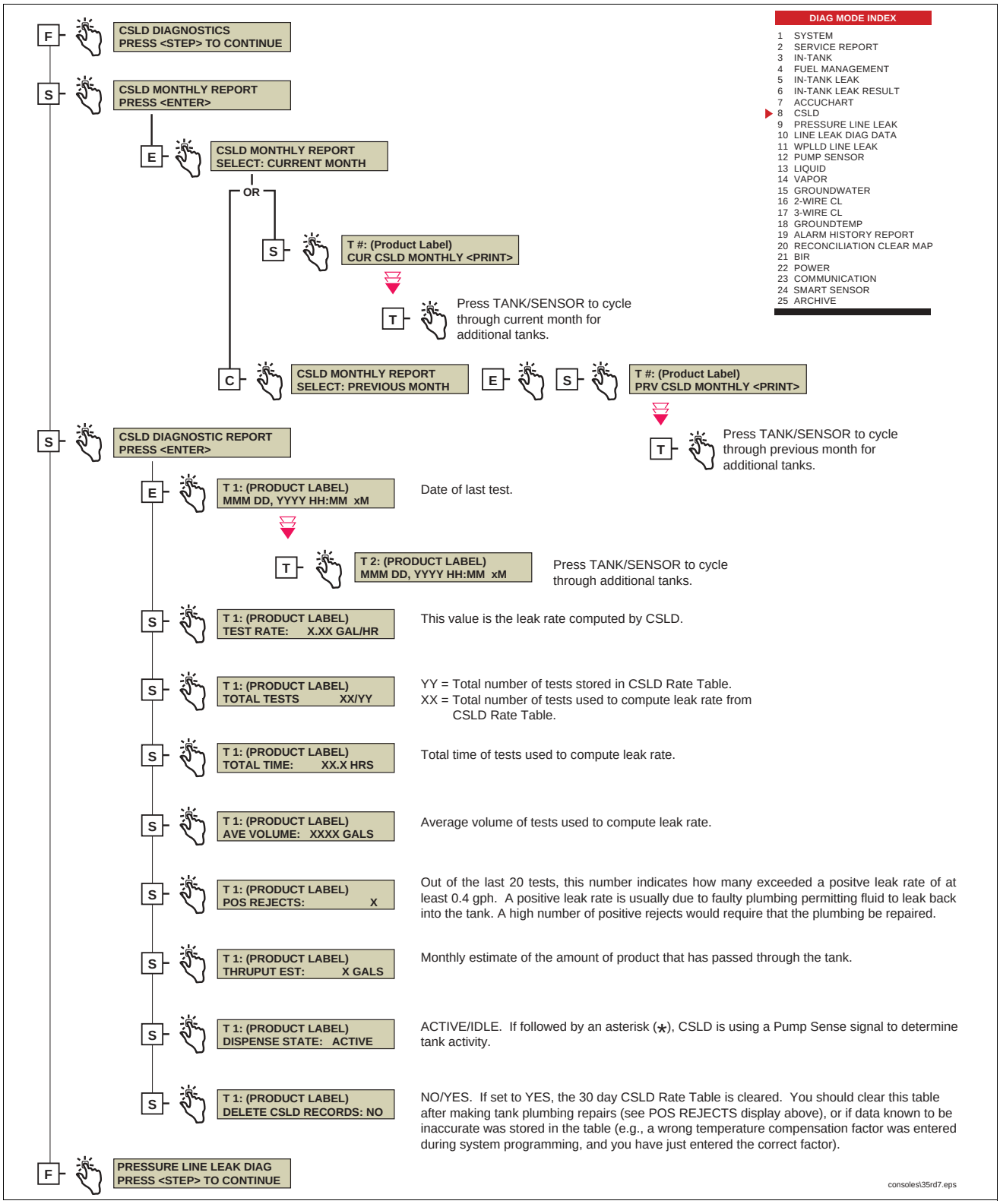


Figure 6-10. CSLD Diagnostics Function Diagram

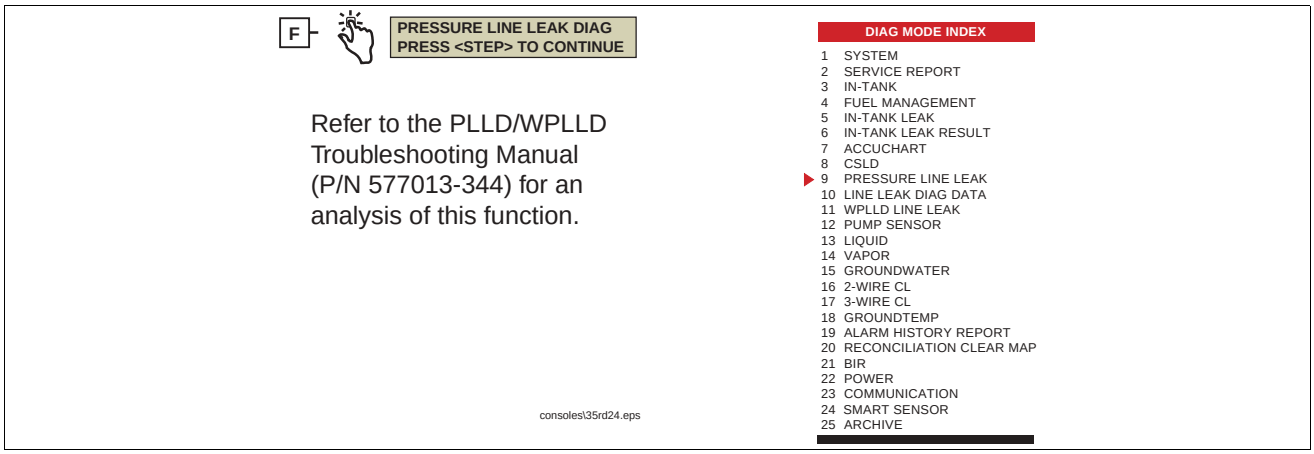


Figure 6-11. Pressure Line Leak Diagnostic Function Diagram

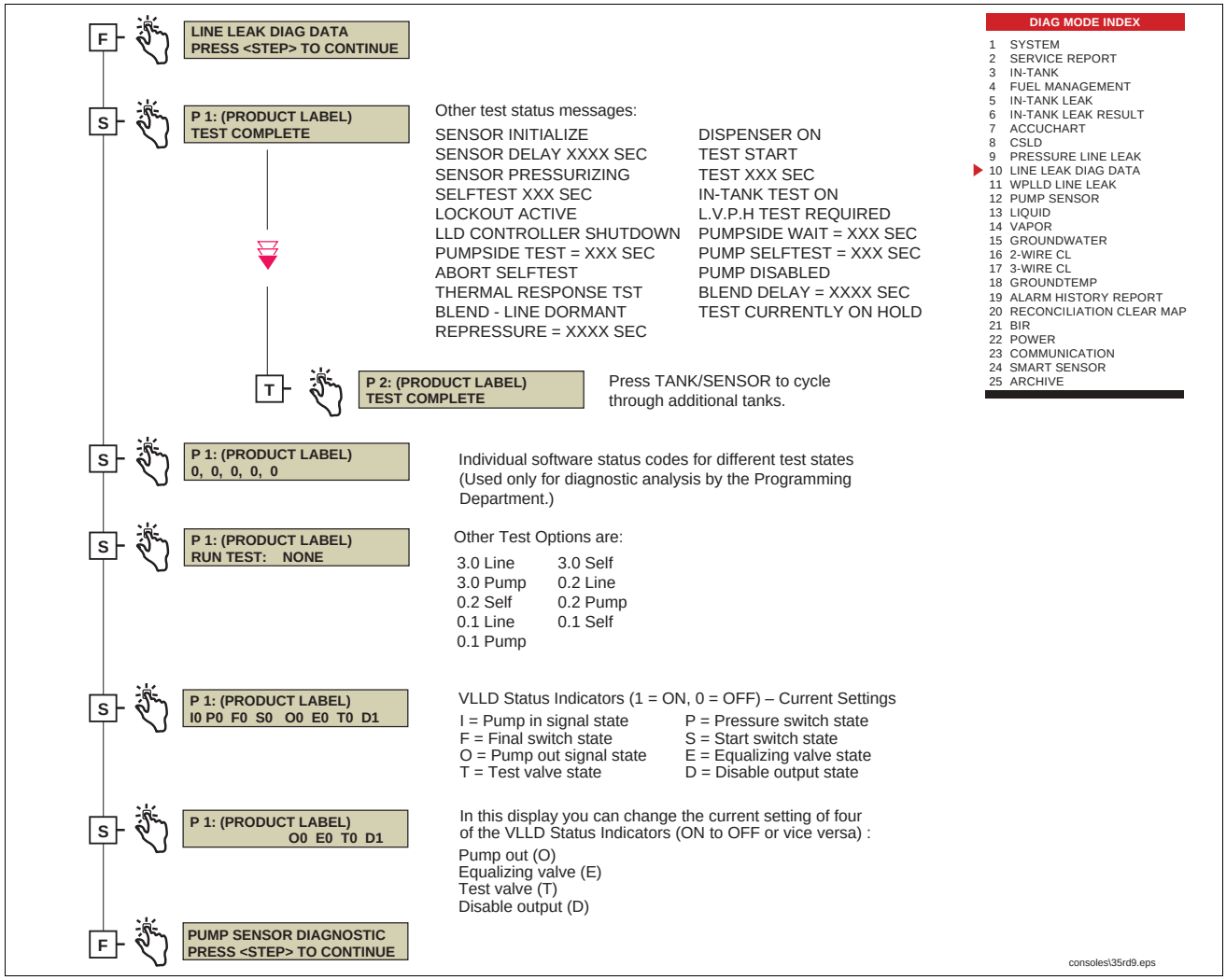


Figure 6-12. VLLD Diagnostic Function Diagram

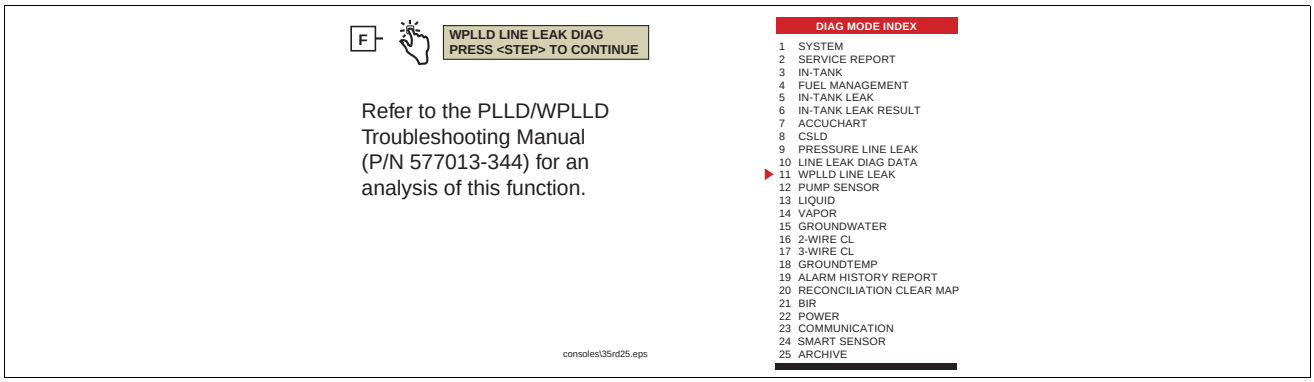


Figure 6-13. WPLLD Line Leak Diagnostic Function Diagram

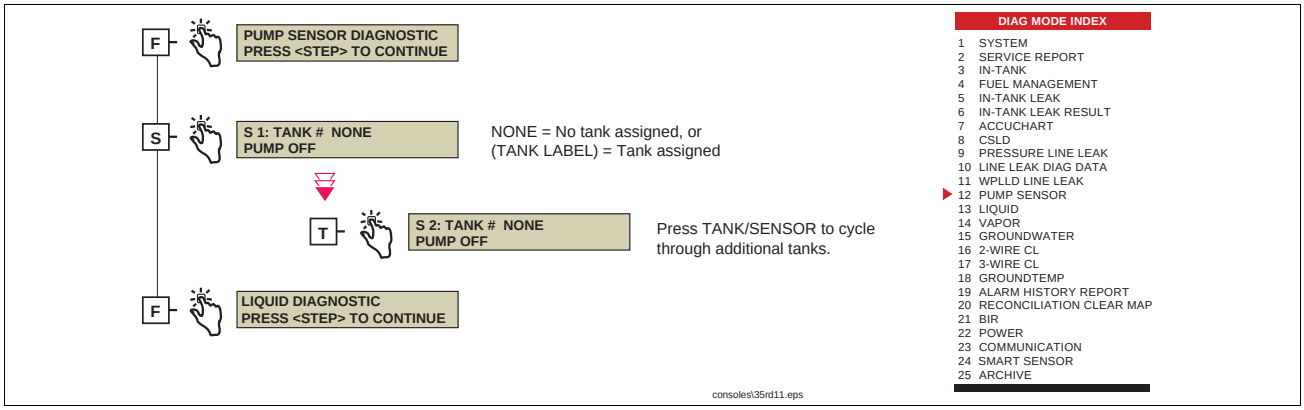


Figure 6-14. Pump Sensor Diagnostic Function Diagram

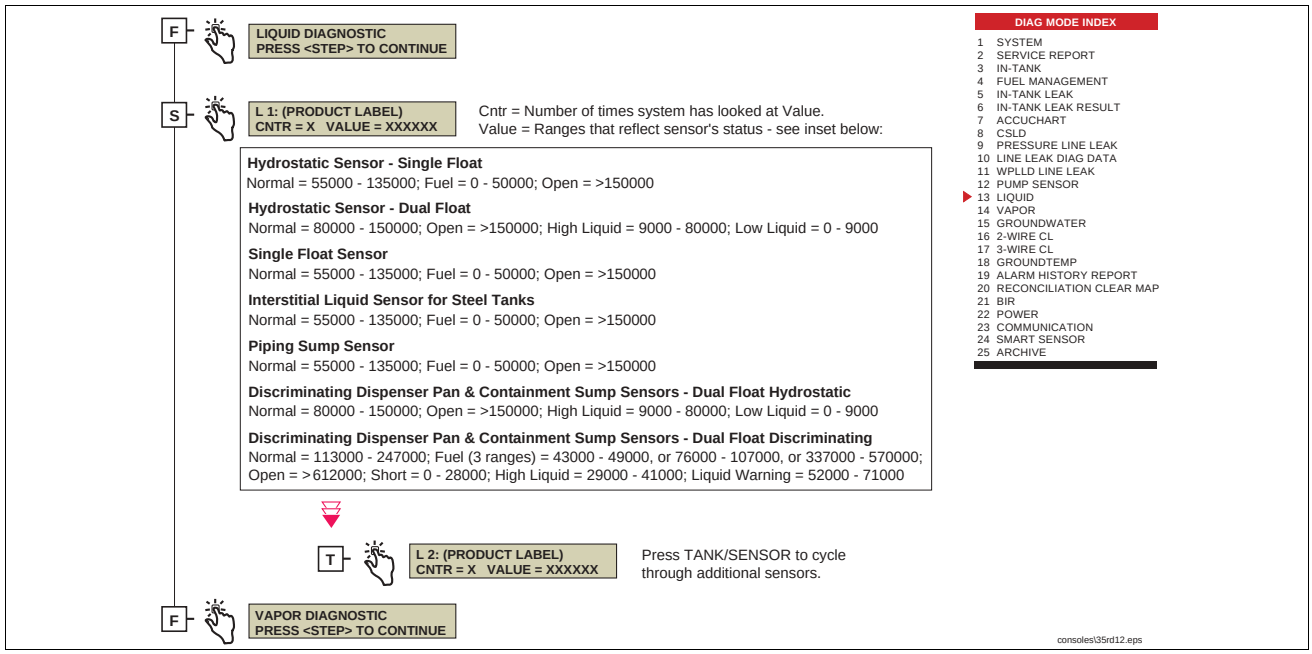


Figure 6-15. Liquid Sensor Diagnostic Function Diagram

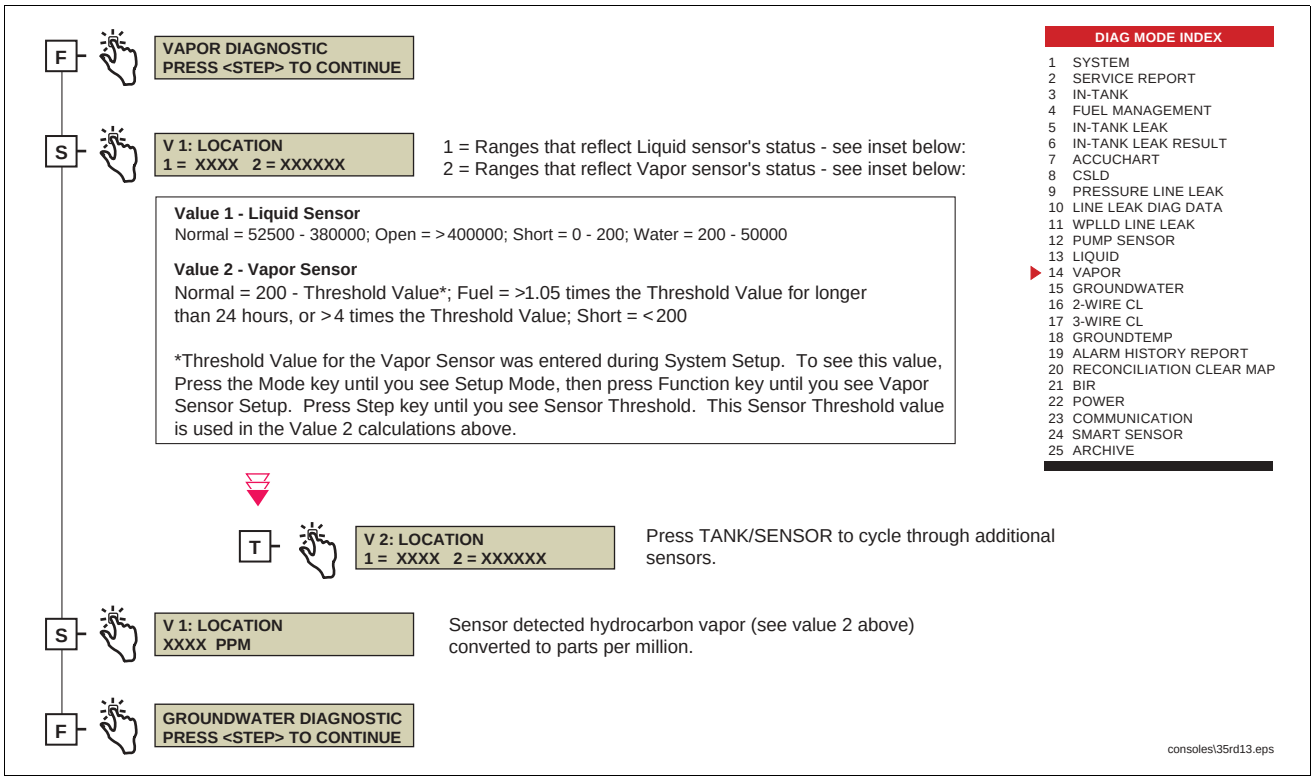


Figure 6-16. Vapor Sensor Diagnostic Function Diagram

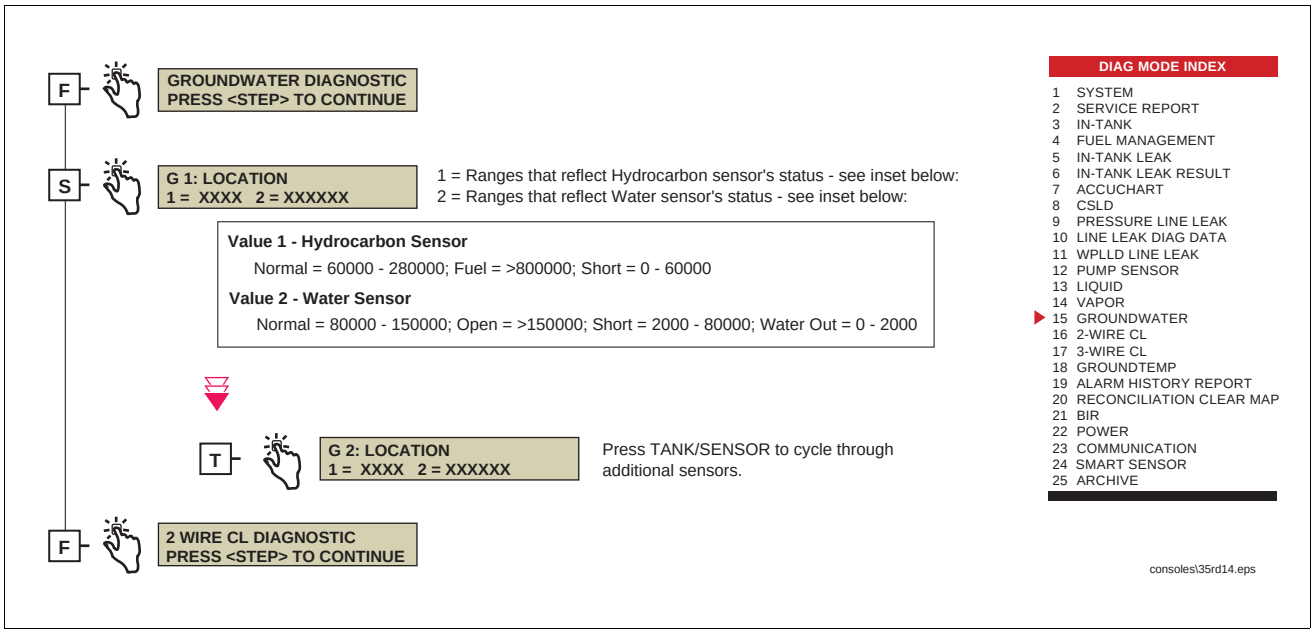


Figure 6-17. Groundwater Sensor Diagnostic Function Diagram

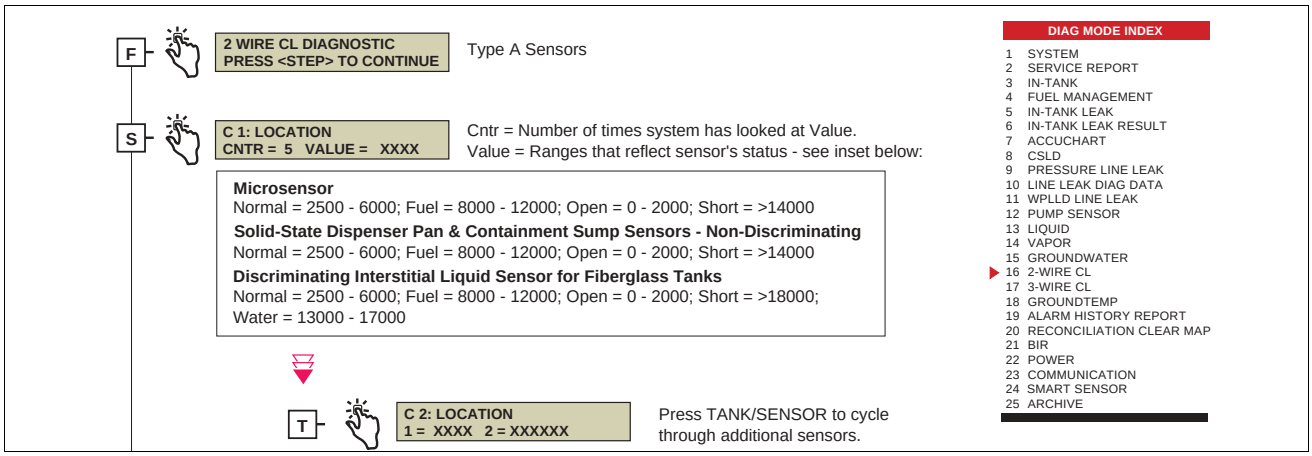


Figure 6-18. 2-Wire CL Sensors Diagnostic Function Diagram

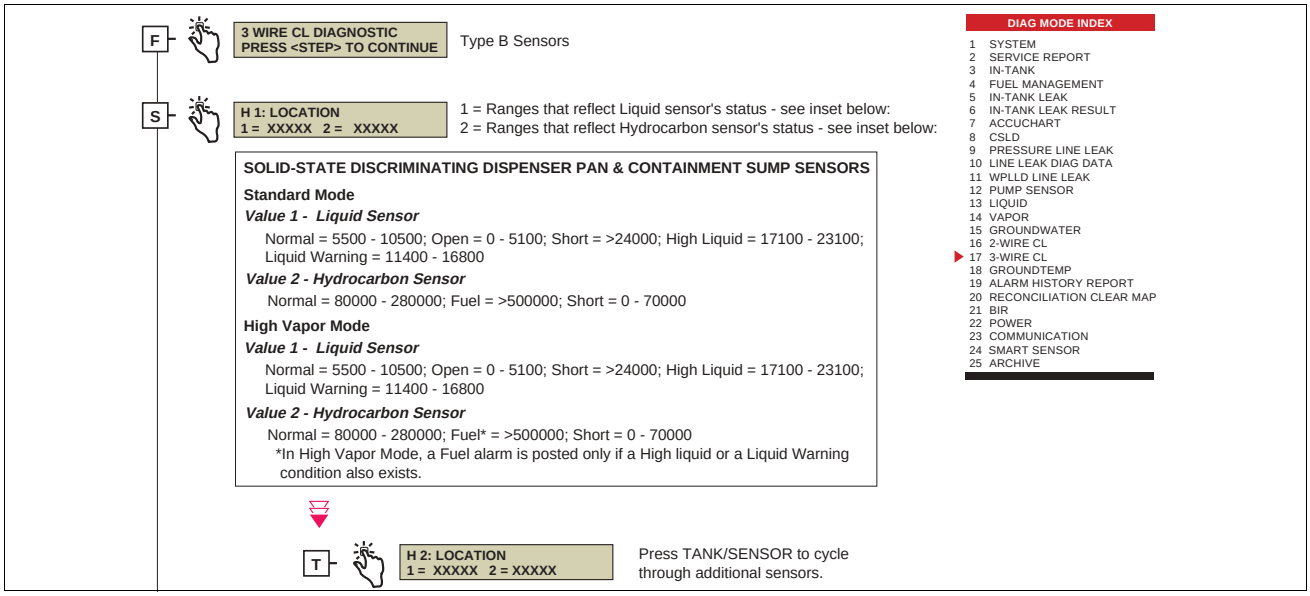


Figure 6-19. 3-Wire CL Sensors Diagnostic Function Diagram

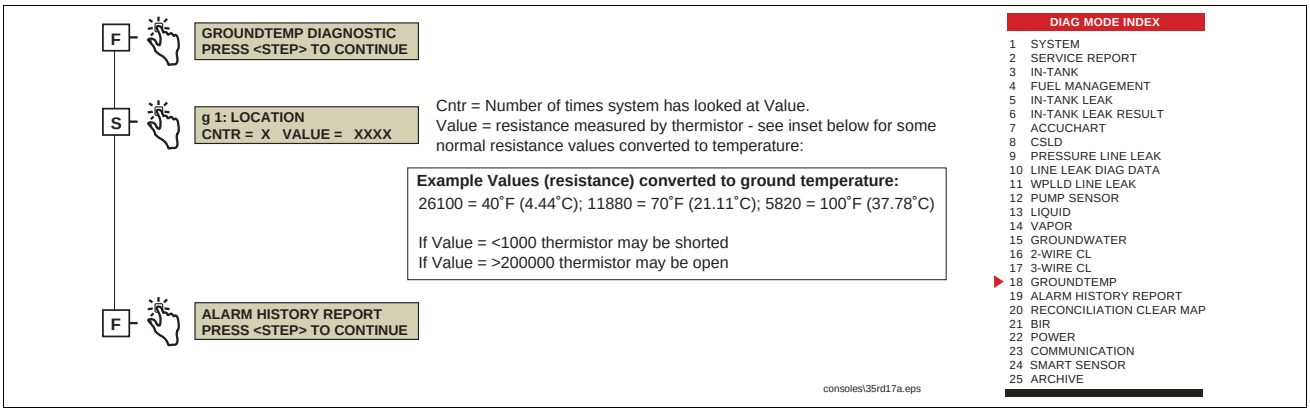


Figure 6-20. Groundtemp (VLLD Option) Diagnostic Function Diagram

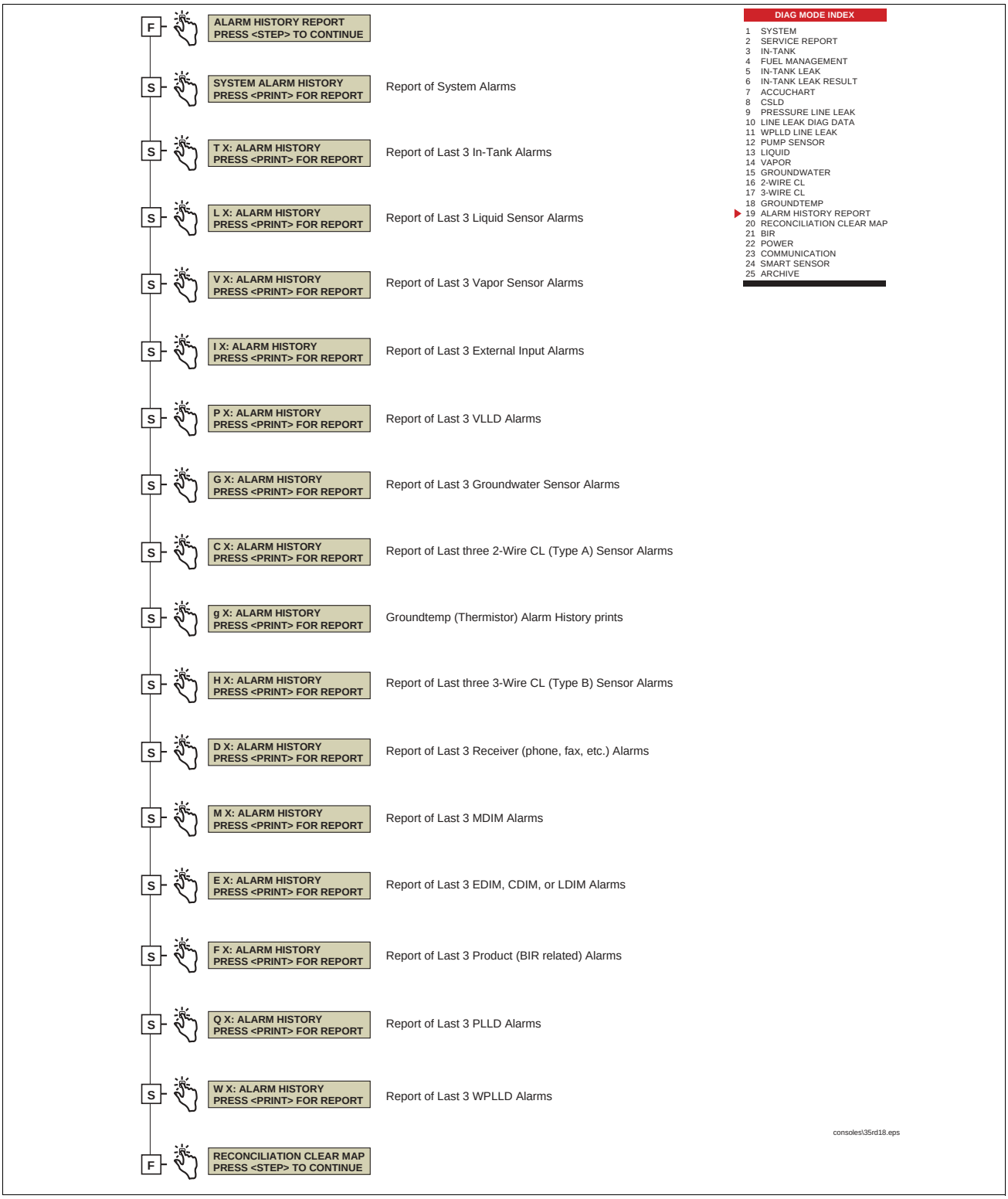


Figure 6-21. Alarm History Report Function Diagram

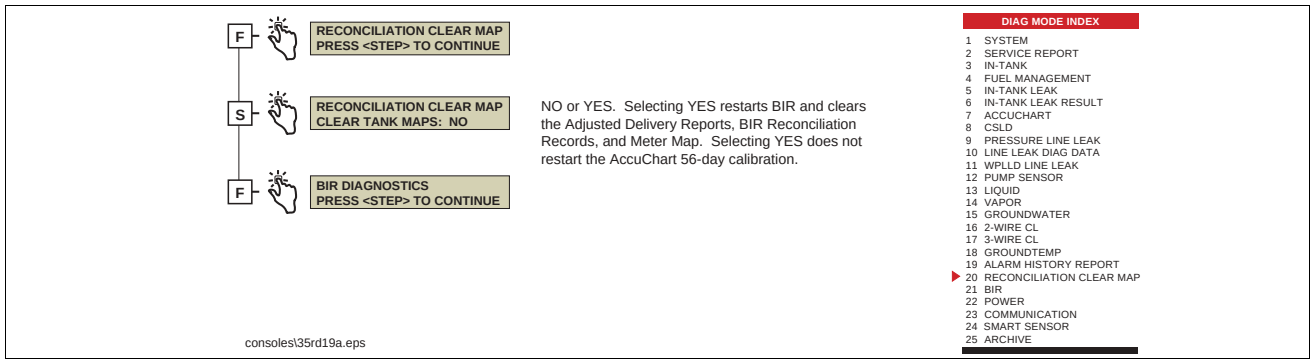


Figure 6-22. Reconciliation Clear Map Function Diagram

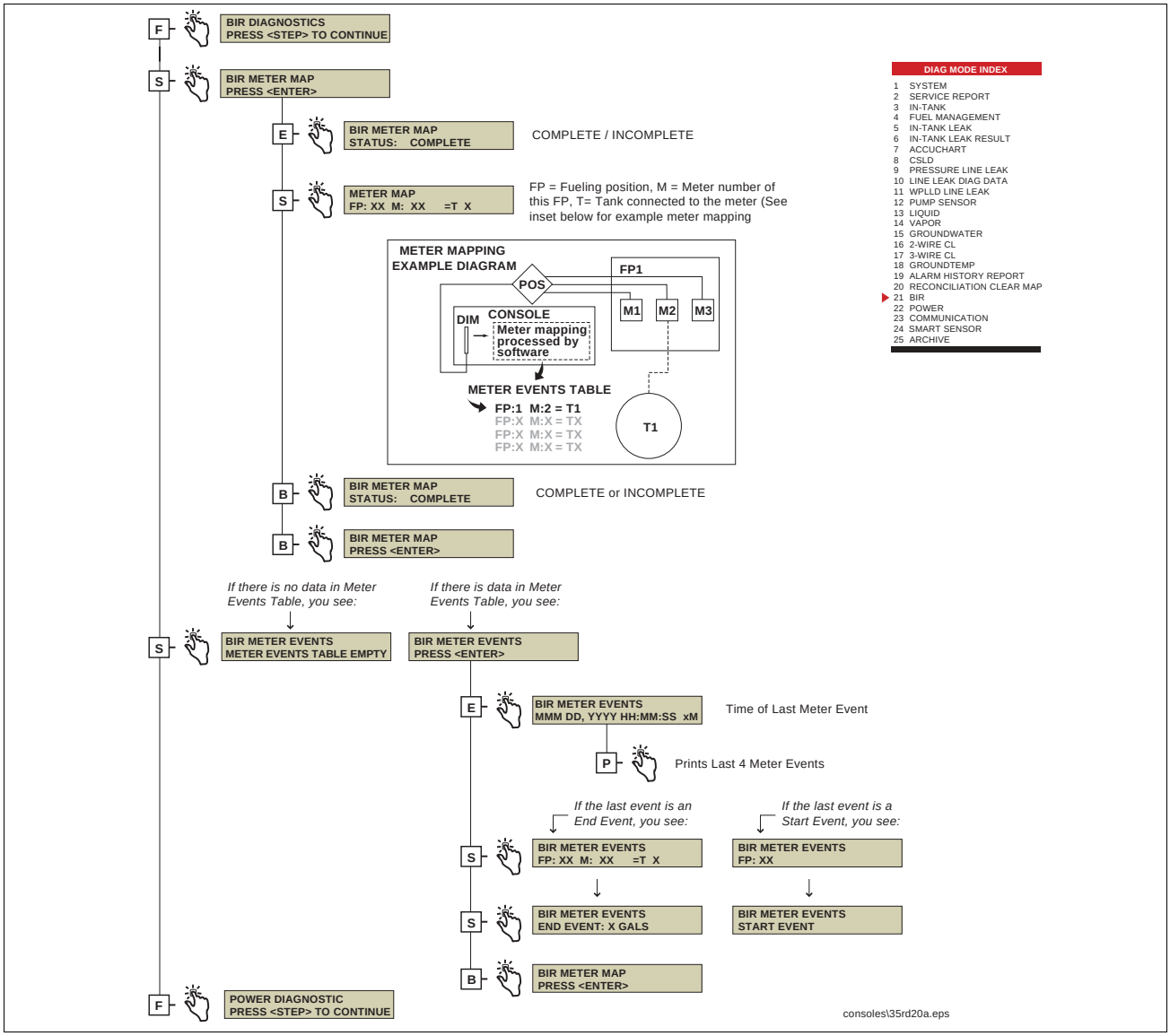


Figure 6-23. BIR Diagnostic Function Diagram

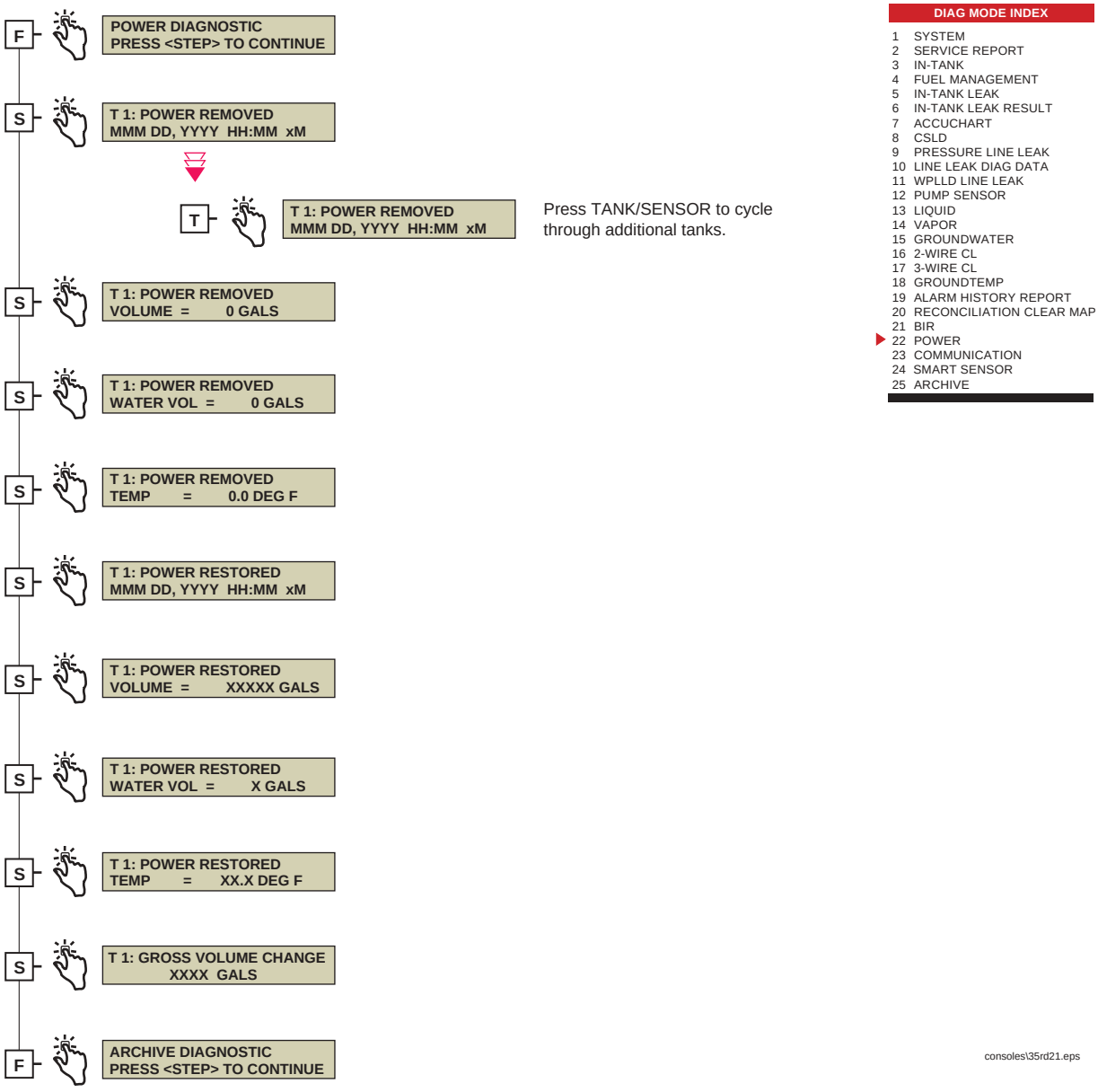


Figure 6-24. Power Diagnostic Function Diagram

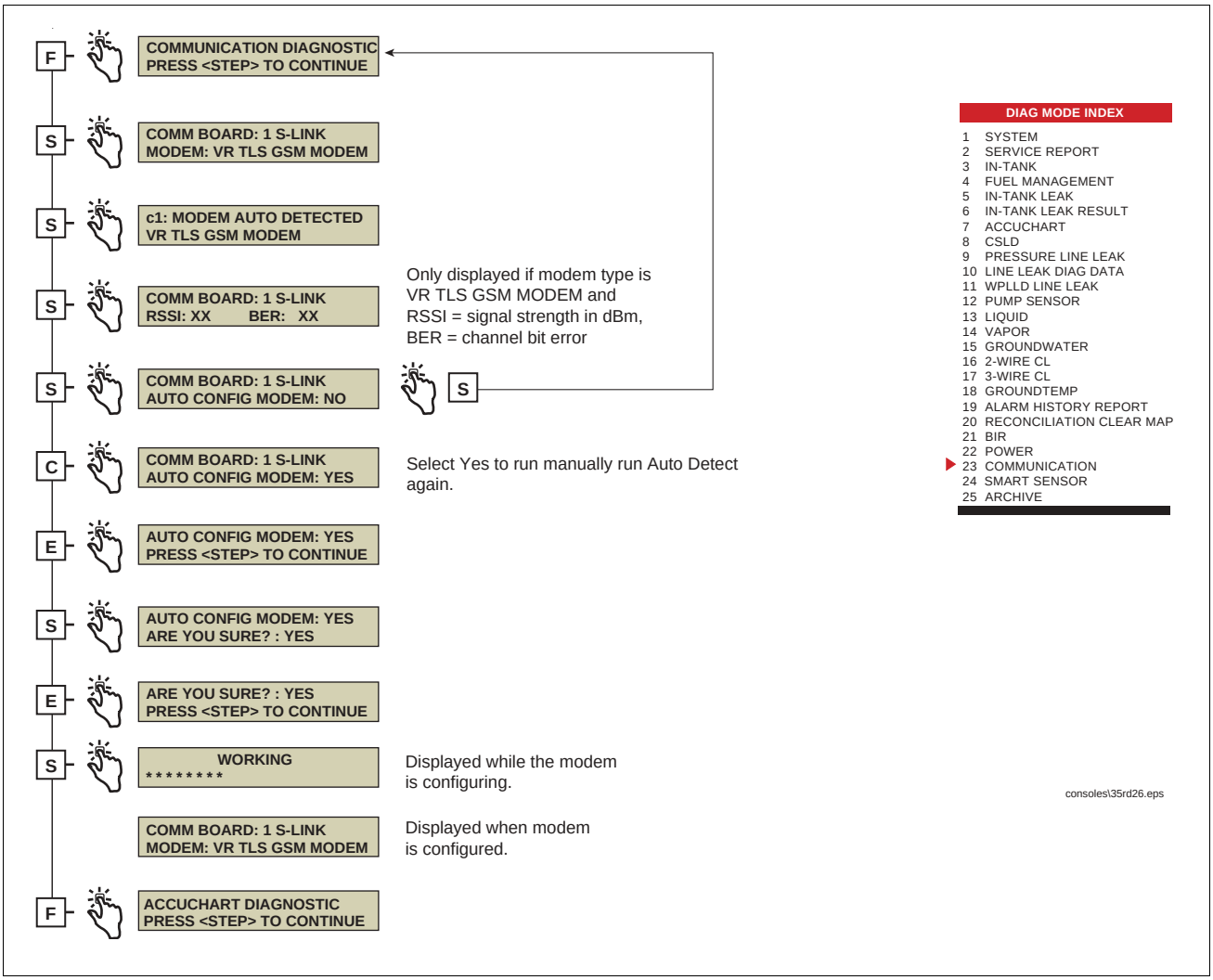


Figure 6-25. Communication Diagnostic Function Diagram

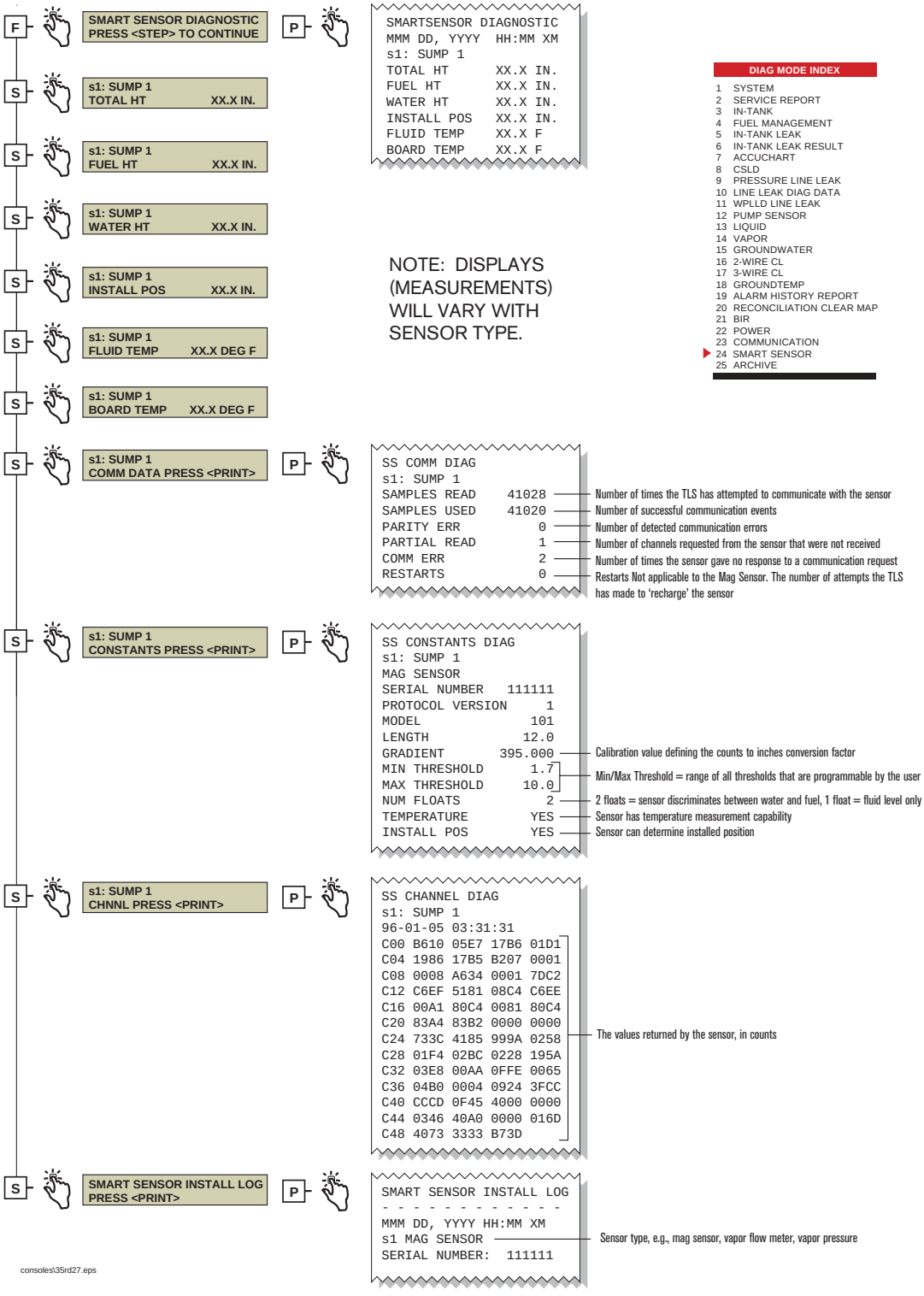


Figure 6-26. Smart Sensor Diagnostic Function Diagram

7 Console Troubleshooting

This section lists console (system) troubleshooting help for common system (Table 7-1) and data communication problems (Table 7-2). For parts locations see “System Parts Identification” on page 1-18.

Table 7-1. Console Troubleshooting

Symptom	Cause	Corrective Procedure
No display reading	No AC power to monitor.	Verify power circuit breaker is switched ON.
	#3 Dip Switch (S1 or SW1) on CPU/ECPU board in closed position.	Place #3 Dip Switch (S1 or SW1) in open position – Cycle power to console OFF/ON.
	AC fuse blown.	Check fuse on AC Input module front panel.
	Defective power supply.	Check power supply voltages.
	Defective display board.	Replace display board.
Partial display segments	Defective power supply.	Check power supply voltages.
	Defective display board.	Replace display board.
Display unintelligible	Ram corrupted.	Turn off AC power and battery switch and restart system.
	EPROMS U2 and U3 on CPU board in wrong sockets (U2 in U3 socket, etc.).	Check for correct positions.
System loses memory	Battery switch set to OFF.	Slide battery switch to ON.
	Bad battery.	Measure battery voltage. See Note 1.
	Defective CPU/ECPU board.	Replace CPU/ECPU board.
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.
Blank printout from integral printer	Defective printer communication module.	Replace printer communication module.
	Defective printer.	Replace printer.
Missing characters on printout	Defective printer.	Replace printer.
Characters “Overprint”	Paper roll installed on take up spool.	Install paper in correct position.
	Defective printer.	Replace printer.

Table 7-1. Console Troubleshooting

Symptom	Cause	Corrective Procedure
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 communication module and printer.
	Defective printer.	Replace printer.
	Defective printer communication module.	Replace printer communication module.

Table 7-2.- Data Communications Chart

Symptom	Cause	Corrective Procedure
System will not communicate via internal SiteFax Module.	Modem Module in slot 4 of Comm Bay card cage.	Move module to slots 1, 2, or 3.
	Incorrect or defective interconnect cable.	Check cable between TLS and telephone jack.
	Problem with telephone line.	Call phone company.
	Incorrect baud rate, parity, data bits, or stop bit settings.	Set all to agree with host device. See *System Setup Manual*.
	Security code enabled when not required.	Disable security code. See *System Setup Manual*.
	Incorrect security code.	Input correct security code or disable security code. See *System Setup Manual*.
	Defective modem module.	Replace modem.
System will not communicate via RS-232 Module	RS-232 Module in slot 4 of Comm Bay card cage.	Move Module to slots Comm Cage slots 1, 2, or 3.
	Incorrect cable.	Use null cable when connecting to terminal/computer. Use straight cable when connected to external modem.
	Incorrect baud rate, parity, data bits, or stop bit settings.	Set all to agree with terminal/host device. See *System Setup Manual*.
	Incorrect security status.	Input security code or disable security code. See *System Setup Manual*.
	Defective RS-232 Module.	Replace module.
	Defective host terminal or modem.	See manufacturer's troubleshooting manual.
	Excessive cable length between host and TLS.	Check cable length--50 ft. maximum.

[1]Batteries on the CPU/ECPU boards are replaceable. If the memory does not hold during power outages, check the battery voltage. Voltage should be approximately 3.6 Volts DC. (Battery part number is 576010-695).

8 Sensor Troubleshooting

This section contains suggested corrective actions for troubleshooting sensor problems.

Sensor Alarm Will Not Clear

Liquid or fuel in containment area.

Sensor Open Alarms

Follow these steps in sequence to troubleshoot Sensor Open 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 576013-879) 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 interface module or to the proper connector position (TLS-300 Consoles), 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. Enter the Diagnostic Mode (ref. Section 6) and step through the diagnostic menu for the problem sensor. These diagnostics provide 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 (TLS-300/TLS-350 Consoles).
2. The wrong sensor type was selected during setup (TLS-300 only).
3. The sensor was not configured during setup but the console measures a resistive value and determines a device is connected (TLS-300/TLS-350 Consoles).

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 576013-879) 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, -360, -361, & -362

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.

Smart Sensor Troubleshooting

The procedures below apply only to Smart Sensors, e.g., 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, Hi Liquid, and Lo 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. For a Communication Alarm the sensor is not responding at all (bad sensor (similar to effects on mag probes), open connection, bad Smart Sensor module, etc.), or an electrically noisy line.
5. If the sensor remains unstable/non-communicable, connect the sensor directly to the console to confirm a faulty sensor.

9 Probe Troubleshooting

This section contains basic probe problem diagnosis and suggested corrected actions for troubleshooting Magnetostrictive Probes (Table 9-1). Refer to *Site Prep and Installation Manual* (Veeder-Root No. 576013-879) and the appropriate probe installation manual for more information about probe, conduit, and wiring installation.

Note: 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.

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.
		2-inch floats with consoles having Version 1 and 2 software.	See Note 1.
		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 2.
		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 2.
		Conduit not grounded properly	See Note 2.
		Non-metallic conduit present	See Note 2.
		Variable speed submersible pump in use	See Note 2.
		Defective barrier board	Replace barrier board.
		Defective probe	Replace probe.
	Ghost tank reading	Defective barrier board	Replace barrier board.
	Fuel temperature reading is incorrect	Defective thermal sensor in probe.	Replace probe.
	Probe does not read out and there is no probe alarm	Probe channel not configured in tank setup	See System Setup Manual.
		Incorrect software for probe/ thermistor module	See Note 3.
	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.

NOTE 1. When 2-inch float kits are installed on mag probes, the fuel height reading will not be correct with older systems still using console software Version 1 and two EEPROMS. These versions require a tank tilt adder of +2.25 when used with Mag probes with 2-inch floats. Systems with Version 3 software or higher do not require this adder.

NOTE 2.Refer to *Site Prep and Installation Manual* (Veeder-Root No. 576013-879).

NOTE 3. The Four-Input Probe/Thermistor Module can only be used in systems with Version 1 software, Rev. F or higher. In Version 2 software or higher, all revision levels are compatible.

Field Troubleshooting Probe-Out Alarms

Attention all Technicians: You must verify all locations utilizing shielded cable are wired correctly. Verify that the drain wire of the shielded cable is connected to the TLS 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 TLS 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 TLSEMC, those printouts must be provided with any returned probe.

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

1. Press Alarm Test Button- (Verify System Alarms)
   - Print / record the active alarms
2. Press Mode Button to display Diag Mode.

3. Press Function until In-Tank Diagnostics appear.
4. Press Print. (If the console does not have a printer, manually record the diagnostic data from each diag screen).

   - Print / record the In-Tank Diagnostics
5. The Probe distance from the TLS must be less than 1000 feet. If the distance is greater than this probe operation is not guaranteed.
6. Ensure the probe wiring conforms to the requirements detailed in the Site Prep and Installation Manual (Veeder-Root No.576013-879).
7. Verify the TLS console is grounded correctly.

   - Is the ground wire at least a 12AWG conductor? Remove ground cable from the grounding lug inside the TLS system, 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.
8. Verify the TLS is on a separate circuit breaker with no shared branch circuits.
9. 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.
10. 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.
11. 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 console's Site Prep manual for correct installation procedures.
12. Before proceeding, ensure that TLS 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.
13. 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.
14. Measure the resistance of the probe wiring from the probe end of the cable to the connections at the console. First disconnect the conductors from the console. Then remove the connector from the probe and short across the two pins of the probe cable connector. (Caution: Do not force jumper into cable connector. Doing so may cause the connector pins to separate and produce a poor connection.) Measure the resistance across the two conductors at the console. 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 each probe conductor to a known good ground to verify it is not shorted. This resistance should be very high (megohms to infinity). When conducting the above, please check the resistance at the TLS and probe end.

15. 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 9-1. Mag Probe Minimum Detected Fluid Levels

Circuit Code	Mag Probe Type	Leak Detect	Name Plate Color	Water Detect	4" Floats		3" Floats		2" Floats	
					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	3.04"	0.63"	3.04"	0.63"	3.23"	.867"
D005	2 float	0.20 gph	Red	Yes	3.04"	0.63"	3.04"	0.63"	3.23"	.867"
D006	Inv. only, 2 flt	None	Green	Yes	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"	–
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"

Table 9-1. Mag Probe Minimum Detected Fluid Levels

Circuit Code	Mag Probe Type	Leak Detect	Name Plate Color	Water Detect	4" Floats		3" Floats		2" Floats	
					Min. Fuel Level	Min. Water Level	Min. Fuel Level	Min. Water Level	Min. Fuel Level	Min. Water Level
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"	–

Mag Probe Channel Counts in Common Liquids

The table below shows the normal operating range of channel counts for magnetostrictive probes in common liquids (fuels).

Table 9-1. 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.

Example Probe Status Printouts

MAGNETOSTRICTIVE PROBE - NORMAL

```
PROBE DIAGNOSTICS
T1: PROBE TYPE MAG7
SERIAL NUMBER 212617
ID CHAN = 0xD004
GRADIENT = 351.69*
NUM SAMPLES = 20

C40              760.0          C41   28090.8
C42              28090.8        C43   28090.8
C44              28090.9        C45   28091.0
C46              28090.9        C47   28090.9
C48              28090.6        C49   28090.9
C10              28090.6        C11   43915.1
C12              34038.4        C13   34247.9
C14              34274.7        C15   34379.1
C16              34715.3        C17   34929.8
C18              43915.9

SAMPLES READ = 450255
SAMPLES USED = 449269
```

MAGNETOSTRICTIVE PROBE - MISSING WATER FLOAT

```
PROBE DIAGNOSTICS
T1: PROBE TYPE MAG7
SERIAL NUMBER 212617
ID CHAN = 0xD004
GRADIENT = 351.6900*

NUM SAMPLES = 20
```

```
C40               27057.2     C41   55118.2
C42               55117.9     C43   55117.9
C44               55118.4     C45   55117.6
C46               29493.6     C47   29493.3
C48               29493.4     C49   29493.7
C10               29493.4     C11   43914.8
C12               34048.5     C13   34239.1
C14               34270.4     C15   34378.2
C16               34718.6     C17   34934.3
C18               43915.6
SAMPLES READ = 249626
SAMPLES USED = 249561
    *Gradient may be 175 - 185, or 348 - 358.
```

10 Dispenser Interface Modules (DIMs)

DIM Descriptions

MECHANICAL DISPENSER INTERFACE MODULE (MDIM) & LOW VOLTAGE DISPENSER INTERFACE MODULE (LVDIM)

Installed in power area of TLS-350R, MDIMs provide an interface for the console to mechanical dispenser heads using high voltage volume pulses. LVDIMs provide an interface for the console to mechanical and electronic dispenser heads and pump controllers using low voltage volume pulses.

Either one of these modules can be installed in any combination with other DIM types.

The MDIM/LVDIM modules allow the console to gather relevant dispensing information including how much product has been dispensed from each fueling station.

MDIMs have 8-pin and LVDIMs have 10-pin external rectangular connectors.

ELECTRONIC DISPENSER INTERFACE MODULE (EDIM)

Installs in a communication port of TLS-350R. EDIMs are used to communicate via RS-232 to Point of Sale or system controllers.

More than one EDIM can be installed in any combination with other DIM types.

EDIMs have one 25-pin D connector outside of the port.

Red and green LEDs are on this board. When red LED is on EDIM is transmitting to external device; when green LED is on external device is transmitting to EDIM.

CURRENT LOOP DISPENSER INTERFACE MODULE (CDIM)

Installs in a communication port of TLS-350R. Various CDIM monitoring applications to include current loop, RS-232 and RS-422.

More than one CDIM can be installed in any combination with other DIM types.

CDIMs have three RJ-45, 8-position modular connectors. Three on-board green LEDs being on indicate data is transmitting to CDIM from external device.

CDIMs cannot transmit to external device.

Connects via 4 wire cable to Cable Adapter Box. Adapter box converts target communication format to RS-422 format for CDIM. Adapter boxes are configured with 2-wire flying leads, 25-pin D or 9-Pin D, T-cable connectors for various applications.

LAN DISPENSER INTERFACE MODULE (LDIM)

Installs in a communication port of TLS-350R to communicate with or monitor POSs, dispensers or system controllers using RS-485 communication standard.

More than one LDIM can be installed in any combination with other DIM types.

LDIMs have a 5-wire Phoenix connector.

Red and green LEDs are on this board. When red LED is on LDIM is transmitting to external device; when green LED is on external device is transmitting to LDIM.

Can be used in 4-wire or 2-wire, RS-485 and RS-422 applications.

DIP Switch default in OPEN position, loopback jumper on LED side for RUN mode.

R1 - 331076-001 - RS-485 two wire.

R2 - 331076-002 - RS-422 four wire.

R3 - 331076-003 - DIM RS-485 two wire. (Install in TLS-350R only.)

R4 - 331076-004 - DIM RS-422 four wire. (Install in TLS-350R only.)

INTERNATIONAL FORECOURT STANDARDS FORUM DISPENSER INTERFACE MODULE (IFSF)

Required for TLS Consoles that are connected to IFSF networks.

Uses Echelon 2-wire FTT10-A medium, as defined by the IFSF standards.

There are 3 LEDs on this board:

- Green LED indicates that the IFSF board is transmitting information to the TLS.
- Red LED indicates the TLS is transmitting information to the IFSF board.
- Amber LED reflects the current state of the IFSF board processor (off is normal state).

There are no LED indicators for network communication.

DIM Tables

DIM Quick Reference Chart								
DIM Part Number❶	Software Revision	Description	Hardware Type	Default Settings				Notes
				Baud	Parity	Length	Stop	
847492-345	349643	Gilbarco GSite	EDIM	1200	Even	7	1	
847490-420	349634	Gilbarco CL	CDIM	Proprietary				❷
847490-431	331353	Tokheim 67A&B	CDIMII❺	9600	None	8	1	❷❼
847490-360	330384	Tokheim DHC	EDIM	1200	Even	7	1	❻
847490-410	349633	Wayne CL	CDIM	Proprietary				❷
847490-400	330435	Schlumberger	CDIM	1200	Even	7	2	❸❻
847400-471	349753	Gasboy RS422	LDIM	9600	None	8	1	
847400-472	349753	Gasboy CFN	LDIM	9600	None	8	1	❻
847490-340	330273	BIR	EDIM	9600	Odd	7	1	**METRIC** ❹
847490-206	330270	Mechanical	MDIM	N/A				❸
847490-210	330270	Low Volt Mech	LVDIM	N/A				❸
847490-470	349646	Tominaga	LDIM	19200	Even	8	1	❷❹❻
847490-440	349633	Bennett	CDIM	4800	Even	8	1	❷
847490-391	349631	UK Block	EDIM	2400	Even	7	1	❸
847490-395	349641	Scheidt & Bach	EDIM	1200	None	8	1	❸

❶ When ordered as upgrade or replacement.
❷ Parameter string is not required for serial communication only.
❸ Will not generate **Communication Alarm.**
❹ **Metric** is the default setting for unit conversion. Requires '**G**' in parameter string for **gallon** units.
❺ A Two port CDIM. Normal CDIMs have 3 ports, CDIMII has two ports that monitor 2 comm channels each.
❻ No blending.
❼ Use 'P' in parameter string for Tokheim 2+1, 3+1, and 4+1 blending dispensers.

CDIM/CDIMII/EDIM Parameter Definitions									
Baud		Parity		Stop Bits		Data Bits		Conversion	
String	Rate	String	Type	String	Bits	String	Bits	String	Unit
B9	9600	N	None	H	1	V	7	G	Gallons
B4	4800	E	Even	S	2	D	8	M	Metric
B2	2400	O	Odd					I	Imperial
B1	1200								
B6	600								
B3	300								
BG	***								

LVDIM/MDIM Pulse Conversion	
String	Pulses per Unit Volume
P	100 (7697 Pulser)
F	10 (7697 on High Volume Pump)
T	**25 (7874 Pulse/Totalizer) MDIM / LVDIM Default**
Q	2.5 (7874 on High Volume Pump)
A	1/2
S	1
W	250
X	500
Y	1000

Female D Connector Pin Outs	
PIN	Function
2	Transmit Data
3	Receive Data
7	Signal Ground

RS232 Loop Back Tool		
PIN	Connect To	PIN
2		3
4		5
20		22

DIM Installation Examples

Various example DIM installation diagrams are shown below and on the following pages and are included as references only. For specific DIM installation details, refer to the appropriate Veeder-Root DIM Installation Manual.

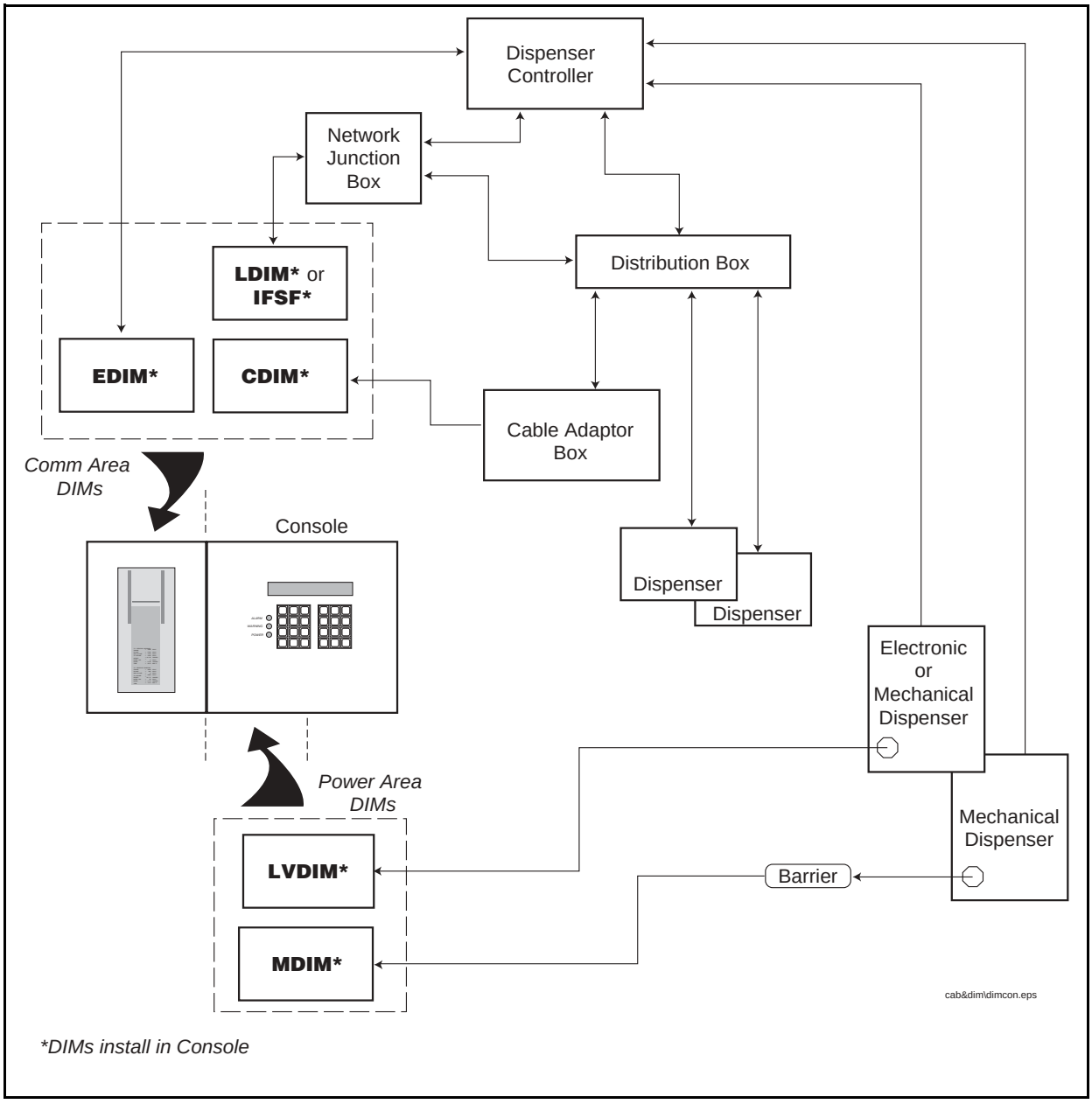


Figure 10-1. Simplified DIM Connections to various Dispensing Systems

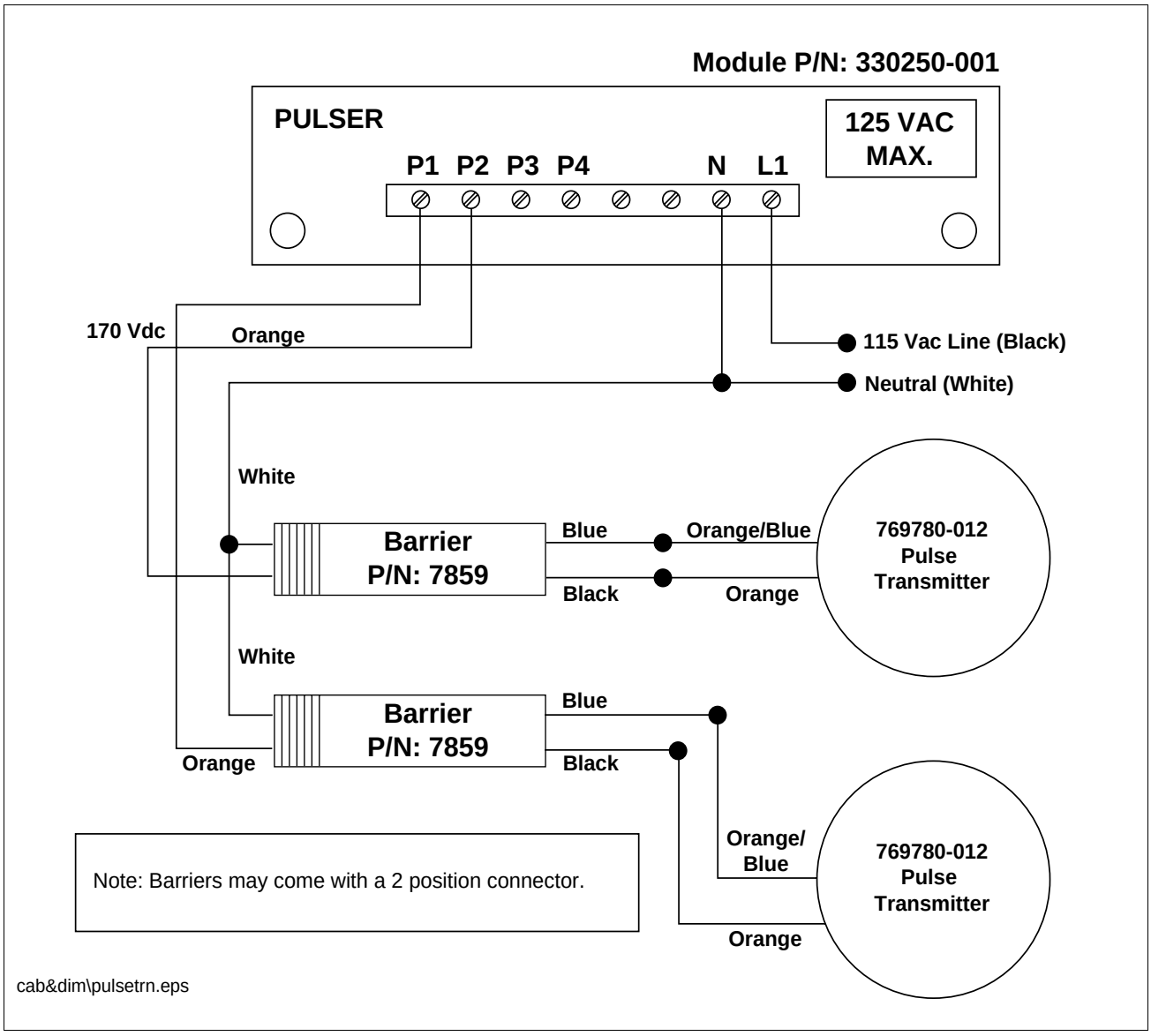


Figure 10-2. Wiring Diagram of Mechanical Dispenser Applications using two 1871/7697 Series Pulse Transmitters and required Barriers (MDIM)

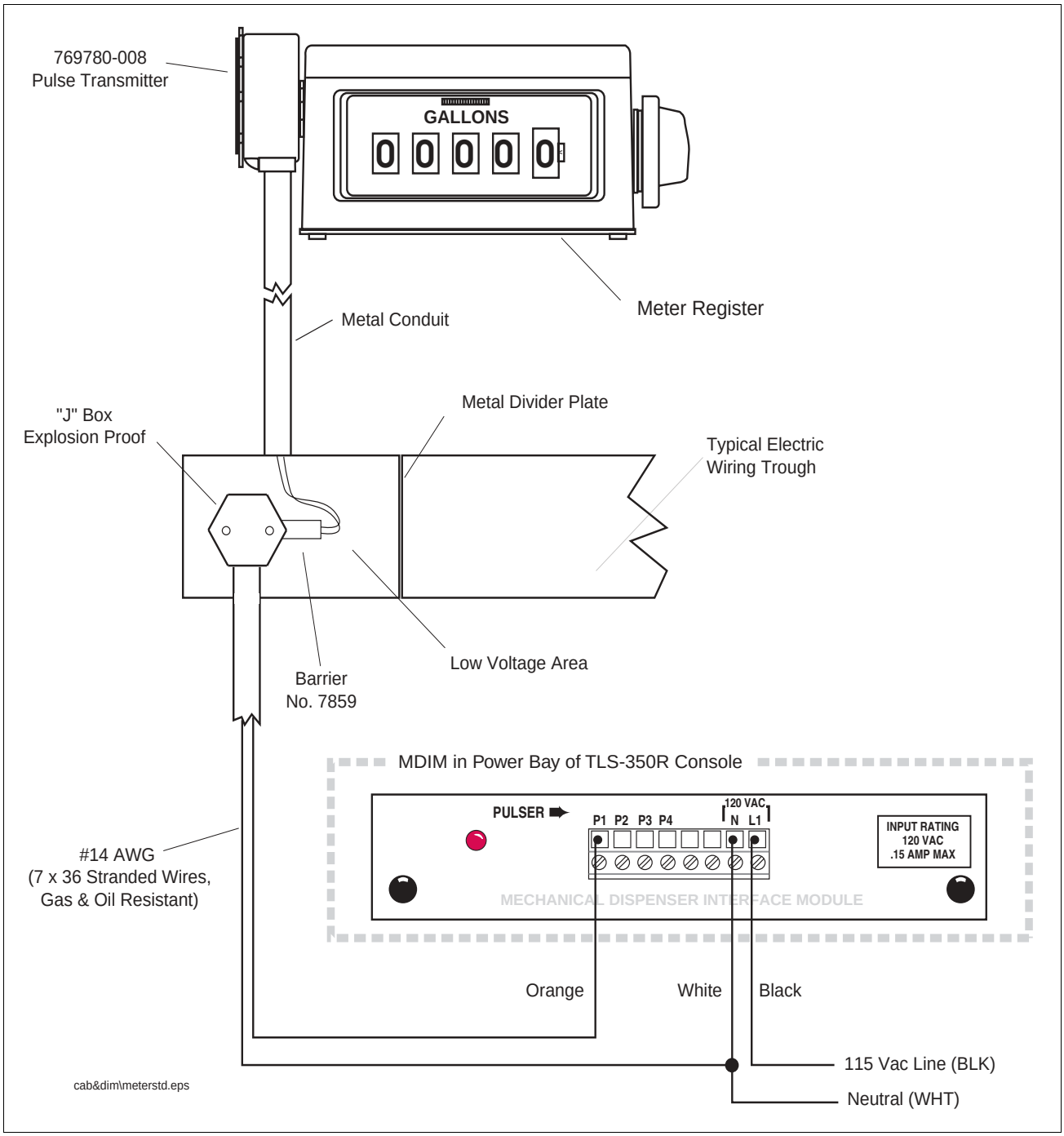


Figure 10-3. Meter Stand Application Using 1871/7697 Series Pulse Transmitter (MDIM)

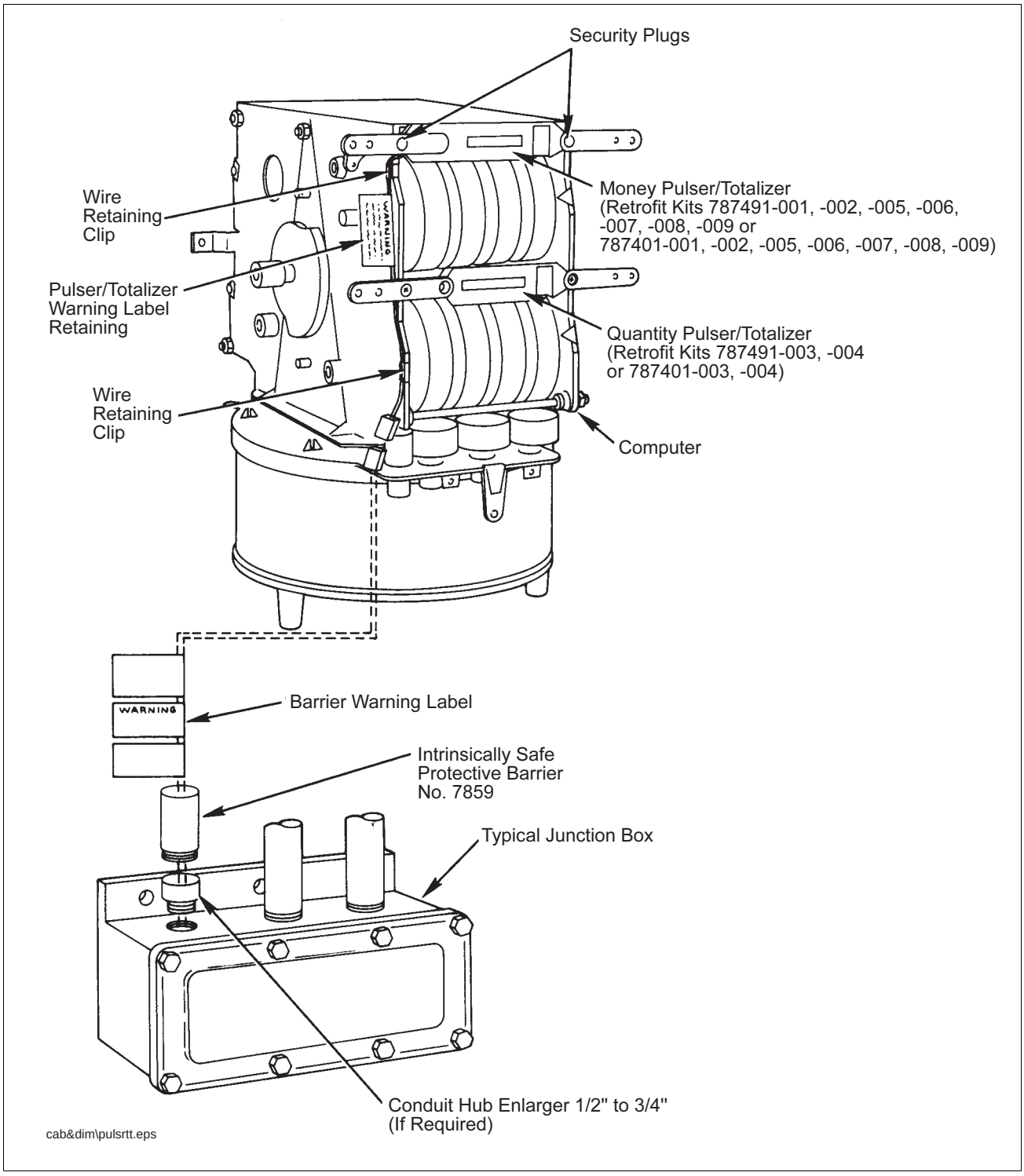


Figure 10-4. Mechanical Dispenser Applications using 7874 Series Pulser/Totalizer (MDIM)

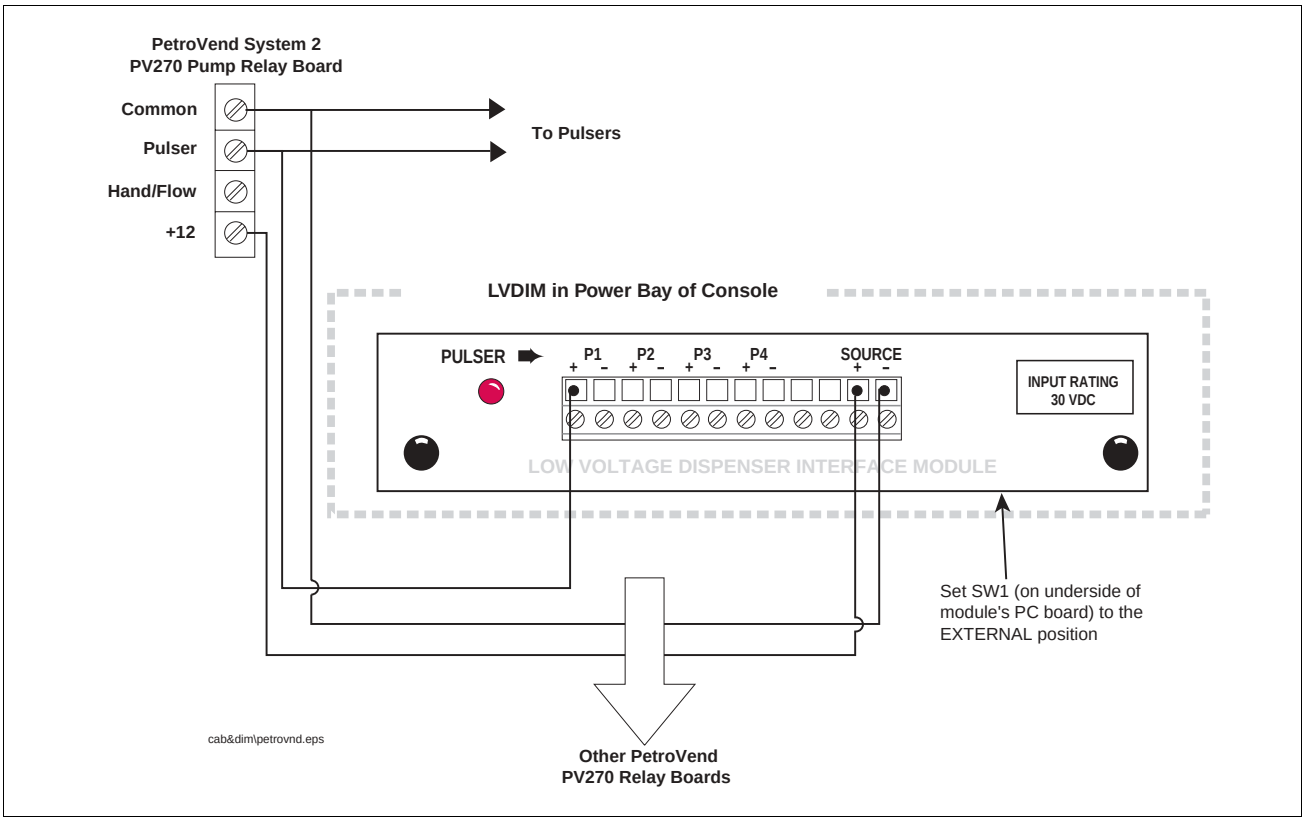


Figure 10-5. Installation with PetroVend System 2 Site Controller (LVDIM)

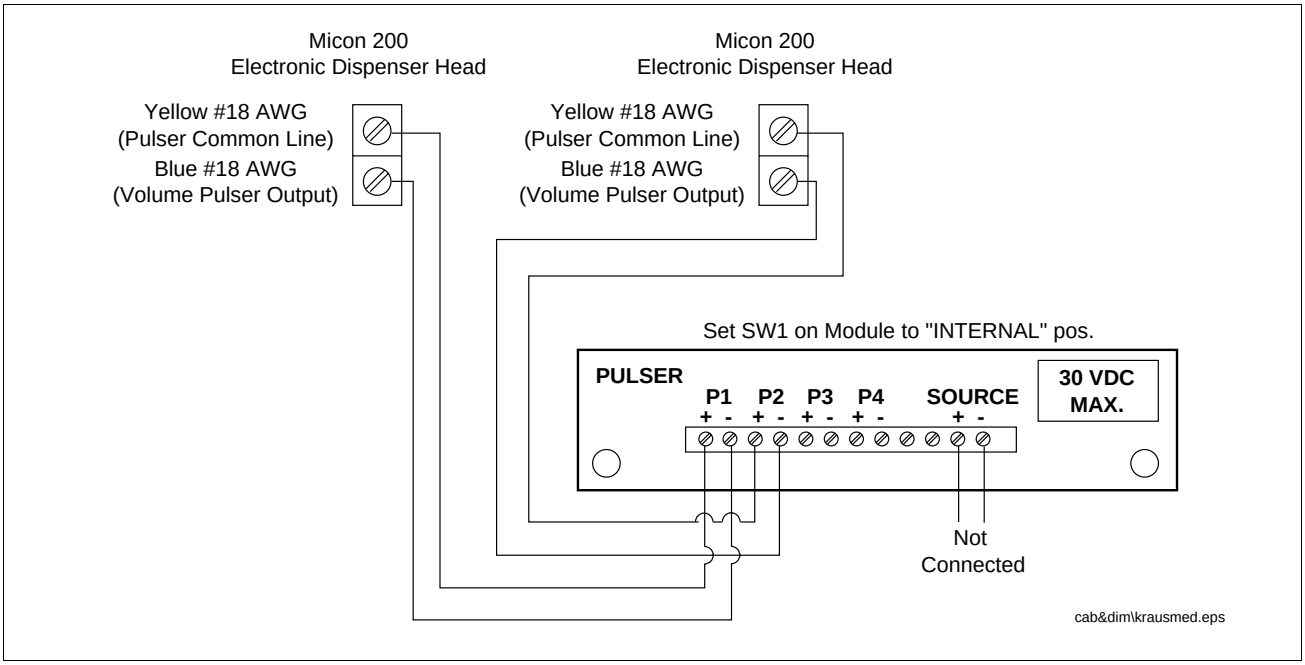


Figure 10-6. Installation with Kraus Micon 200 Series Elecronic Dispeners (LVDIM)

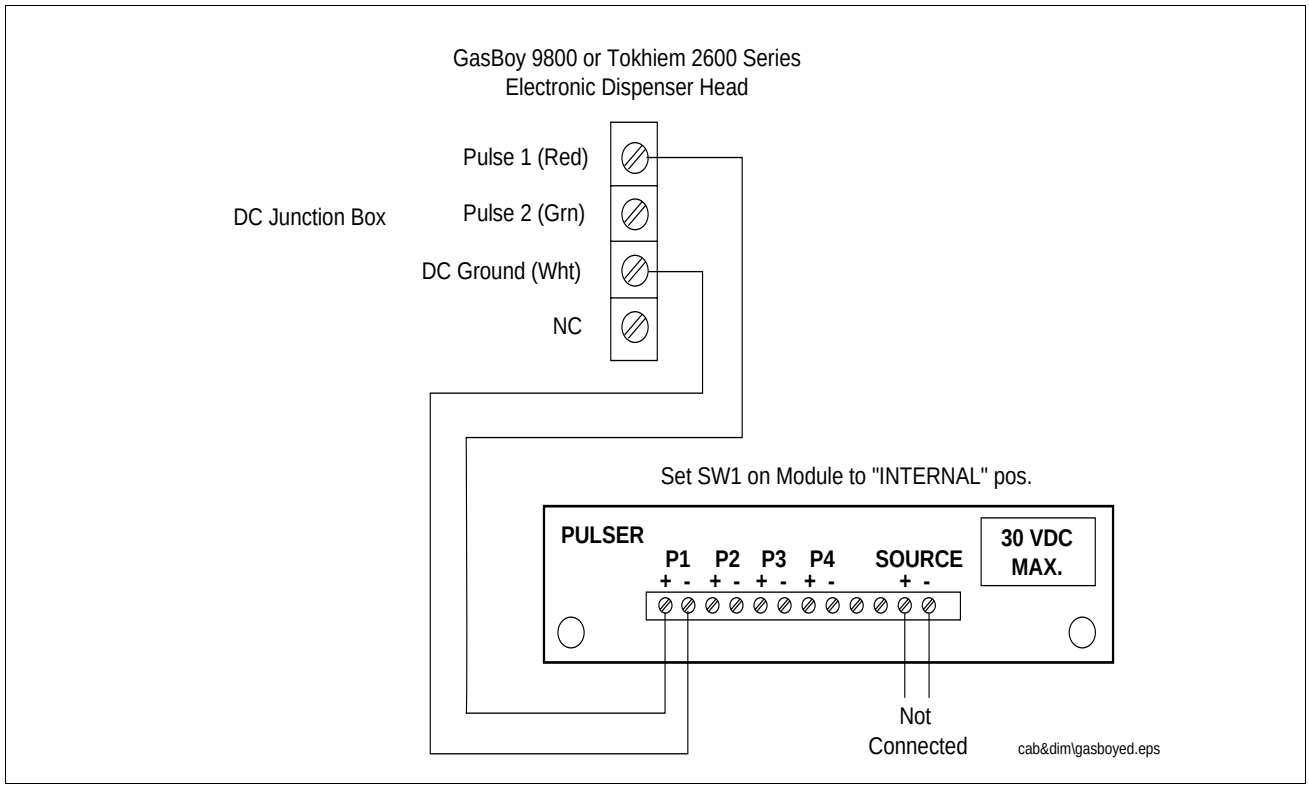


Figure 10-7. Installation with GasBoy 9800 Series Electronic Dispensers (LVDIM)

Interface Module Hardware Configuration

Set DIP Switches 1 and 2 to the CFN Communication parity used at your site (Refer to Table 10-1).

Ensure that power is OFF when changing the switch settings.

Table 10-1. Interface Module Parity DIP Switch Settings

Baud Rate	Data Bits	CFN Parity	SW 1 Position				SW 2 Position			
			1	2	3	4	1	2	3	4
9600	8	None (Default)	0	0	0	0	0	0	0	0
9600	7	Even	0	0	0	1	0	0	0	0
9600	7	Odd	0	0	1	0	0	0	0	0

0 = Off/Open
1 = On/Closed

Figure 10-8 is a cut-away of the dip switch banks on the Gasboy Interface Module:

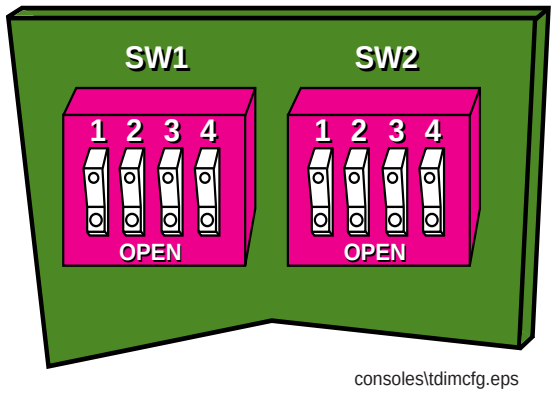


Figure 10-8. Dip Switch Banks on the Gasboy Interface Module (LVDIM)

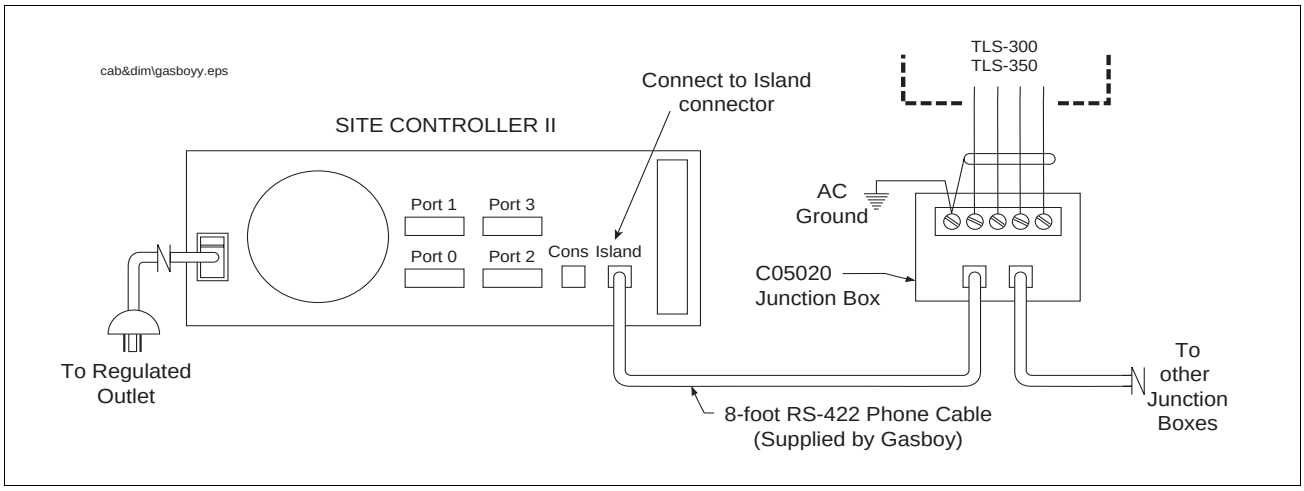


Figure 10-9. Gasboy Island Loop Interface Configuration. for TLS-350 (LVDIM) - Kit No. 331088-XXX

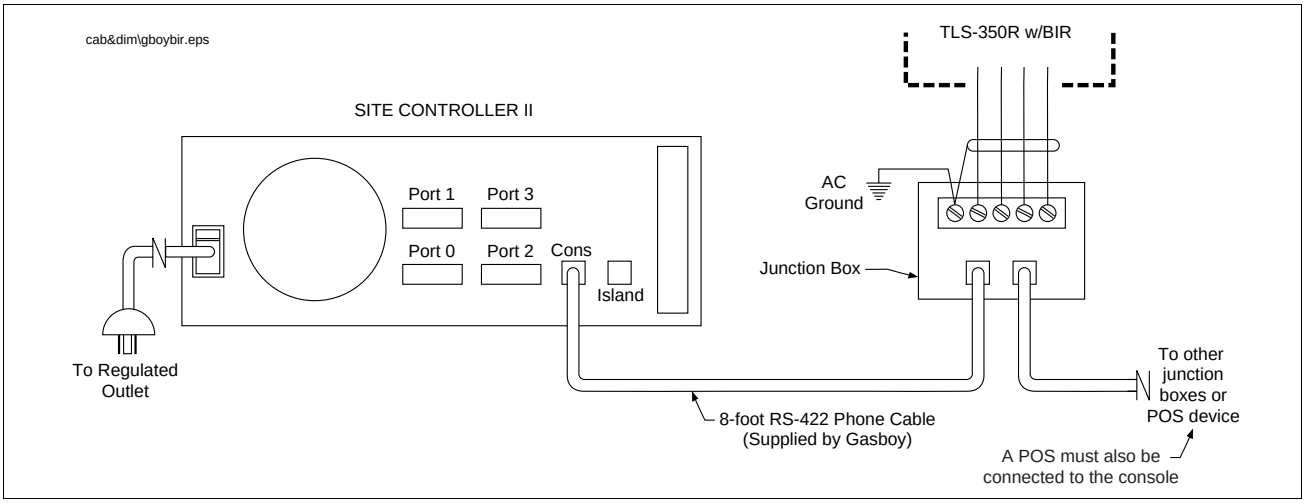


Figure 10-10. Gasboy Console Loop Interface Required Config. for TLS-350R w/BIR (LVDIM) - Kit No. 331088-XXX

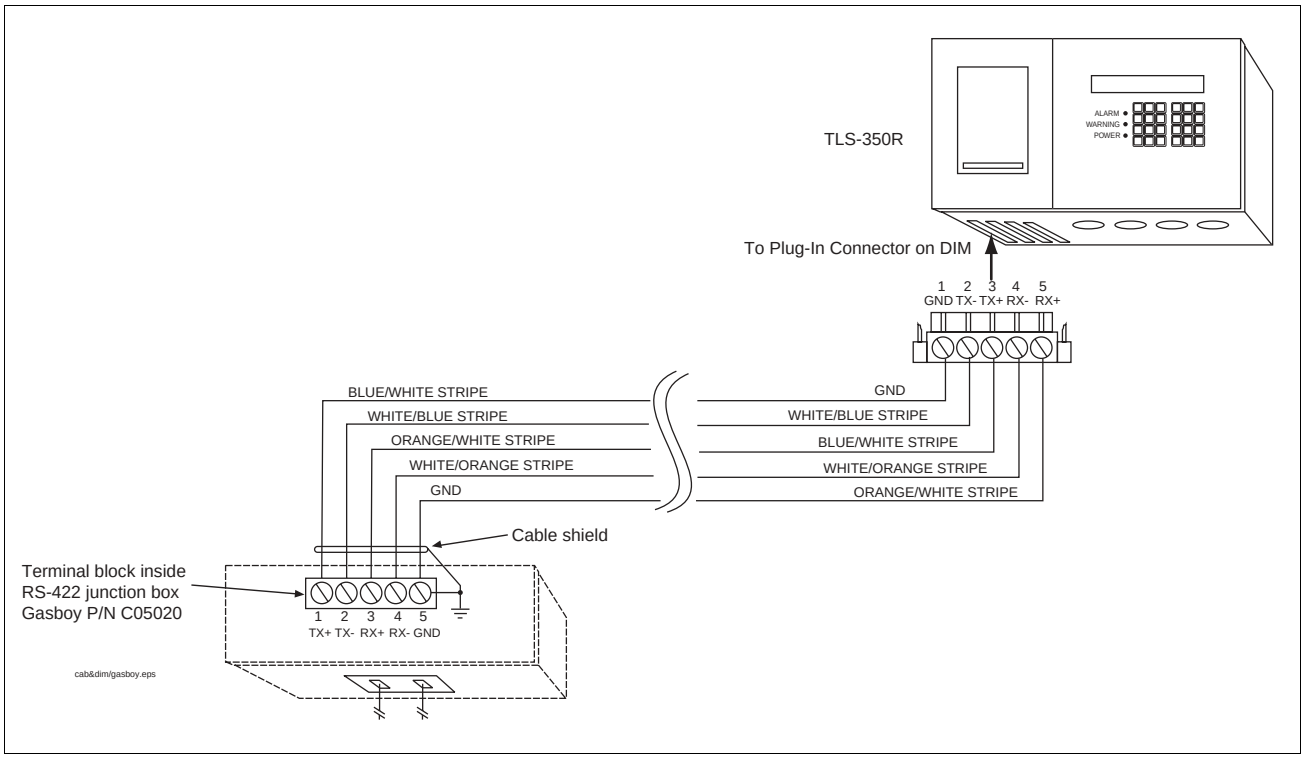


Figure 10-11. Gasboy CFN Interface (LVDIM) - Kit No. 331088-XXX

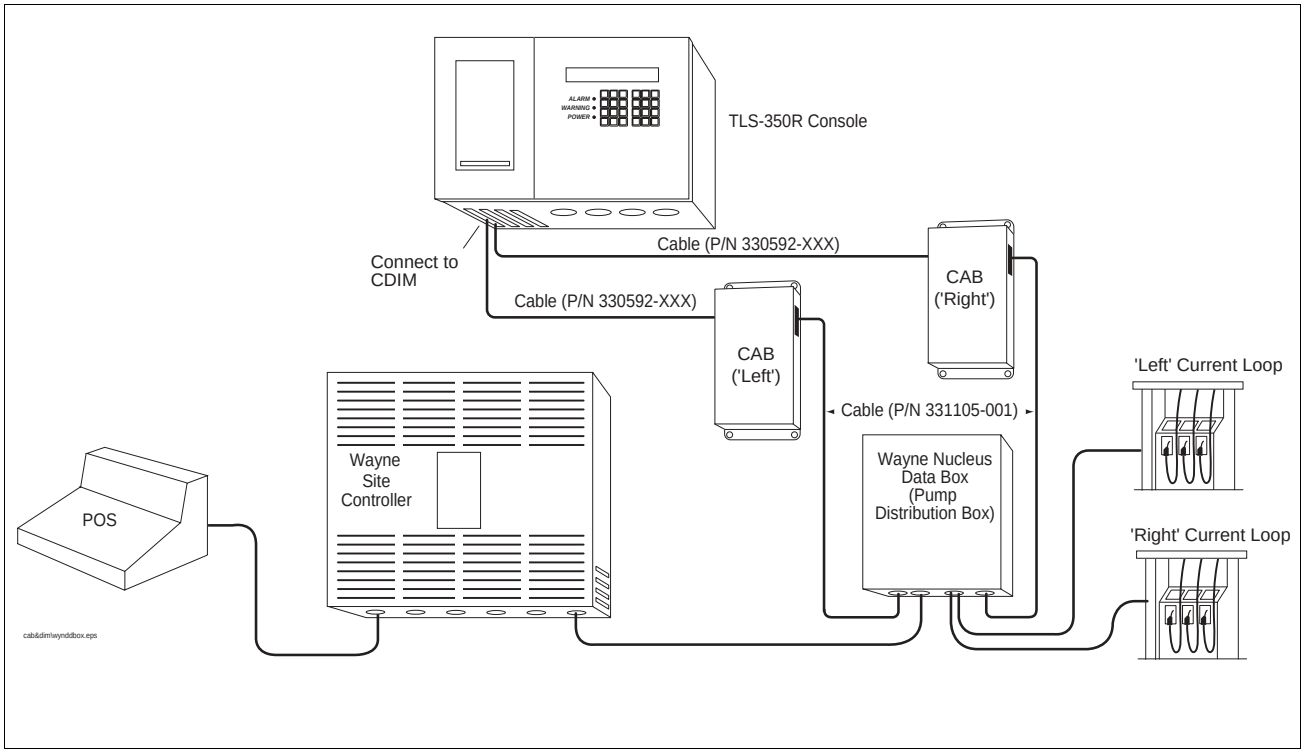


Figure 10-12. Wayne Dispenser Data Box Current Loop (CDIM) - Kit No. 848703-XXX

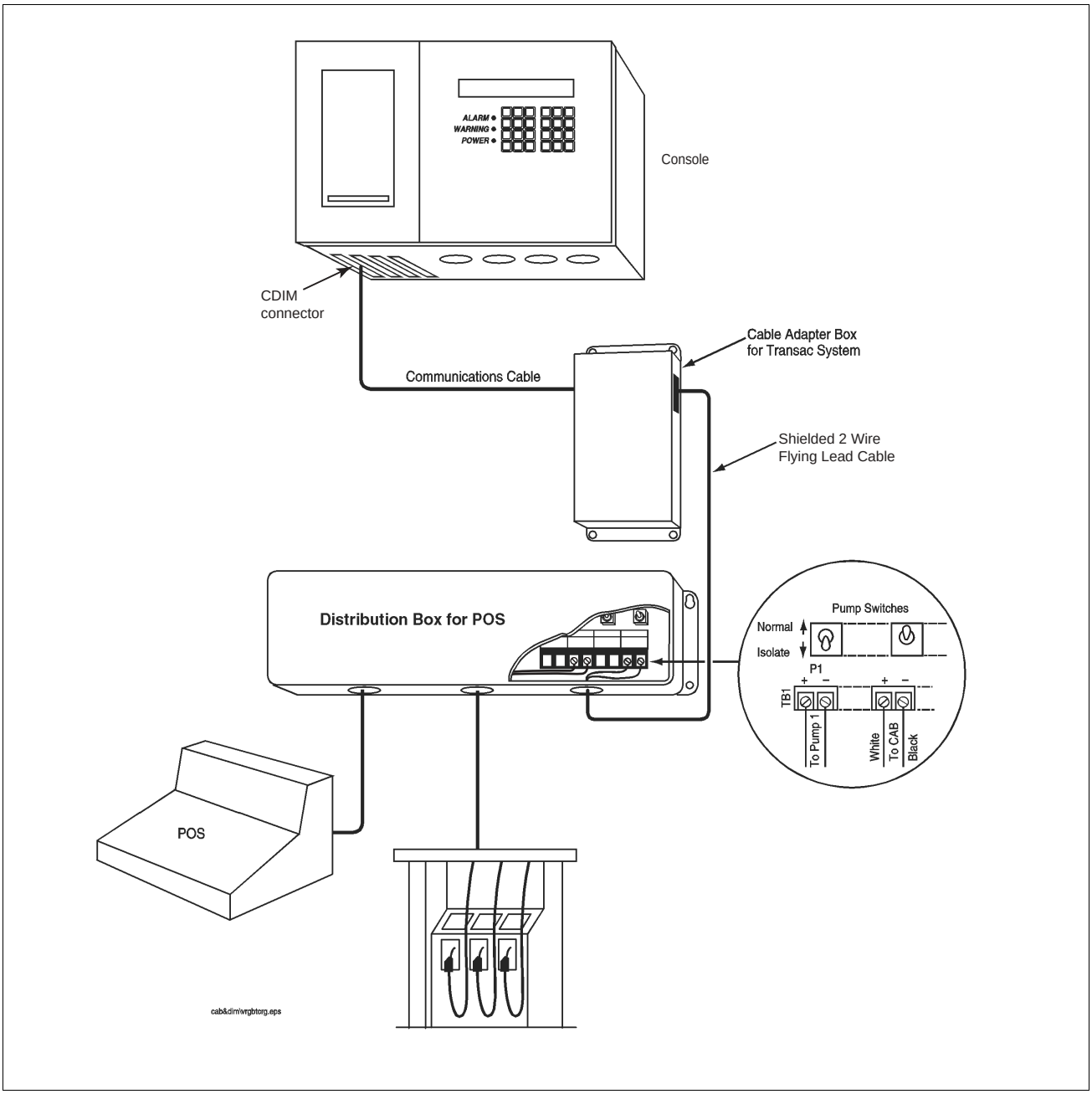


Figure 10-13. Gilbarco Transac Series Current Loop Interface (CDIM) - Kit No. 848702-XXX

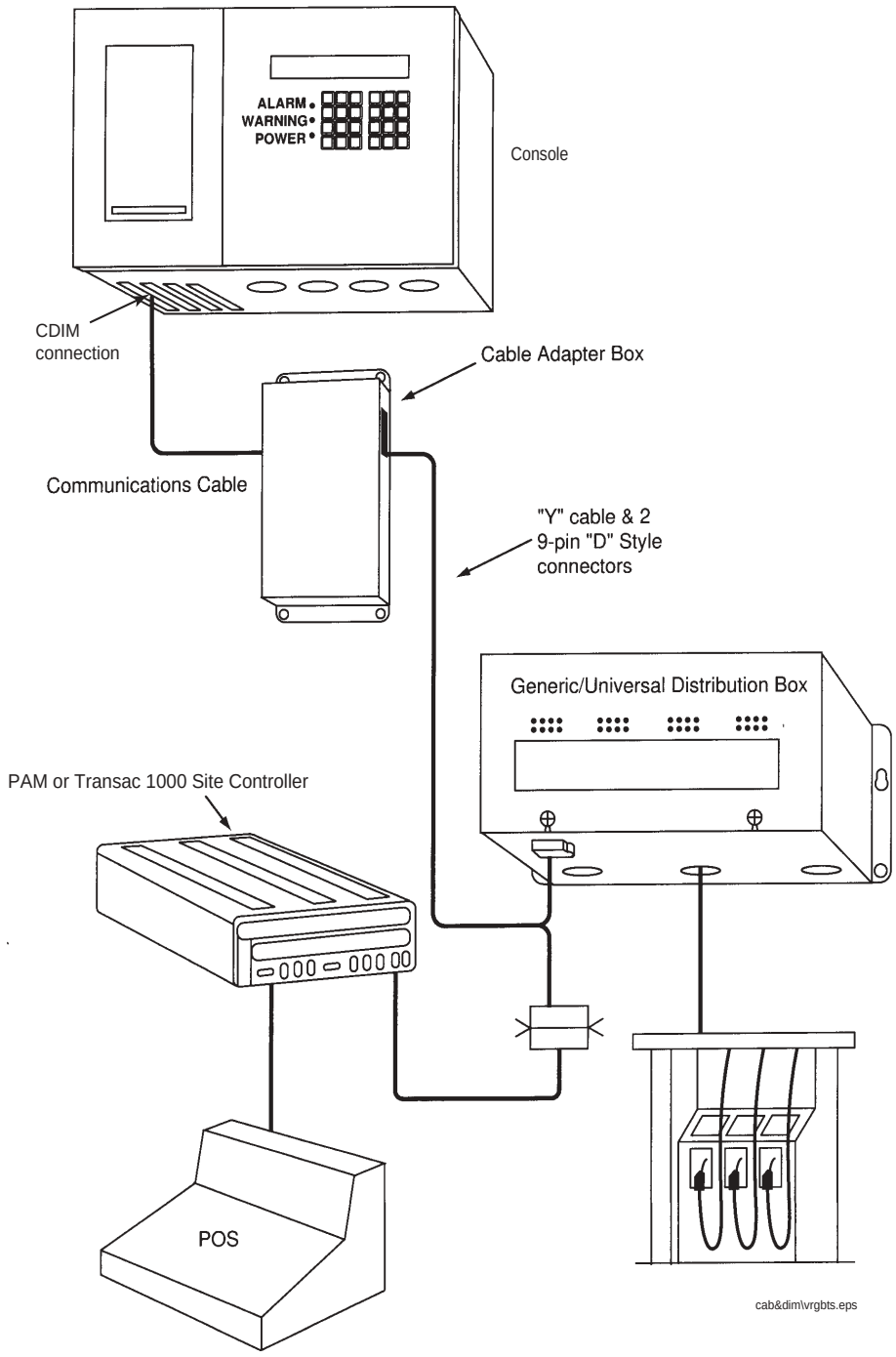


Figure 10-14. Gilbarco Transac System 1000 Current Loop Interface (CDIM) - Kit No. 848722-XXX

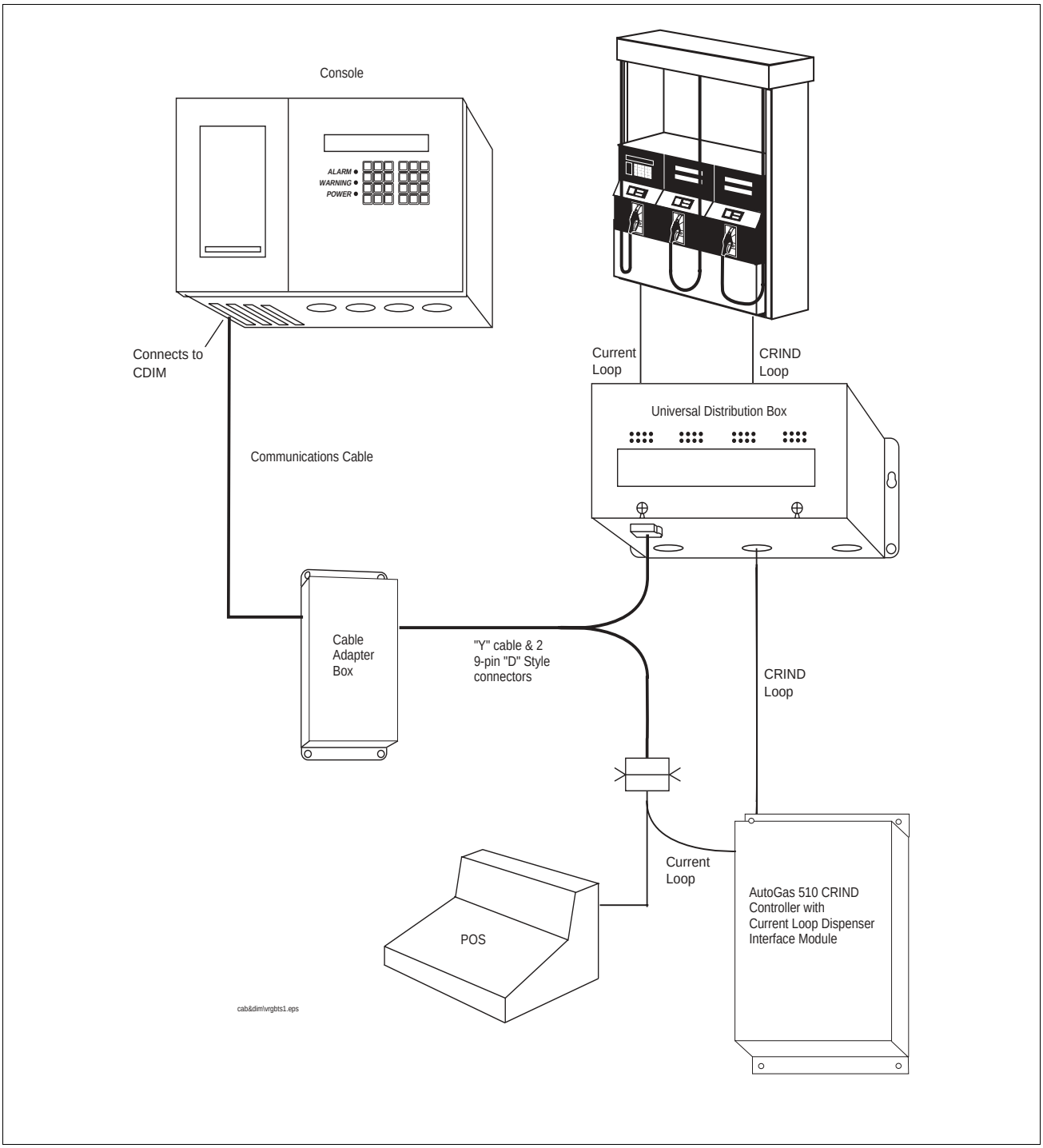


Figure 10-15. Gilbarco Autogas 510 CRIND Controller with Current Loop Interface (CDIM) - Kit No. 848702-XXX

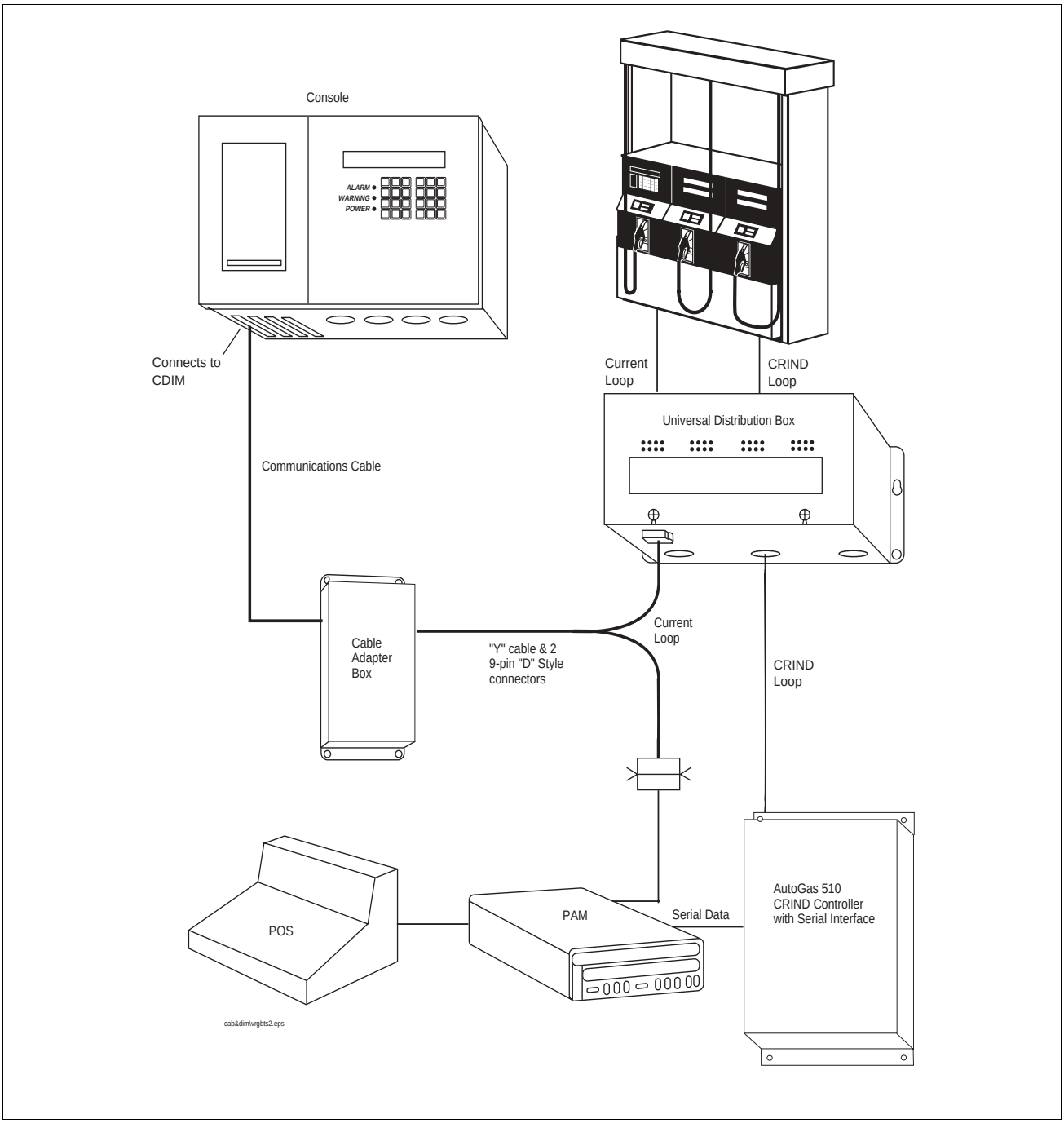


Figure 10-16. Gilbarco AutoGas 510 CRIND Controller with Serial Interface (CDIM) - Kit No. 848702-XXX

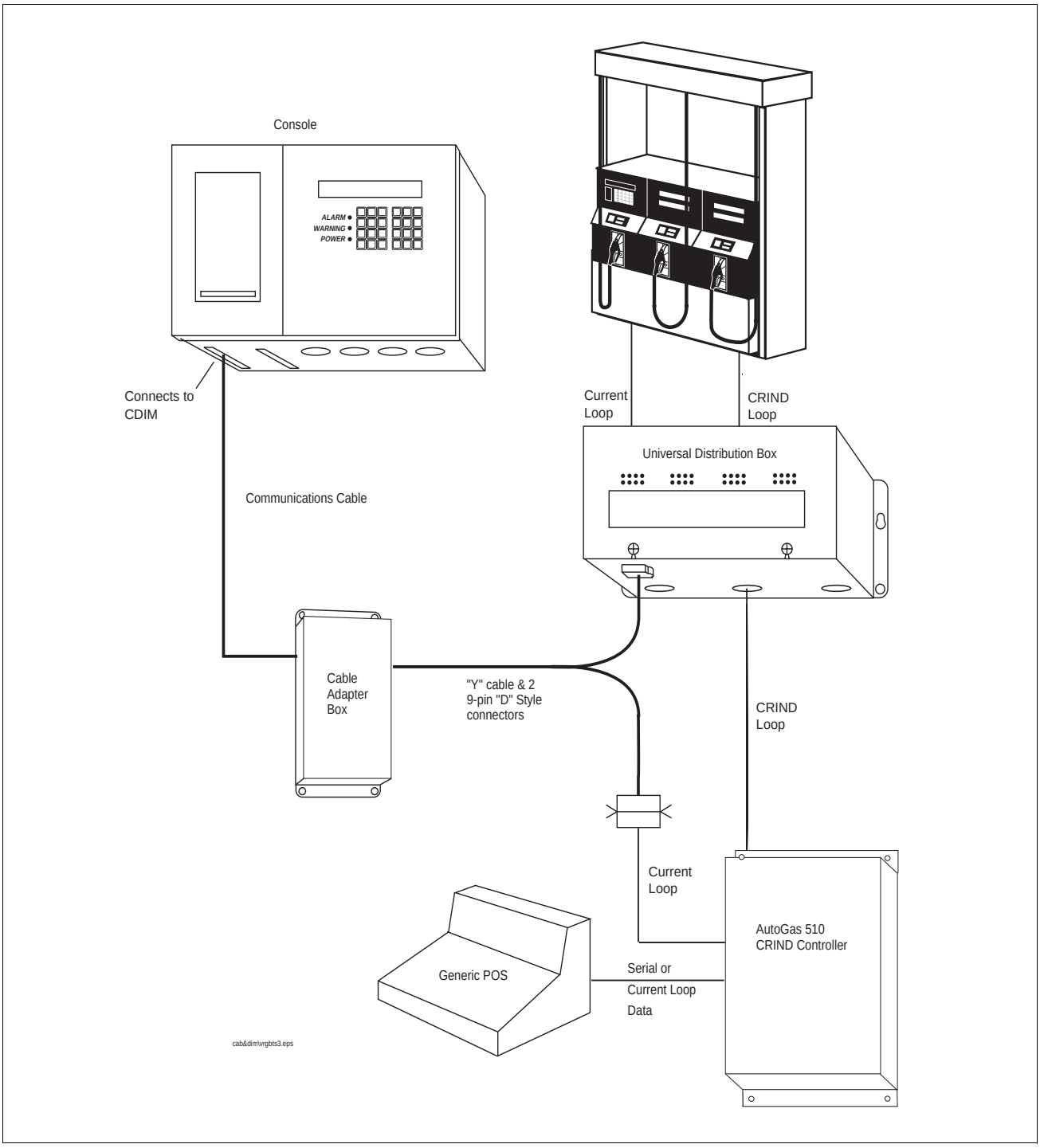


Figure 10-17. Gilbarco AutoGas 510 CRIND Controller (CDIM) - Kit No. 848702-XXX

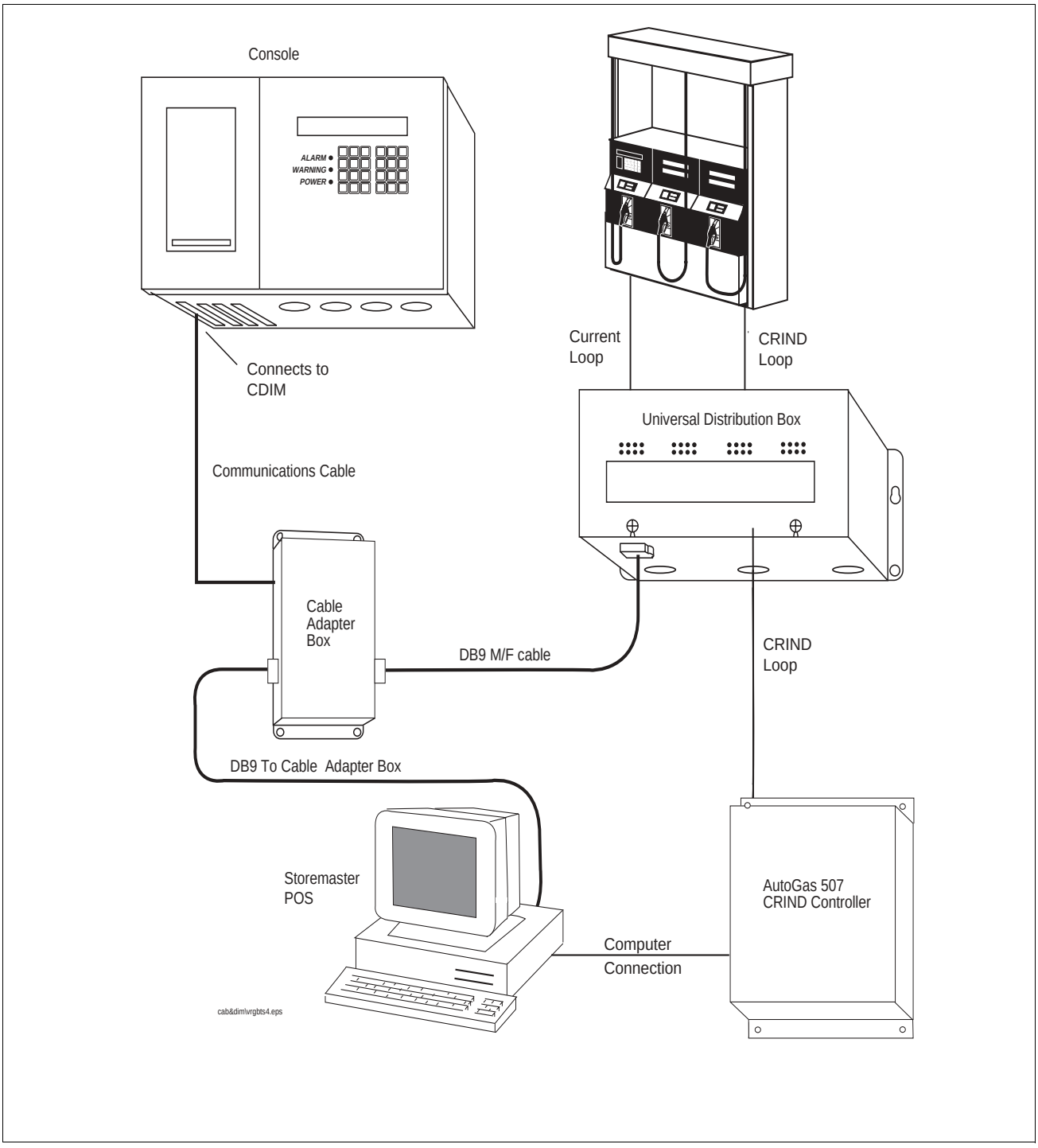
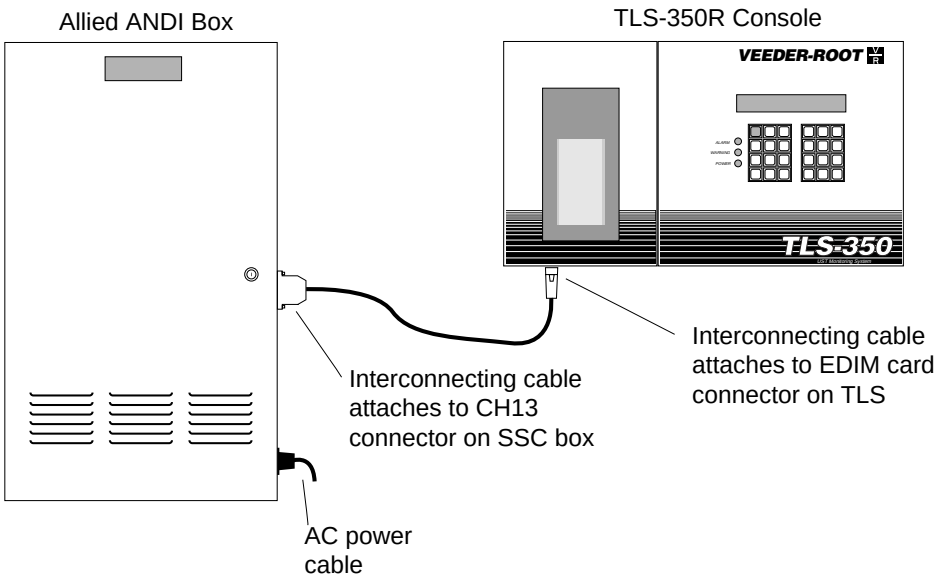


Figure 10-18. Gilbarco AutoGas 507 CRIND Controller (CDIM) - Kit No. 848741-XXX



Pin to Pin of Interconnecting Cable (25 DBM)

Female (@SSC)		Male (@TLS)
2		2
3		3
4		4
5		5
6		6
7		7
8	N/C	N/C 8
9	N/C	N/C 9
10	N/C	N/C 10
11		N/C 11
12	N/C	N/C 12
13	N/C	N/C 13
14	N/C	N/C 14
15	N/C	N/C 15
16	N/C	N/C 16
17	N/C	N/C 17
18	N/C	N/C 18
19	N/C	N/C 19
20	N/C	N/C 20
21	N/C	N/C 21
22	N/C	N/C 22
23	N/C	N/C 23
24	N/C	N/C 24
25	N/C	N/C 25

cab&dim\alldssc.eps

Figure 10-19. Allied ANDI Site Controller Installation with 25 Pin D-Connector (EDIM)

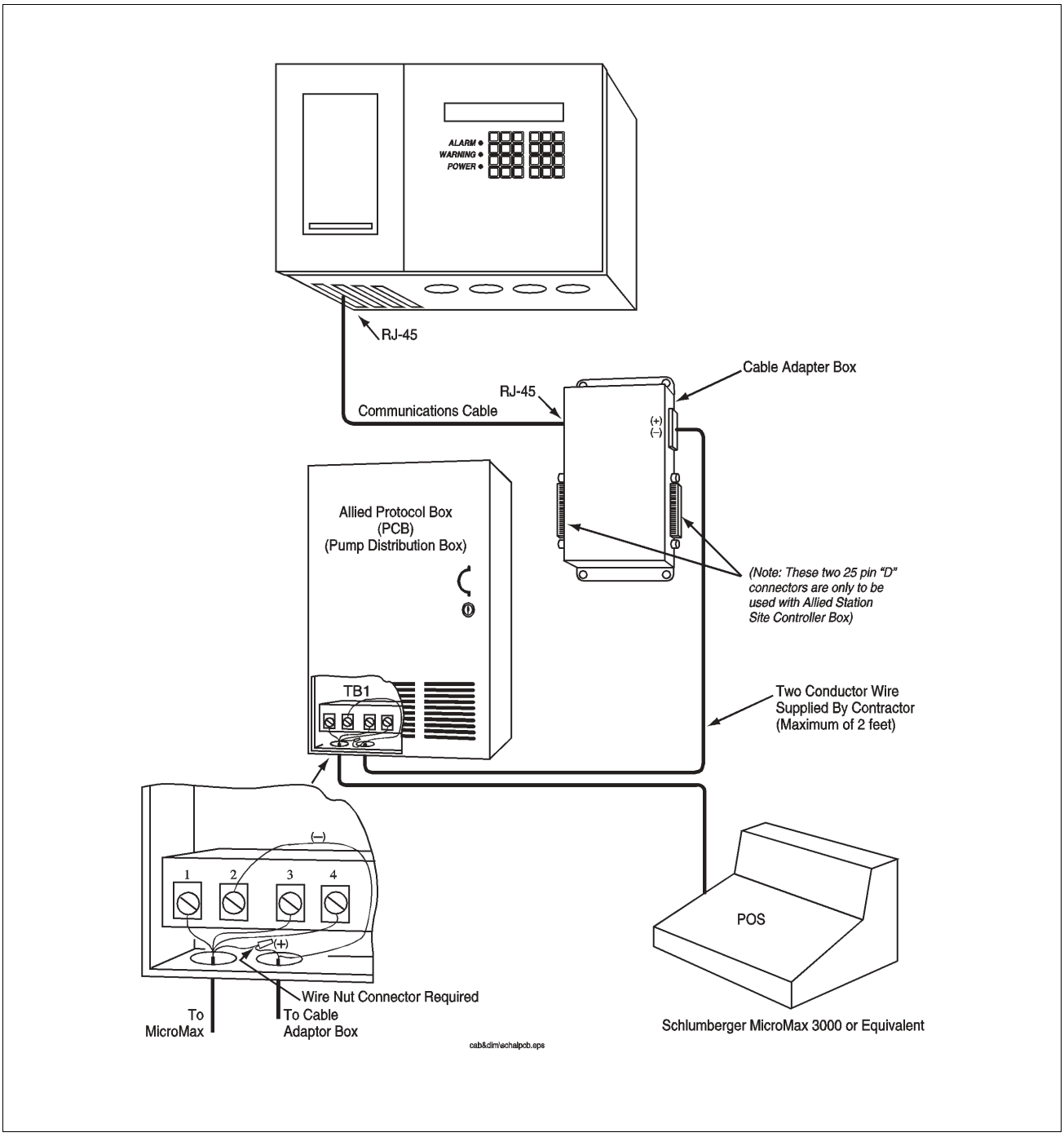


Figure 10-20. Schlumberger MicroMax POS with Allied Protocol Box Current Loop Interface (CDIM) - Kit No. 848711-XXX

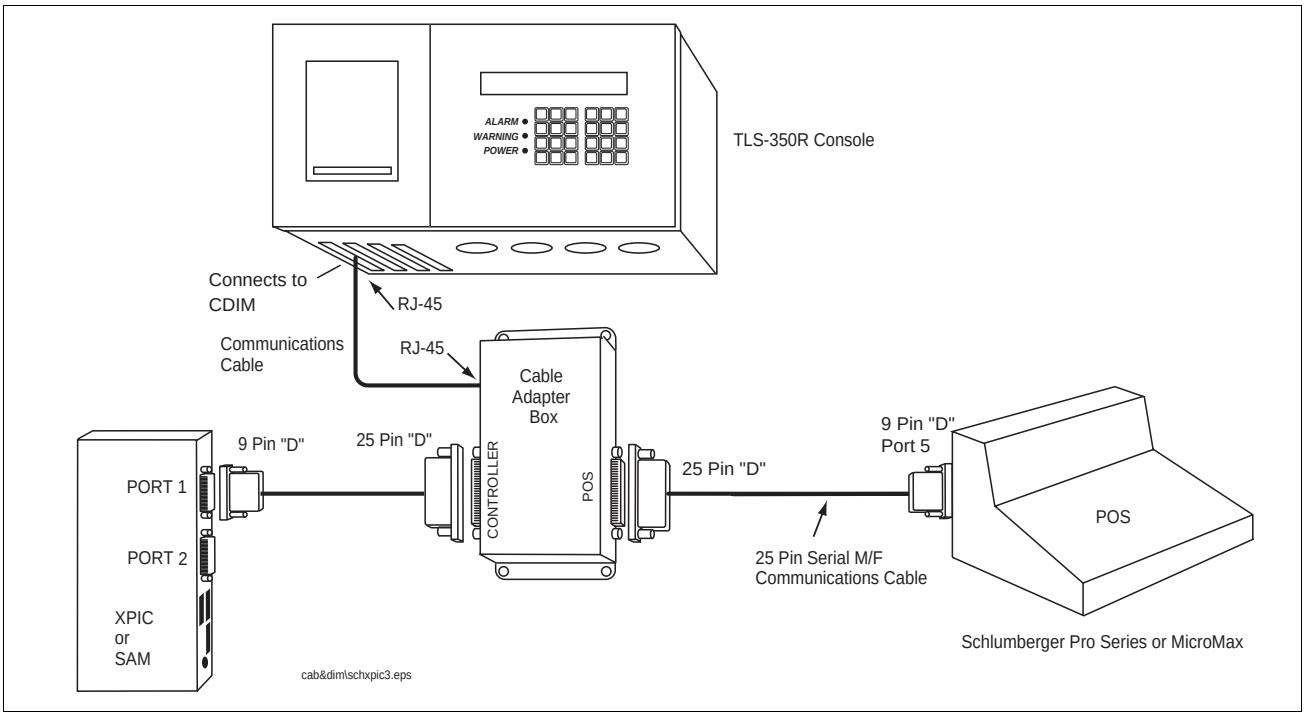


Figure 10-21. Schlumberger Pro Series or MicroMax POS with SAM or XPIC Controller Box and RS-232 Cable Adapter Box Interface (CDIM) - Kit No. 848731-XXX

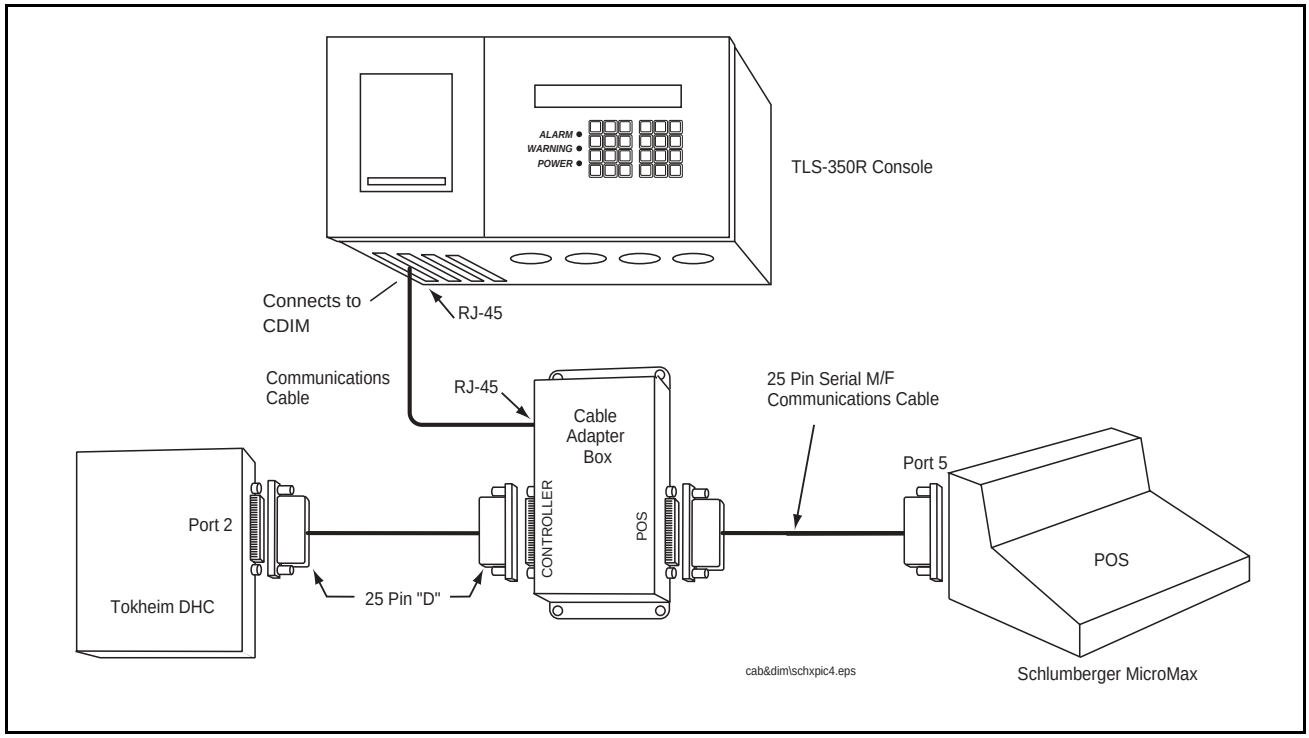


Figure 10-22. Schlumberger MicroMax POS with Tokheim DHC Controller Box and RS-232 Cable Adapter Box Interface (CDIM) - Kit No. 848711-XXX

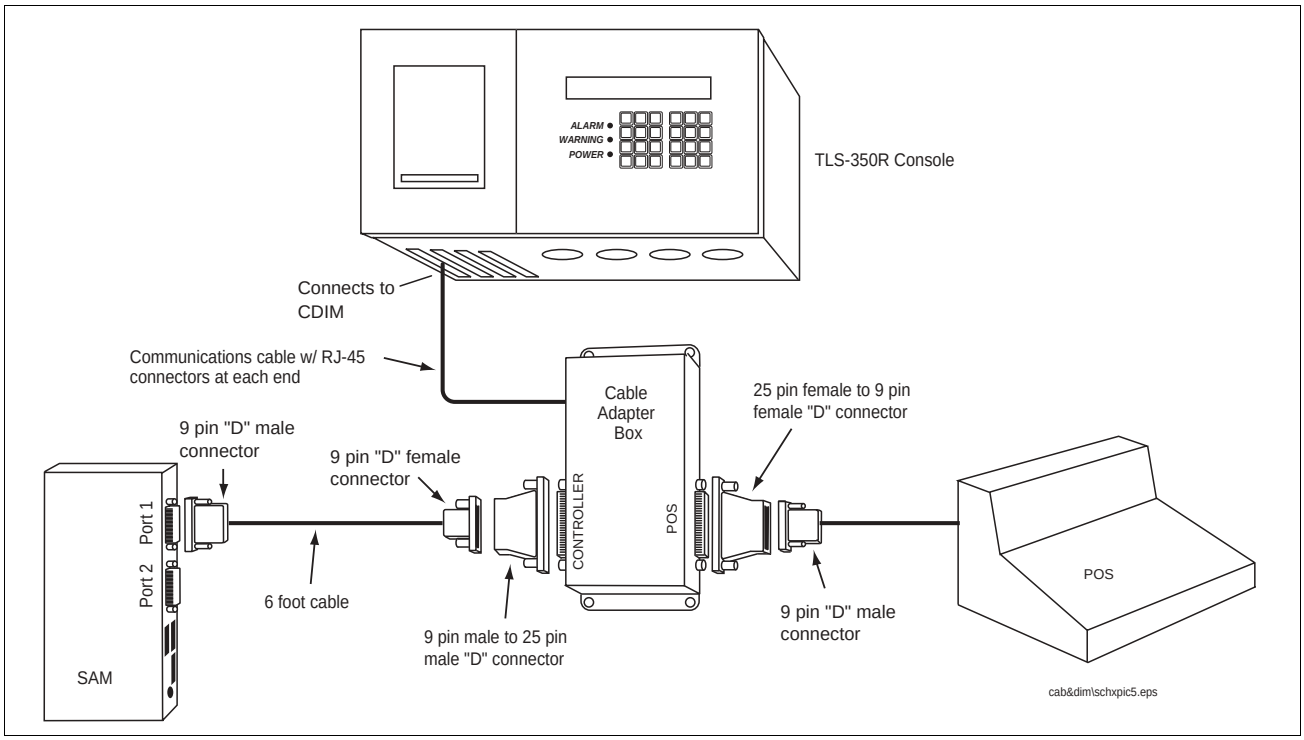


Figure 10-23. Schlumberger Verifone with SAM and RS-232 Cable Adapter Box Interface (CDIM) - Kit No. 848731-XXX

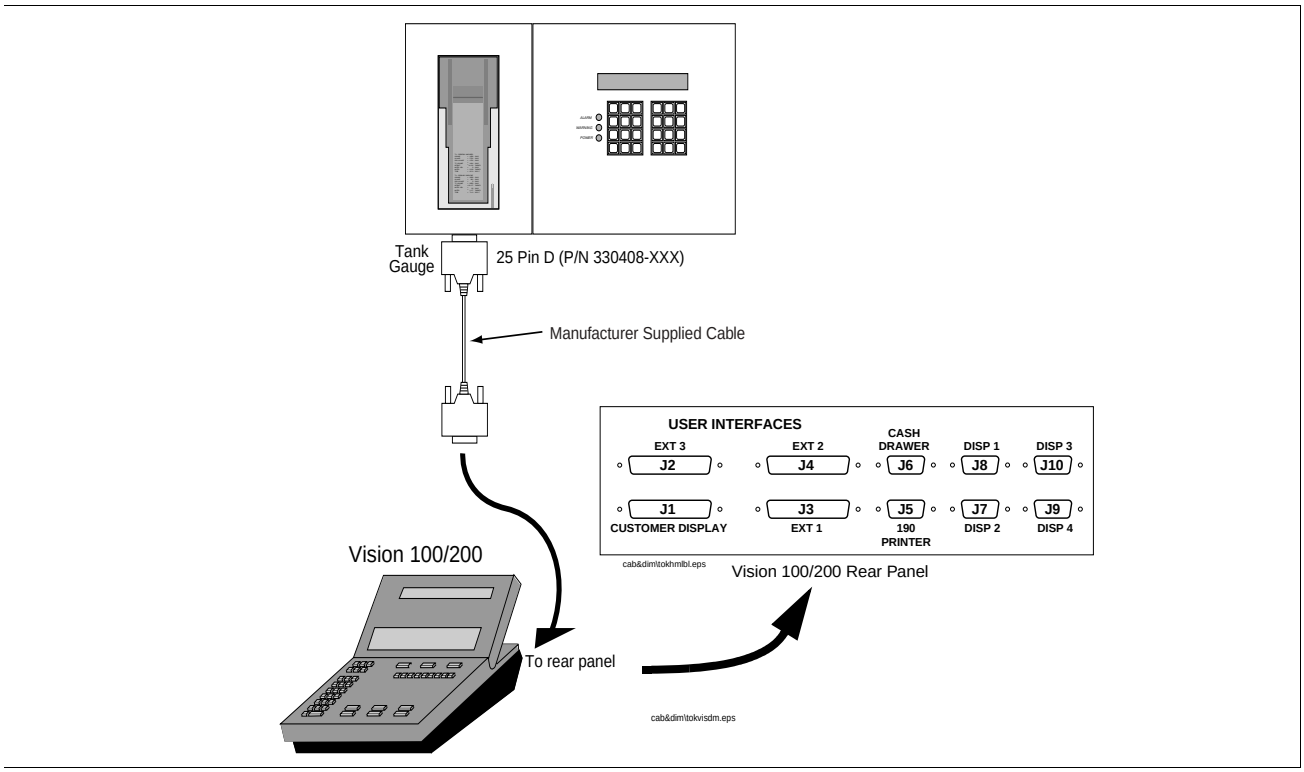


Figure 10-24. Tokheim Vision 100/200 In-Console DHC Installation (EDIM) - Kit No. 330408-XXX

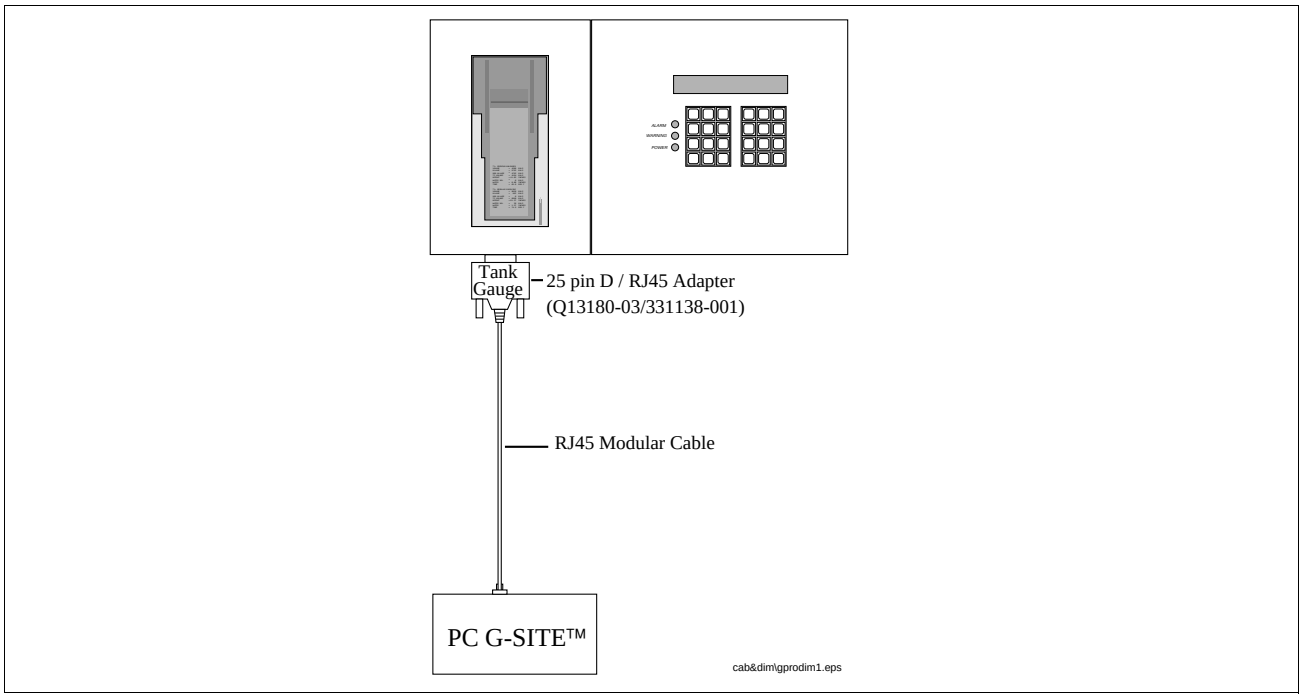


Figure 10-25. Gilbarco PC SITE™ Installation - RJ-45 Connector (EDIM) - Kit No. 331063-XXX

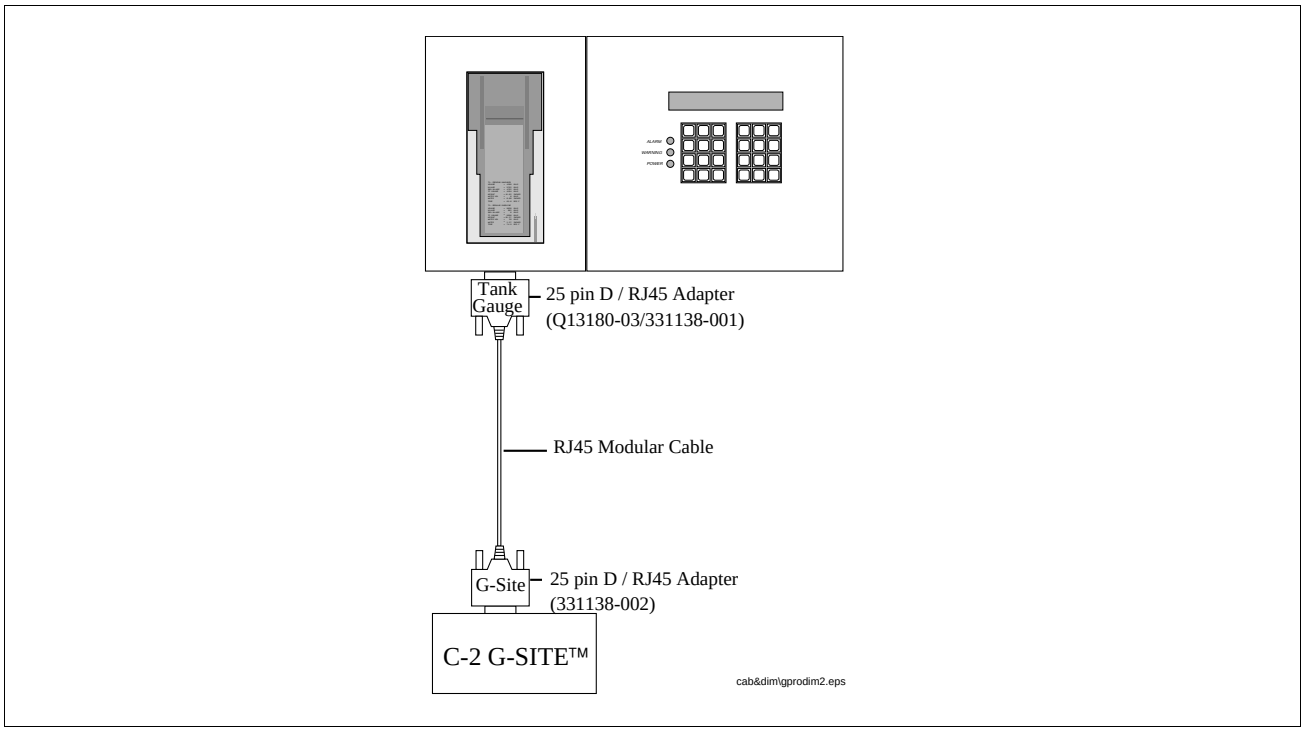


Figure 10-26. Gilbarco C-2 G-SITE™ Installation - 25-Pin D Connector (EDIM) - Kit No. 332063-XXX

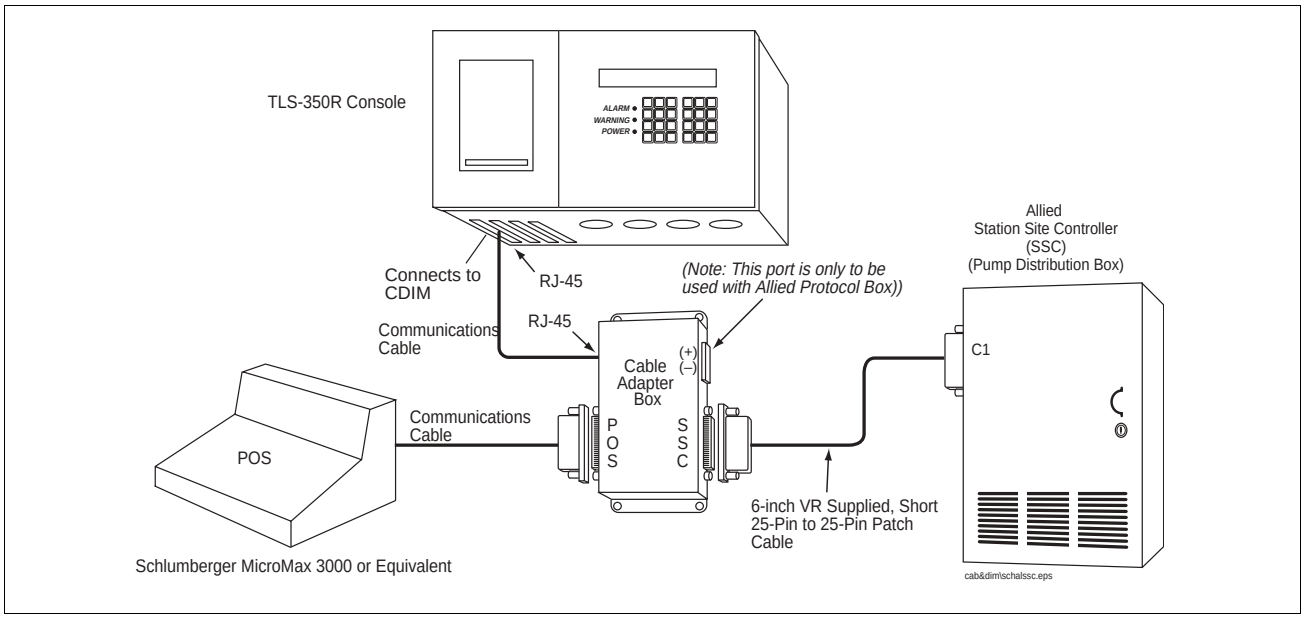


Figure 10-27. Schlumberger MicroMax POS with Allied Station Site Controller Box Current Loop Interface (CDIM) - Kit No. 848711-XXX

DIM Troubleshooting Charts

The charts below contains basic DIM problem diagnosis and suggested corrected actions for both disabled DIM and DIM communication alarms:

- Disabled DIM Alarm – for all DIM types (Figure 10-28)
- EDIM/LDIM Communication Alarm (Figure 10-28)
- CDIM Communication Alarm (Figure 10-30)

In each chart, follow the action steps in the left column, and depending on the result in the right two columns (YES or NO), go to the next action step indicated. The grayed-in steps contain either end results (E) or steps for further action (A).

DISABLED DIM ALARM (ALL DIM TYPES)			
This alarm means that the DIM module has stopped communicating with central processing unit of the console. There are limited number of actions you can take to resolve this problem without having to replace the DIM board.			
Step	**Description**	**Yes**	**No**
1	[press the ALARM TEST button] **Does the alarm go away?**	**E1**	**3**
2	**Are the software revision number and created date displayed in the screen?** Note alarm string message: 'E1:','M2:'... etc. [MODE] -> DIAGNOSTIC [FUNCTION]-> SYSTEM DIAGNOSTIC [STEP]-> DIM DIAGNOSTIC DATA [ENTER] -> DIM software revision screen. [TANK/SENSOR]-> until screen is displayed for the DIM with the alarm by matching 'E1', 'M1' you noted.	**3**	**A1**
3	**Does the alarm return after 2 minutes?** Turn the console power 'off' and then back 'on'.	**A1**	**E1**
A1	Replace the DIM.		
E1	The DIM is working properly.		

Figure 10-28. Disabled DIM Alarm

EDIM/LDIM COMMUNICATION ALARM			
This alarm indicates that the DIM module has stopped communicating with external equipment to which it is connected by the RS-232 cable. To trouble shoot this problem you will verify that the DIM is operating properly and that all connections to external equipment are correct.			
Step	**Description**	**Yes**	**No**
1	[press ALARM/TEST button] **Does the alarm go away?**	**E1**	**2**
2	**Is there a DISABLED DIM ALARM also posted for this DIM?**	**A4**	**3**
3	**Is this the correct type of DIM for the external equipment it is connected to?** Verify the DIM part number shipped with the DIM part number listed in the Installation Manual. Or do the following: Note alarm string message: 'E1:','E2:'... or 'M1','M2'... etc. [MODE] -> DIAGNOSTIC [FUNCTION]-> SYSTEM DIAGNOSTIC [STEP]-> DIM DIAGNOSTIC DATA [ENTER] -> DIM software revision screen. [TANK/SENSOR]-> until screen is displayed for the DIM with the alarm by matching 'E1', 'M1' you noted. Note the software revision number to verify what is required for your application.	**4**	**A5**
4	**Is the cable connected to both the DIM and the correct port on the external equipment?** (Double check the correct port is being used on the external equipment.)	**5**	**A1**
5	**Are any of the LED's flashing on the DIM board?**	**6**	**7**
6	**Is the setup string entered for this DIM correct according to the Installation Manual?** Note alarm string message: 'E1:','E2:'... or 'M1','M2'... etc. [MODE] -> SETUP MODE [FUNCTION]-> RECONCILIATION SETUP [STEP]-> DISP. MODULE SETUP STRING [TANK/SENSOR]-> until screen is displayed for the DIM with the alarm by matching 'E1', 'M1'	**7**	**A2**
7	**Does the DIM loop-back tool put both LED's ON steady?**	**8**	**A6**
8	**Does the cable meet Installation Manual specifications?** Is it wired according to specification, and pass the ohm tests?	**E2**	**A3**
A1	Connect the cable to both the DIM and External Equipment. Restart the troubleshooting procedures after 2 minutes, or immediately after a console power cycle.		
A2	Enter the correct parameter string according the instructions in the Installation Manual. Restart the troubleshooting procedures after 2 minutes, or immediately after a console power cycle		
A3	Install factory authorized cables. Restart the troubleshooting procedures after 2 minutes, or immediately after a console power cycle.		
A4	Use the DISABLED DIM ALARM troubleshooting table first.		
A5	Obtain the correct DIM and/or Installation Kit.		
A6	Replace the DIM.		
E1	The DIM board is operational. It is normal for COMMUNICATION ALARMS to occur if the cable was disconnected for longer than 1 minute, or if the external equipment was turned off for longer than one minute.		
E2	All the questions you have answered indicated that the system should be operational. There may be problems with the external equipment such as software compatibility.		

Figure 10-29. EDIM/LDIM Communication Alarms

CDIM COMMUNICATION ALARM

This alarm indicates that the DIM module has stopped receiving communication from cable adapter box (CAB). To trouble shoot this problem you will verify that the DIM is operating properly and that all the connections to external equipment are correct.

Step	Description	Yes	No
1	[press the ALARM TEST button] **Does the alarm go away?**	E1	2
2	**Is there a DISABLED DIM ALARM also posted for this DIM?**	E2	3
3	**Is this the correct type of DIM for the external equipment it is connected to?** Verify the DIM part number shipped with the DIM part number listed in the Installation Manual. Or do the following: Note alarm string message: 'E1:','E2:'... or 'M1','M2'... etc. [MODE] -> DIAGNOSTIC [FUNCTION]-> SYSTEM DIAGNOSTIC [STEP]-> DIM DIAGNOSTIC DATA [ENTER] -> DIM software revision screen. [TANK/SENSOR]-> until screen is displayed for the DIM with the alarm by matching 'E1', 'M1' you noted. Note the software revision number and to verify what is required for your application.	4	A3
4	**Is the DIM connected to the correct Cable Adapter Box required for this system?**	5	A3
5	**Is the CAB properly cabled to the external equipment, as defined by the Installation Manual, with the CAB bypass switch in 'RUN' mode?**	6	A4
6	**Is the LED on the CAB flashing (fast flicker)?**	7	9
7	**Is the LED on the DIM that corresponds to the port connected to the CAB flashing in a similar manner as the CAB?**	8	A5
8	**Is the setup string entered for this DIM correct according to the Installation Manual?** Note alarm string message: 'E1:','E2:'... or 'M1','M2'... etc. [MODE] -> SETUP MODE [FUNCTION]-> RECONCILIATION SETUP [STEP]-> DISP. MODULE SETUP STRING [TANK/SENSOR]-> until screen is displayed for the DIM with the alarm by matching 'E1', 'M1'	9	A1
9	Move the RJ45 connection at the DIM to one of the other three ports. **Is the LED on the CAB flashing?**	A5	A6

A1	Enter the correct parameter string according the instructions in the Installation Manual. Restart the troubleshooting procedures after 2 minutes, or immediately after a power cycle.
A2	Use the DISABLED DIM ALARM Trouble shooting table first.
A3	Obtain the correct CDIM and/or Installation Kit.
A4	Ensure that the entire installation is complete before you begin troubleshooting.
A5	Replace the DIM
A6	Replace the DIM card and installation kit. It is not possible to determine which device is the problem from the responses.
E1	The CDIM board is operational. It is normal for COMMUNICATION ALARMS to occur if the cable was disconnected for longer than 1 minute, or if the external equipment was turned off for longer than one minute.
E2	All the questions you have answered indicate that the system should be operational. There may be problems with the external equipment such as software incompatibility.

Figure 10-30. CDIM Communication Alarm

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.

MAXIMUM TANK CAPACITY

Single tank - 30,000 gallons

Manifolded tanks - 30,000 gallons per manifolded set (3 tanks maximum per set).

MONTHLY THROUGHPUT GUIDELINES

Table 11-1.Tank Capacity / Monthly Throughput Limitations*

Product	Tank Capacity				
	<10,000	**12,000**	**15,000**	**20,000**	**30,000**
Gasoline	200,000	200,000	200,000	150,000	100,000
Diesel	200,000	200,000	200,000	200,000	200,000

*Total capacity of manifolded tanks establishes the throughput restrictions for that product. Installations exceeding these limitations may not pass monthly tests.

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.

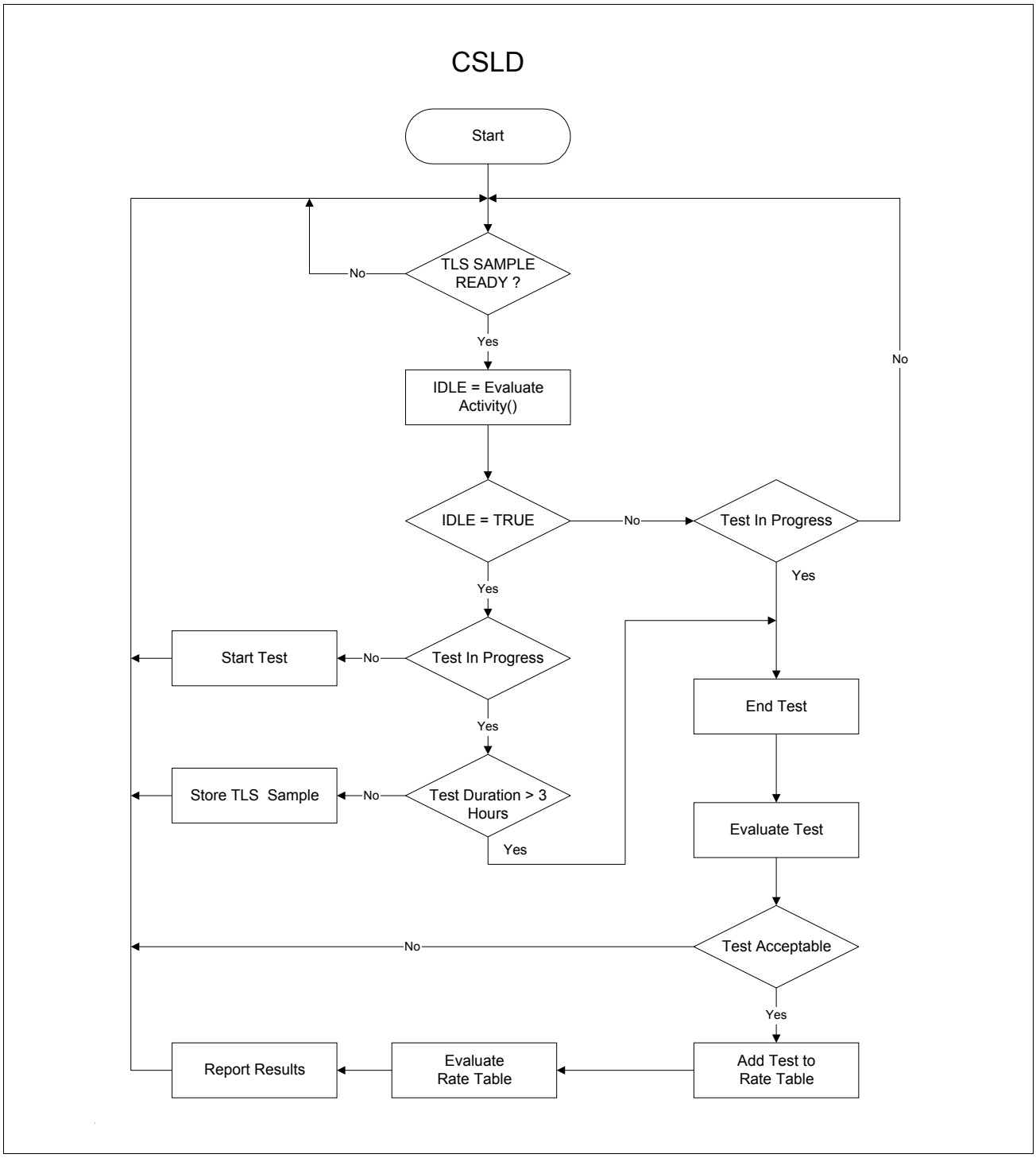


Figure 11-1. CSLD Decision Process Block Diagram

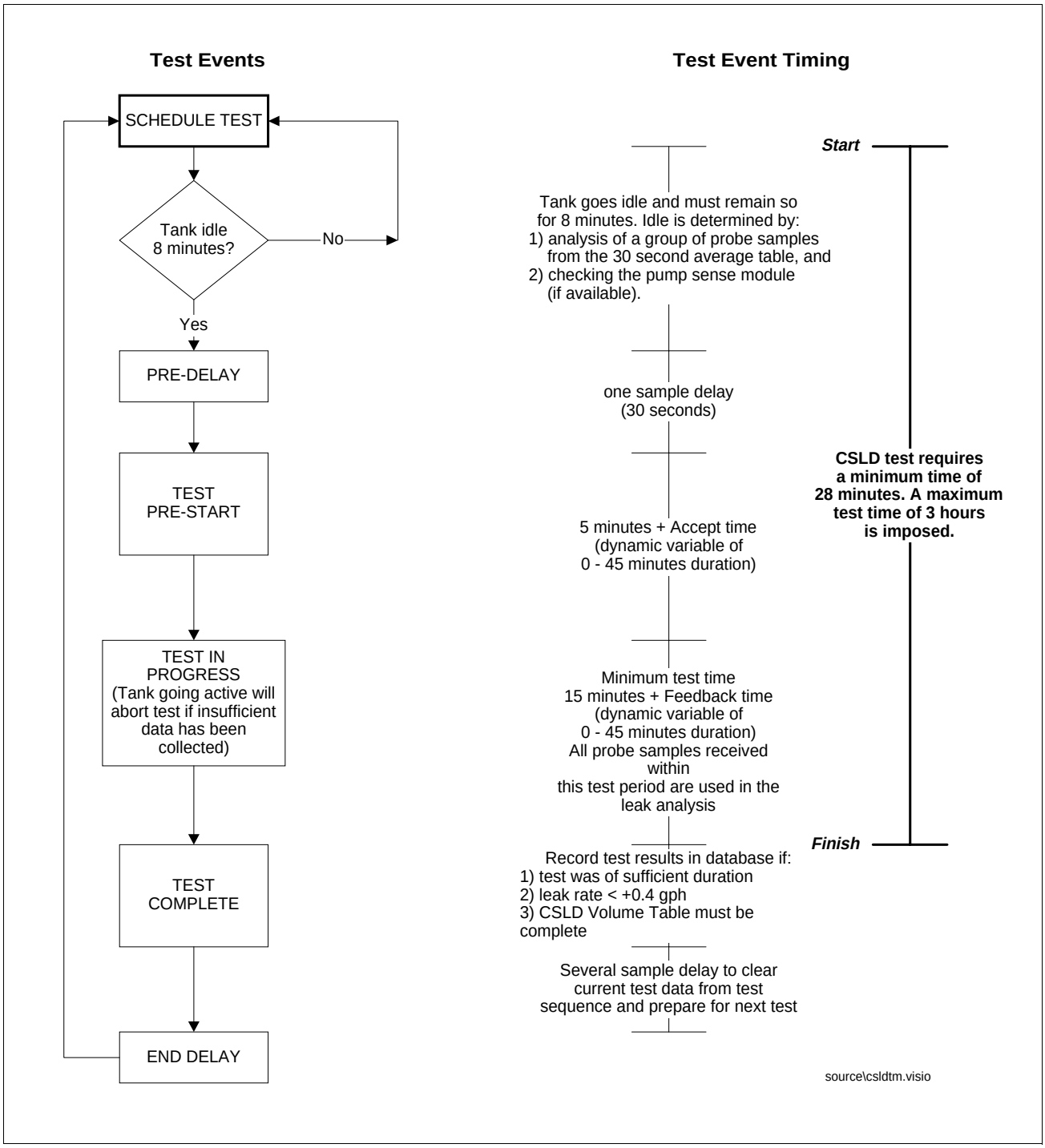


Figure 11-2. CSLD Leak Test Timing Sequence

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

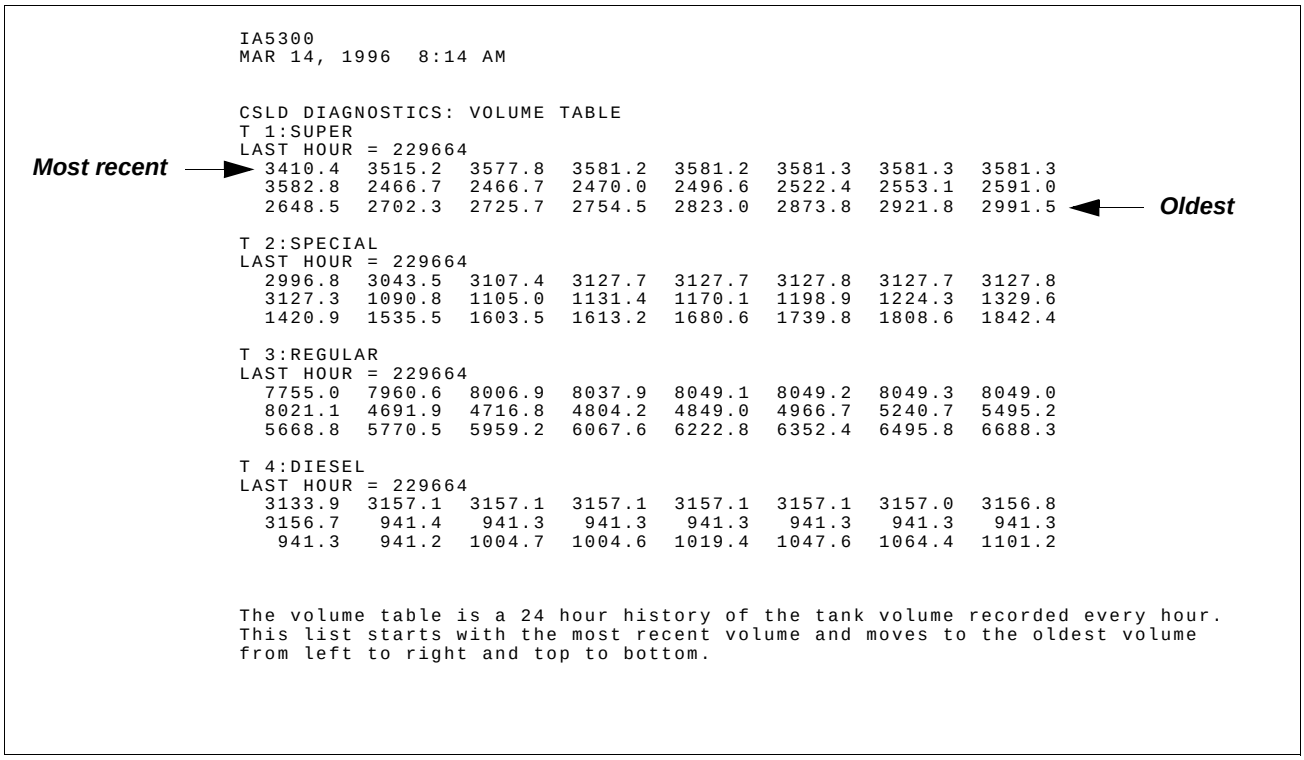


Figure 11-5. CSLD Volume Table Example

SMPLS = Samples
TCVOL = 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 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

You can also print out the CSLD DIAGNOSTICS from the DIAGNOSTIC Mode to see the actual calculated value (see Figure 6-7).

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 Manual 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
   a. Around the packer O-ring.
   b. At the threads of the two-inch pipe coming from the turbine motor.
   c. The gasket between the turbine motor and mounting flange.
   d. 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 Fequency 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 extreme 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.

   a. 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.

   b. Have the Stage II vapor recovery system inspected and tested.

   c. 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.

   a. Check the water level in the tank.

   b. Monitor the tank for increasing water levels.

   c. 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 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 rate table leak rates (LRATE). 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 soulution 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 IA500 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 Test Fail Alarm an equipment problem has not been identified, perform a static leak test. Be sure that the prodcut 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 in the DIAG MODE at the console front panel or via the RS-232 command shown below.

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> I10200 SYSTEM CONFIGURATION REPORT
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

OR - if assigned to WPLLD collect the following report:

1. <Control-A> I7A000 WPLLD LINE LEAK GENERAL SETUP

OR - if assigned to VLLD collect the following reports:

1. <Control-A> I75200 SET VOLUMETRIC LINE LEAK TANK NUMBER
2. <Control-A> I75D00 SET VOLUMETRIC LINE LEAK DISPENSE MODE

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   TC VOLUME   ULLAGE   HEIGHT   WATER    TEMP
1      REGULAR          2311        2303     3705    39.21    0.0    65.2
2      REGULAR SLAVE    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 SLAVE
      TIME  ST   LRT    AVTMP   TPTMP   BDTMP   TMRT    DISPNS    VOL    INTVL    DEL    ULLG    EVAP
RATE TABLE EMPTY
```

The slave 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
```

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

```
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
```

Large positive rates.

```
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
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	TCVOL	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   TC 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

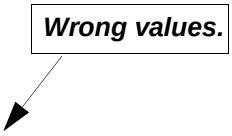
IA5100

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
```




```
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

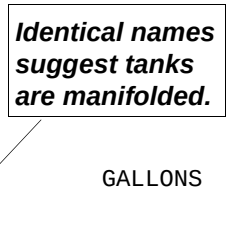
Diagnostics

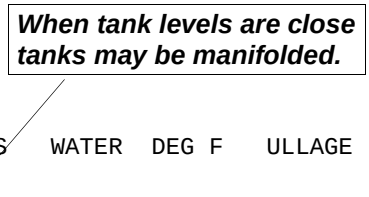
```
200
Station Header 1
Station Header 2
Station Header 3
Station Header 4

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
```





```
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


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   3
 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


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 programmed as manifolded would have a common result.

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

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	TCVOL	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

DISPENSE STATE: ACTIVE *  762.432312
T 2:UNLEADED NORTH
        TIME   SMPLS     TCVOL    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
```

T2's volume increases as T1 fills it.

```
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 TC 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
```

No tests.

Table not full.

```
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

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

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


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  71.2 -0.00  1687  2856  29.5   40.2  457  7.3
9805240018  0 -0.018  55.4  14.7  72.0 -0.03   561  7499  33.5    4.6  255  8.1
9805240144  0 -0.041  55.3  14.7  72.0 -0.03   565  7470  23.5    6.0  256  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
```

Comparing compensated LRATE to uncompensated AVLRATE shows excessive compensation.

OK

Abnormal temperatures.

Large jump in temp following delivery.

```
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
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.                                253  7.7
9805270015  0  0.051  46.7  14.7  71.                                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
```

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

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

Bad probe thermistor values.

```
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
```

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. Examing 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
```

Comparing compensated LRATE to uncompensated AVLRTE shows excessive compensation.

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
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	-0.02	2578	4110	149.5	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

Intermittant bad values.

```
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 -0.16  2720  1342  66.5   28.3  545 0.000
0005142248  3 -0.013  60.1 -79.5  70.7  0.00  3087  3396 129.5   14.9  438 0.000
0005150138  3  0.007  60.1 -72.9  70.6 -0.00  2507  3396  45.0   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
```

Intermittant 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. Examing the IA52 command did not show erroneous thermistor values. However, examining the IA51 command showed that the board temperature value was intermittantly 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

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

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


I61100
MAY  7, 1999 10:13 AM

LEAK TEST METHOD
- - - - - -  - - - - - -
TEST CSLD    : TANK 8
Pd = 95%
CLIMATE FACTOR:MODERATE
```

Manifolded set.

Positive rejects.

Positives

```
TEST ON DATE : TANK 9
JAN  1, 1996
START TIME : DISABLED
TEST RATE  :0.20 GAL/HR
DURATION   : 2  HOURS


S61109
MAY  7, 1999 10:15 AM

LEAK TEST METHOD
- - - - - -  - - - - - -
TEST CSLD    : TANK 9
Pd = 95%
CLIMATE FACTOR:MODERATE


IA5108
MAY  7, 1999 10:16 AM


CSLD DIAGNOSTICS: RATE TABLE


S05408
MAY  7, 1999 10:16 AM

T 8:REGULAR 1           CSLD RECORDS DELETED
T 9:REGULAR 2           CSLD RECORDS DELETED
```

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 Frequency to CSLD and delete rate table.

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
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
```

High 90s inconsistent with other tanks.

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

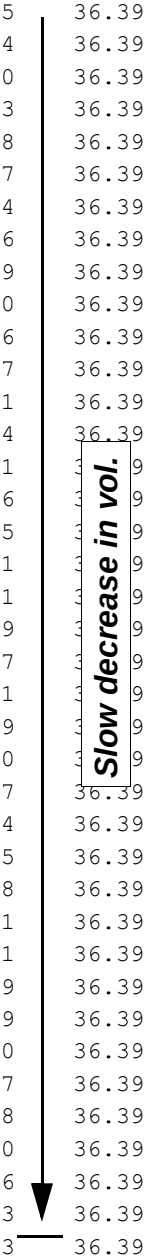
T 1:PREM

TIME	SMPLS	TCVOL	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
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

Dispensing

Slow decrease in vol.

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
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
```

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.

12 BIR Troubleshooting

Business Inventory Reconciliation (BIR), an option for TLS-350R Consoles, automatically performs tank-to-meter mapping, tank calibration (AccuChart), and delivery and sales reconciliation to provide the customer with real-time, precise inventory control. This section contains BIR troubleshooting information and examples of actual BIR problems and their solutions.

BIR Troubleshooting Requirements

To troubleshoot BIR, you must have a PC or data terminal to collect important diagnostic reports via RS-232 or modem connection. Veeder Root cannot diagnose some of the more complex BIR problems without access to all of the reports discussed in this section. The majority of the reports needed in this analysis can not be printed on the console's printer.

There are three categories of BIR problems:

- Meter mapping errors,
- Tank calibration (AccuChart) errors, and
- Dispenser Interface Modules (DIM) communication problems

Meter mapping problems, and to some degree tank calibration problems, and BIR variance analysis are contained in this section.

BIR Features

- Inventory reconciliation
- Automatic tank to dispenser meter mapping
- Adjusted delivery reports
- Automatic tank calibration (AccuChart)

BIR Methods

INVENTORY RECONCILIATION

Variance = End Volume - Start Volume + Sales - Deliveries

ADJUSTED DELIVERY REPORTS

Adjusted Delivery = End Volume - Start Volume + Sales

Requirements for BIR with Manifolded Tanks

- Both 3XX software and a Memory Expansion Module are required for siphon or a combination of siphon and line manifolding.
- At least 1XX software for line only manifolding.

ACCUCHART RESTRICTIONS WITH MANIFOLDED TANKS

- Only 2 tanks are allowed in a siphon manifolded set.
- Only 4 siphon manifolded sets per system.
- The tank diameters in a siphon manifolded set must be within 6 inches of each other.
- The total siphon manifolded set's capacity must be less than 30,000 gallons.

*If these restrictions are not met BIR will be operational on the siphon manifolded set, but not AccuChart.

Alarms

BIR GENERATES 3 ALARMS

- Close Daily Pending - BIR is waiting for an idle period to close the daily report.
- Close Shift Pending - BIR is waiting for an idle period to close the shift report.
- Prod Threshold Alm - The periodic variance of a product exceeded the BIR calculated threshold.

DISPENSER INTERFACE MODULES (DIMS) GENERATE 3 ALARMS

Because of the many types of DIMs and DIM-to-POS connection possibilities, please refer to the DIM section of this manual to troubleshoot the three DIM alarms:

- Disabled DIM
- Communication Alarm
- BDIM Transaction Alarm

BIR Setup Errors

METER DATA PRESENT ENTRY

If there is meter data present and this entry is incorrectly set to NO, the map will never complete because the auto-meter mapping program will not assign this tank to a meter.

If there is no meter data present and this entry is incorrectly set to YES, a BIR report will be generated for this tank. There will be large reconciliation errors because there is no sales information.

BIR TEMPERATURE COMPENSATION

If the meters are reporting temperature compensated volumes, this entry must be set to YES. Incorrect setting of this entry will result in variance errors.

BIR ALARM THRESHOLD AND OFFSET

If the Periodic Reconciliation Alarm is enabled and the BIR Alarm Threshold and/or Alarm Offset values are entered incorrectly, incorrect reporting of the alarm may occur.

If the variance for the reconciliation period exceeds the maximum limit determined by the Alarm Threshold and Alarm Offset values, the Periodic Reconciliation Alarm will be posted. This maximum limit value is determined by the following formula:

Max. variance value = (Alarm Threshold%) x (total sales) + Alarm Offset

For example, the Alarm Threshold is set to 1 percent, the Alarm Offset is set to 130 gallons, total sales for the reconciliation period is 100,000 gallons, the maximum variance limit before posting the Periodic Reconciliation Alarm would be:

(0.01) x (100,000) + 130 = 1000 + 130 = 1130 gallons

BIR Variance Errors

GENERAL

1. The periodic variance is the summation of the daily variances.
2. The polarity of the variance is either positive or negative.
   a. A negative variance results when the TLS Console starting and ending volumes indicate more fluid has left the tank than the POS reported sales indicate.
   b. A positive variance results when the TLS Console starting and ending volumes indicate less fluid has left the tank than the POS reported sales indicate.
3. An examination of the BIR daily history table will indicate whether a large periodic variance is a summation of smaller daily variances with the same sign or whether there are isolated instances of large daily variances.
4. Typically, variances will be larger on days when there has been a large volume change (large sales or a delivery or both).
5. Typically, variances will be larger on days when the tank fluid level is operating at the extremes (full or almost empty). This is due to calibration errors; accuracy should improve as the tank calibrates.
6. Large negative variances indicate lost sales data. However, don't overlook the possibility that a negative variance could be caused by a tank or line leak!
7. Large positive variances indicate lost delivery data.
8. There are severall sources of variance errors: lost or inaccurate VOLUME DATA, lost or inaccurate SALES DATA.

POSSIBLE CAUSES OF LOST OR INACCURATE TLS CONSOLE VOLUME DATA

1. Isolated variances (usually large):
   a. Fluid level too low (INVALID FUEL LEVEL - common)
   b. Fluid level too high, fluid in the riser, float stuck in the riser (OVERFILL ALARM)
   c. Malfunctioning probe (possible PROBE OUT ALARM, stuck float, etc.)
   d. Tank calibrating during the day (V106 and V107 only - 3 times)
   e. Lost Deliveries (V106 and V107 only - rare).
   f. Adding fluid to the tank without tripping a delivery report.
   g. Removing fluid from the tank, through a means that by-passes the POS (site maintenance, water removal, etc.)
2. Continuous variances usually of the same sign:

a. Inaccurate tank calibration.
b. Reconciliation temperature compensation incorrectly setup.
c. One or more meters are not being reported.

POSSIBLE CAUSES OF LOST OR INACCURATE SALES DATA

1. Isolated variances (usually large):
   a. Malfunctioning DIM (possible DISABLED DIM ALARM).
   b. NO POS communication (possible COMMUNICATION ALARM).
   c. A period when the TLS Console was not powered.
   d. Removing fluid from the tank through a means that by-passes the POS (theft, water removal, etc.).
   e. Meter-map state changes to incomplete (V106 and V107 only).
   f. Meter totalizer rollover.
   g. Meter maintenance.
2. Continuous variances usually of the same sign :
   a. DIM programmed incorrectly.
   b. Inaccurate meter.
   c. Incorrect meter-map (usually on start-up due to pattern matching).
   d. Removing fluid from the tank, through a means that by-passes the POS (meter not connected to POS, leaks, etc.).
   e. One or more meters are not being reported.

Reports Used to Analyze BIR Variance Problems

I20100 STANDARD INVENTORY REPORT

1. Identifies the site for record keeping and evaluation of environmental extremes.
2. Develop an overview of the site:
   a. Only two gasoline grades, e.g., Premium and Regular (could be blenders).
   b. Two tanks same product (could be manifolded tanks).
   c. Add ullage and inventory to get ballpark capacities.
   d. Are there low volume products, such as kerosene, waste oil, etc.
3. Check all parameters (volume, temperature, water, etc.), do they make sense?

```
I20100
STATION HEADER INFO
JUN 26, 1996 2:36 PM
TANK   PRODUCT         VOLUME   TC 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
```

I11100 AND I11200 PRIORITY AND NON-PRIORITY ALARM HISTORY

Look for Communication, DIM, Invalid Fuel Level, and Probe Out alarms that occurred during the problem period.

I11100

```
DEC 18, 1997, 3:04 PM
PRIORITY ALARM HISTORY
ID  CATEGORY DESCRIPTION ALARM TYPE           STATE     DATE      TIME
T3  TANK     REGULAR     LOW PRODUCT ALARM    CLEAR     12-18-97  1:32AM
T3  TANK     REGULAR     LOW PRODUCT ALARM    ALARM     12-17-97  5:56PM
E1  OTHER    B1G         COMMUNICATION ALARM  CLEAR     10-15-97  9:34AM
E1  OTHER    B1G         DISABLED DIM ALARM   CLEAR     1-01-96   8:08AM
E1  OTHER    B1G         DISABLED DIM ALARM   ALARM     1-01-96   8:08AM
E1  OTHER    B1G         COMMUNICATION ALARM  ALARM     1-01-96   8:01AM
T1  TANK     SUPER       PROBE OUT            ALARM     1-01-96   7:01AM
```

I11200

```
DEC 18, 1997, 3:05 PM
NON-PRIORITY ALARM HISTORY
ID CATEGORY DESCRIPTION ALARM TYPE          STATE    DATE     TIME
T3 TANK     REGULAR     INVALID FUEL LEVEL  CLEAR    11-08-97 1:01AM
T3 TANK     REGULAR     INVALID FUEL LEVEL  ALARM    11-07-97 6:31PM
```

I@A400 DAILY RECONCILIATION LIST FOR LAST 31 DAYS (62 ON NEWER VERSIONS)

An alternate command would be IC0700 which gives you the Current or Previous Periodic Report.

1. Determine if the variance problem is associated with a significant number of large variances or the result of small errors of the same polarity.
2. Rule of thumb: a daily variance less than 1% of the day's sales is OK.
3. Large errors (usually isolated)
   a. Check sales, if zero or unusually low, look for POS communication problems, DIM problems, or power outages.
   b. Undetected delivery? TLS Console end volume greater than TLS Console start volume. Deliveries will be lost if TLS Console is not powered, site unmaps (V107), or probe problems.

c. Mismapped meter(s). Sales are reported to the wrong tank. This tank will have a positive variance. The tank the meter is actually mapped to will have a negative variance of approximately equal magnitude.

d. Invalid fuel levels, probe outs, stuck floats, site maintenance.

4. Small errors of the same polarity.

   a. Check AccuChart.

   b. Check temperature compensation setup.

```
I@A400
DEC  9, 1997 10:12 AM
BASIC_RECONCILIATION HISTORY

T 1:BRONZE

REQUEST ST  STRT TIME   END TIME STRT_VL  END_VL  SALES  DELIV OFFSET VARIEN
9711080200 9711080200 9711090200  9256.3  7662.2    0.0    0.0    0.0-1594.1
9711090200 9711090200 9711100200  7662.2  6093.3    0.0    0.0    0.0-1568.9
9711100200 9711100200 9711110200  6093.3  4194.3    0.0    0.0    0.0-1899.0
9711110200 9711110200 9711120200  4194.3  9586.9    0.0 6618.2    0.0-1225.5
9711120200 9711120200 9711130200  9586.9  8024.1    0.0    0.0    0.0-1562.8
9711130200 9711130200 9711140200  8024.1  6263.8 1477.5    0.0    0.0 -282.8
9711140200 9711140200 9711150200  6285.1  7967.5 2284.3 3945.9    0.0   20.8
9711150200 9711150200 9711160200  7967.5  6197.8 1788.3    0.0    0.0   18.6
9711160200 9711160200 9711170200  6197.8  4696.4 1514.2    0.0    0.0   12.8
9711170200 9711170200 9711180200  4696.4 10763.6 2176.3 8216.9    0.0   26.5
9711180200 9711180200 9711190200 10763.6  8969.7 1802.6    0.0    0.0    8.8
9711190200 9711190200 9711200200  8969.7  7451.5 1528.4    0.0    0.0   10.2
9711200200 9711200200 9711210200  7451.5  7551.1 1510.3 1599.8    0.0   10.0
9711210200 9711210200 9711220200  7551.1  5861.0 1702.9    0.0    0.0   12.8
9711220200 9711220200 9711230200  5861.0  4345.7 1531.5    0.0    0.0   16.3
9711230200 9711230200 9711240200  4345.7  3072.0 1289.4    0.0    0.0   15.7
9711240200 9711240200 9711250200  3072.0  8845.3 1381.9 7147.6    0.0    7.6
9711250200 9711250200 9711260200  8845.3  7616.4  777.2    0.0    0.0 -451.7
9711260200 9711260200 9711270200  7616.4  6194.1    0.0    0.0    0.0-1422.3
9711270200 9711270200 9711280200  6194.1  4439.8    0.0    0.0    0.0-1754.3
9711280200 9711280200 9711290200  4439.8  2527.2    0.0    0.0    0.0-1912.6
9711290200 9711290200 9711300200  2527.2  7825.3    0.0 7150.2    0.0-1852.1
9711300200 9711300200 9712010200  7825.3  6243.7    0.0    0.0    0.0-1581.6
9712010200 9712010200 9712020200  6243.7  4827.5 1347.9    0.0    0.0  -68.3
9712020200 9712020200 9712030200  4827.5  3381.5 1463.5    0.0    0.0   17.5
```

IA5400 CONSOLE 30 SECOND AVERAGE VOLUME HISTORY

Look for volume stability when the **tank is idle** (variation <0.5 gallon typically).

```
IA5400
DEC  9, 1997 10:11 AM


CSLD DIAGNOSTICS: MOVING AVERAGE TABLE

T 1:BRONZE
         TIME  SMPLS  TCVOL   HEIGHT   AVGTEMP   TOPTEMP    BDTEMP
971209094911     31  7830.4   59.7     45.10      43.47     37.76
971209094941     32  7830.4   59.7     45.10      43.47     37.76
971209095011     31  7830.4   59.7     45.10      43.47     37.76
971209095041     30  7830.3   59.7     45.10      43.46     37.76
971209095111     31  7830.3   59.7     45.10      43.46     37.76
```

I61500 METER DATA PRESENT

Pay special attention to any tank in which the flag is set to NO.

I61500

SEP 3, 1996 9:53 AM

TANK	PRODUCT LABEL	METER DATA
1	SUPER	NO
2	UNLEADED STP	YES
3	UNLEADED STORAGE	YES
4	KERO	YES

I90200 SOFTWARE REVISION

If manifolded tanks are present, system software must be the 3XX series.

```
I90200
DEC  9, 1997 10:08 AM
SOFTWARE REVISION LEVEL
VERSION 114.04
SOFTWARE# 346114-100-E
CREATED - 97.07.09.16.33

S-MODULE# 330160-103-A
SYSTEM FEATURES:
  PERIODIC IN-TANK TESTS
  ANNUAL IN-TANK TESTS
  BIR
  FUEL MANAGER
```

AUTOMATIC METER MAPPING

Auto tank/meter mapping analyzes the metered sales data and the tank volume data. If a transaction volume for a particular meter event uniquely matches a drop in volume in one of the available tanks, a “vote” in favor of mapping that tank to the meter is made.

When a sufficient number of votes indicates that a meter is connected to an available tank, then the meter will be mapped to that tank. Should the automatic meter mapping algorithm recognize a meter-to-tank pattern it will map the tank, even before there are a sufficient number of votes. Automatic meter mapping is recommended over manual meter mapping (see “Manual Meter Mapping” on page 12-10 for exceptions).

In the case of manifolded tanks, the meter is mapped to the primary tank. The primary tank is defined as the lowest numbered tank in the manifolded set.

A tank can be mapped to only one meter for a given Fuel Position (FP). There is an exception beginning with Version 111 or 311 software. If the FP has only 2 meters and the tank product is diesel (identified by the thermal coefficient of expansion being <0.0005 [U.S. units]), auto meter mapping will allow the mapping of both meters to the same tank.

A tank will be unavailable for mapping if any of the following conditions are true:

- In-tank programming parameter Meter Data Present set to NO,
- It is manifolded and the console has 1XX software,
- It is not configured,
- Probe data is not being collected, or
- Probe not magnetostrictive type.

BIR will not produce reports while the meter map is incomplete

The meter map is declared incomplete when:

- Any reported meter has not been mapped to a tank,
- A probeless tank (one connected to the POS, but not monitored by the console) has not been manually mapped (see “Manual Meter Mapping” on page 12-10 for this procedure), or
- A previously “retired” meter is reactivated.

  If an unmapped meter has not been reported by a POS within 24 hours of the last report, the meter is declared “retired”. A retired meter may be a phantom meter incorrectly reported by the POS, or it may be a seldom heard from meter, such as one connected to a kerosene tank. Until the “retired” meter is mapped, every time the meter is activated, and for 24 hours thereafter, BIR is suspended.

TANK/METER CROSS REFERENCES

In addition to the tank/meter map, the following cross references are maintained:

- Real fueling position to logical fueling position cross reference, and
- Real meter to logical meter cross reference.

TANK/METER CROSS REFERENCE DIAGRAM

A POS terminal identifies a specific meter by reporting a Fueling Position (FP) number and a Meter (M) number (see Figure 12-1). The translation or cross referencing of the FP and M numbers reported by the POS terminal is necessary because of console memory limitations.

The POS reports FP numbers in the range 0 - 99 (referred to as Real FP numbers in the diagram). The console is limited to 36 FPs. The POS FP numbers 0 - 99 are cross referenced by the console to 0 - 35 (referred to as Logical FP numbers in the diagram).

The POS reports Meter numbers in the range 0 - 99 (referred to as Real M numbers in the diagram). The console is limited to 6 meters (M) per FP. The POS M numbers 0 - 99 are cross referenced by the console to 0 - 5 (referred to as Logical M numbers in the diagram).

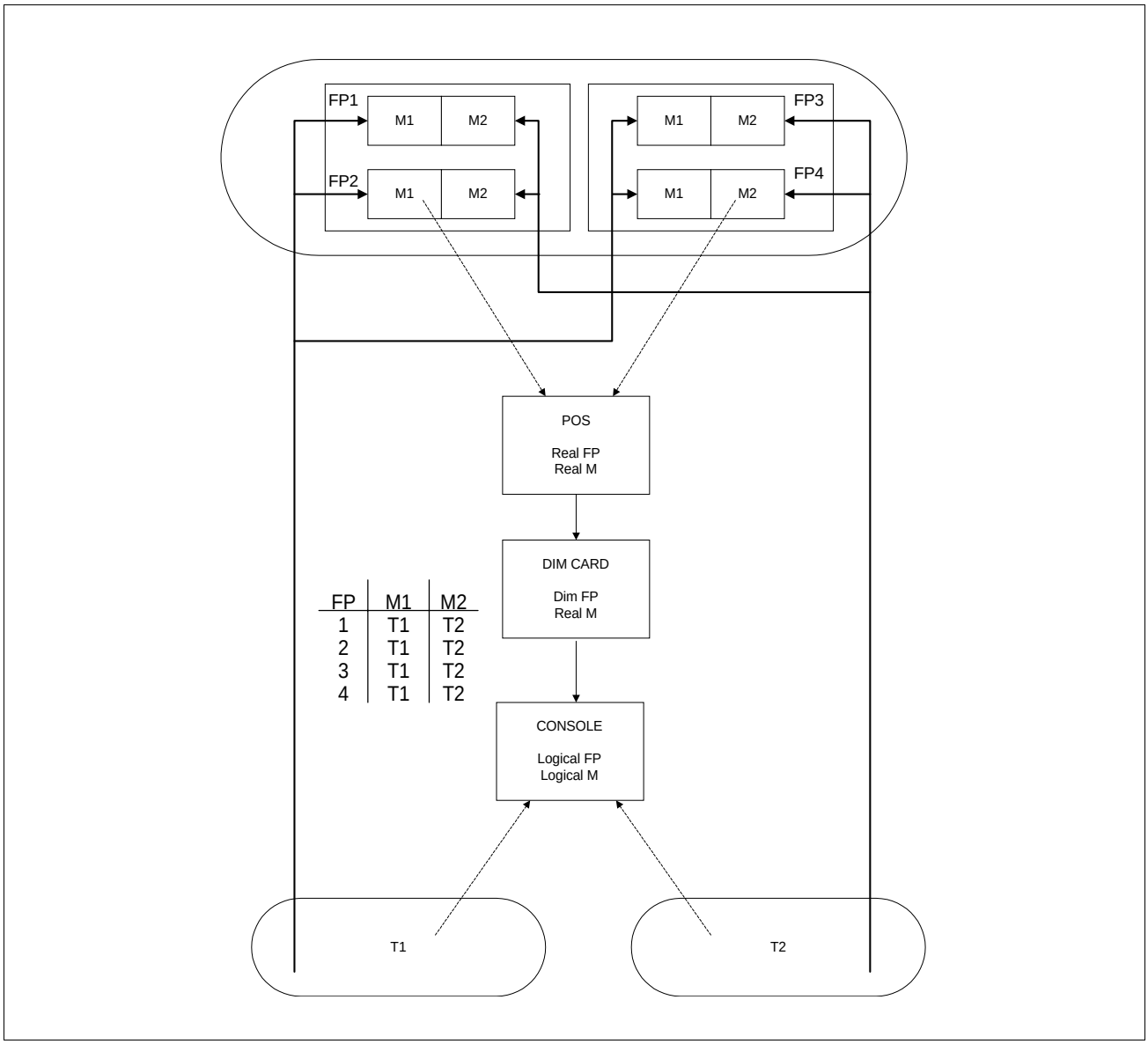
In addition, more than one DIM board is allowed, so it is possible to have two POS terminals reporting the same FP and M numbers. A number identifying each DIM board is added to the Real FP to ensure a unique number (referred to as the DIM FP in the diagram).

POS===>DIM Event===>Meter Event

Real FP===>DIM FP===>Logical FP

Real M===>Logical M===>Logical M

All attempts are made to obtain a one-to-one mapping. If all Real FP numbers are within 0 to 35, the Real FP number will equal the Logical FP number. If all Real Meter numbers are within 0 to 5, the Real Meter number will equal the Logical Meter number.



FP	M1	M2
1	T1	T2
2	T1	T2
3	T1	T2
4	T1	T2

Figure 12-1. Tank/Meter Map Diagram

Manual Meter Mapping

A manual tank/meter map can be entered through the keyboard (SETUP MODE, Reconciliation Setup Function, Modify Tank/Meter Map Step) or through the RS-232 command 7B1. The meter must be identified by bus, slot, real FP, and real M.

A manually entered tank/meter map is locked and cannot be changed by auto-meter mapping. In all displays, printouts, and RS-232 diagnostic reports a locked meter is indicated by an asterisk following the tank number.

In some applications the dispensing data sent from the POS terminal to the TLS Console will contain meter transactions from a tank(s) in which there is no probe. Unable to match the transaction with a corresponding height change, the tank-meter mapping algorithm will declare the map incomplete and BIR will be inhibited. You must manually map a "probeless" meter into the tank/meter map before it will be declared complete and BIR can begin.

A manually mapped meter is considered locked. Auto meter mapping will not change a locked meter.

RS-232 COMMAND 7B1

A manual meter map can be entered through the keyboard (SETUP MODE, RECONCILIATION SETUP Function, MODIFY TANK/METER MAP Step) or through the RS-232 command 7B1.

The 7B1 command requires the meter in question to be fully identified by it's meter number, fueling position, and the bus and slot in which the dispenser interface module (DIM) is located. The bus and slot parameters are required because the Console supports multiple DIM cards. The 7B1 command also requires a tank number to which to map the meter.

A manually mapped meter is considered locked. Auto meter mapping will not change a locked meter.

7B1 REPORT PARAMETERS:

BUS - This is the bus in which the DIM card is placed. There are currently two busses which will support DIM cards:

- Type 2 - Console Power Area slots (MDIMs, LVDIMs)
- Type 3 - Console Comm Cage slots (EDIMs, CDIMs, LDIMs, and IFSF DIMS)

SLOT - This is the slot in which the DIM board is placed. The slots available are dependent on the bus as follows:

- Slots 9 - 16 (Type 2 bus)
- Slots 1 - 6 (Type 3 bus)

FUEL_P - This is the fueling position number reported by the POS terminal. It must be within the range 0 - 99. (The POS FP numbers 0 - 99 are cross referenced by the console to 0 - 35.)

METER - This is the meter number reported by the POS terminal. It must be within the range 0 - 99. (The POS M numbers 0 - 99 are cross referenced by the console to 0 - 5.)

TANK - Any one of the following tank numbers are acceptable:

- -1 (indicates a tank with no probe [99 for keyboard entry])
- 0 (indicates removal of the meter from the map)
- Any tank number that meets the BIR requirements. Note: Meter Data Present = YES.

COMMAND 7B1 INQUIRY EXAMPLES

Inquiry Response If The Map Is Empty.

```
Command:
```

I7B100

Response:

```
I7B100
JAN 1, 2000 8:41 AM
FUELING POSITION - METER - TANK MAP

BUS                   SLOT      FUEL_P     METER      TANK

TANK MAP EMPTY
```

Inquiry Response With Four Meters Reported

Command:

I7B100

Response:

```
I7B100
JAN 1, 2000 8:42 AM
FUELING POSITION - METER - TANK MAP

BUS                   SLOT      FUEL_P     METER      TANK

3                     1         18         1          1

3                     1         18         2          ?

3                     1         18         3          X

3                     1         18         4          R

3                     1         18         5          2*
```

Definitions of symbols in tank column:

FP18/M1	1	Meter is mapped to tank 1.
FP18/M2	?	Meter is not mapped.
FP18/M3	X	Meter is mapped to a probeless tank.
FP18/M4	R	Meter is retired. This meter position has not been mapped and has not been reported within 24 or more hours. Retiring a meter allows the meter mapping algorithm to declare the tank map complete if all other reported meters have been mapped or retired.
	*	Indicates the meter has been manually mapped and cannot be changed by the auto meter mapping procedure.

COMMAND 7B1 SETUP EXAMPLES

An explanation of the RS-232 7B1 command is shown below with the entries defined.

S7B100 B S FP M T

where:

B = bus (2 or 3)

S = slot (bus 2: 9-16, bus 3: 1-6)

FP = fueling position (0-99)*

M = meter (0-9)*

T = tank (-1, 0, or any legitimate tank number)

*Identify unknown Fueling Positions/Meter Numbers as follows:

- The station must be idle throughout this procedure.
- From the console's front panel, clear the meter map (DIAG mode - RECONCILIATION CLEAR MAP function).
- The response from the I7B100 command should be TANK MAP EMPTY.
- Dispense a small amount of product from the meter in question.
- Wait 2 minutes after the completion of the dispensing.
- The response from the I7B100 command should identify the bus, slot, fueling position number, and meter number of the meter in question. The tank parameter will indicate **?** because the meter is not mapped.
- If additional meters need to be identified it is not necessary to clear the map; just confirm that 2 minutes after a dispense from the next meter to be identified, a meter was added to the I7B100 command list.

COMMAND SETUP ERROR DETECTION

All parameters are checked before the command is performed. If an error is detected, the command parameters will be repeated with the parameter in error replaced with **??**

Example of A Rejected Command with the Fueling Position Out of Range

Command:

S7B100 3 1 108 3 2

Response:

FP must be within 0 - 99

```
S7B100
JAN 1, 1995 8:43 AM
FUELING POSITION - METER - TANK MAP

BUS                 SLOT      FUEL_P   METER    TANK

3                   1         ??       3        2
```

?? indicates FP value out of range.

MANUAL METER MAPPING EXAMPLES

Mapping FP18/M1 to tank 1

Command:

S7B100 3 1 18 1 1

Response:

```
S7B100
JAN 1, 1995 8:42 AM
FUELING POSITION - METER - TANK MAP

BUS                 SLOT      FUEL_P   METER    TANK

3                   1         18       1        1
```

Mapping FP18/M3 to a probeless tank

Command:

S7B100 3 1 18 3 -1

Response:

```
S7B100
JAN 1, 1995 8:43 AM
FUELING POSITION - METER - TANK MAP
BUS                 SLOT      FUEL_P    METER    TANK
3                   1         18         3        X
```

Removing FP18/M4 from the map

Command:

S7B100 3 1 18 4 0

Response:

```
S7B100
JAN 1, 1995 8:43 AM
FUELING POSITION - METER - TANK MAP
BUS                  SLOT   FUEL_P   METER    TANK
3                    1      18       4        -
```

Automatic Meter-Mapping Errors

Automatic meter-mapping errors usually occur during the first few days and will be corrected automatically.

MAP NEVER COMPLETES

1. Meter data present set to NO for a tank that has meter data.
2. One of the tanks has an invalid fuel height condition.
3. One of the tanks has a probe out alarm.
4. One of the tanks is not configured.
5. A meter with no console height data is reporting sales (probeless tank see below).
6. Manifolded tanks with 1XX software (software must be 3XX with extra RAM).
7. DIM programmed incorrectly.

MAP UNSTABLE

1. Retired Meters - Real Meters (*Seldom Used)*

   This situation may occur when the site has a Fueling Position/Meter combination that is seldom used (e.g., a kerosene tank in the summer). If the map is complete and a dispense occurs on this FP/Meter combo, the map will go incomplete. The map will stay incomplete until this FP/Meter combo is mapped, OR retired after 24 hours of non-use.

   The preferred method to map a retired or unmapped meter is to map the meter manually through the keyboard (SET-UP MODE, RECONCILIATION SETUP Function, MODIFY TANK/METER MAP Step) or the RS-232 serial meter mapping command (7B1).

   Alternatively, the auto-meter mapping algorithm will map the meter when the following procedure performed. First wait until the station is idle (no dispensing on any tanks for at least 5 minutes), dispense 6 or more gallons from this

FP/Meter combo, wait 5 minutes and dispense 6 more gallons. Wait 5 minutes and verify the map is complete. At this time the dispensed fluid may be returned to the tank.

2. Retired Meters - Phantom Meters

   If a POS or a DIM reports a meter that does not exist, the meter mapping algorithm will try to map it. Until the meter is retired the site will be declared unmapped. Possible causes for a phantom meter might be an incompatibility between the POS and DIM (reference Section 10, DIM troubleshooting), or by electrical noise in the cabling.

INCORRECT MAPPING

1. Pattern matching may have predicted a pattern that does not exist. As votes build evidence that the map is wrong, the map may be changed to an unmapped state. Eventually the voting will correct the map. This will only be a start up issue.
2. Incorrect sales data may produce incorrect votes. Conflict between the POS and the DIM or the DIM setup is incorrect are possible causes.
3. Noisy or inaccurate data may produce incorrect votes. Some possible sources of data problems: bad probe, some vapor recovery systems.

Reports Used in Analyzing Meter Map Problems

I@A002 METER MAP DIAGNOSTICS

Typically a site will completely map within a day or two. Low throughput tanks and sites with random mappings that the pattern matching algorithm cannot take advantage of may take longer. If a site is not mapped after two weeks it should be examined.

1. Look for unmapped or retired meters.
   a. Are these meters real or phantom meters?
   b. Real meters - Is TLS Console data available for them?
      - YES: manually map the meter to the proper tank.
      - NO: manually map the meter to a probeless tank.
2. Phantom meters

   Pursue a DIM, POS, or installation problem.
3. Look for voting stability.

   Are most of the votes unanimous? NO: Check TLS Console 30 second average history for volume stability. Check for correct DIM setup for POS.

```
I@A002
MAR 26, 1996  9:27 AM
MAP IS COMPLETE

 FP|     METER          **TANK_MAP_BALLOT**
   |     0          1          2          3          4          5
---+-------------------------------------------------------------
```

```
  0|M0>3:0/0/0 M1>3:1/1/1 M2>3:2/2/2    -:-/-/-    -:-/-/-    -:-/-/-
   |9603260815 9603260747 9603252346      *          *          *
---+-------------------------------------------------------------------
  1|M0>2:0/0/0 M1>1:1/1/1 M2>2:2/2/2    -:-/-/-    -:-/-/-    -:-/-/-
   |9603260837 9603260815 9603260808      *          *          *
---+-------------------------------------------------------------------
  2|M0>3:0/0/0 M1>1:1/1/1 M2>3:2/2/2    -:-/-/-    -:-/-/-    -:-/-/-
   |9603260827 9603260856 9603260839      *          *          *
---+-------------------------------------------------------------------
  3|M0>2:0/0/0 M1>3:1/1/1 M2>3:2/2/2    -:-/-/-    -:-/-/-    -:-/-/-
   |9603260916 9603260722 9603260733      *          *          *
---+-------------------------------------------------------------------
  4|M0>2:0/0/0 M1>3:1/1/1 M2>2:2/2/2    -:-/-/-    -:-/-/-    -:-/-/-
   |9603260838 9603260915 9603260909      *          *          *
---+-------------------------------------------------------------------
  5|M0>2:0/0/0 M1>3:1/1/1 M2>3:2/2/2    -:-/-/-    -:-/-/-    -:-/-/-
   |9603260902 9603260733 9603260916      *          *          *
---+-------------------------------------------------------------------
  6|M0>1:0/0/0 M1>3:1/1/1 M2>1:2/2/2    -:-/-/-    -:-/-/-    -:-/-/-
   |9603260908 9603260922 9603251410      *          *          *
---+-------------------------------------------------------------------
  7|M0>3:0/0/0 M1>1:1/1/1 M2>3:2/2/2    -:-/-/-    -:-/-/-    -:-/-/-
   |9603260808 9603260856 9603260911      *          *          *
---+-------------------------------------------------------------------
  8|M3>1:3/3/3    -:-/-/-    -:-/-/-    -:-/-/-    -:-/-/-    -:-/-/-
   |9603260908      *          *          *          *          *
---+-------------------------------------------------------------------
  9|M3>2:3/3/3    -:-/-/-    -:-/-/-    -:-/-/-    -:-/-/-    -:-/-/-
   |9603260856      *          *          *          *          *
---+-------------------------------------------------------------------

    Unmapped   Retired    Probeless
---+-------------------------------------------------------------------
 15|U >0:0/8/8 R >0:8/8/8 X >0:8/8/8    -:-/-/-    -:-/-/-    -:-/-/-
   |9603260902 9603260733      *          *          *          *
---+-------------------------------------------------------------------
```

Legend for report I@A002 above: U = unmapped, R = retired, X = probe

For Example, the FP9 M0 voting ballet is M3>1:3/3/3

Where:

M3	=	mapped to tank 4 (3+1*)
3/3/3	=	three votes for tank 4
9603260908	=	date of last reported event for this meter, not necessarily the last vote (YYMMDDHHMM)

*Tank numbers are zero based (e.g., tank 1 is 0, tank 2 is 1, tank 3 is 2 and tank 4 is 3).

I@A900 BIR MESSAGES

1. Examine the time messages:
   a. Identify how long the system has been running.
   b. Look for excessive time changes, power outages.
2. Examine meter map issues:
   a. Is the map complete?
   b. How long did it take to complete.
   c. Is the complete/incomplete status stable? If it was not, was it a startup issue?
   d. Are meter/tank mappings changing? Check the meter mapping diagnostic
3. Pay attention to time stamps. Problems in this message buffer may not be current. They may have resulted from an earlier problem that has been fixed.

```
I@A900
SEP 3, 1996 9:53 AM
ASR ERROR EVENT HISTORY BUFFER
TIME           CODE   MESSAGE
960101080012   1008   700101000000 FORWARD
960730080310   1008   960101080309 FORWARD
960730104401   1008   960730080312 FORWARD
960801081827   1011   MAP IS INCOMPLETE
960801081827   1011   MAP IS COMPLETE
960803141857   1011   MAP IS INCOMPLETE
960804170727   1011   MAP IS COMPLETE
960805173827   1011   MAP IS INCOMPLETE
960807132022   1011   MAP IS COMPLETE
960809113157   1011   MAP IS INCOMPLETE
960810184600   1011   MAP IS COMPLETE
960811191224   1011   MAP IS INCOMPLETE
960815150333   1011   MAP IS COMPLETE
```

```
960816155152   1011   MAP IS INCOMPLETE
960818143027   1011   MAP IS COMPLETE
960819151050   1011   MAP IS INCOMPLETE
960819161418   1011   MAP IS COMPLETE
960820164436   1011   MAP IS INCOMPLETE
960821151357   1011   MAP IS COMPLETE
```

Procedure for Identifying AccuChart Problems

WHAT IS THE COMPLAINT?

1. Stick/chart reading does not agree with TLS Console volume. This is because AccuChart takes into account tank variations that the stick/chart method does not.
2. Excessive variance

First determine if AccuChart is the source of the variance error.

If AccuChart is not enabled or the user enable is NO, then BIR is not using AccuChart.

1. The reasons why AccuChart would not be enabled are:
   a. Meter Data Present = NO
   b. Siphon manifolded with 1XX software.
   c. Diameter or Capacity not entered.
   d. User multi-point chart bad.
   e. Diameter not within 20% of probe length (V108 or V109 software).
   f. Not a Mag probe.
   g. Tank profile set to LINEAR.
2. The reasons why the user enable flag is NO are:
   a. There has never been a calibration (too early in the calibration or low throughput)
   b. The AccuChart update scheduling method is set to Never.
   c. The AccuChart update scheduling method is set to Complete and AccuChart is still calibrating.
   d. The AccuChart update scheduling method is set to Periodic and it has been less than 28 days since AccuChart began calibrating.

If AccuChart is being used by BIR, check the Fitness (value). This is a measure of how well the tank chart matches the data. In general, fitness values >1 (>5 for manifolded tanks) indicates an inaccurate calibration.

Causes for inaccurate calibration.

1. User programmed incorrectly the tanks's diameter, full volume, profile, or manifolding.
2. Inadequate tank usage during the calibration period.
3. Meter mapping problems during the calibrating period.
4. Noisy or inaccurate data (probe or dispenser).

5. Calibration is incomplete.

Reports Used to Analyze AccuChart Problems

I@B600 ACCUCHART STATUS

1. Check to see if AccuChart is enabled (Enabled = ON).
2. Check User Enable parameter, if OFF, AccuChart is not being used.
3. Check Mode:
   a. Calibration: Check duration to determine how long the tank has been calibrating. Depending on throughput, the first COE (capacity, offset, end shape) calibration occurs after two weeks. AccuChart needs 56 days to complete.
   b. Monitor Mode: Indicates AccuChart is complete. Check alarm status and MSSE (fitness) value. These are an indication of how well the current data compares to the final AccuChart calibration.
4. Check MINht and MAXht:

   These values will indicate the range over which the tank was calibrated. If it is a small range and the calibration is complete or almost complete, the tank was not adequately exercised during the calibration period.
5. Check CAP_O_E COUNT:

   Check for no calibrations or less accurate capacity-only calibrations.
   a. V108, V109 software - If count is 0, then no calibrations have been performed. If count is less than 4, then less accurate capacity-only calibration.
   b. V110 or later software - If count is 3, no calibrations have been performed. Capacity-only calibrations have been eliminated.
6. Reasons for insufficient calibrations:
   a. AccuChart not enabled.
   b. Low throughput (check daily sales or CSLD A52 diag).
   c. Early in the calibration Period.

IB@B601

```
JUN 26, 1996 2:36 PM

ACCU-CHART DIAGNOSTICS - CALIBRATION STATUS
TANK 1 CAL STATUS
ENABLE = ON    MODE = CALIBRATE      ALARM = OFF      USER ENABLE = OFF

START TIME    DURATION      MSSE    SUMWT     SIGMA     MINht    maxHT
605558407         48.0      0.56     3372      3.98       19.2     53.8

CALIBRATION     CAP     CAP_O_E     DIAM   TILT    SLICE
COUNT                         6        0      0        0
SUMWEIGHT       444        2142        0      0        0
```

IB9400 ACCUCHART CALIBRATION HISTORY

1. Check the startup record: The first record indicates the startup time of AccuChart and the user entered parameters: capacity, diameter, and tank profile (SHAPE F). (Shape F value of 0 = 1 point tank profile was entered, 1 = 4 point tank profile was entered, and 0.5 = 20 point tank profile was entered.) Are the user entered parameters correct?
2. Any subsequent records that are identical to the startup record indicate AccuChart was reset.
3. Look at the final calibration.
   a. Determine the type of calibration by looking at the parameters changed.
   b. There should be at least one calibration where offset was adjusted.
   c. Look at the Fitness value: values <1.0 indicate AccuChart was able to reduce the errors to an acceptable level at the time of calibration. Manifolded tanks will have larger fitness values (>5.0).

IB9400
DEC 9, 1997 10:13 AM

ACCU_CHART CALIBRATION HISTORY

T 1:BRONZE

DATE/TIME	DIAM	LENGTH	OFFSET	TILT	SHAPE F	CAPACITY	FITNESS
97/09/19 10:43	2400	8007	0.0	25.4	1.00	43459	0.00
97/09/30 14:07	2404	7959	13.6	25.4	1.00	43426	0.21
97/10/07 21:52	2401	7970	14.3	25.4	1.00	43350	0.14
97/10/30 19:52	2420	7878	19.9	25.4	1.00	43680	0.24
97/11/05 13:43	2403	7979	11.1	25.4	1.00	43480	0.27

Startup record.

Resetting AccuChart

If it has been determined that the calibration is inaccurate and the cause has been repaired, AccuChart should be reset (ref. Accuchart Diagnostics Function - Figure 6-9 on page 6-8).

Contacting Tech Support

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

1. <Control-A> I10200 System Configuration Report
2. <Control-A> I11100 Priority Alarm History
3. <Control-A> I11200 Non-priority Alarm History
4. <Control-A> I20100 Inventory Report
5. <Control-A> IC070001 Basic Inventory Reconciliation Periodic “Row” Report (Previous)
6. <Control-A> IC070000 Basic Inventory Reconciliation Periodic “Row” Report (Current)
7. <Control-A> I60A00 Set Tank Linear Calculated Full Volume
8. <Control-A> I61200 Set Tank Manifolded Partners

9. <Control-A> I61500 Set BIR Meter Data Present
10. <Control-A> I7B100 Set BIR Meter/Tank Mapping
11. <Control-A> I90200 System Revision Level Report
12. <Control-A> IA5400 CSLD Diagnostics, Moving Average Table
13. <Control-A> IB9400 AccuChart Calibration History
14. <Control-A> I@A400 Basic Reconciliation History
15. <Control-A> I@A002 Meter Map Diagnostics
16. <Control-A> I@A900 ASR Error Event History Buffer
17. <Control-A> I@B600 AccuChart Diagnostics - Calibration Status

BIR Troubleshooting Examples

/***/

Example 1:

In this example the fluid level went below the operating level of the probe. An active INVALID FUEL LEVEL during 11-10-94 through 11-11-94 identified this condition. This is a very common problem.

I@A400

REQUEST ST	STRT TIME	END TIME	STRT_VL	END_VL	SALES	DELIV	OFFSET	VARIEN
9411090200	9411090200	9411100200	585.1	427.6	155.9	0.0	0.0	-1.5
9411100200	9411100200	9411110200	427.6	275.6	174.3	0.0	0.0	22.3
9411110200	9411110200	9411120200	275.6	1953.0	217.5	1800.1	0.0	94.8
9411120200	9411120200	9411130200	1953.0	1837.1	118.9	0.0	0.0	2.9

NON-PRIORITY ALARM HISTORY

ID	CATEGORY	DESCRIPTION	ALARM TYPE	STATE	DATE	TIME
T 1	TANK	SPECIAL	INVALID FUEL LEVEL	CLEAR	11-11-94	1:03AM
T 3	TANK	REGULAR	DELIVERY NEEDED	CLEAR	11-11-94	10:50AM
T 3	TANK	REGULAR	DELIVERY NEEDED	ALARM	11-10-94	6:03PM
T 1	TANK	SPECIAL	INVALID FUEL LEVEL	ALARM	11-10-94	1:18PM

/***/

Example 2:

In the following example a COMMUNICATION ALARM was active from 94/12/03 through 94/12/08. This error is easy to spot because the sales value is 0 and it occurs in all tanks. Note: the lost sales were recovered on the day the POS was reconnected because cumulative meter data was available.

TANK 1 - BASIC_RECONCILIATION HISTORY

REQUEST ST	STRT TIME	END TIME	STRT_VL	END_VL	SALES	DELIV	OFFSET	VARIEN
9412010200	9412010200	9412020200	274.2	274.2	61.5	0.0	0.0	61.4
9412020200	9412020200	9412030200	274.2	2414.1	187.6	2321.5	0.0	6.0
9412030200	9412030200	9412040200	2414.1	2270.5	0.0	0.0	0.0	-143.6
9412040200	9412040200	9412050200	2270.5	2271.1	0.0	0.0	0.0	0.6
9412050200	9412050200	9412060200	2271.1	2046.1	0.0	0.0	0.0	-225.1
9412060200	9412060200	9412070200	2046.1	1848.4	0.0	0.0	0.0	-197.7
9412070200	9412070200	9412080200	1848.4	1690.6	0.0	0.0	0.0	-157.8
9412080200	9412080200	9412090200	1690.6	1397.9	1017.8	0.0	0.0	725.1
9412090200	9412090200	9412100200	1397.9	1246.7	153.5			2.2

Lost Sales

TANK 2 - BASIC_RECONCILIATION HISTORY

REQUEST ST	STRT TIME	END TIME	STRT_VL	END_VL	SALES	DELIV	OFFSET	VARIEN
9412010200	9412010200	9412020200	1995.0	1543.6	457.9	0.0	0.0	6.5
9412020200	9412020200	9412030200	1543.6	4096.9	446.8	2991.7	0.0	8.4
9412030200	9412030200	9412040200	4096.9	3924.4	0.0	0.0	0.0	-172.5
9412040200	9412040200	9412050200	3924.4	3885.6	0.0	0.0	0.0	-38.8
9412050200	9412050200	9412060200	3885.6	3576.9	0.0	0.0	0.0	-308.6
9412060200	9412060200	9412070200	3576.9	3337.3	0.0	0.0	0.0	-239.6
9412070200	9412070200	9412080200	3337.3	3094.2	0.0	0.0	0.0	-243.1
9412080200	9412080200	9412090200	3094.2	2734.5	1370.2	0.0	0.0	1010.6
9412090200	9412090200	9412100200	2734.5	2288.6	449.4	0.0	0.0	3.4

```
/*************************************************************************/
Example 3:
   This example demonstrates an incorrect meter-map due to pattern matching.
   The meters for Tank 15 (a seldom used kerosene tank) are mapped to Tank 1.
   The errors are roughly similar and opposite in sign. The meter-map
   shows the inconsistent mapping of the meters which fooled the pattern
   matcher. This situation took longer to correct because of the limited use
   of kerosene tank. Further evidence of this situation is available in the
   ASR ERROR EVENT HISTORY BUFFER, where the re-mapping t0 => t14 is reported
   (internally tank numbers go from 0 to 15)for Fps 3 and 4.

TANK 1 - BASIC_RECONCILIATION HISTORY

REQUEST ST  STRT TIME   END TIME STRT_VL  END_VL  SALES  DELIV OFFSET VARIEN
9501280200 9501280200 9501290200  3184.7  3167.1   33.1    0.0    0.0   15.5
9501290200 9501290200 9501300200  3167.1  3143.3   42.6    0.0    0.0   18.8
9501300200 9501300200 9501310200  3143.3  2953.0  243.5    0.0    0.0   53.2
9501310200 9501310200 9502010200  2953.0  2823.1  129.7    0.0    0.0   -0.3
9502010200 9502010200 9502020200  2823.1  2753.6   67.2    0.0    0.0   -2.3

TANK 15 - BASIC_RECONCILIATION HISTORY

REQUEST ST  STRT TIME   END TIME STRT_VL  END_VL  SALES  DELIV OFFSET VARIEN
9501280200 9501280200 9501290200  2964.8  2947.9    0.0    0.0    0.0  -16.9
9501290200 9501290200 9501300200  2947.9  2926.9    0.0    0.0    0.0  -21.0
9501300200 9501300200 9501310200  2926.9  2862.4    0.0    0.0    0.0  -64.5
9501310200 9501310200 9502010200  2862.4  2817.7   38.5    0.0    0.0   -6.2
9502010200 9502010200 9502020200  2817.7  2785.9   30.2    0.0    0.0   -1.6


I7B000
JAN  8, 1995  8:54 AM
LOGICAL       REAL     |     METER
  FP     FP  BUS  SLOT| 0  1  2  3  4  5
----------------------+------------------
   1      2    3    2 | 2 14 16  1  U  U
   2      3    3    2 | 2 14 16  1  U  U
   3      4    3    2 | 2 14 16  1  U  U
   4      5    3    2 | 2 14 16  1  U  U

I@A900
FEB 2, 1995  8:52 AM
ASR ERROR EVENT HISTORY BUFFER

TIME         CODE MESSAGE
900101062628 1008 700101000000 FORWARD
950101080014 1008 900101062628 FORWARD
950127080052 1008 950101080051 FORWARD
950127094202 1008 950127080131 FORWARD
950127095140 1011 MAP IS INCOMPLETE
950127133642 1011 MAP IS COMPLETE
950131072012 1013 fp3 m3 t0 => t14
950131072012 1013 fp4 m3 t0 => t14

I7B000
FEB 2, 1995  8:54 AM
LOGICAL       REAL     |     METER
  FP     FP  BUS  SLOT| 0  1  2  3  4  5
----------------------+------------------
   1      2    3    2 | 2 14 16  1  U  U
   2      3    3    2 | 2 14 16  1  U  U
   3      4    3    2 | 2 14 16 15  U  U
   4      5    3    2 | 2 14 16 15  U  U
```

Pattern Mapping Incorrectly Mapped These Meters To Tank 1.

Auto-Meter Mapping Detected And Corrected The Error.

Example 4. Customer complaint: missing days in reconciliation.

```
I@A400
SEP 3, 1996 9:53 AM
BASIC_RECONCILIATION HISTORY
```

T1: SUPER

REQUEST ST	STRT TIME	END TIME	STRT_VL	END_VVL	SALES	DELIV	OFFSET	VARIEN
9608030000	9608031429	9608040002	10588.0	10415.5	171.3	0.0	0.0	-1.3
9608040000	9608051736	9608060000	12287.4	12159.0	123.8	0.0	0.0	-4.6
		---- MISSING DATA ----						
9608060000	9608060000	9608070002	12159.0	14025.2	652.4	2535.7	0.0	-17.1
9608070000	9608091031	9608100011	8381.6	11501.1	4283.8	7625.3	0.0	-221.9
		---- MISSING DATA ----						
9608100000	9608111907	9608120000	11222.3	10421.5	796.2	0.0	0.0	-4.7
		---- MISSING DATA ----						
9608130000	9608130002	9608140000	11384.5	11231.1	2849.3	2751.2	0.0	-55.3
9608140000	9608140000	9608150000	11231.1	11566.0	2556.1	2940.9	0.0	-49.9

-- TABLE ABBREVIATED FOR THIS EXAMPLE, BUT IT IS INDICATIVE OF AN UNSTABLE MAP --

200
Station ID
XXXdd
yyydddd

SEP 3, 1996 9:53AM

TANK	PRODUCT	GALLONS	INCHES	WATER	DEG F	ULLAGE
1	SUPER	10364	73.64	0.0	76.6	4612
2	UNLEADED STP	8736	64.10	0.8	79.4	6240
3	UNLEADED STORAGE	8375	63.75	0.0	79.0	6601
4	KERO	3434	68.23	1.1	72.3	722 ◄—

Kerosene is considered an unusual product because of its usually low throughput.

CONFIRM KEROSENE SALES DATA IS BEING REPORTED BY THE POS.

I61500

SEP 3, 1996 9:53 AM

TANK	PRODUCT LABEL	METER DATA PRESENT
1	SUPER	YES
2	UNLEADED STP	YES
3	UNLEADED STORAGE	YES
4	KERO	YES ◄—

REPORT @A9 CONFIRMS THAT MAP IS UNSTABLE.

I@A900

SEP 3, 1996 9:53 AM

ASR ERROR EVENT HISTORY BUFFER

TIME	CODE	MESSAGE
960101080012	1008	700101000000 FORWARD
960730080310	1008	960101080309 FORWARD
960730104401	1008	960730080312 FORWARD
960801081827	1011	MAP IS INCOMPLETE
960803141857	1011	MAP IS COMPLETE
960804170727	1011	MAP IS INCOMPLETE
960805173827	1011	MAP IS COMPLETE
960807132022	1011	MAP IS INCOMPLETE
960809113157	1011	MAP IS COMPLETE
960810184600	1011	MAP IS INCOMPLETE
960811191224	1011	MAP IS COMPLETE
960815150333	1011	MAP IS INCOMPLETE
960816155152	1011	MAP IS COMPLETE
960818143027	1011	MAP IS INCOMPLETE
960819151050	1011	MAP IS COMPLETE
960819161418	1011	MAP IS INCOMPLETE
960820164436	1011	MAP IS COMPLETE
960821151357	1011	MAP IS INCOMPLETE
960822151457	1011	MAP IS COMPLETE

I7B100

SEP 3, 1996 9:54 AM

FUELING POSITION - METER - TANK MAP

BUS	SLOT	FUEL_P	METER	TANK
3	2	1	2	2
3	2	1	3	1
3	2	2	2	2
3	2	2	3	1
3	2	3	2	2
3	2	3	3	1

```
 3      2        4       2        2
 3      2        4       3        1
 3      2        5       2        2
 3      2        5       3        1
 3      2        6       2        2
 3      2        6       3        1
 3      2        7       2        2
 3      2        7       3        1
 3      2        8       2        2
 3      2        8       3        1
 3      2        9       2        2
 3      2        9       3        1
 3      2        10      2        2
 3      2        10      3        1
 3      2        11      2        2
 3      2        11      3        1
 3      2        12      2        2
 3      2        12      3        1
 3      2        17      0        R
```

Retired - there was a sale report for this meter, however, there was not enough information to map it and it was not reported again for a 24-hour period.

S7B100

```
SEP 3, 1996 9:56 AM
FUELING POSITION - METER - TANK MAP
BUS  SLOT  FUEL_P  METER  TANK
---------------------------------
3    2     17      0      4
```

Here we manually map the meter to the kerosene tank.

```
I7B100
SEP 3, 1996 9:56 AM
FUELING POSITION - METER - TANK MAP

BUS   SLOT  FUEL_P  METER  TANK
---------------------------------
 3    2      1      2      2
 3    2      1      3      1
 3    2      2      2      2
 3    2      2      3      1
 3    2      3      2      2
 3    2      3      3      1
```

```
3     2      4      2      2
3     2      4      3      1
3     2      5      2      2
3     2      5      3      1
3     2      6      2      2
3     2      6      3      1
3     2      7      2      2
3     2      7      3      1
3     2      8      2      2
3     2      8      3      1
3     2      9      2      2
3     2      9      3      1
3     2      10     2      2
3     2      10     3      1
3     2      11     2      2
3     2      11     3      1
3     2      12     2      2
3     2      12     3      1
3     2      17     0      4*
```

Meter is mapped to Tank 4 - (* indicates meter was manually mapped).

Example 5. Customer complaint: No BIR Data

```
200
100550 EAGLE OIL
156 N. LASALLE
CHICAGO, IL

SEP 11, 1997 10:39 AM

TANK    PRODUCT          GALLONS   INCHES   WATER    DEG F   ULLAGE
1       BLUE WEST MASTER 4642      45.14    0.0      65.6    4878
2       BLUE EAST SLAVE  4649      45.20    0.8      65.2    4871
3       SILVER           4495      44.08    0.0      64.8    5025
4       GOLD             3438      36.33    0.0      68.4    6082
```

Note manifolded tanks.

```
I61200
SEP 11, 1997 10:39 AM
```

```
TANK MANIFOLDED PARTNERS

TANK    PRODUCT LABEL      MANIFOLDED TANKS
1       BLUE WEST MASTER   2
2       BLUE EAST SLAVE    1
3       SILVER             NONE
4       GOLD               NONE
```

Confirm tanks are manifolded.

```
I61500
SEP 11, 1997 10:39 AM

TANK   PRODUCT LABEL        METER DATA
1      BLUE WEST MASTER     YES
2      BLUE EAST SLAVE      YES
3      SILVER               YES
4      GOLD                 YES
```

Always check for Meter Data Present set to Yes.

```
I@A400
SEP 11, 1997 10:41 AM
BASIC_RECONCILIATION HISTORY

T1: BLUE WEST MASTER
T2: BLUE EAST SLAVE

REQUEST ST STRT TIME END TIME STRT_VL END_VL SALES DELIV OFFSET VARIEN
EMPTY
BASIC_RECONCILIATION HISTORY

T1: BLUE WEST MASTER
T2: BLUE EAST SLAVE

REQUEST ST STRT TIME END TIME STRT_VL END_VL SALES DELIV OFFSET VARIEN
EMPTY
BASIC_RECONCILIATION HISTORY

T3: SILVER

REQUEST ST STRT TIME END TIME STRT_VL END_VL SALES DELIV OFFSET VARIEN
```

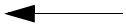
Report @A4 confirms complaint - No BIR data

EMPTY

BASIC_RECONCILIATION HISTORY

T4: GOLD

REQUEST ST STRT TIME END TIME STRT_VL END_VL SALES DELIV OFFSET VARIEN

EMPTY 

I@A002 ***CHECK MAP.***
SEP 11, 1997 10:40 AM
MAP IS INCOMPLETE

```
 FP|     METER          **TANK_MAP_BALLOT**
   |     0          1          2          3          4          5
---+-------------------------------------------------------------------
  0|M3>3:3/3/3 M2>3:2/2/2 U >2:3/2/2    -:-/-/-    -:-/-/-    -:-/-/-
   |9708081319 9708081326 9708081357      *          *          *
---+-------------------------------------------------------------------
  1|M3>3:3/3/3 M2>3:2/2/2 U >3:2/3/2    -:-/-/-    -:-/-/-    -:-/-/-
   |9708081319 9708081404 9708081357      *          *          *
---+-------------------------------------------------------------------
  2|M3>3:3/3/3 M2>3:2/2/2 U >3:3/2/3    -:-/-/-    -:-/-/-    -:-/-/-
   |9708081358 9708081239 9708081404      *          *          *
---+-------------------------------------------------------------------
  3|M3>1:3/3/3 M2>2:2/2/2 U >3:2/2/3    -:-/-/-    -:-/-/-    -:-/-/-
   |9708081308 9708081357 9708081412      *          *          *
---+-------------------------------------------------------------------
  4|M3>1:3/3/3 M2>3:2/2/2 U >1:2/3/3    -:-/-/-    -:-/-/-    -:-/-/-
   |9708081341 9708081116 9708081324      *          *          *
---+-------------------------------------------------------------------
  5|M3>1:3/3/3 M2>3:2/2/2 U >2:3/2/2    -:-/-/-    -:-/-/-    -:-/-/-
   |9708081307 9708081408 9708081410      *          *          *
---+-------------------------------------------------------------------
  6|M3>1:3/3/3 M2>1:2/2/2 U >1:2/2/3    -:-/-/-    -:-/-/-    -:-/-/-
   |9708081404 9708081009 9708081314      *          *          *
---+-------------------------------------------------------------------
  7|M3>2:3/3/3 M2>2:2/2/2 U >2:2/3/2    -:-/-/-    -:-/-/-    -:-/-/-
   |9708081335 9708081206 9708081116      *          *          *
---+-------------------------------------------------------------------
  8|M3>1:3/3/3 M2>2:2/2/2 U >2:2/3/3    -:-/-/-    -:-/-/-    -:-/-/-
   |9708081231 9708080952 9708081351         *          *          *
---+-------------------------------------------------------------------
  9|M3>2:3/3/3 M2>1:2/2/2 U >3:3/2/3    -:-/-/-    -:-/-/-    -:-/-/-
   |9708081320 9708080915 9708081408   *          *          *
---+-------------------------------------------------------------------
 10|M3>1:3/3/3 M2>1:2/2/2 U >1:3/3/3    -:-/-/-    -:-/-/-    -:-/-/-
   |9708081349 9708081025 9708081408    *          *          *
---+-------------------------------------------------------------------
 11|M3>3:3/3/3 M2>2:2/2/2 U >2:2/2/3    -:-/-/-    -:-/-/-    -:-/-/-
   |9708080818 9708080829 9708080917         *          *          *
---+--------------------------------------------------------------------
```

Meter 2 for all FPs is unmapped.

Only Tanks 3 and 4 are mapped. The manifolded tanks (1 & 2) are not mapped. (Note - Tank numbers are zero based in this report, e.g., M3 = mapped to T4.)

```
I90200
DEC  9, 1997 10:08 AM
SOFTWARE REVISION LEVEL
VERSION 114.04
SOFTWARE# 346114-100-E
CREATED - 97.07.09.16.33

S-MODULE# 330160-103-A
SYSTEM FEATURES:
  PERIODIC IN-TANK TESTS
  ANNUAL IN-TANK TESTS
  BIR
  FUEL MANAGER
```

902 indicates software version is 1XX which does not support BIR for manifolded tanks. Version 3XX software is required.

Example 6. Customer complaint: :Large Variance

The reconciliation shows a variance on the order of 25%.
This number is too large to be an accuchart error.
This is true for all tanks.

```
I@A401
JAN  4, 2000  3:35 PM
BASIC_RECONCILIATION HISTORY

T 1:UNLEADED

REQUEST ST  STRT TIME   END TIME STRT_VL  END_VL  SALES  DELIV OFFSET VARIEN
9911030200 9911030200 9911040200  4142.1  3719.4  545.5    0.0    0.0  122.8
9911040200 9911040200 9911050200  3719.4  3172.6  690.2    0.0    0.0  143.4
9911050200 9911050200 9911060200  3172.6  5766.4  738.3 3165.6    0.0  166.6
9911060200 9911060200 9911070200  5766.4  5254.9  665.9    0.0    0.0  154.3
```

The tank calibration records show a consistent ratio of 25% for tanks 1 and 2,and 15% for tank 3. Because the records are consistent this could not be lost sales, something is wrong with the tls volume or the sales volume.

```
I@B900
JAN  4, 2000  3:35 PM

TANK CALIBRATION DATA
=======================
T 1:UNLEADED

Opening  Closing    TLS    Dispensed  Tank/Meter
Height   Height   Volume    Volume      Ratio
 44.336   44.146     19.79    25.50     0.7761
 44.146   44.028     12.26    16.40     0.7478
 44.028   43.948      8.40    11.31     0.7428
 43.947   43.918      3.04     4.10     0.7427
```

```
 43.918   43.840      8.15    10.79     0.7550
 43.840   43.724     12.06    15.76     0.7650
 43.724   43.650      7.72    10.10     0.7647
 43.649   43.522     13.25    17.40     0.7617
 43.522   43.472      5.17     6.78     0.7631
 43.473   43.377      9.96    12.90     0.7724
```

For all tanks accuchart is not enabled.
Accuchart is not capable of calibrating linear tanks so it does not enable when the tank profile is set to linear.

I@B600
JAN 4, 2000 3:36 PM

```
ACCU-CHART DIAGNOSTICS - CALIBRATION STATUS

TANK 1 CAL STATUS
ENABLE = OFF    MODE = CALIBRATE    ALARM = OFF    USER ENABLE = OFF

START TIME  DURATION     MSSE    SUMWT    SIGMA   MINht   MAXht  UPDATES
         0       0.0     0.00        0     0.00    0.0     0.0        0

CALIBRATION    CAP  CAP_O_E   DIAM   TILT  SLICE
      COUNT              0      0      0      0
  SUMWEIGHT      0        0      0      0      0
```

The only way to determine that the profile is set to linear is to run the 60A command.

I60A00
JAN 4, 2000 3:38 PM

```
TANK FULL VOLUME

TANK   PRODUCT LABEL          TANK PROFILE   GALLONS
 1     UNLEADED                   LINEAR      10000
 2     PLUS                       LINEAR       6000
 3     PREMIUM                    LINEAR       8000
 4                                1 PT            0
```

The 1 Point Full Volume command 604 gives no indication that the profile is linear!

I60400
JAN 4, 2000 4:01 PM

```
TANK FULL VOLUME

TANK   PRODUCT LABEL             GALLONS
 1     UNLEADED                   10000
 2     PLUS                        6000
 3     PREMIUM                     8000
 4                                    0
```

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