Veeder-Root In-Station Diagnostics (ISD)

Install, Setup, & Operation Manual

For VST Processors, Veeder-Root Polisher, Franklin Fueling System Clean Air Separator (CAS) and Hirt VCS 100

VEEDER-ROOT

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TLS-350R, TLS-350 PLUS, TLS-350J AND TLS-300I/C, AND TLS2 MONITORING SYSTEMS

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IN STATION DIAGNOSTICS (ISD)

For components used in ISD systems (Vapor Flow Sensor, Vapor Pressure Sensor, Software, TLS RF, Wireless Repeater, Wireless Transmitter & Wireless Receiver), excluding **LAMPS, FUSES, AND LITHIUM BATTERIES**, the following warranty applies:

We warrant that this product shall be free from defects in material and workmanship and is compliant with all applicable performance standards and specifications for which it has been certified,, for a period of one (1) year from the date of ISD start-up when proof of the date of install is provided or twenty-four (24) months from the date of manufacture when proof of date of installation is not provided. During the warranty period, we and or our representative will repair or replace the product, if determined by us to be defective, at the location where the product is in use, at no charge to the purchaser.

For ISD components installed after the initial ISD start-up, we warrant that these products shall be free from defects in material and workmanship and is compliant with all applicable performance standards and specifications for which it has been certified, for a period of one (1) year from the date of installation when proof of the date of install is provided or fifteen

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1 Introduction

Site Requirements 1
Supported Vapor Recovery Systems 2
Contractor Certification Requirements 2
Related Manuals 2
Safety Precautions 3
Example Site Diagrams 3

2 Installation

Vapor Flow Meter 5
Vapor Pressure Sensor 5
Installing TLS Console Modules - General Notes 5
    Circuit Directory 6
Smart Sensor Interface Module 7
NVMEM203 Board 7
Site Shut Down Requirements 7
Dispenser Interface Module (DIM) 7
Probe Interface Module 7
I/O Combination or 4-Relay Module 7
Multi-Port Card for Vapor Processor Communication 8
TLS Console with V-R Vapor Polisher 8
TLS Console with VST Processor 8
TLS Console with Hirt VSC 100 Processor 10

3 Setup

Introduction 11
    System Setups 11
    Alarm Setups 11
External Input Setup - Hirt VCS 100 Processor Only 12
Smart Sensor Setup 13
ATM Pressure Sensor Setup 14
EVR/ISD Setup 15
Output Relay Setup - VST ECS Membrane Processor 19
PMC Setup for VST Processors 20
Alarm Setup 21
    Introduction 21
    Alarm Setup for Sites with Line Leak Detection 23
    Alarm Setup for Sites without Line Leak Detection 25
    Alarm Setup for Sites with Dispenser Relays 27

4 ISD Operability Test Procedure

Vapor Pressure Sensor Verification Test 29
Vapor Flow Meter Operability Test 29
Vapor Processor Operability Test 29

5 Operation

Alarms 30
    Overview of TLS console Interface 30
    Warning Posting 30
    Alarm Posting 31
    Site Re-enable 31
    Alarm Logs 32
    Alarm Sequence 33

ISD Alarm Summary 33
Other Alarms 35
Reports 36
Viewing ISD Reports 37
Viewing ISD Reports via RS-232 Connection 41
Connecting Laptop to Console 41
Connecting Laptop to Console 42
Sending Console Commands.....44

6 Maintenance

TLS Console 54
Vapor Flow Meter 54
Vapor Pressure Sensor 54

7 Diagnostic Menus

Smart Sensor Diagnostic Menu 55
Calibrate Smart Sensor Menu 56
ISD Diagnostic Menu 57
VST ECS Membrane Processor Diagnostic Menu 59
Veeder-Root Vapor Polisher Diagnostics 59
Automatic Control.....59
Manual control.....59
Veeder-Root Vapor Polisher PMC Diagnostic Menu 60

Appendix A: Site EVR/ISD Equipment Location Worksheet

Single-Hose Fueling Position Dispensers A-1
Multi-Hose Fueling Position Dispensers A-4

Figures

Figure 1. Example Site Diagram - TLS Console Controlled Vapor Processor 4
Figure 2. TLS console Interface Module Bays 6
Figure 3. V-R Vapor Polisher Connections to TLS Console 8
Figure 4. VST ECS Membrane Processor Connections 9
Figure 5. Hirt VCS 100 Processor Connections to TLS Console 10
Figure 6. External Input Setup For Hirt VCS 100 Processor 12
Figure 7. Smart Sensor Setup 13
Figure 8. Smart Sensor Setup Printout Example 13
Figure 9. EVR/ISD Setup 1 15
Figure 10. EVR/ISD Setup 2 16
Figure 11. EVR/ISD Setup 3 17
Figure 12. Example VST ECS Printout 18
Figure 13. Output Relay Setup for VST ECS Membrane Processor.....19
Figure 14. Output Relay Setup Printout Examples for TLS Console Controlled Processor 19
Figure 15. PMC Setup - VST Processors 20
Figure 16. Site Tank Control Examples 21
Figure 17. Dispenser Control Examples 22
Figure 18. Assigning ISD Shut Down Alarms in Line Leak Disable Setup 23
Figure 19. Example Line leak Disable Setup Printout 24
Figure 20. Assigning ISD Shut Down Alarms in Output Relay Setup 25
Figure 21. Example printout - ISD Alarms Assignments - Output Relay Setup.....26
Figure 22. Assigning ISD Shut Down Alarms in Dispenser Relay Setup 27

Figure 23. Example printout - ISD Hose Alarm Assignments - Dispenser Relay Setup 28
Figure 22. TLS console alarm interface 30
Figure 23. Example Warning posting 31
Figure 24. Example Alarm posting 31
Figure 25. ISD Alarm Override Procedure 32
Figure 26. Printing ISD Reports on Console Printer 37
Figure 27. ISD Status Report Example - TLS console printout 38
Figure 28. ISD Daily Report Example - TLS console printout 39
Figure 29. ISD Monthly Report Example - TLS console printout 40
Figure 30. Connecting laptop to TLS console for serial communication 41
Figure 31. Connection Description window 42
Figure 32. Connect To window 42
Figure 33. Console comm port settings printout example 43
Figure 34. HyperTerminal main window 44
Figure 35. ISD Daily Report Details - Serial to PC Format (Example report with Veeder-Root Polisher) 46
Figure 36. ISD Monthly Status Report - Serial to PC Format (Example report with Veeder-Root Polisher) 47
Figure 37. ISD Alarm Status Report - Serial to PC Format (Example report with Veeder-Root Polisher) 48
Figure 38. VST Vapor Processor Runtime Diagnostics Report - Serial to PC Format 49
Figure 39. V-R Vapor Polisher Runtime Diagnostics Report - Serial to PC Format 49
Figure 40. Vapor Processor Status Report - Serial to PC Format 50
Figure 41. Non-Priority Alarm History Report - Serial to PC Format 51
Figure 42. Priority Alarm History Report - Serial to PC Format 51
Figure 43. Vapor Valve Status Report - Serial to PC Format 52
Figure 44. Smart Sensor Sub Alarm History Report - Serial to PC Format 52
Figure 45. PMC Daily Vapor Polisher Diagnostic Report - Serial to PC Format 53
Figure 46. Smart Sensor Diagnostic Menu 55
Figure 47. Smart Sensor Calibration Menu 56
Figure 48. ISD Diagnostic Menu 57
Figure 49. VST ECS Membrane Processor Diagnostic Menu 59
Figure 50. PMC Diagnostic Menus 60

Tables

Table 1. Vapor Recovery System 2
Table 2. Related Manuals 2
Table 3. ISD Alarm Summary 33
Table 4. Other Alarms 35
Table 5. Wireless Related Sensor Alarms 35
Table 6. Serial Commands for ISD Alarm, Monthly, and Daily Reports 45
Table 7. Vapor Processor Runtime Diagnostic Report Event Codes 50
Table 8. Clear Test Repair Menu 58

1 Introduction

In-Station Diagnostic (ISD) equipment is designed to monitor the collection and containment of vapors by vapor recovery equipment. The ISD software monitors the vapor recovery equipment using the Veeder-Root (V-R) TLS console platform, sensor inputs, and dispenser fuel events. ISD provides test reports, generates alarms following test/equipment failures, and finally, shuts down the site upon the occurrence of designated alarms.

This manual provides instructions to install, setup, and operate the special components of the Veeder-Root ISD system that are not covered in existing documentation shipped with other non-ISD specific V-R equipment (e.g., Mag probes, line leak detection, etc.). The ISD feature is an option for the TLS console platform, and as such, many of the installation/setup/operation instructions for non-ISD specific tasks (e.g., line leak detection) are covered in TLS-3XX supplied literature.

WARNING! Revision or reprogramming of the TLS may require notification of the local Certified Unified Program Agency (CUPA).

Site Requirements

Below are the requirements for all vapor recovery systems except where noted.

- V-R TLS-350R/EMC w/BIR, TLS-350 Plus/EMC Enhanced, TLS-350/EMC and Red Jacket ProMax consoles with ECPUII - install as per TLS-3XX Site Prep manual, setup following instructions in TLS-3XX System Setup Manual.
- A flash memory board (NVMEM203) for ISD software storage - installed on the ECPU2 board in place of the console's 1/2 Meg RAM board - install as per TLS-350 Series Board and Software Replacement Manual, no setup required.
- An available RS-232 module is required for RS-232 access to ISD reports - install as per instructions shipped with module, connect to the port using instructions in this manual.
- An output relay or dispenser relay board is required (either 4-Output Relay module, I/O Combination module) to shut down each Submersible Turbine Pump (STP) or dispenser upon activation of certain ISD alarms (these alarms can also be assigned in Line Leak Disable setup to shut down the STP or dispenser if Line Leak detection feature is installed) - install as per instructions shipped with module or line leak system, setup ISD shut down alarms either using output relays or line leak system following instructions in this manual. Two output relays on either of these two modules are also required for vapor processor motor control - install as per instructions in this manual.
- Dispenser Interface module (DIM) for the type of dispensers installed - install as per installation manual shipped with device, setup following instructions in DIM manual and TLS-3XX Setup Manual. Note: the DIM supplies flow meter event inputs needed for ISD analysis.
- One V-R Mag probe in each of the gasoline tanks being monitored - install as per installation manual shipped with device, setup following instructions in TLS-3XX Setup Manual.
- Smart Sensor module is required to monitor Air Flow Meters and Vapor Pressure Sensor (up to 8 devices per module, or 7 if customer is using Smart Sensor module / embedded pressure). Install and connect following instructions in the Air Flow Meter and Vapor Pressure Sensor installation Guides.
- Air Flow Meters (one for each dispenser) - install as per ISD Flow Meter installation manual shipped with meter, setup following instructions in this manual. Also referred to as Vapor Flow Meters within this manual.
- Vapor Pressure Sensor (one per site) - install as per ISD Pressure Sensor installation manual shipped with sensor, setup following instructions in this manual.
- When monitoring a VST ECS membrane processor a Multi-port controller module is required.

Supported Vapor Recovery Systems

Table 1 lists V-R supported vapor recovery system.

Table 1. Vapor Recovery System

Name	CARB Executive OrderBA
Balance Phase II EVR System including ISD	VR-204

Contractor Certification Requirements

Veeder-Root Contractor Certification Requirements	Installer Certification[6]	ATG Technician Certification[7]	VR Vapor Products Certification[8]
Install[1] ISD	X	X	X
Install PMC	X	X	X
Install CCVP	X	X	X
Install Wireless ISD/PMC	X	X	X
Installation Checkout[2]		X	X
ATG Startup[3] / Training[4] / Service[5]		X	X
ISD Startup / Training / Service			X
PMC Startup / Training / Service			X
CCVP Startup / Training / Service			X
Wireless ISD/PMC Startup / Training / Service			X
Install Pressure Sensor (ATG)	X	X	X
Maintain Pressure Sensor (ATG)		X	X
Calibrate Pressure Sensor (ATG)		X	X
Clear ATG Pressure Sensor Alarm (ATG)		X	X
Clear ISD/PMC Alarms (ISD/PMC)			X

[1]Perform wiring and conduit touting; equipment mounting
[2]Inspect wiring and conduit routing; equipment mounting
[3]Turn power on, program and test the systems
[4]Provide supervised field experience in service techniques and operations
[5]Troubleshoot and provide routing maintenance
[6]UST Monitoring Systems – Installer (Level 1)
[7]Certified UST Monitoring Technician
[8]VR Vapor Products

Warranty Registrations may only be submitted by selected Distributors. Certified installers are required to provide the GDF operator with the completed Equipment Warranty Notice, form 577013-868, for their records.

Related Manuals

The manuals in Table 2 below are shipped with the equipment on the V-R Tech Docs CD-ROM and will be needed to install related equipment.

Table 2. Related Manuals

V-R Manual	Part Number
TLS-3XX Site Prep Manual	576013-879
ISD Balance Flow Meter Installation Guide	IOM 15 VR-204
Vapor Pressure Sensor For Vent Stacks Installation Guide (For Sensor P/N 861190-X0X)	IOM 27 VR-204
Pressure Sensor Installation Guide (For Sensor P/N 331946-001)	IOM13 VR-204

Table 2. Related Manuals

V-R Manual	Part Number
TLS-3XX Series Consoles System Setup Manual	576013-623
TLS-3XX Series Consoles Operator's Manual	576013-610
Serial Comm Modules Installation Guide	577013-528
ISD Troubleshooting Manual	577013-819
TLS-350 Series Board and Software Replacement Manual	576013-637
TLS-350R Point-of-Sale (POS) Application Guide	577013-401
Input/Output Modules Installation	576013-614
TLS RF Wireless 2 System (W2) Installation and Maintenance Guide	577013-964

Safety Precautions

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

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.

WARNING
Heed the adjacent instructions to avoid damage to equipment, property, environment or personal injury.

⚠ WARNING

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

Turn power Off at the circuit breaker. Do not connect the console AC power supply until all devices are installed.

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

Example Site Diagrams

Figure 1 shows an example site with a VST ECS membrane vapor processor. The diagram shows setups unique to ISD which are discussed in this manual (marked with a star), and those setups performed following instructions in the appropriate sections of the TLS-3XX System Setup manual, such as In-Tank setup (marked with a hexagon).

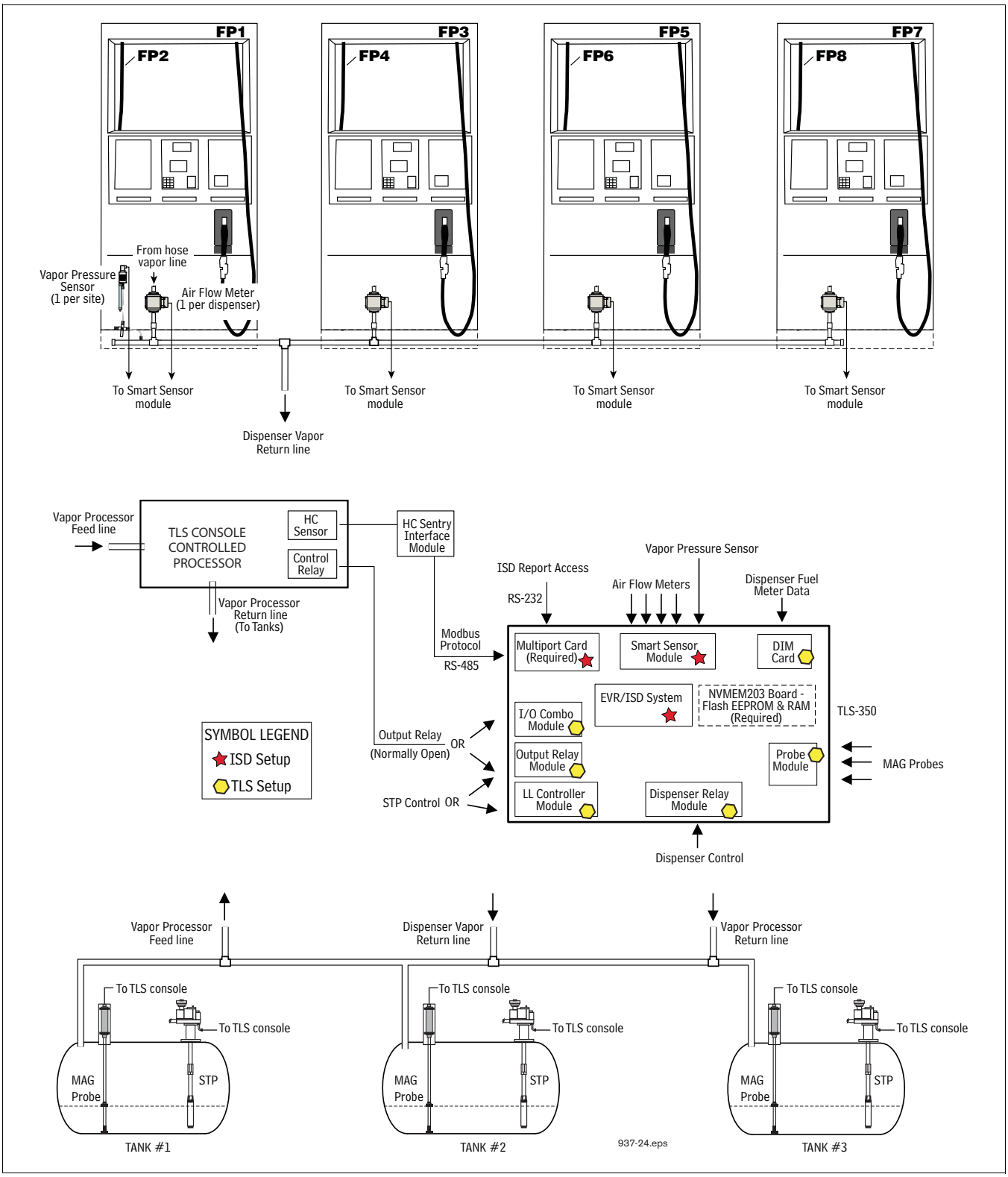


Figure 1. Example Site Diagram - TLS Console Controlled Vapor Processor

2 Installation

This section discusses the installation and wiring of the hardware required to enable the TLS console to perform ISD monitoring of the site's gasoline vapor recovery equipment (non-gas tanks are not monitored):

- Vapor Flow Meter
- Vapor Pressure Sensor
- Smart Sensor Interface Module (8 input and 7 input w/embedded pressure versions)
- NVMEM203 board - required
- 4-Relay Output Module or Dispenser Relay Module or I/O Combination Module
- Line Leak Detection
- Dispenser Interface Module
- Probe Interface Module
- Multi-port Card (for VST ECS Membrane Processor only)

All field wiring, its type, its length, etc., used for TLS console sensors must conform to the requirements outlined in the Veeder-Root TLS-3XX Site Prep manual (P/N 576013-879) and to additional field wiring requirements specified in related connected components, such as for Pressure Sensors.

Vapor Flow Meter

Install one Vapor Flow Meter in the vapor return piping of each gasoline dispenser following the instructions in the ISD Balance Flow Meter Installation guide (IOM 15 VR-204). Program the meter following instructions in this manual.

Vapor Pressure Sensor

Install one vapor pressure sensor as detailed in the applicable Pressure Sensor Installation Guide shown in Table 2. Program the meter following instructions in this manual.

Installing TLS Console Modules - General Notes

TLS consoles have three bays in which interface modules can be installed; Comm bay (left door) and Power and Intrinsically-Safe bays (right door). Smart Sensor modules are installed in the Intrinsically-Safe (I.S.) bay only (Figure 2).

Most consoles will be shipped with modules installed as ordered. If additional features are added at a later date, modules will be field installed.

In all cases, the position of the modules, their respective connectors and the devices wired to the connectors must be recorded to prevent improper replacement during installation or service. A circuit directory for Power and I.S. bay Interface Modules is adhered to the back of the right-hand door for this purpose.

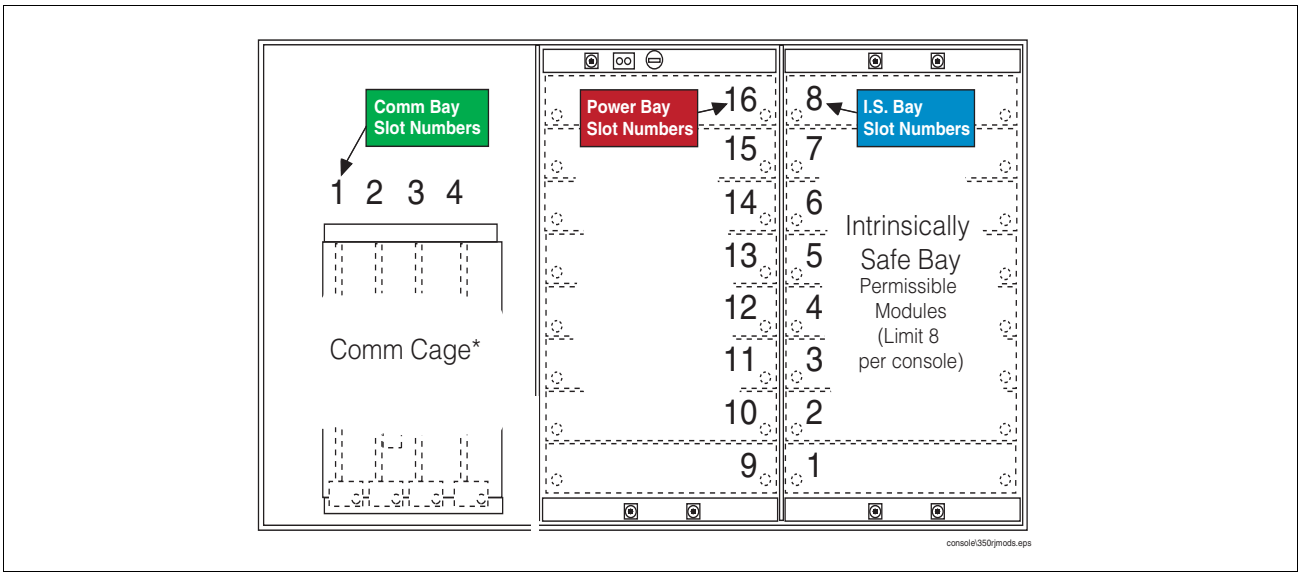


Figure 2. TLS console Interface Module Bays

CAUTION! During programming, module positions and the devices wired to each module are identified and stored in memory. If a connector is removed and reinstalled on a different module after programming, or if an entire module with its connector is removed and reinstalled in a different module slot, the system will not properly recognize the data being received.

Module Position

1. Record on the circuit directory the type of module in each slot location.
2. If a system contains multiple modules of a single type (i.e., two Smart Sensor Modules), they may be swapped between their respective slot locations, however, the connectors must remain with their original locations, not with the original modules.

Connector Position

1. Identify all connectors according to their slot location using the self-adhesive numbering labels furnished with each module. Accurately record on the circuit directory the location of each device wired to the connector as you attach wires to the module.
2. Once a device has been wired to certain terminals on a connector and the system has been programmed, the wires from that device may not be relocated to other terminals without reprogramming the system.

Grounding Probe and Sensor Shields

Connect probe and sensor cable shields to ground at the console only. Do not ground both ends of the shield.

CIRCUIT DIRECTORY

A circuit directory is adhered to the inside of the right-hand door. It should be filled out by the installer as the module's connectors are being wired.

The following information should be recorded for each slot:

- Module Type: record what type of module has been installed in the slot, e.g., Smart Sensor Module.
- Position Record: record the physical location and/or type of device wired to each terminal of the module connector in the slot, e.g., AFM1.

Smart Sensor Interface Module

The Smart Sensor Interface Module 8 input or 7 input w/embedded pressure versions monitor Air Flow Meter (AFM) and Vapor Pressure Sensor (VPS) inputs.

Switch off power to the TLS console while you install modules and connect sensor wiring.

Open the right door of the console and slide the necessary Smart Sensor modules into empty I.S. Bay slots. Connect the field wiring from each of the sensors following instructions in the Flow Meter and Pressure Sensor manuals. Setup the Smart Sensor module(s) following instructions in this manual.

NVMEM203 Board

Verify that a NVMEM203 board is installed in the TLS console (ref. Figure 2-7 in the V-R TLS-3XX Series Consoles Troubleshooting Manual P/N 576013-818, Rev Q or later). This board contains flash EEPROM and RAM needed to run ISD software and store ISD reports. No setup is required.

Site Shut Down Requirements

Normal ISD operation requires TLS console control of the STP in each of the gasoline tanks. If the site has Wireless Pressure Line Leak Detection (WPLLD), Pressure Line Leak Detection (PLLD) or Volumetric Line Leak Detection (VLLD) for each tank, you can use the line leak disable setup to control the vapor recovery tanks (diesel tanks do not require shutdown). If the site does not have line leak detection for all vapor recovery tanks, you can use output relay setup to control each tank. In lieu of line leak detection, install the necessary modules (output relay) to control each gasoline tank. Alternately, you can install Dispenser Relay Modules to control dispensing.

Dispenser Interface Module (DIM)

Verify that a dispenser interface module (DIM) is installed in the TLS console communication bay (ref. Figure 2) and that it is designed to communicate with the type of gasoline dispensers installed at the site. The ISD software requires dispenser fuel flow meter data inputs. Reference TLS-350R Point-of-Sale (POS) Application Guide to select correct DIM card. Refer to the manual shipped with the DIM for installation instructions, refer to the TLS-3XX System Setup manual to program the DIM.

Probe Interface Module

Verify that a Probe Interface Module(s) is installed (Intrinsically-Safe bay) and that a Mag probe is in each gasoline tank and is connected to the module(s). Program the Mag probes following instructions in the TLS-3XX System Setup manual.

I/O Combination or 4-Relay Module

Connect the vapor processor motor control relay to two relays on either the 4-Relay or I/O Combination module as shown in Figure 4.

Multi-Port Card for Vapor Processor Communication

A Multi-port card is needed for RS-485 communication with the TLS console and is required with VST ECS membrane processor installations. Verify that a Multi-port card is installed in slot 4 of the card cage in the communications bay of the TLS console (ref. Figure). When installing this card, refer to the V-R Serial Comm Modules Installation Guide (577013-528) for instructions. Connect this card to the vapor processor as shown in Figure 4. Program the card as instructed in this manual.

TLS Console with V-R Vapor Polisher

Figure 3 shows the interconnection wiring between a TLS console and a V-R Vapor Polisher.

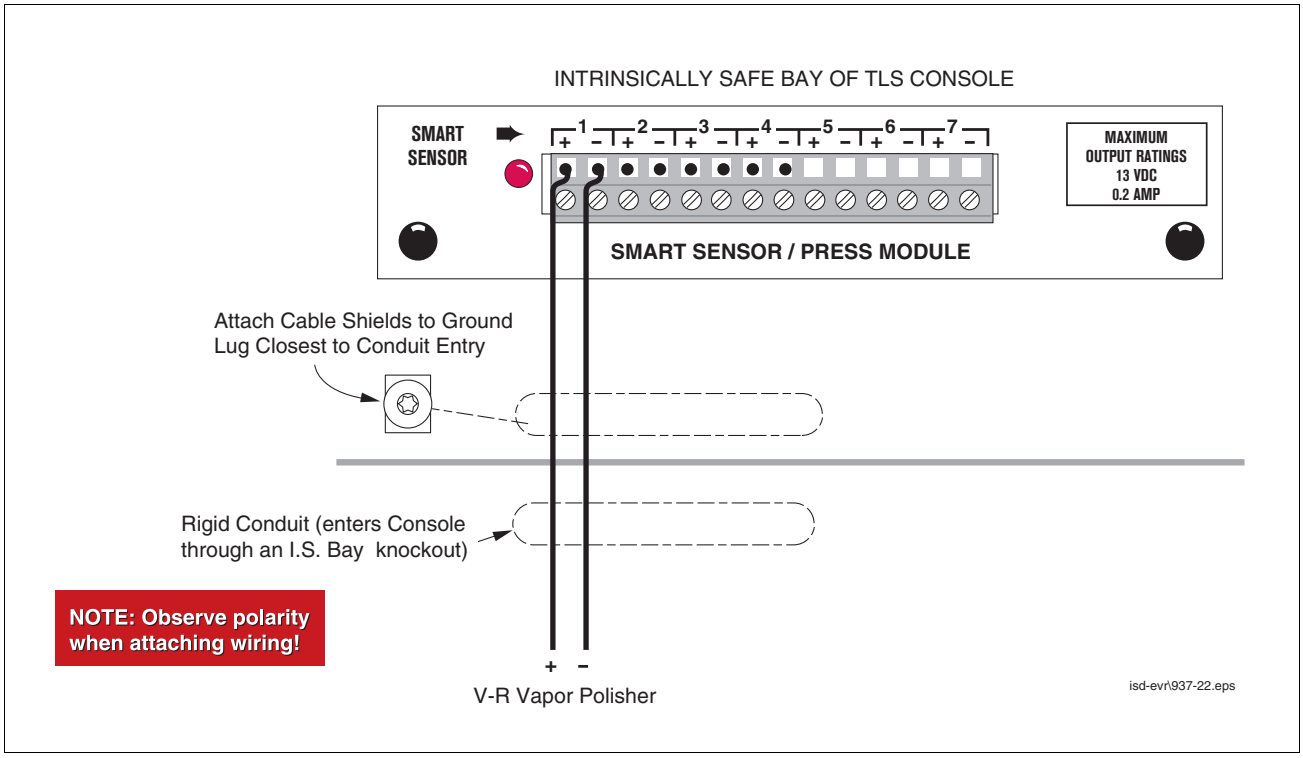


Figure 3. V-R Vapor Polisher Connections to TLS Console

TLS Console with VST Processor

Figure 4 shows the interconnection wiring between a TLS console and a VST ECS Membrane Processor. For VST Green Machine Processor see IOM V204 18.

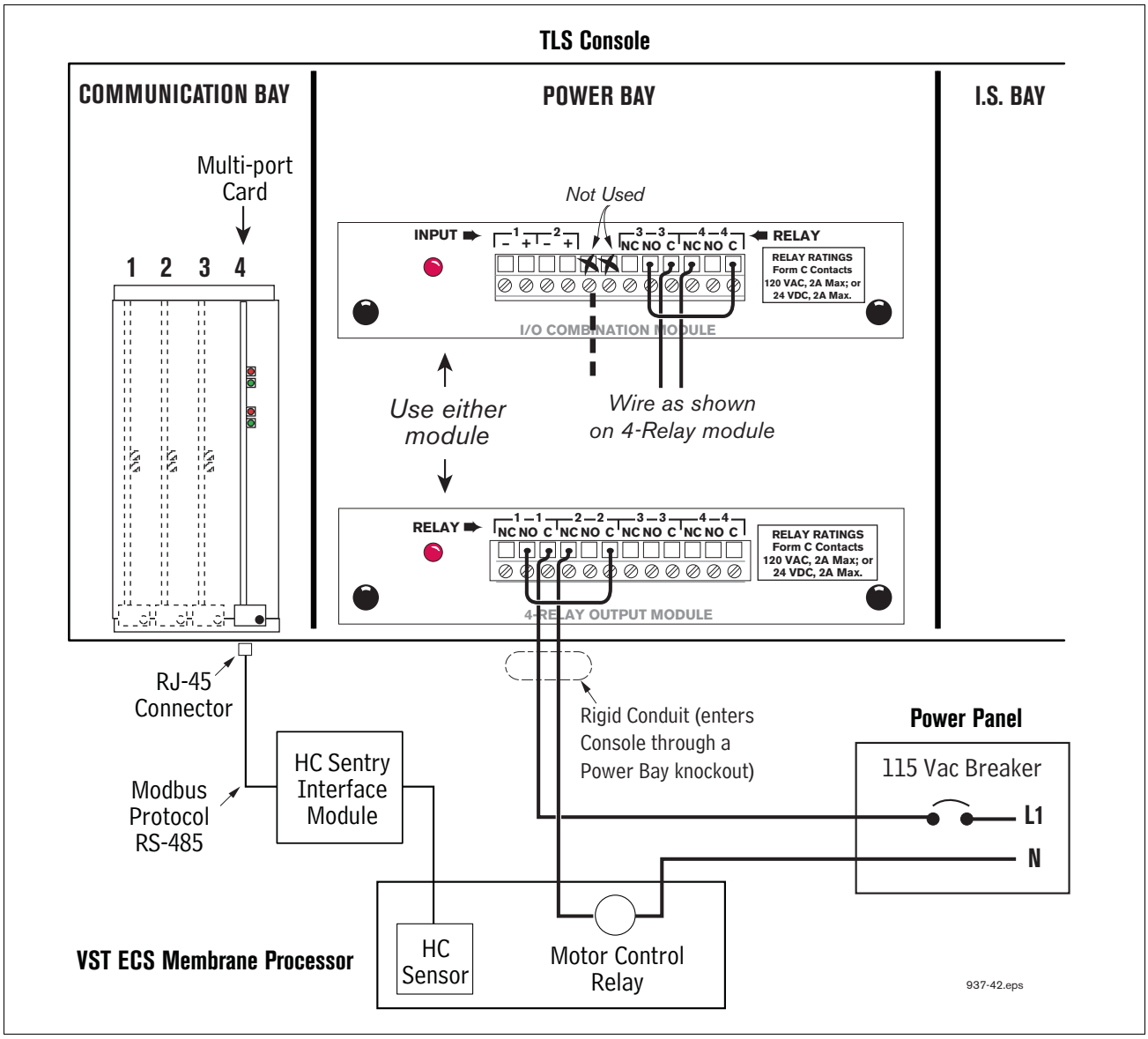


Figure 4. VST ECS Membrane Processor Connections

TLS Console with Hirt VSC 100 Processor

Figure 5 shows the interconnection wiring between a TLS console and a Hirt VCS 100 Processor.

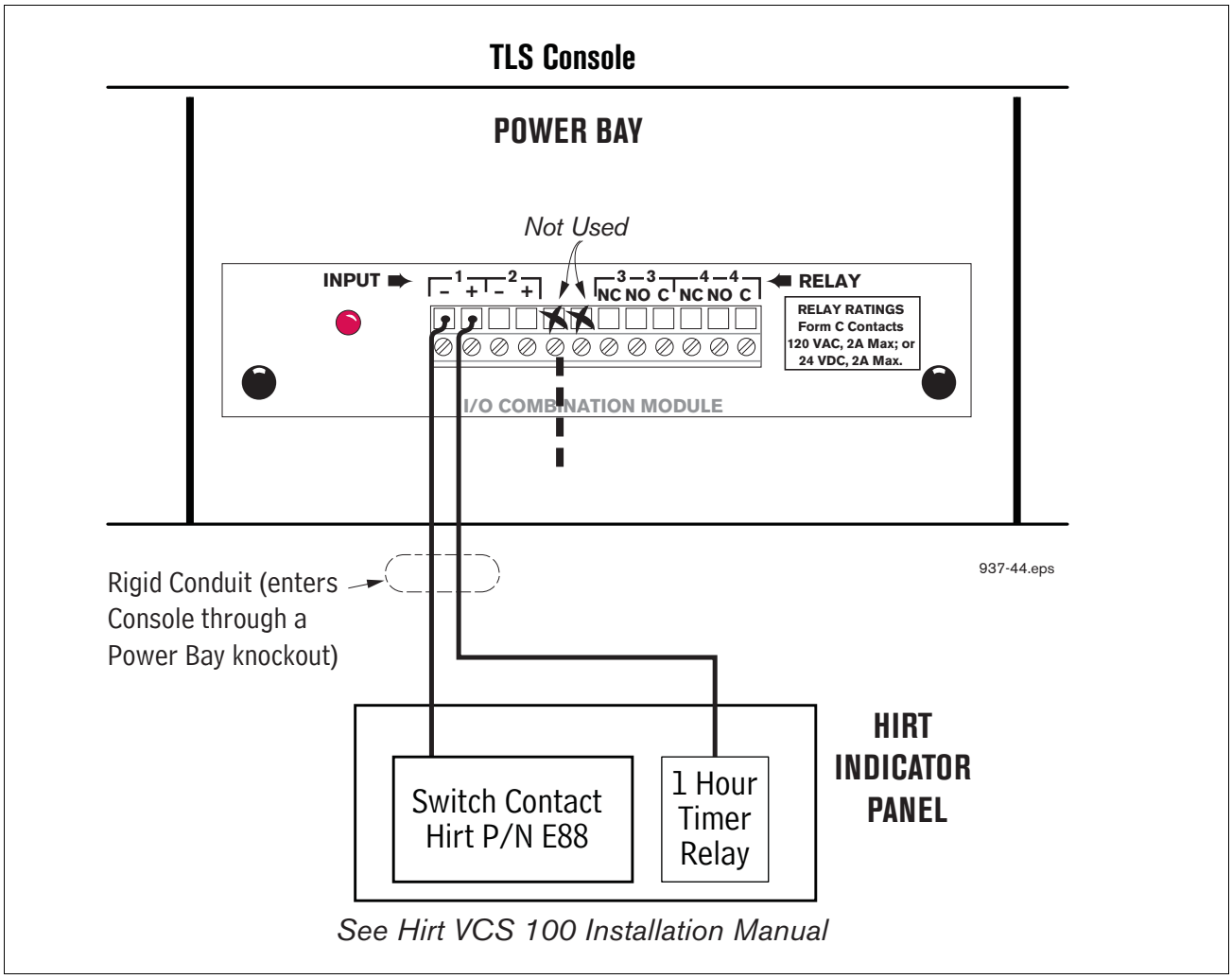


Figure 5. Hirt VCS 100 Processor Connections to TLS Console

3 Setup

Introduction

This section describes how to program the ISD system using the TLS console's front panel buttons and display. The procedures in this manual follow standard TLS console setup programming input, i.e., keypad/display interaction. If necessary, refer to Section 2 of the TLS-3XX System Setup manual (P/N 576013-623) to review entering data via the front panel keypads.

All ISD-related equipment must be installed at the site and connected to the TLS console prior to beginning the setups covered in this section. As with all TLS connections, you cannot change sensor wiring or module slots after programming or the system will not recognize the correct data. Reference the section entitled "Connecting Probe/Sensor Wiring to Consoles" in the TLS-3XX Site Prep and Installation manual (P/N 576013-879) for rewiring precautions.

SYSTEM SETUPS

- External Input Setup - Hirt VCS 100 Processor Only
- Smart Sensor Setup - All ISD site (Figure 7)
  This setup mode function programs the Smart Sensor Interface module to monitor the Air Flow Meters, ATM, Vapor Valve and the Pressure Sensor.
- EVR/ISD Setup - All ISD sites (Figure 9, Figure 10 and Figure 11)
  This setup mode function programs the TLS console for EVR/ISD vapor recovery monitoring and reporting.
- Verify Console Date/Time
  Check the console front panel to confirm display of current date and time. Reset if necessary (refer to current date/current time setups in TLS-3XX System Setup manual).

ALARM SETUPS

One or more TLS setups below must be performed to shut down the tank or the dispenser should certain ISD alarms occur:

- For ISD sites with line leak detection - XLLD Line Disable Setup (go to Figure 18)

  This setup assigns ISD alarms to a line leak detector that will shut down the tank's STP.
- For ISD sites without line leak detection - Output Relay Setup (go to Figure 20)

  This setup assigns ISD alarms to a relay that will shut down the tank's STP.
- For ISD sites with dispenser shutdown - Dispenser Relay Setup (go to Figure 22)

  This setup assigns ISD alarms to a relay that will shut down the dispenser.

External Input Setup - Hirt VCS 100 Processor Only

The I/O Combination Module is installed in the Power bay of the TLS console. Figure 7 diagrams the External Input setup procedure required with the Hirt VCS 100 processor.

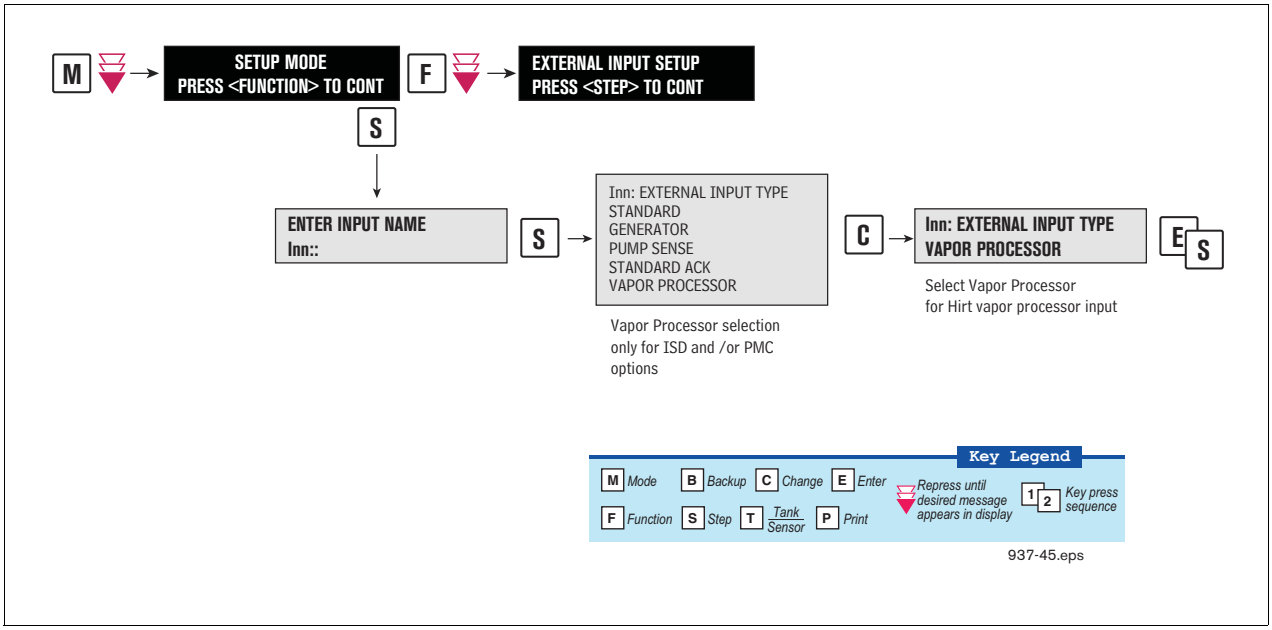


Figure 6. External Input Setup For Hirt VCS 100 Processor

Smart Sensor Setup

The Smart Sensor Interface Module is installed in the Intrinsically-Safe bay of the TLS console. This module monitors Air Flow Meters, ATM, Vapor Valve and the Vapor Pressure Sensor. Figure 7 diagrams the Smart Sensor setup procedure. Figure 8 shows a printout of the Smart Sensor setup.

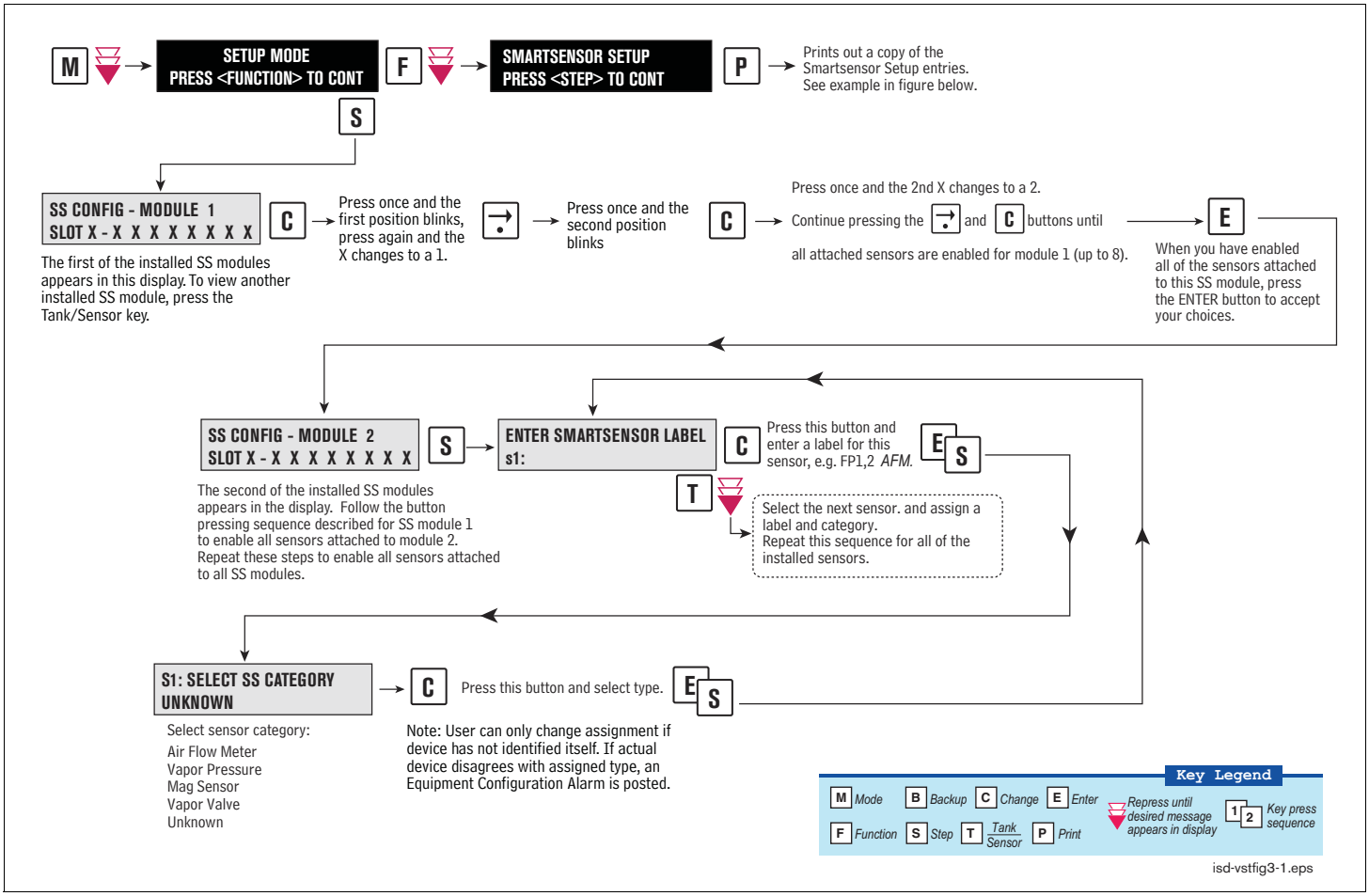


Figure 7. Smart Sensor Setup

```
SMARTSENSOR SETUP
----------------------

S01:FP 1   - 2
CATEGORY AIR FLOW METER

S02:VAPOR PRESSURE
CATEGORY VAPOR PRESSURE
```

isd-evr\sssetprt.eps

Figure 8. Smart Sensor Setup Printout Example

ATM Pressure Sensor Setup

The ATM Pressure Sensor is factory installed in the SmartSensor / Press module and preassigned to channel 8. At least one SmartSensor / Press module, which contains the ATM Pressure Sensor, must be installed in the console. You must configure at least one ATM Pressure Sensor for use by the Vapor Polisher or a PMC Set-up Fail will occur. NOTE: if more than one SmartSensor / Press module is installed, only one ATM Pressure Sensor needs to be configured.

Look in console and note the slot position of the SmartSensor / Press module. Enter the Setup Mode and press the FUNCTION key until you see the message:

SMARTSENSOR SETUP
PRESS <STEP> TO CONTINUE

Press STEP until you see the message:

SS CONFIG - MODULE *n*
SLOT *x* - X X X X X X X X

Where *x* is the slot number containing the SmartSensor / Press module. Press the → key to move the cursor to the last (8th) X. Press CHANGE and the message below should appear:

SLOT *x* - X X X X X X X 8
PRESS <STEP> TO CONTINUE

Press STEP:

ENTER SMARTSENSOR LABEL
s 8:

NOTE: In the example above, the ATM P sensor position is 8 but it could be16, 32, or 40 depending on the SmartSensor's module number.

Press CHANGE and enter a label:

ENTER SMARTSENSOR LABEL
s 8: (ATMP Sensor Label)

Press ENTER to accept your label:

s 8: (ATMP Sensor Label)
PRESS <STEP> TO CONTINUE

Press STEP:

s 8: SELECT SS CATEGORY
UKNOWN

Press CHANGE until you see the message:

s 8: SELECT SS CATEGORY
ATM P SENSOR

Press ENTER to accept the category. Press STEP, then BACKUP to return to the configuration display for Smart Sensor module 1:

SS CONFIG - MODULE 1 SLOT *x* - X X X X X X X X

This completes the ATM Pressure Sensor configuration.

EVR/ISD Setup

You must choose the appropriate data sheet from Appendix A for the vapor recovery system installed at your facility (e.g., Single or Multi-Hose Dispensers) and record in those sheets, all of the unique information from sensors/hose positions, prior to beginning the TLS EVR/ISD set up procedure below.

Figure 9 describes the first of the EVR/ISD setup programming diagrams.

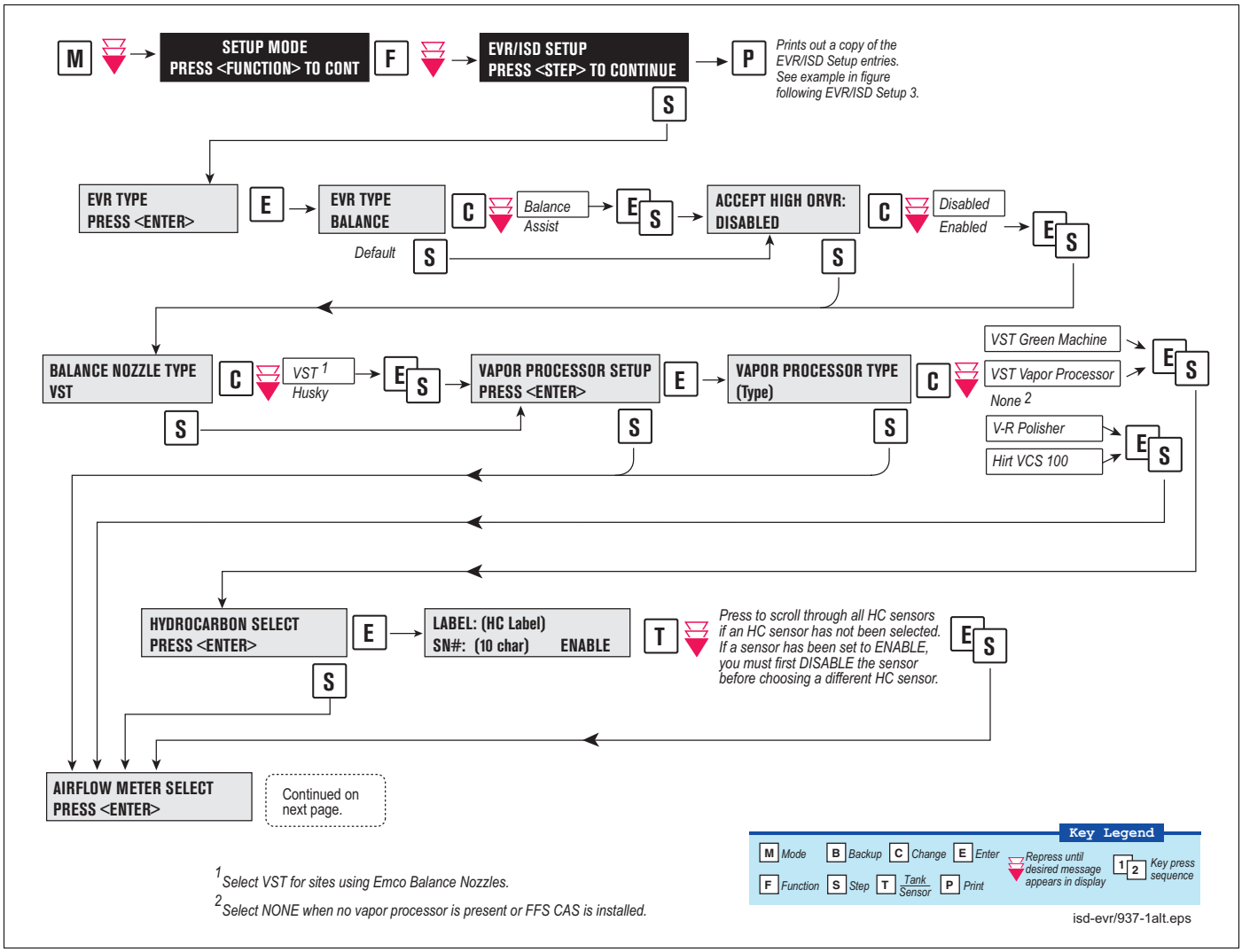


Figure 9. EVR/ISD Setup 1

Figure 10 describes the second of the EVR/ISD setup programming diagrams.

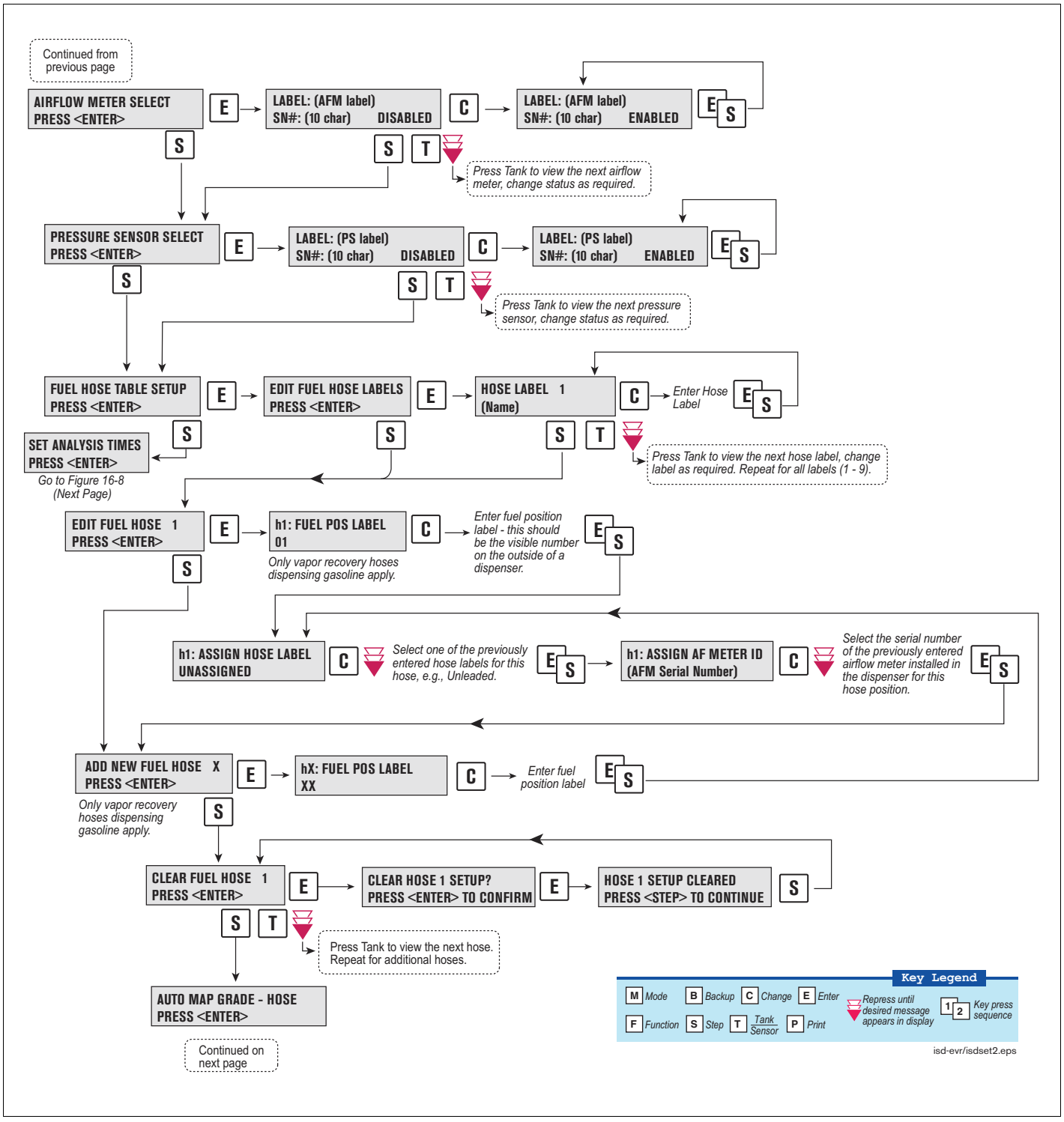


Figure 10. EVR/ISD Setup 2

Figure 11 describes the last of the EVR/ISD setup programming diagrams.

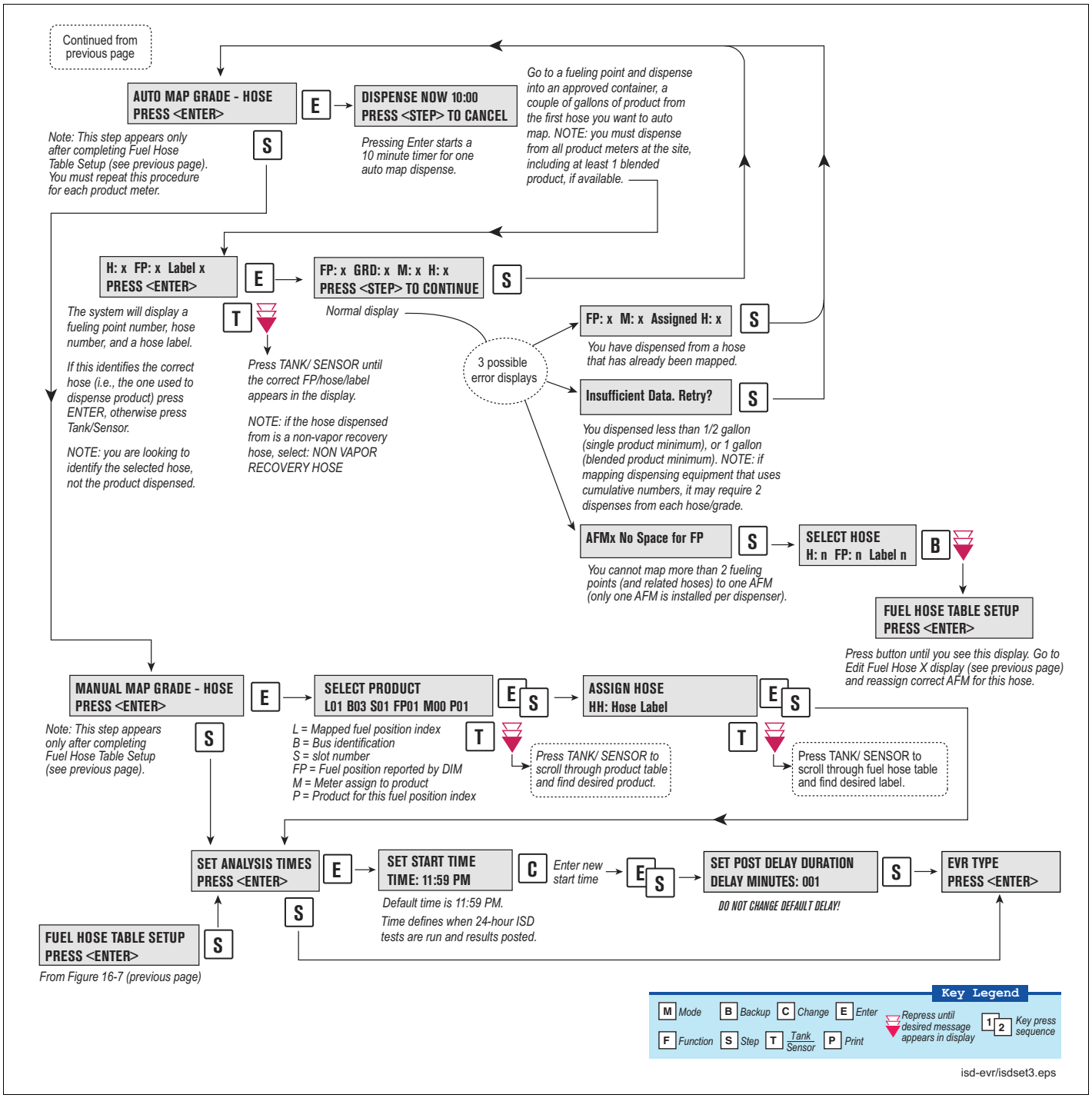
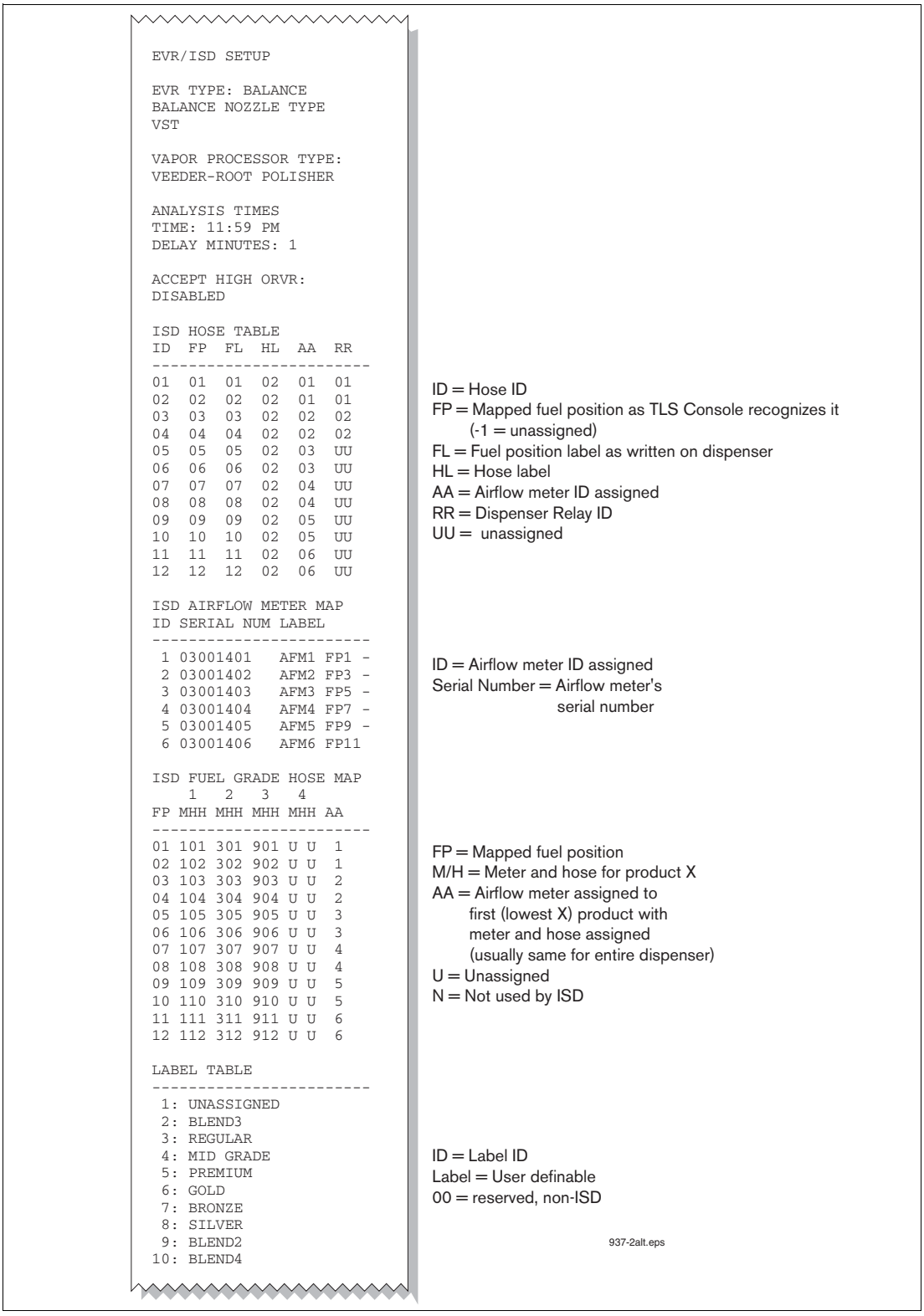


Figure 11. EVR/ISD Setup 3



```
EVR/ISD SETUP

EVR TYPE: BALANCE
BALANCE NOZZLE TYPE
VST

VAPOR PROCESSOR TYPE:
VEEDER-ROOT POLISHER

ANALYSIS TIMES
TIME: 11:59 PM
DELAY MINUTES: 1

ACCEPT HIGH ORVR:
DISABLED

ISD HOSE TABLE
ID  FP  FL  HL  AA  RR
------------------------
01  01  01  02  01  01
02  02  02  02  01  01
03  03  03  02  02  02
04  04  04  02  02  02
05  05  05  02  03  UU
06  06  06  02  03  UU
07  07  07  02  04  UU
08  08  08  02  04  UU
09  09  09  02  05  UU
10  10  10  02  05  UU
11  11  11  02  06  UU
12  12  12  02  06  UU

ISD AIRFLOW METER MAP
ID SERIAL NUM LABEL
------------------------
 1 03001401   AFM1 FP1 -
 2 03001402   AFM2 FP3 -
 3 03001403   AFM3 FP5 -
 4 03001404   AFM4 FP7 -
 5 03001405   AFM5 FP9 -
 6 03001406   AFM6 FP11

ISD FUEL GRADE HOSE MAP
    1   2   3   4
FP MHH MHH MHH MHH AA
------------------------
01 101 301 901 U U  1
02 102 302 902 U U  1
03 103 303 903 U U  2
04 104 304 904 U U  2
05 105 305 905 U U  3
06 106 306 906 U U  3
07 107 307 907 U U  4
08 108 308 908 U U  4
09 109 309 909 U U  5
10 110 310 910 U U  5
11 111 311 911 U U  6
12 112 312 912 U U  6

LABEL TABLE
------------------------
 1: UNASSIGNED
 2: BLEND3
 3: REGULAR
 4: MID GRADE
 5: PREMIUM
 6: GOLD
 7: BRONZE
 8: SILVER
 9: BLEND2
10: BLEND4
```

ID = Hose ID
FP = Mapped fuel position as TLS Console recognizes it
(-1 = unassigned)
FL = Fuel position label as written on dispenser
HL = Hose label
AA = Airflow meter ID assigned
RR = Dispenser Relay ID
UU = unassigned

ID = Airflow meter ID assigned
Serial Number = Airflow meter's serial number

FP = Mapped fuel position
M/H = Meter and hose for product X
AA = Airflow meter assigned to first (lowest X) product with meter and hose assigned (usually same for entire dispenser)
U = Unassigned
N = Not used by ISD

ID = Label ID
Label = User definable
00 = reserved, non-ISD

937-2alt.eps

Figure 12. Example VST ECS Printout

Output Relay Setup - VST ECS Membrane Processor

The Output Relay setup programs an output relay so that the TLS console can switch a controlled vapor processor on and off as shown in Figure 13.

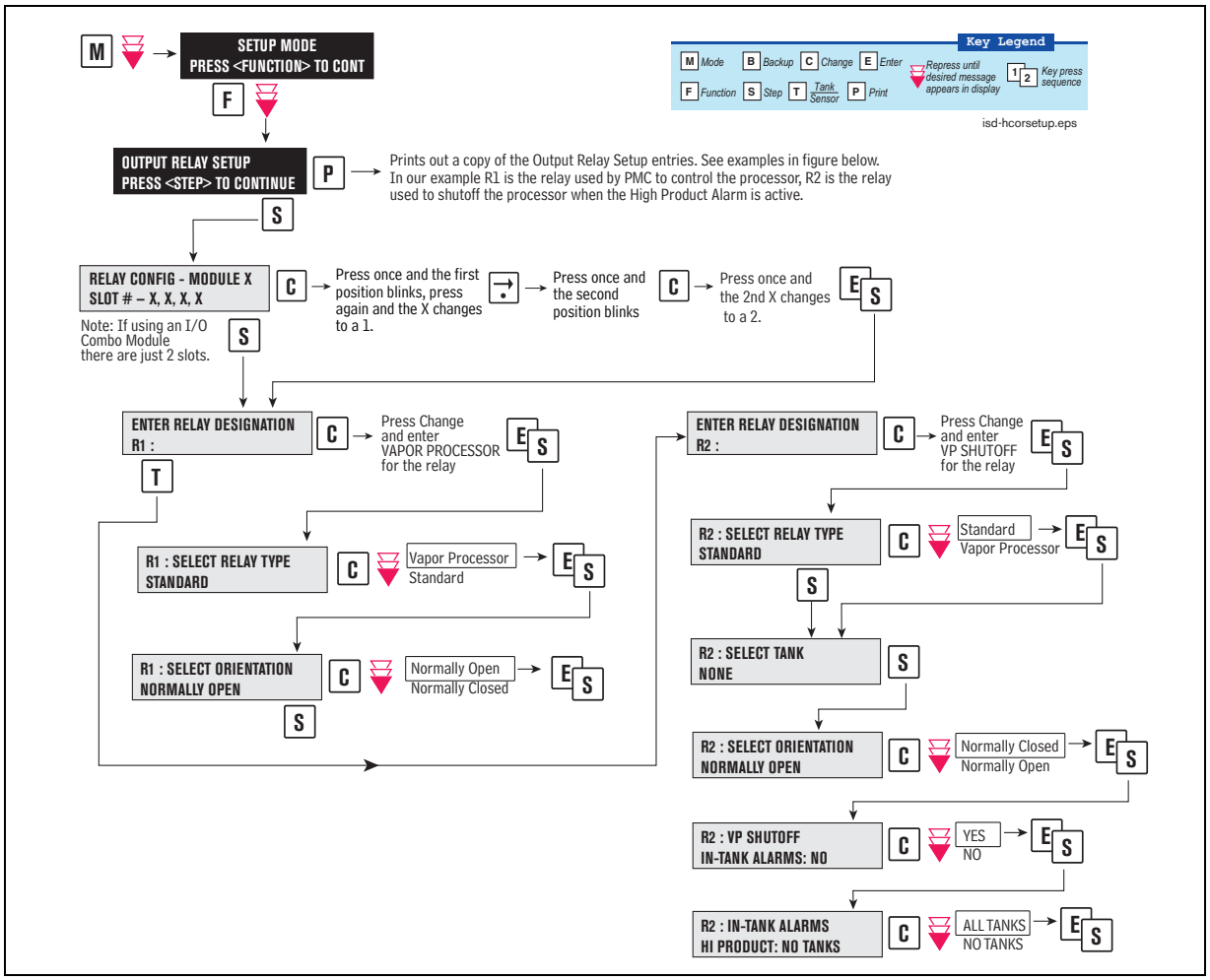


Figure 13. Output Relay Setup for VST ECS Membrane Processor

Figure 14 shows example setup printouts of the Output Relays setup.

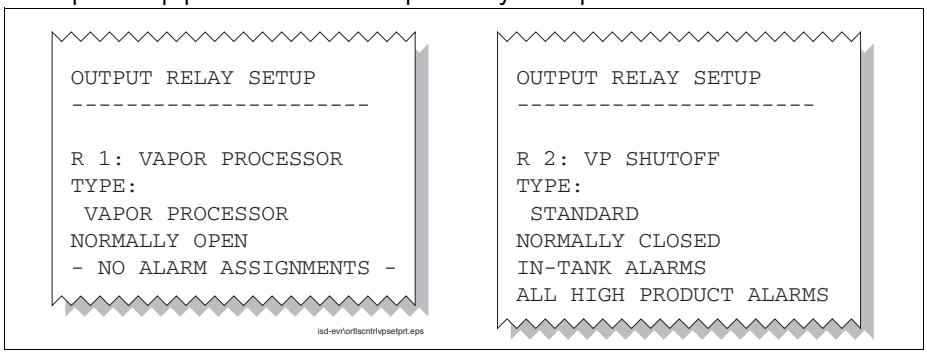


Figure 14. Output Relay Setup Printout Examples for TLS Console Controlled Processor

PMC Setup for VST Processors

PMC setup allows you to select the maximum runtime and the start/stop pressure of TLS console controlled vapor processors (see Figure 15).

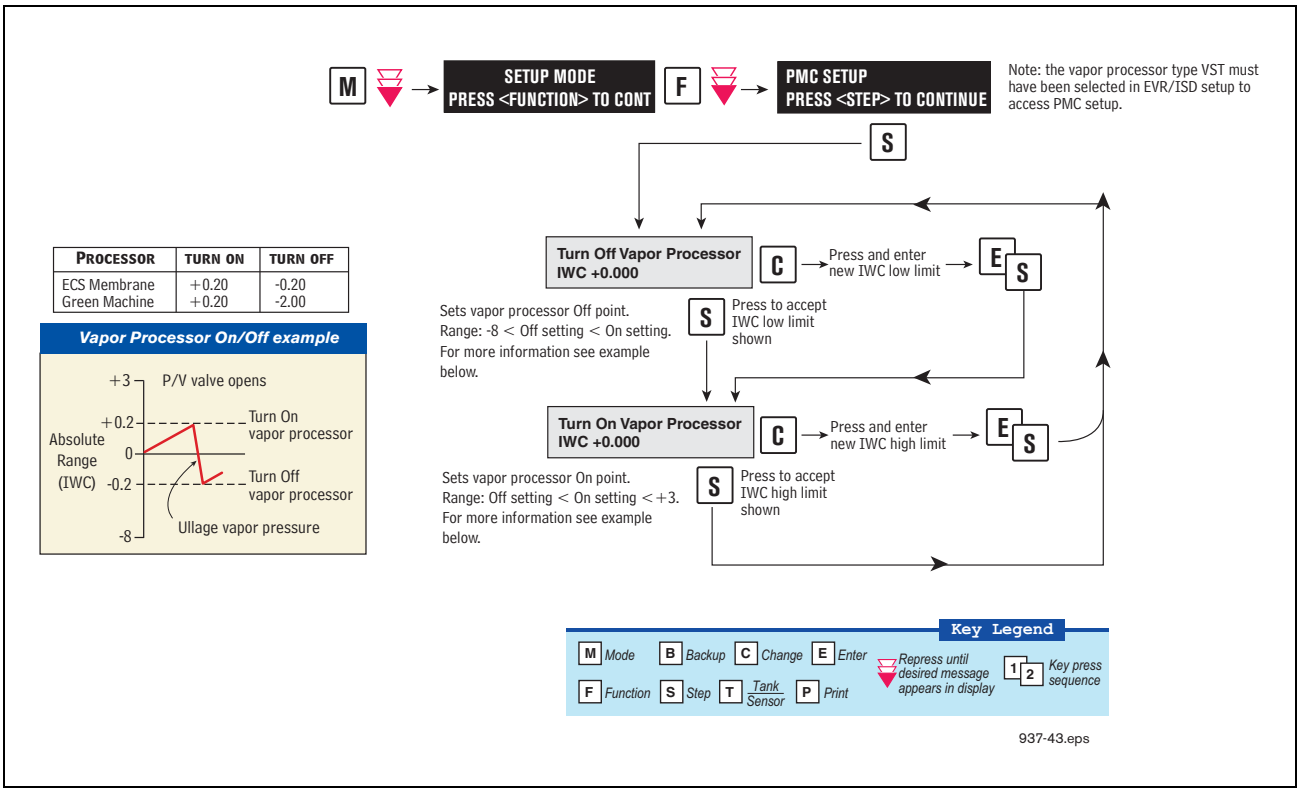


Figure 15. PMC Setup - VST Processors

Alarm Setup

INTRODUCTION

California regulations (VAPOR RECOVERY CERTIFICATION PROCEDURE, CP-201, DATED MAY 25, 2006 CERTIFICATION PROCEDURE FOR VAPOR RECOVERY SYSTEMS AT GASOLINE DISPENSING FACILITIES, Sections 9.1.2) require shut down of dispensing systems that generate specific alarm conditions. To accomplish this, the TLS must be configured to control the gasoline tank's pump (diesel tanks are not monitored) or the gasoline dispensers in order to disable them when ISD shutdown alarm conditions occur. Prior to setting up ISD shut down alarms, you will need to determine how the site's tank pumps or dispensers are controlled. If the site has line leak detection, you can shut down the line (tank) by assigning the ISD alarms in Line Leak Disable setup. In the absence of line leak detection, you can assign the ISD alarms to Output Relays which in turn can be wired to shut down the tank or assign ISD alarms to Dispenser Relays which can be used to shut down the dispenser. Figure 16 illustrates two examples of tank pump control, one using a line leak/output relay combination and one using output relays.

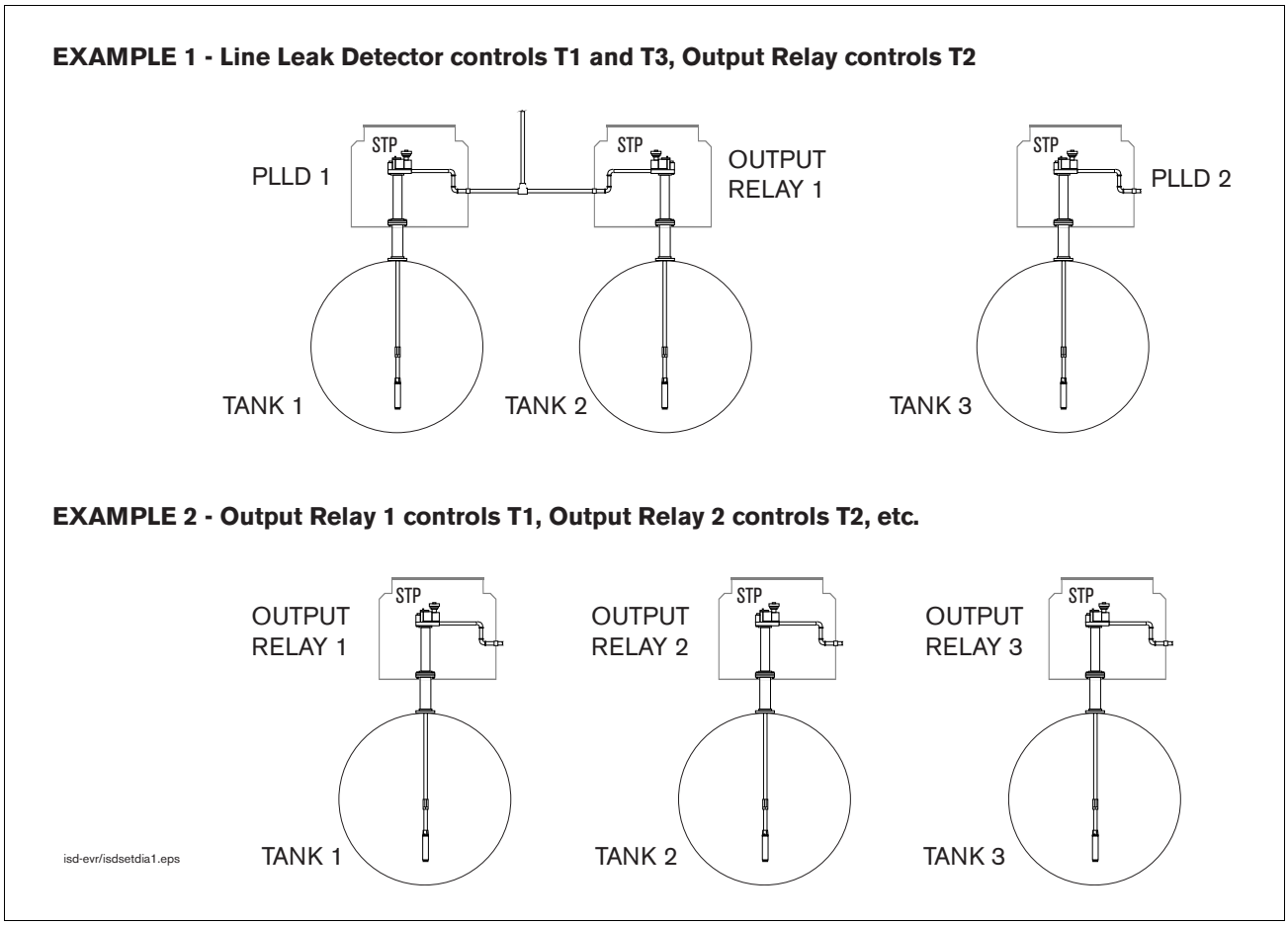


Figure 16. Site Tank Control Examples

Referencing the figure above, in example 1, you would assign the ISD shut down alarms for tank 1 to PLLD 1 in PLLD Line Leak Disable setup, for tank 2 to a relay in Output Relay Setup, and for tank 3 to PLLD 2 in PLLD Line Leak Disable setup. In example 2, you would assign the ISD shut down alarms for tank 1 to output relay 1, tank 2 to output relay 2, and tank 3 to output relay 3.

Figure 17 illustrates two examples of dispenser control using Dispenser Relay modules.

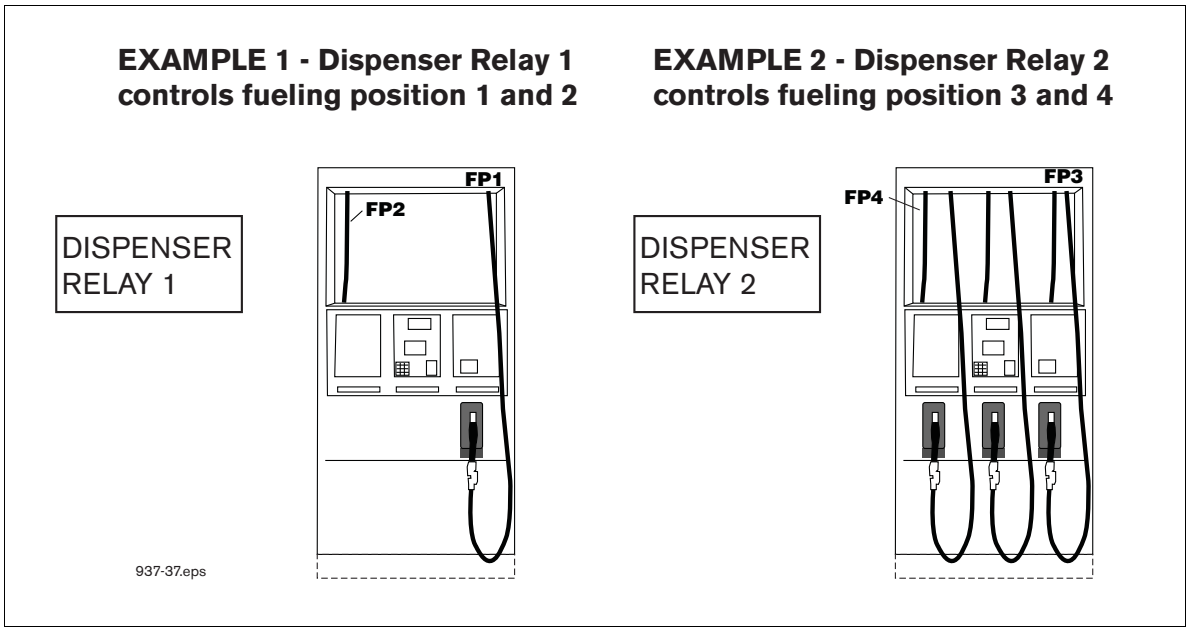


Figure 17. Dispenser Control Examples

You can assign ISD containment shut down alarms to the submersible pump output relays and assign ISD collection alarms to the dispenser relay as shown above.

ALARM SETUP FOR SITES WITH LINE LEAK DETECTION

Figure 18 illustrates the setup steps required to assign ISD Shut Down Alarms to a tank having a line leak detection system installed.

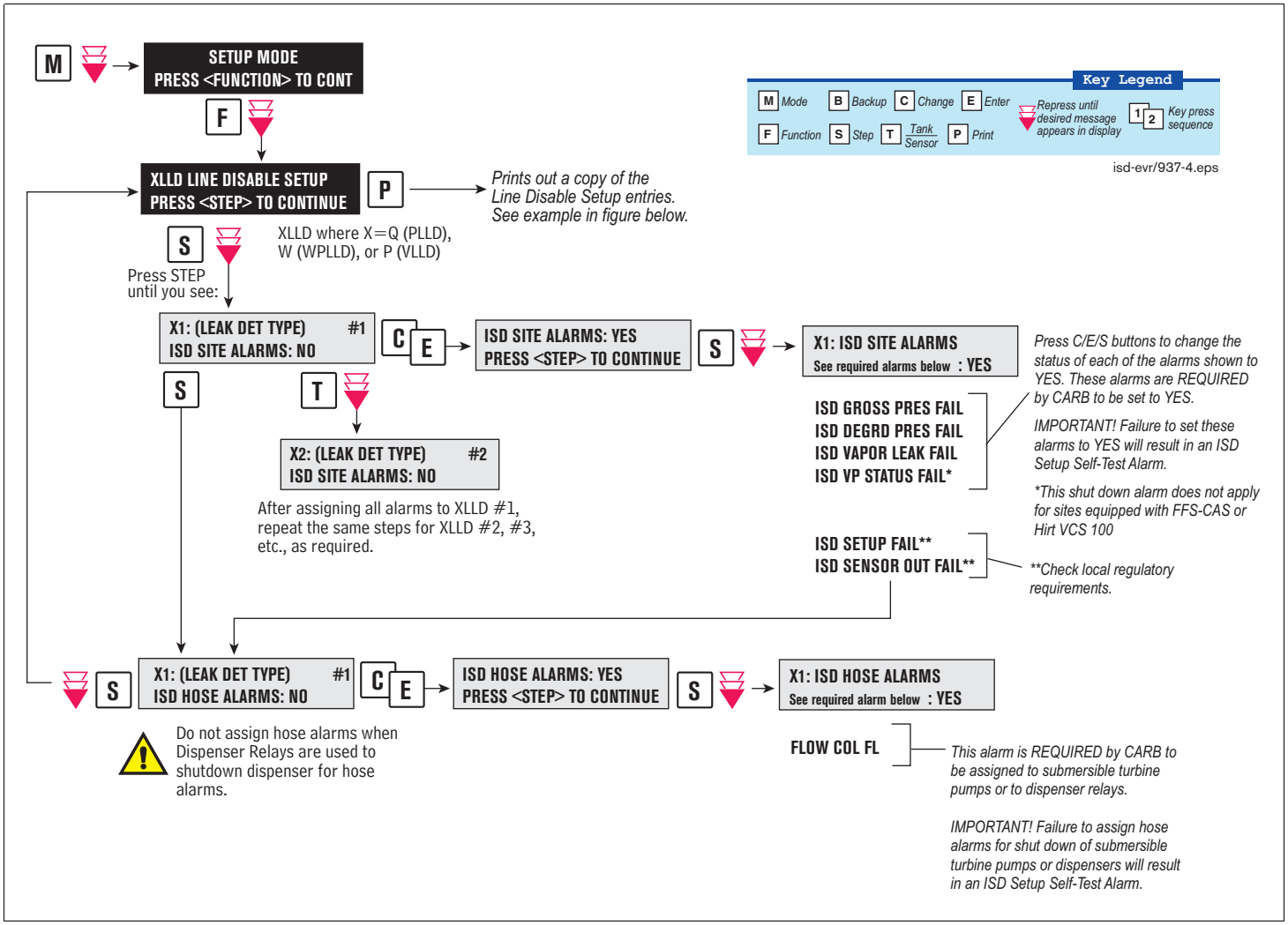


Figure 18. Assigning ISD Shut Down Alarms in Line Leak Disable Setup

Figure 19 shows a resulting printout of the Line Leak Disable setup with ISD alarms assigned when Dispenser Relay modules are not used.

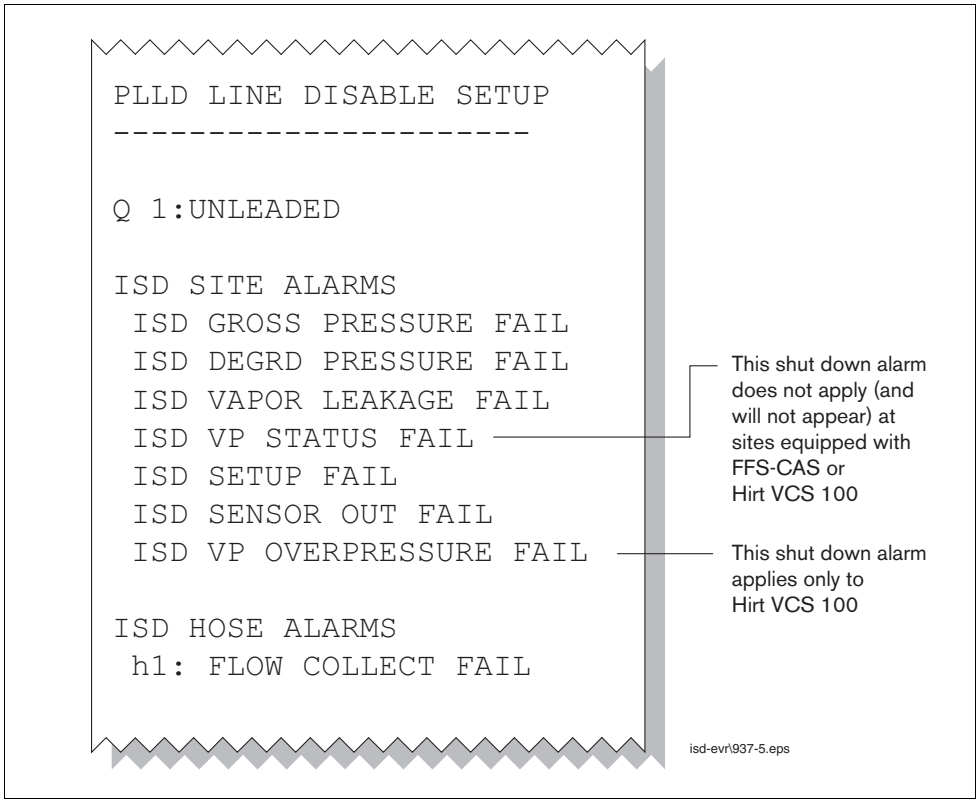


Figure 19. Example Line leak Disable Setup Printout

ALARM SETUP FOR SITES WITHOUT LINE LEAK DETECTION

Figure 20 illustrates the setup steps required to assign ISD Shut Down Alarms to a tank using either a Four Relay Output Module or an I/O Combination Module.

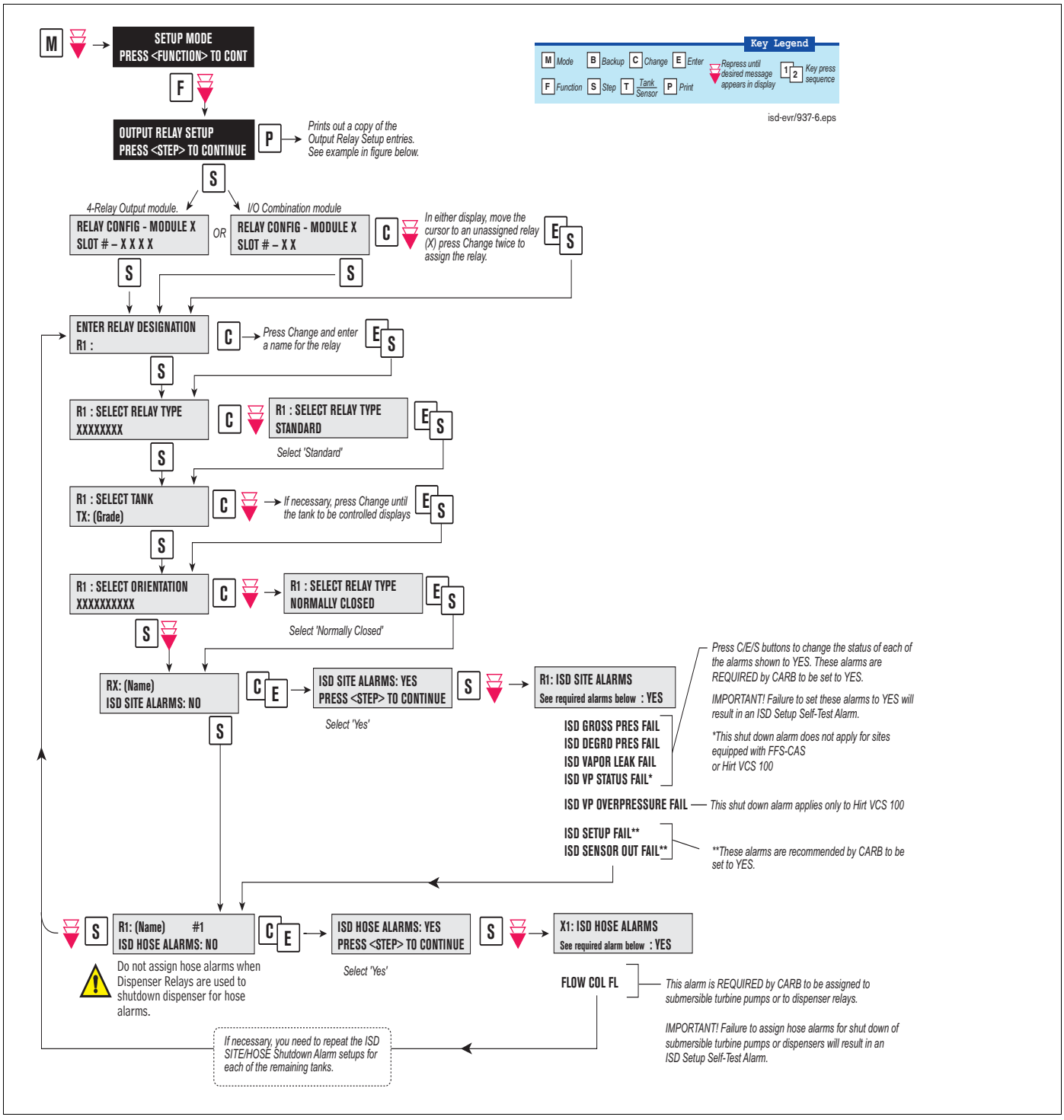


Figure 20. Assigning ISD Shut Down Alarms in Output Relay Setup

Figure 21 shows a resulting printout of the Output Relay setup with ISD alarms assigned when Dispenser Relay modules are not used.

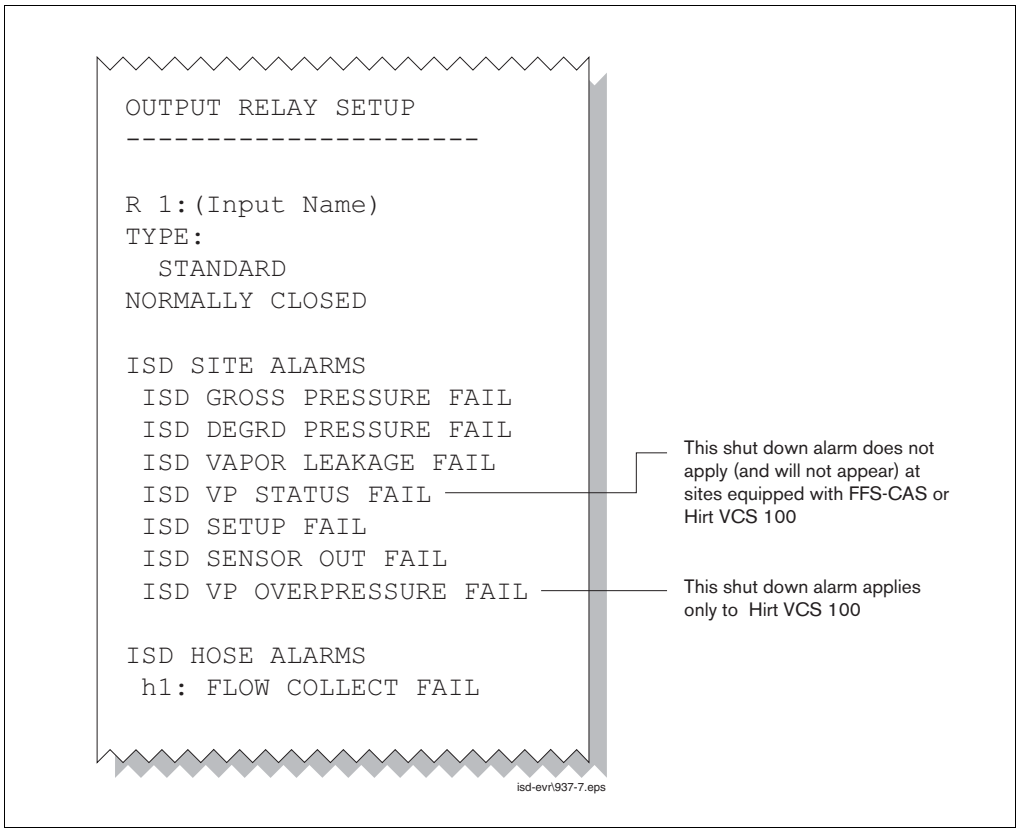


Figure 21. Example printout - ISD Alarms Assignments - Output Relay Setup

ALARM SETUP FOR SITES WITH DISPENSER RELAYS

Figure 22 illustrates the setup steps required to assign ISD Shut Down Alarms to a dispenser using a Dispenser Relay Module.

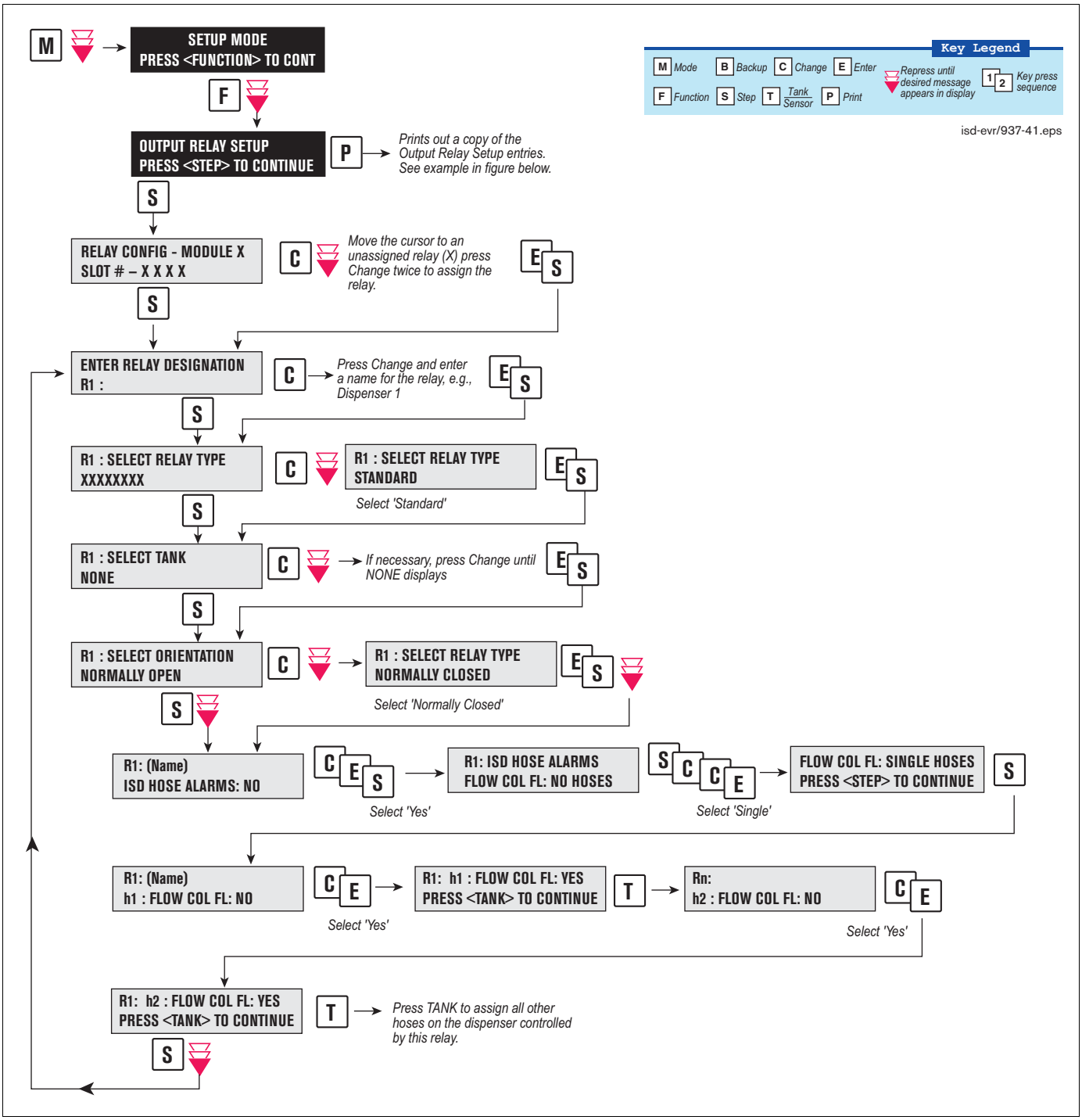


Figure 22. Assigning ISD Shut Down Alarms in Dispenser Relay Setup

Figure 23 shows a resulting printout of the Dispensor Relay setup with ISD hose alarms assigned.

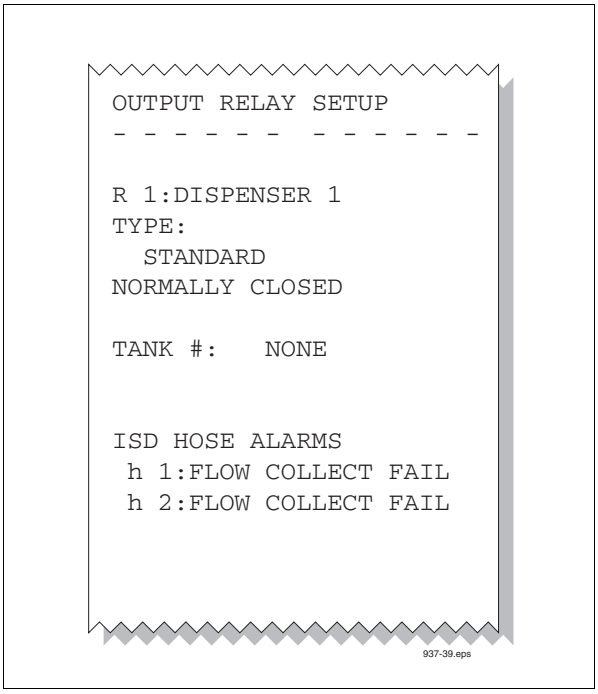


Figure 23. Example printout - ISD Hose Alarm Assignments - Dispenser Relay Setup

4 ISD Operability Test Procedure

The following procedures shall be used at field sites to determine the operability of the Veeder-Root ISD system to satisfy the requirements documented in VAPOR RECOVERY CERTIFICATION PROCEDURE, CP-201, DATED MAY 25, 2006 CERTIFICATION PROCEDURE FOR VAPOR RECOVERY SYSTEMS AT GASOLINE DISPENSING FACILITIES. Testing the ISD equipment in accordance with this procedure will verify the equipment's operability for Vapor Containment Monitoring and Vapor Collection Monitoring.

Veeder-Root's TLS console ISD System Self-Test Monitoring algorithms are designed to verify proper selection, setup and operation of the TLS console modules and sensors and will not complete and report passing test results in the event of a failure of components used in the system. Completed ISD monitoring tests are evidence that:

- The system was properly powered for data collection
- All necessary ISD sensors were setup and connected
- All necessary ISD sensors were operating within specification
- All internal components including TLS console modules were properly setup and operating within specification

Veeder-Root recommends printing a copy of the ISD ALARM STATUS and ISD DAILY report (REF. Section 5, Operation of the ISD Install, Setup & Operation Manual) periodically to determine that compliance tests are being completed in accordance with local and state regulations.

Vapor Pressure Sensor Verification Test

See EO VR 204 Exhibit 10 for the Pressure Sensor Verification Test.

Vapor Flow Meter Operability Test

See EO VR 204 Exhibit 17 for the ISD Vapor Flow Meter Operability Test Procedure.

Vapor Processor Operability Test

See EO VR 204 Exhibit 8 and 9 for the VST ECS Membrane Operability Test.

5 Operation

Alarms

OVERVIEW OF TLS CONSOLE INTERFACE

The TLS console is continuously monitoring the vapor recovery system, PMC and ISD sensors for alarm conditions such as excessively high or low vapor collection, containment system vapor leakage and equipment problems.

During normal operation when the TLS console and monitored EVR/ISD System is functioning properly and no alarm conditions exist, the "ALL FUNCTIONS NORMAL" message will appear in the system status (bottom) line of the console display, and the green Power light will be On (see Figure 22).

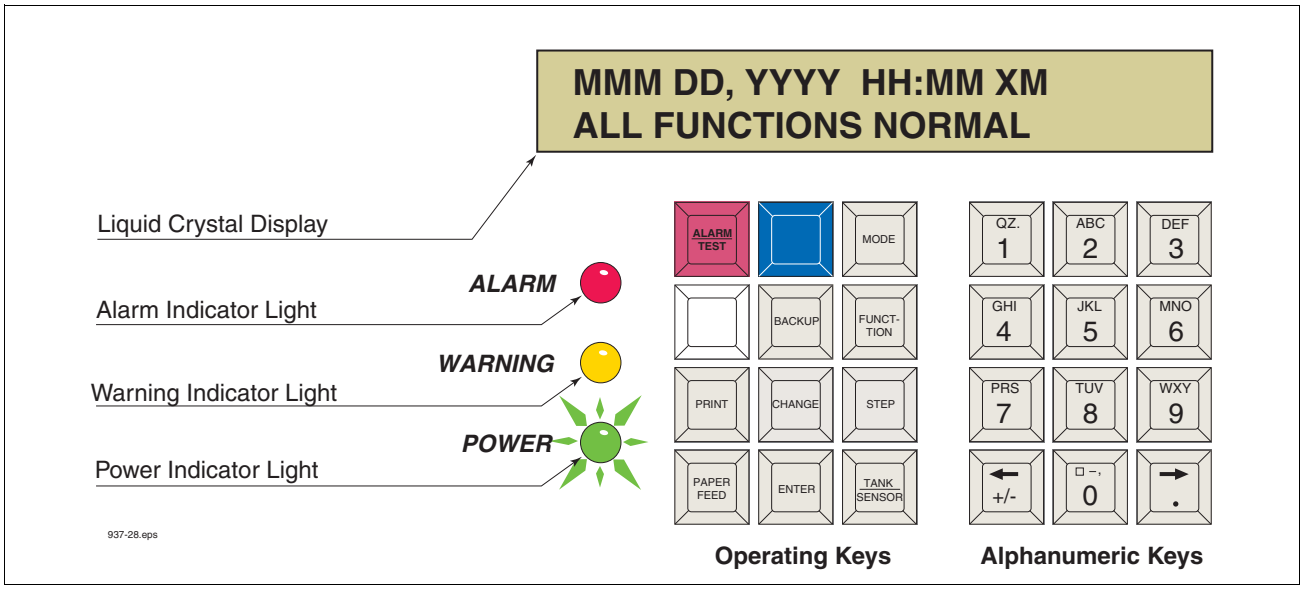


Figure 22. TLS console alarm interface

If an alarm condition occurs the system displays the condition type and its location. If more than one condition exists, the display will continuously cycle through the appropriate alarm messages. The system automatically prints an alarm report showing the alarm type, its location and the date and time the alarm condition occurred.

Warning and alarm posting causes the TLS console-based system to activate warning or failure indicator lights, an audible alarm, and an automatic strip paper printout documenting the warning or alarm. Historical reports of warning and alarm events are available for up to one year.

WARNING POSTING

Displayed messages alert you to the source and type of alarm. Printed messages show the type and location of the alarm. In the Warning example in Figure 23, the display's second line and printed message indicates that the containment system's vapor leak rate has increased above the allowed standard generating a warning.

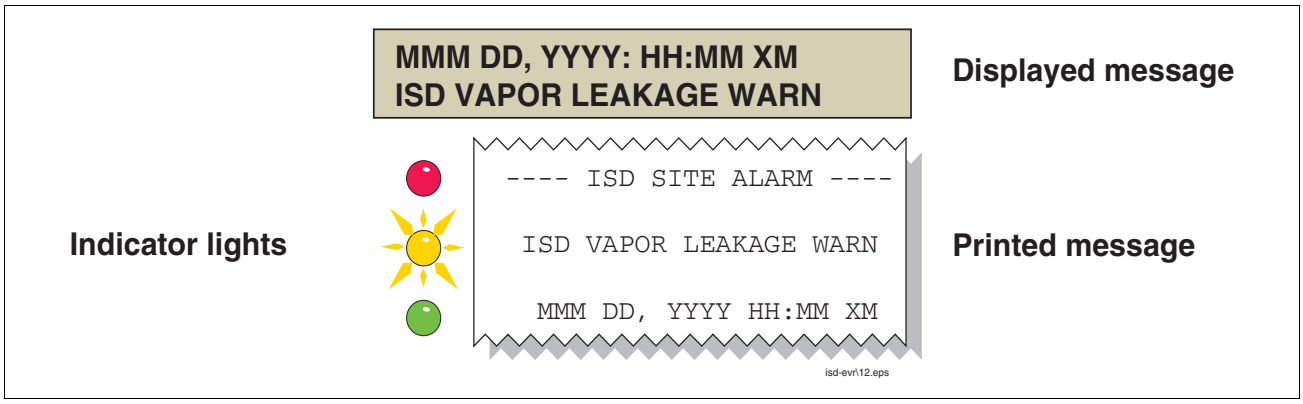


Figure 23. Example Warning posting

The TLS console also logs an entry to the Warning Log upon posting a warning.

ALARM POSTING

Displayed messages alert you to the source/number and type of alarm. Printed messages show the type and location of the alarm. In the alarm example in Figure 24 the display's second line and printed message indicates that vapor collection on hose 1, FP1 Super has dropped below the allowed standard resulting in a failure alarm. (By default, for unihose dispensers, FP1 BLEND3 will be displayed rather than FP1SUPER as shown below.)

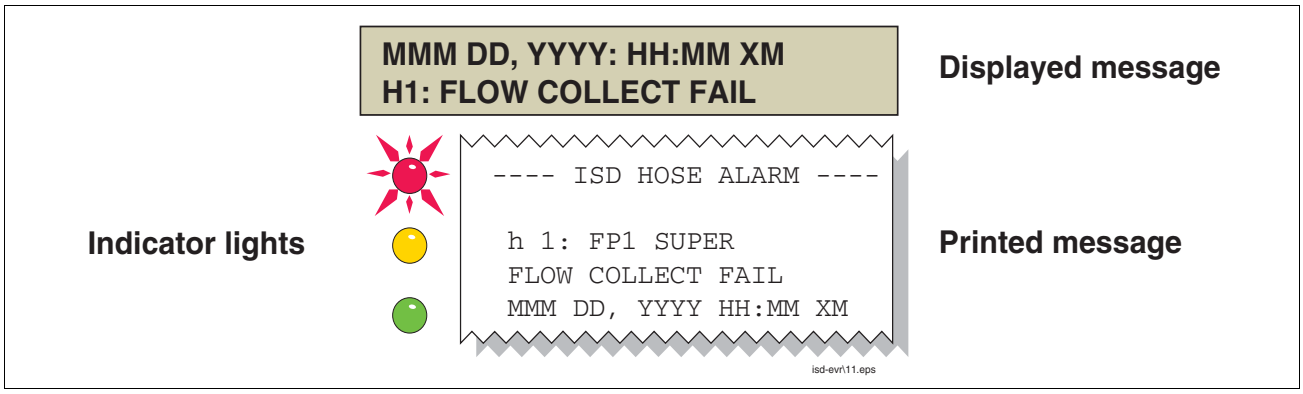


Figure 24. Example Alarm posting

Upon posting a failure alarm, the TLS console logs an entry to the Failure Log, prohibits fuel dispensing from all ISD gasoline fueling points or effected fueling points when dispenser shutdown is enabled and logs a shutdown event to the Shutdown & Misc. Event Log.

ISD can prohibit fuel dispensing from all gasoline fueling points by shutting down the submersible pumps in all gasoline tanks or individual fueling points using dispenser relays. The method of overriding an ISD Alarm shutdown is discussed in the “Site Re-enable” section.

SITE RE-ENABLE

The TLS console ALARM/TEST button allows you to perform a logged shutdown override and resume dispensing. Figure 25 illustrates the ISD alarm override procedure.

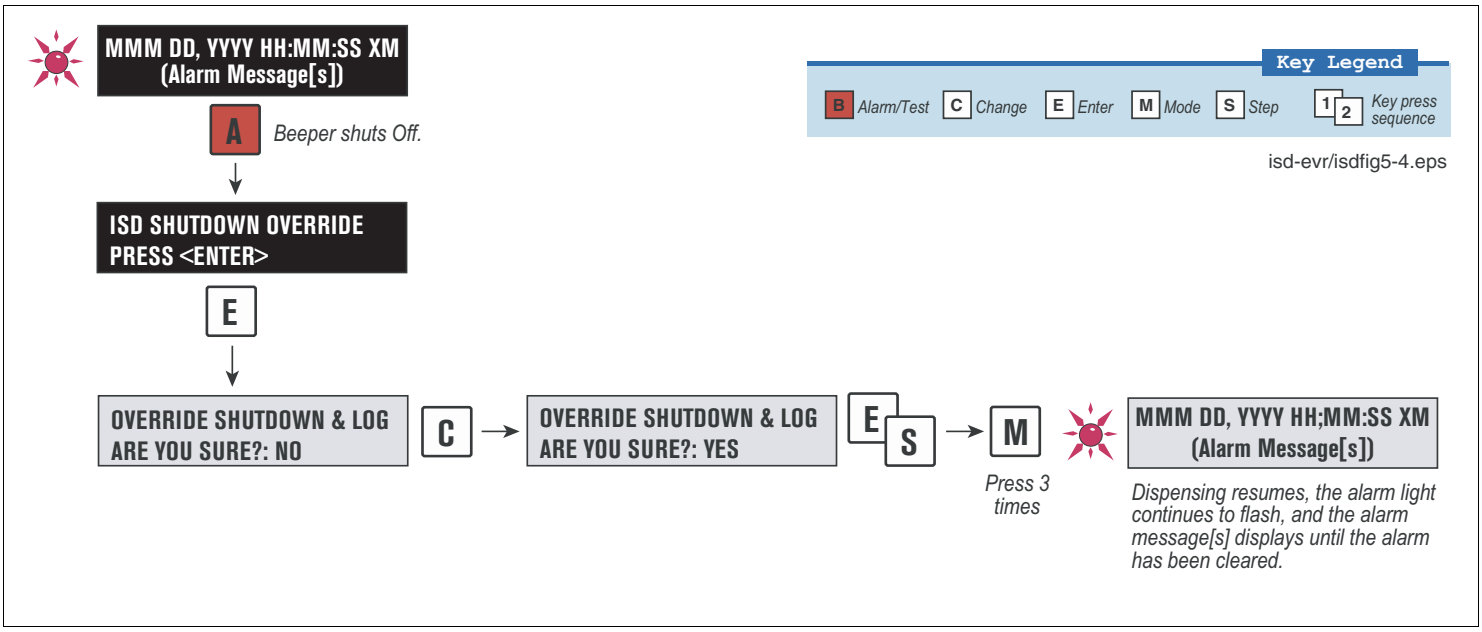


Figure 25. ISD Alarm Override Procedure

ALARM LOGS

Alarms will be recorded in the Warning Log or Failure Log of the monthly reports, which can be viewed electronically or via the integral printer (if queued in the most recent 10 events). The following example shows an excerpt from an electronically accessed monthly report.

Monthly Report Warning & Failure Log Examples:

```
WARNING ALARMS
DATE     TIME     DESCRIPTION                      READING          VALUE
08-03-15 00:01:26 FLOW PERFORMANCE HOSE BLOCKAGE   FP12 BLEND4       BLKD
08-02-17 00:00:49 FLOW PERFORMANCE HOSE BLOCKAGE   FP 1 BLEND4        0.59
08-02-01 00:01:07 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC   22.39
FAILURE ALARMS
DATE     TIME     DESCRIPTION                      READING          VALUE
08-03-14 00:01:26 FLOW PERFORMANCE HOSE BLOCKAGE   FP12 BLEND4       BLKD
08-02-13 00:01:45 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC   36.56
08-02-12 00:01:46 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC   37.74
08-02-11 00:01:57 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC   30.10
```

937-21.eps

ALARM SEQUENCE

Each ISD monitoring test operates once each day on sensor data gathered over a fixed time interval and with a minimum required number of monitored events. The interval is a fixed number of calendar days depending on the test being run. As an example, the ISD Gross Pressure Containment Monitoring test requires seven calendar days of data. In this example, each daily test result represents a test based on the prior seven days' time period. When a test first fails, a warning is posted and a warning event is logged. If this condition persists for seven more consecutive days, an alarm is posted, a failure alarm event is logged and the site is shutdown. If the condition continues, additional failure events are logged and the site will continue to be shutdown each day.

ISD Alarm Summary

Table 3 summarizes the ISD Alarms - Alarms with a superscript 2 will result in a site shutdown.

Table 3. ISD Alarm Summary

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD VAPOR LEAKAGE WARN	Containment	Yellow	Containment system leaks at 2 times the TP-201.3 standard	• Troubleshooting Guide www.vsthose.com/carbs_components.aspx • Exhibit 4 • Exhibit 14 (when FFS-CAS is installed)
ISD VAPOR LEAKAGE FAIL[2]	Containment	Red	8th Consecutive Failure of Pressure Integrity (Vapor Leak) Test	
ISD GROSS PRESSURE WARN	Containment	Yellow	95th percentile of 7-days' ullage pressure exceeds 1.3 IWC	• VST Processor - Troubleshooting Guide www.vsthose.com/carbs_components.aspx - Exhibit 9 - Exhibit 10 - Check pressure sensor ball valve for correct position. • FFS-CAS Troubleshooting - Check FFS-CAS ball valves for correct positions. • Veeder Root Polisher - Check vent statck ball valve for correct position. - Check pressure sensor ball valve for correct position
ISD GROSS PRESSURE FAIL[2]	Containment	Red	8th Consecutive Failure of Gross Containment Pressure Test	
ISD DEGRD PRESSURE WARN	Containment	Yellow	75th percentile of 30-days' ullage pressure exceeds 0.3 IWC	
ISD DEGRD PRESSURE FAIL[2]	Containment	Red	31st Consecutive Failure of Degradation Pressure Test	
hnn: FLOW COLLECT WARN	Collection	Yellow	Vapor collection flow performance is less than 50%	• Troubleshooting Guide www.vsthose.com/carbs_components.aspx • Exhibit 5 • Exhibit 6 • Exhibit 17
hnn: FLOW COLLECT FAIL[2]	Collection	Red	2nd Consecutive Failure of Vapor Collection Flow Performance Monitoring Test	

Table 3. ISD Alarm Summary

Displayed Message	ISD Monitoring Category	Light Indicator	Description	Suggested Troubleshooting[1]
ISD VP STATUS WARN[4, 5, 6, 8.]	Processor	Yellow	Failure of Vapor Processor Effluent Emissions or Duty Cycle test	• Troubleshooting Guide www.vsthose.com/carbs_components.aspx • VP Emission Test • VP Duty Cycle Test
ISD VP STATUS FAIL[2, 4, 5, 6, 8]	Processor	Red	2nd Consecutive Failure of Vapor Processor Status test	
VP EMISSION WARN[3, 4, 5, 6, 8]	Processor	Yellow	Mass emission exceeded the certified threshold	• Troubleshooting Guide www.vsthose.com/carbs_components.aspx • Exhibit 8 • Exhibit 9 • Exhibit 11
VP EMISSION FAIL[3, 4, 5, 6, 8]	Processor	Red	2nd Consecutive Mass emission test failure	
VP DUTY CYCLE WARN[3, 4, 8]	Processor	Yellow	Duty cycle exceeds 18 hours per day 0r 75% of 24 hours	• Troubleshooting Guide www.vsthose.com/carbs_components.aspx • PMC Setup Procedure • Exhibit 4 • Exhibit 9 • Exhibit 10
VP DUTY CYCLE FAIL[3, 4, 7, 8]	Processor	Red	2nd Consecutive Duty Cycle Test Failure	
ISD SENSOR OUT WARN	Self-Test	Yellow	Failure of Sensor Self-Test	• Confirm ISD sensor & module installation / communication per VR 204 IOM Section 12, Chapter 2
ISD SENSOR OUT FAIL	Self-Test	Red	8th Consecutive Failure of Sensor Self-Test	
ISD SETUP WARN	Self-Test	Yellow	Failure of Setup Test	• Confirm EVR/ISD programming per VR 204 IOM Section 12
ISD SETUP FAIL	Self-Test	Red	8th Consecutive Failure of Setup Test	
ISD VP PRESSURE WARN[9]	Processor	Yellow	90th percentile of 1 day ullage pressure exceeds 2.5 IWC.	Exhibit test for HIRT
ISD VP PRESSURE FAIL[9]	Processor	Red	2nd consecutive failure of Vapor Processor Overpressure Test.	

[1]See ISD Troubleshooting Manual, P/N 577013-819, and the VST ISD Troubleshooting Guide 9513-003 found at www.vsthose.com for a complete list of suggestions.

[2]ISD Shutdown Alarms - see “Site Re-enable” on page 31.

[3]This warning will result in an ISD VP Status Warn.

[4]VST ECS Membrane Processor.

[5]Veeder-Root Polisher

[6]VST Processor

[7]This failure will result in an ISD VP STATUS FAIL.

[8]Does not apply to FFS-CAS or Hirt VCS 100 processor or VST Green Machine.

[9]Hirt VCS 100

Other Alarms

Table 4 summarizes additional alarms that may be posted by ISD related equipment. These alarms are not critical to vapor recovery functionality, but could indicate erroneous setup or equipment malfunction. NOTE: Additional TLS console alarms listed in the TLS-3XX Operator's manual may be posted and may lead to an ISD shutdown alarm if persistent (see ISD Troubleshooting Manual for details). Table 5 lists wireless related sensor alarms.

Table 4. Other Alarms

Displayed Message	Light Indicator	Set Condition	Clear Condition
MISSING RELAY SETUP	Red	One or more required shutdown alarms have not been assigned to a relay.	Setup required shutdown alarms.
MISSING TANK SETUP	Red	There are no vapor recovery (gasoline) tanks defined or a gasoline pump has not been assigned to a control (shut down) device in at least one tank.	Complete gasoline tank setup.
MISSING HOSE SETUP	Red	There are no product meters assigned to a hose.	Assign at least 1 product meter to a hose.
hnn: VPRFLOW MTR SETUP	Red	Incoming transaction from a hose with an unavailable Vapor Flow Meter.	Configure Vapor Flow Meter (Smart Sensor) and enable it in ISD.
MISSING VAPOR PRES SEN	Red	There is no Vapor Pressure Sensor setup or detected.	Complete Vapor Pressure Sensor setup.
MISSING VAPOR FLOW MTR	Red	There is no Vapor Flow Meter setup or detected.	Complete Vapor Flow Meter setup.
fnn: CHK VAPOR FLOW MTR	Red	Failure of locked rotor test - possible locked vapor flow meter.	Locked rotor test passes or vapor flow meter deconfigured, or test cleared.

Table 5. Wireless Related Sensor Alarms

Displayed Message	Device	Light Indicator	Desription	Suggested Troubleshooting
BATTERY WARNING	Vapor Valve, Vapor Flow Meter	Yellow	Device transmitter reports battery status as 'Replace' for 24 hours	Remove and replace battery pack

Reports

There are two main reports (CP-201 required) that are stored by the ISD system: the Monthly Status Report, stored for 12-months, and the Daily Status Report, stored for 365 days. A third report discussed in this section is the ISD Status Report. You can print out ISD reports from the TLS console front panel as shown in Figure 26.

- The monthly report includes:
  - ISD operational up-time (as a percentage)
  - EVR/ISD system pass time (as a percentage)
  - The Warning Log
  - The Failure Log
  - The Misc. Event Log
- The daily report includes:
  - Maximum and minimum ullage pressures
  - Results of the Vapor Containment Monitoring Gross (75th percentile), Degradation (95th percentile) ullage pressure test and Vapor Leakage Detection (CVLD) tests
  - Vapor Collection Monitoring test results for each fueling position
  - Vapor Processor Monitoring test results
- ISD Status Report
  - Last test report results

VIEWING ISD REPORTS

You can print out ISD reports from the TLS console front panel as shown in Figure 26.

.

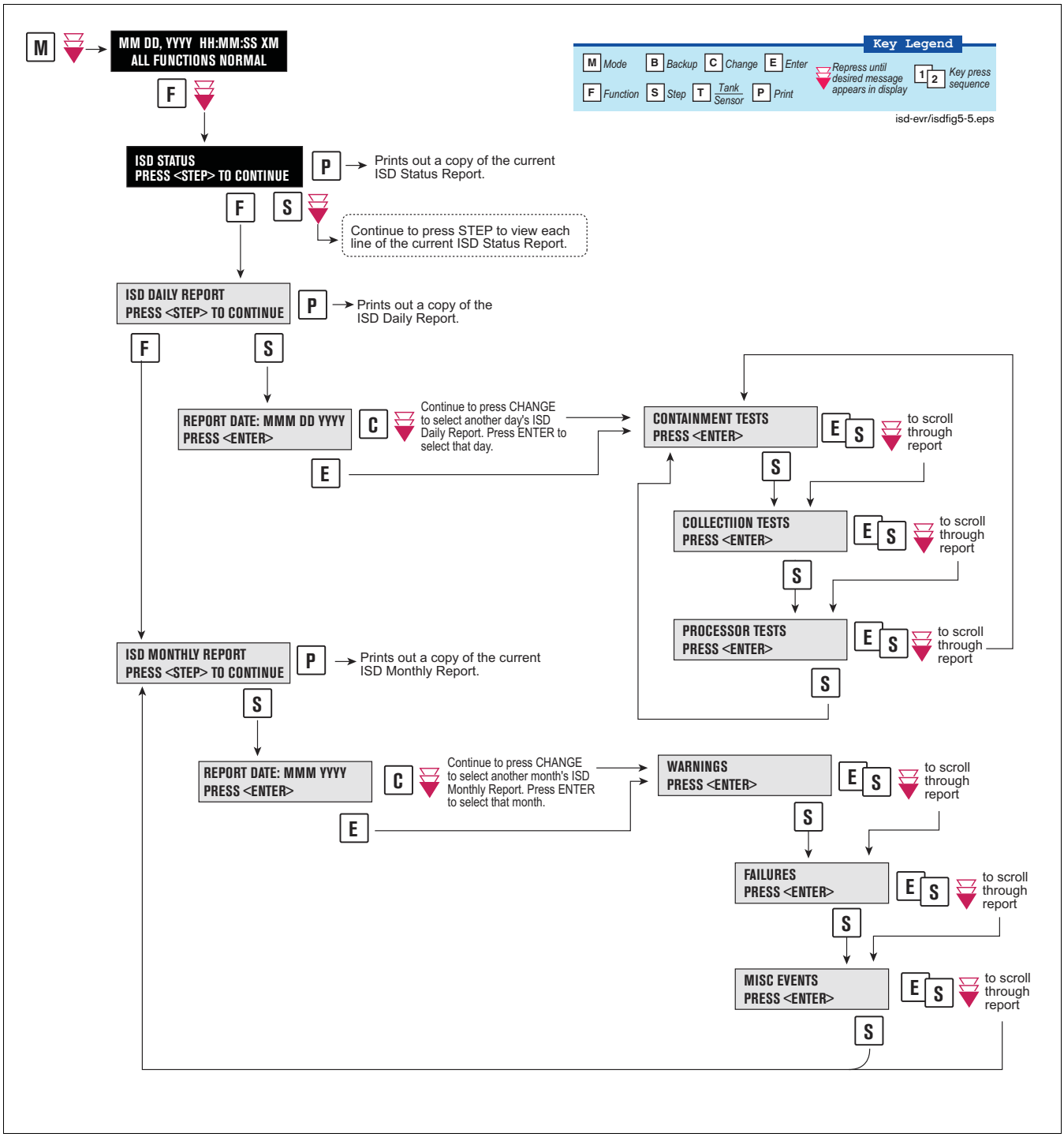


Figure 26. Printing ISD Reports on Console Printer

Figure 27 shows an example ISD Status Report.

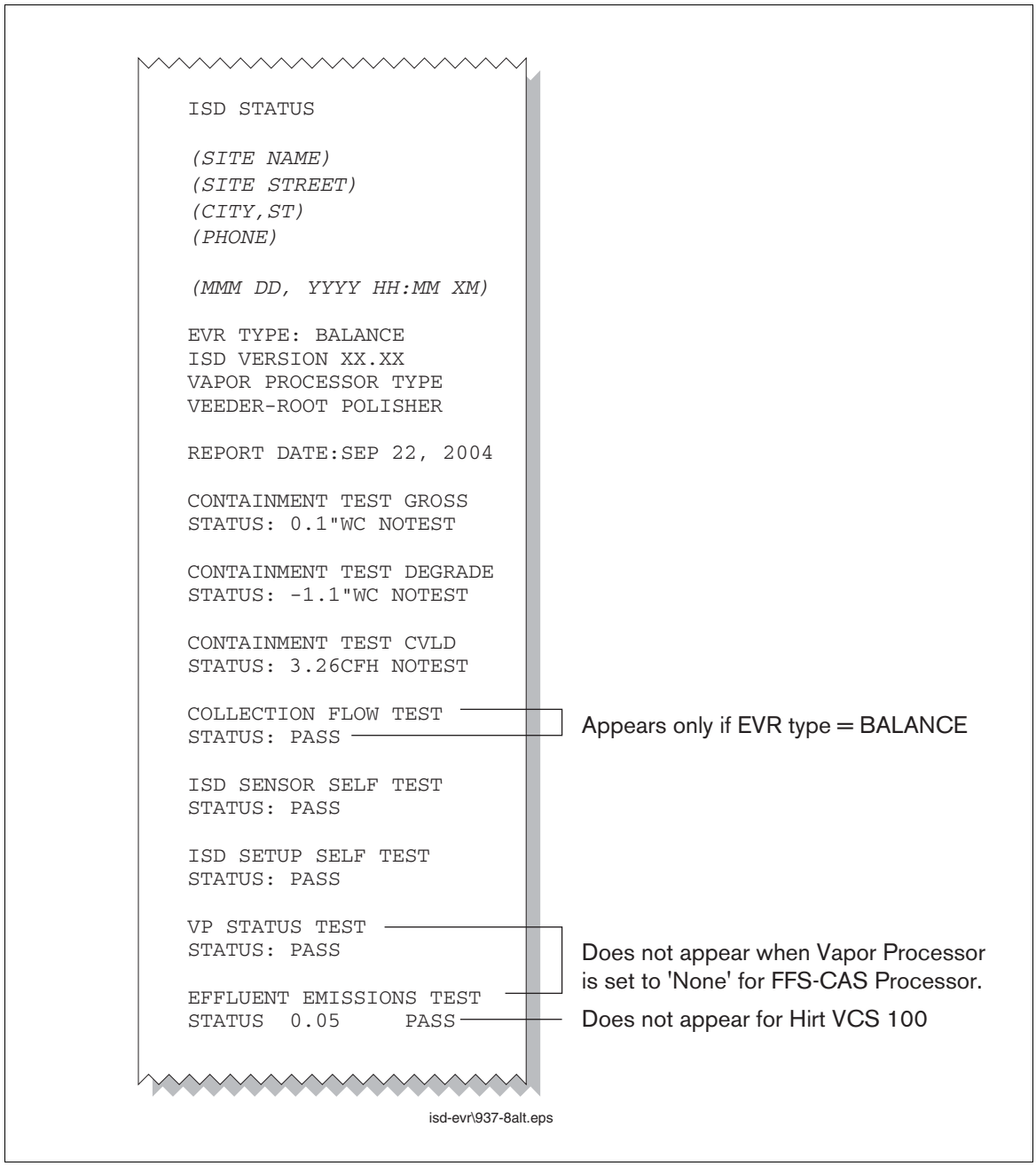


Figure 27. ISD Status Report Example - TLS console printout

Figure 28 shows an example ISD Daily Report.

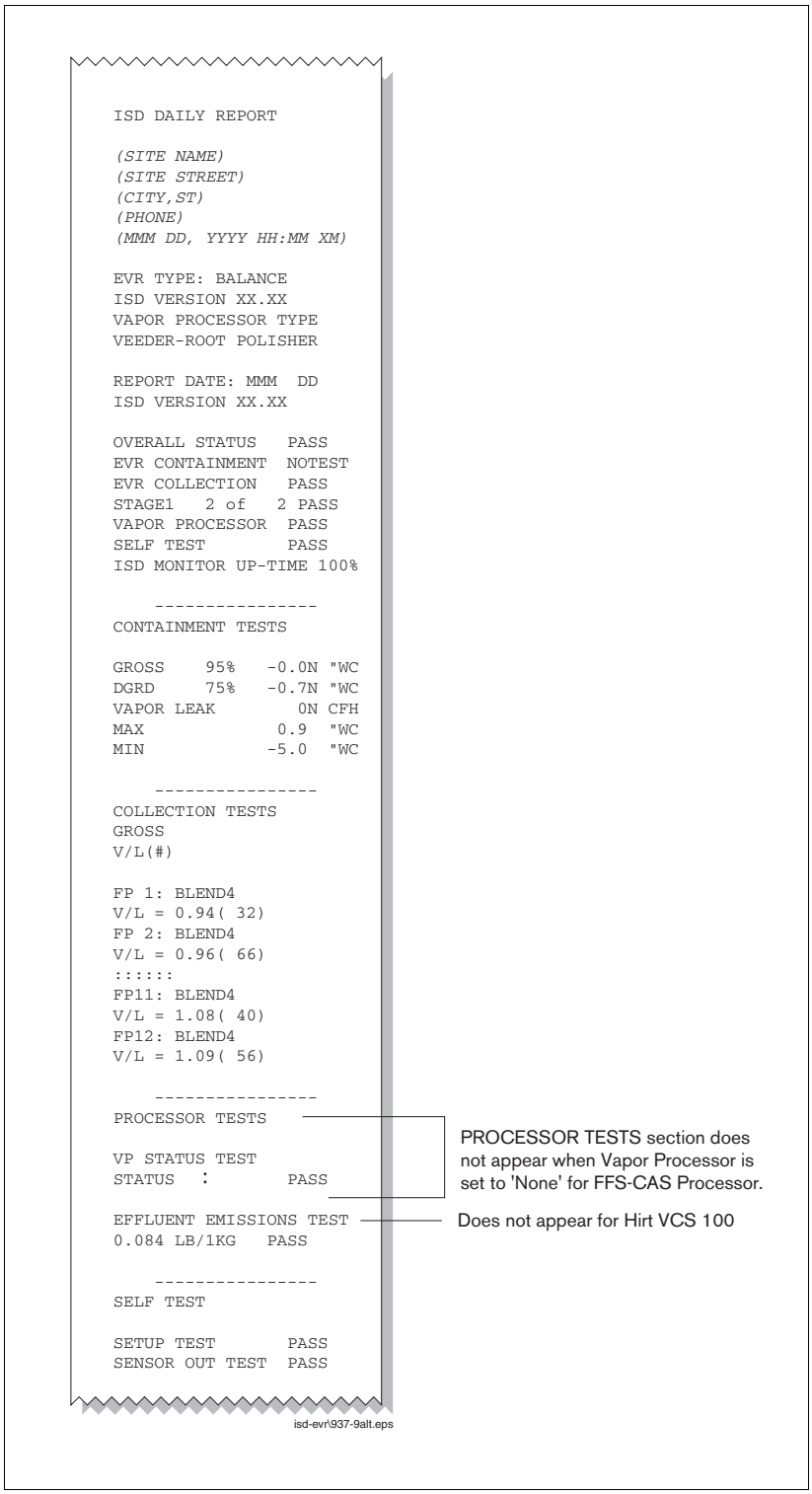


Figure 28. ISD Daily Report Example - TLS console printout

Figure 29 shows an example ISD Monthly Report.

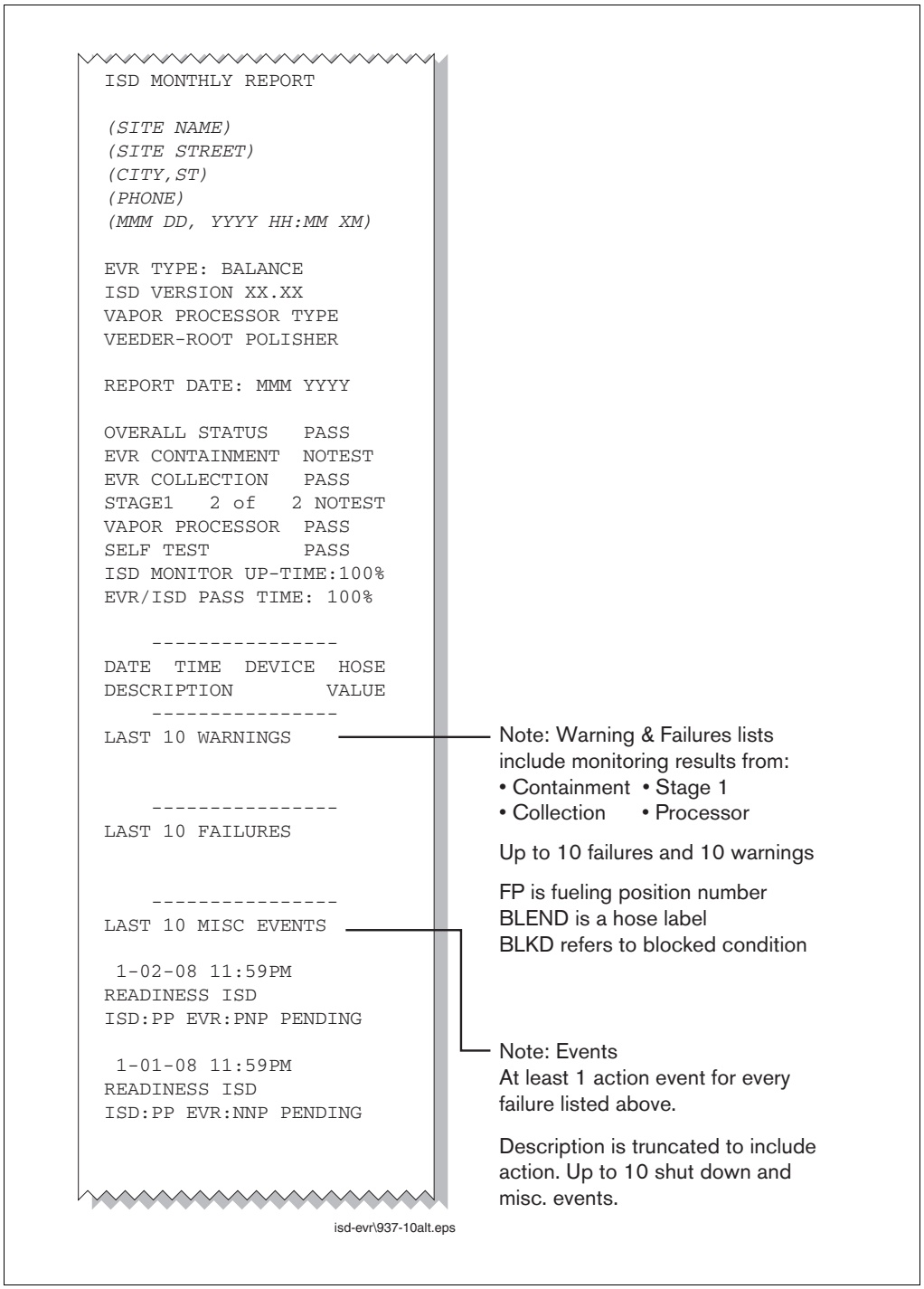
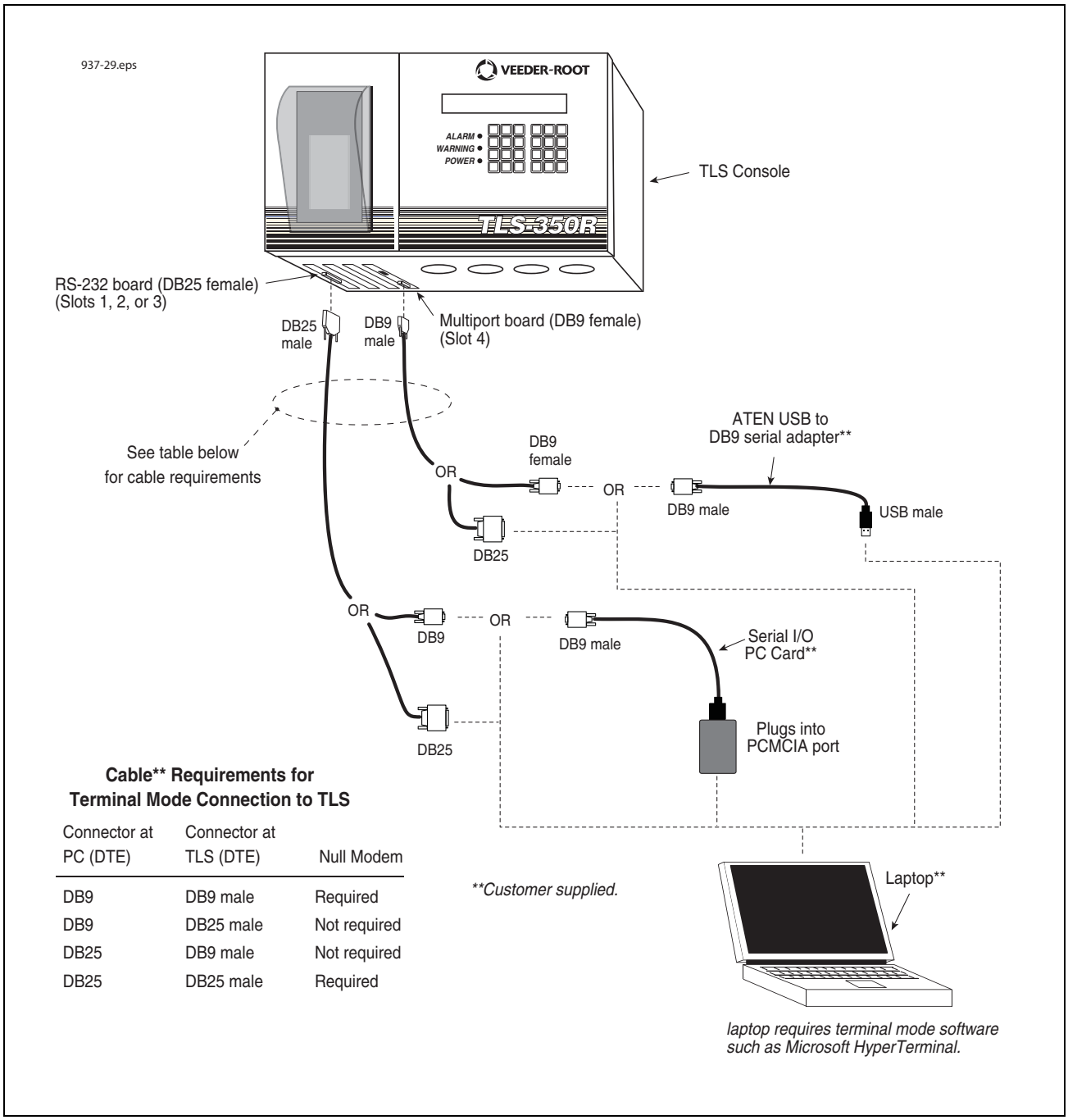


Figure 29. ISD Monthly Report Example - TLS console printout

Viewing ISD Reports via RS-232 Connection

CONNECTING LAPTOP TO CONSOLE

Connect your laptop to the TLS console's RS-232 or Multiport module using one of the methods shown in the examples in Figure 30 below.



Cable Requirements for Terminal Mode Connection to TLS**

Connector at PC (DTE)	Connector at TLS (DTE)	Null Modem
DB9	DB9 male	Required
DB9	DB25 male	Not required
DB25	DB9 male	Not required
DB25	DB25 male	Required

Figure 30. Connecting laptop to TLS console for serial communication

CONNECTING LAPTOP TO CONSOLE

1. Open your laptop's serial communication program, e.g., HyperTerminal. You can typically find HyperTerminal under: Start/Programs/Accessories/Communications.

2. After opening the terminal software program, ignore (cancel) any modem/dialing related request windows since you will be directly connecting to the console via serial communications. When the Connection Description window appears (Figure 31), enter a connection name, e.g., TLSDIRECT, and click the OK button.

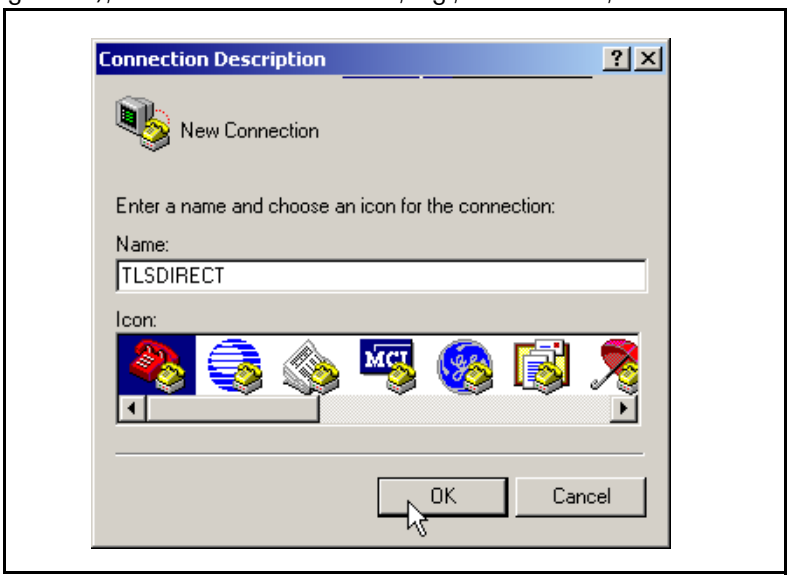


Figure 31. Connection Description window

3. After clicking the OK button, you may see a repeat of the modem/dialing windows, in which case ignore (cancel) them all.

4. When the Connect To window appears (Figure 32), depending on your connection method, select either COM1 (If RS-232 port on laptop), USB-Serial Controller (if using USB port on laptop), or Serial I/O PC Card (if using PCMCIA port on laptop) in the 'Connect using' drop down box, then click OK button.

Figure 32. Connect To window

5. Next you should see the 'Port Settings' window.

IMPORTANT! The settings of the laptop's com port must match those of the console's com port to which you are connected.

a. Go to the console front panel press the MODE key until you see:

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

b. Press the FUNCTION key until you see the message:

```
COMMUNICATIONS SETUP
PRESS <STEP> TO CONTINUE
```

c. Press the STEP key until you see the message:

```
PORT SETTINGS
PRESS <ENTER>
```

d. Press the PRINT key to printout the port settings for all communication modules installed in the console. Figure 33 shows an example port settings printout with the RS-232 module installed. Using the console port settings in the example below, your HyperTerminal 'Port Settings' window entries would be Bits per second - 2400, Data bits - 7, Parity - Odd, Stop Bits - 1. For the 'Flow Control' entry select None. Click OK.

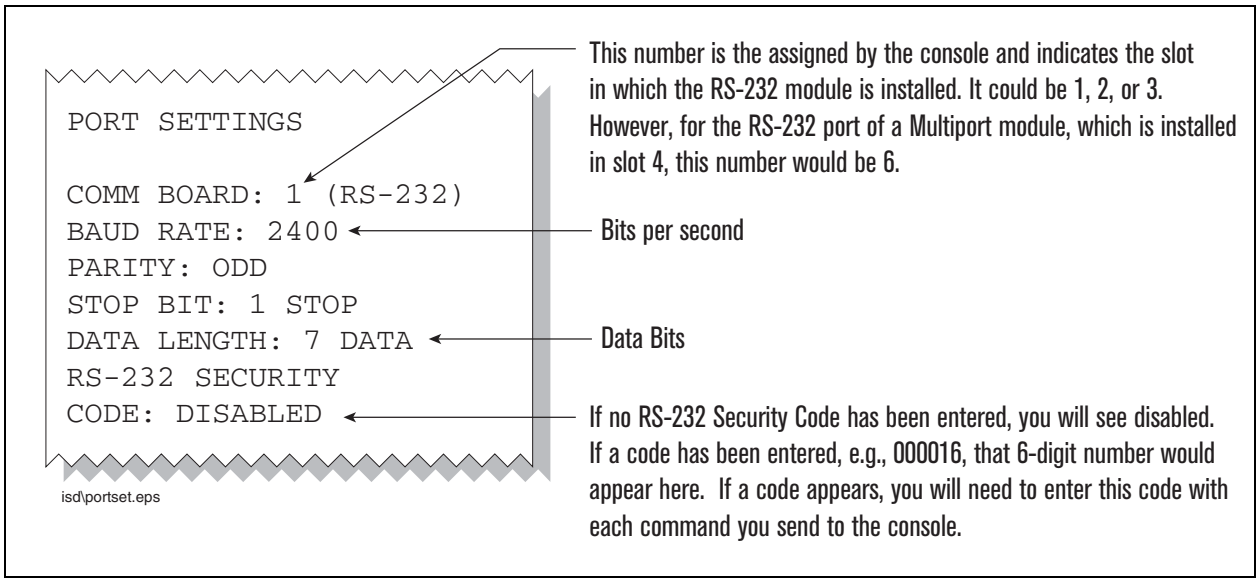


Figure 33. Console comm port settings printout example

In the example port settings printout above, the RS-232 Security Code is disabled. If the code was enabled you would see a 6-digit number which you will need to enter to access the console (refer to the 'Sending Console Commands' paragraph below for more information).

6. After entering your port settings, the program's main window appears (Figure 34).

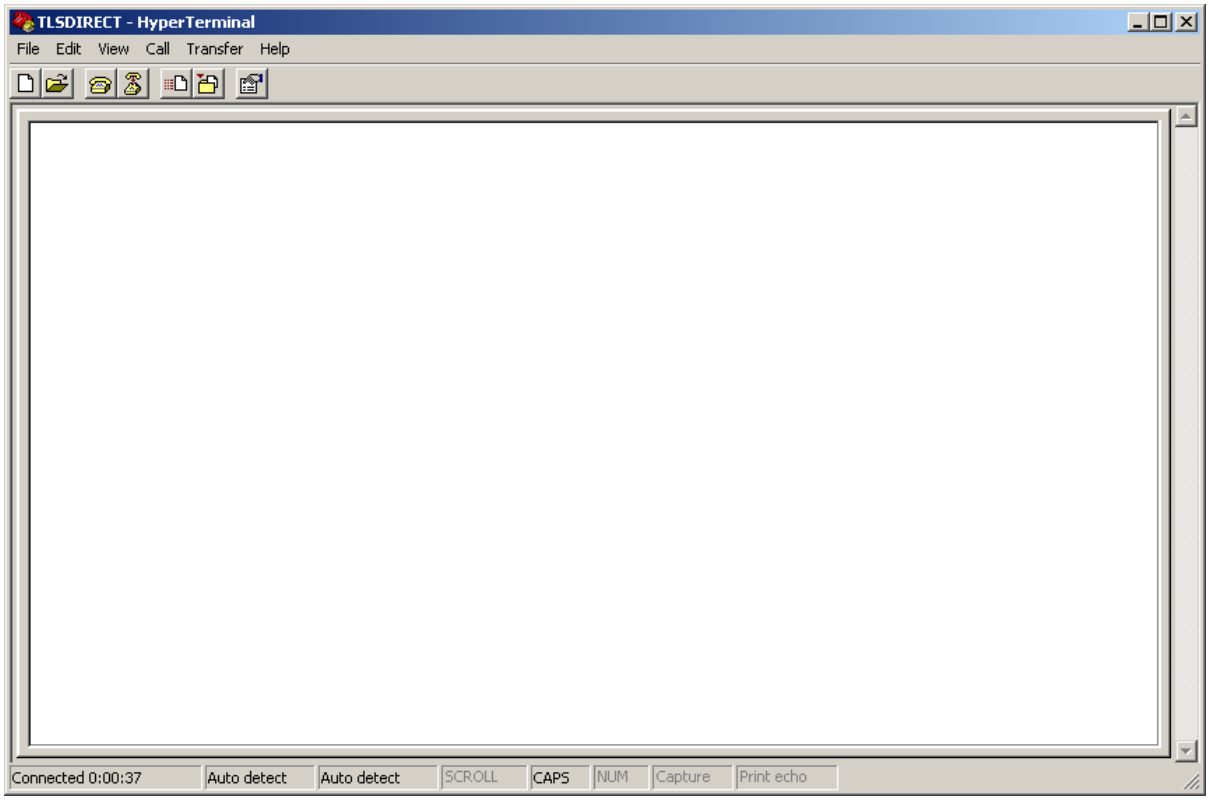


Figure 34. HyperTerminal main window

SENDING CONSOLE COMMANDS

Table 6 shows four important ISD console commands: IV0500, IV0200, IV0100, and IB6100. The <SOH> shown in the table means that you must press and hold the **Cntrl** key while you press the **A** key.

For example, let's say you want to see the Daily Report Details for the last 10 days.

Note: If you want to see the characters of the command as you type them in, click on File menu, then select Properties/Settings (tab)/ASCII Setup and click the check box for 'Echo typed characters locally', then click OK to close the window(s) and return to the main screen.

If the RS-232 Security Code is disabled - press and hold the Ctrl key while you press the A key, then type in IV0500010. If the RS-232 Security Code is enabled (e.g., 000016) you must enter the security code before the command - press and hold the Ctrl key while you press the A key, then type in 000016IV0500010.

You will see the typed command on the screen: ☺IV0500010 followed by the response (report) from the console. The ☺ symbol indicates CrtlA and the ♥ symbol indicates the end of the response.

If the console recognizes the command the response displays as soon as the command is typed in.

If the console does not recognize the command you would see something like ☺IV0500010☺9999FF1B♥ which indicates the console did not recognize the command.

All responses (Reports) can be printed or saved to a file. See the terminal program's help file for instructions.

Table 6. Serial Commands for ISD Alarm, Monthly, and Daily Reports

Report Type	Serial Command (PC to Console)[1]
Daily Report Details (See example Figure 35)	<SOH>IV0500ddd Where ddd = number of days, 001 = yesterday and today, 002 = two days ago, etc.
Monthly Status Report (See example Figure 36)	<SOH>IV0200yyyymm Where yyyy = year number, e.g. 2003, mm = month number, 01 = January, 02 = February, etc.
Alarm Status (See example Figure 37)	<SOH>IV0100
V80 Vapor Processor Runtime Diagnostic Report[2] (See examples Figure 38 and Figure 39)	<SOH>IV8000
Vapor Processor Status Report[2] (See example Figure 40)	<SOH>IV8200
Vapor Valve Status Report[2] (See example Figure 43)	<SOH>IB6100
Non-Priority Alarm History Report (See example Figure 41)	<SOH>I11100
Priority Alarm History Report (See example Figure 42)	<SOH>I11200
Smart Sensor Sub Alarm History Report (See example Figure 44)	<SOH>IB6200
Daily Vapor Polisher Diagnostic Report (See example Figure 45)	<SOH>IV8800yyyymmddnnnn Where: yyyy = year number, e.g., 2003, mm = month number (01 = January, 02 = February, etc.), dd = day of the month, nnnn = number of records after the date entered (9999 = all).

[1]<SOH> = Control A. For more information on TLS console serial commands, refer to the V-R Serial Interface Manual.

[2]Not available for FFS-CAS Processor or Hirt VCS 100.

IV0500
JAN 8, 2008 3:52 PM isd-evr\937-11alt.eps

(SITE NAME)
(SITE STREET)
(CITY, ST)
(PHONE)

ISD DAILY REPORT DETAILS

EVR TYPE: BALANCE
ISD TYPE: XX.XX
VAPOR PROCESSOR TYPE: VEEDER-ROOT POLISHER

OVERALL STATUS :WARN EVR VAPOR COLLECTION :PASS
EVR VAPOR CONTAINMENT :WARN
ISD MONITOR UP-TIME :100% STAGE I TRANSFERS: 10 of 10 PASS
EVR/ISD PASS TIME : 81% VAPOR PROCESSOR :PASS

Status Codes: (W)Warn (F)Fail (D)Degradation Fail (G)Gross Fail
(ISD-W)ISD Self-Test Warning (ISD-F)ISD Self-Test Fail (N)No Test

	ISD	ISD	---CONTAINMENT TESTS---					STAGE		---COLLECTION TESTS		
	EVR	%UP	GROSS	DGRD	MAX	MIN	LEAK	I	VAPOR	FP1	FP2	FP3
DATE	STATUS	TIME	95%	75%	"WC	"WC	CFH	XFR	PRCSR	BLEND	BLEND	BLEND
12/28	W	100%	0.2	-0.3	0.7	-2.5	18W	PASS	PASS	0.94	1.07	1.10
12/29	W	100%	0.2	-0.3	0.7	-3.0	16W	PASS	PASS	0.95	0.85	1.11
12/30	PASS	100%	0.2	-0.3	0.7	-4.1	0	PASS	PASS	0.95N	0.99	1.02
12/31	PASS	100%	0.2	-0.3	0.8	-3.0	0	PASS	PASS	0.97	0.96	1.17
01/01	PASS	100%	0.2	-0.3	-0.2	-3.3	0		PASS	0.86	1.02	0.99
01/02	PASS	100%	0.2	-0.3	0.9	-5.0	0	PASS	PASS	0.94	0.96	1.20
01/03	PASS	100%	0.2	-0.3	1.1	-4.3	0	PASS	PASS	0.82	1.10	1.13
01/04	PASS	100%	0.4	-0.3	1.9	-2.8	0		PASS	1.07	1.01	1.10
01/05	PASS	100%	0.2	-0.3	2.8	-5.0	0	PASS	PASS	0.97	1.12	0.84
01/06	PASS	100%	0.2	-0.3	0.4	-5.0	0	PASS	PASS	0.80	1.23	1.11
01/07	PASS	100%	0.2	-0.3	0.6	-5.0	0	PASS	PASS	0.93	0.96	1.07

---COLLECTION TESTS-DAILY AVERAGE HOSE FLOW PERFORMANCE----------

	FP4	FP5	FP6	FP7	FP8	FP9	FP10	FP11	FP12
DATE	BLEND	BLEND	BLEND	BLEND	BLEND	BLEND	BLEND	BLEND	BLEND
12/28	1.06	1.16	0.96	1.21	1.10	1.03	1.08	1.13	1.13
12/29	1.03	1.12	1.16	1.07	1.13	1.01	0.97	1.06	1.06
12/30	1.04	0.96	0.95	1.06	1.11	0.97	1.14	1.18	0.94
12/31	1.07	1.20	1.05	1.10	1.00	0.90	1.09	1.07	1.27
01/01	1.03	1.18	1.19	0.85	1.16	1.24	1.13	1.31	1.16
01/02	0.94	0.98	1.10	0.97	1.10	0.91	0.98	1.08	1.09
01/03	1.12	0.96	1.17	1.12	1.07	1.06	1.12	1.12	1.10
01/04	1.04	1.18	1.09	1.16	1.16	0.90	1.19	1.05	1.13
01/05	1.13	0.94	1.11	1.02	1.10	1.10	1.21	1.19	1.04
01/06	1.11	1.14	1.09	1.10	1.18	0.95	1.15	1.09	1.05
01/07	0.96	1.13	1.07	0.84	1.13	1.02	1.06	1.12	1.00

Figure 35. ISD Daily Report Details - Serial to PC Format (Example report with Veeder-Root Polisher)

```
IV0200
JAN  8, 2008  3:53 PM                                          isd-evr\937-12alt.eps

(SITE NAME)
(SITE STREET)
(CITY, ST)
(PHONE)

ISD MONTHLY STATUS REPORT

EVR TYPE: BALANCE
ISD TYPE: XX.XX
VAPOR PROCESSOR TYPE: VEEDER-ROOT POLISHER


OVERALL STATUS             :FAIL            EVR VAPOR COLLECTION :FAIL
EVR VAPOR CONTAINMENT      :WARN
ISD MONITOR UP-TIME        :100%            STAGE I TRANSFERS: 33 of 33 PASS
EVR/ISD PASS TIME          : 77%            VAPOR PROCESSOR      :WARN

CARB EVR CERTIFIED OPERATING REQUIREMENTS

ISD MONITORING TEST PASS/FAIL THRESHOLDS
                                                    PERIOD    BELOW  ABOVE

VAPOR COLLECTION BALANCE SYS FLOW PERFORMANCE        1DAYS     0.60  ----
VAPOR CONTAINMENT GROSS FAIL, 95th PERCENTILE        7DAYS     ----  1.30"wcg
VAPOR CONTAINMENT DEGRADATION, 75th PERCENTILE      30DAYS     ----  0.30"wcg
VAPOR CONTAINMENT LEAK DETECTION FAIL @2"WCG         7DAYS     ---- 12.5cfh
STAGE I VAPOR TRANSFER FAIL, 50th PERCENTILE        20MINS     ----  2.50"wcg
VAPOR PROCESSOR MASS EMISSION FAIL (LB/1KG)          1DAYS     ----  0.32

WARNING ALARMS
DATE     TIME     DESCRIPTION                     READING         VALUE
07-12-30 00:02:33 VAPOR CONTAINMENT LEAKAGE       CFH@2 INCHES WC  15.51
07-12-29 00:02:07 VAPOR CONTAINMENT LEAKAGE       CFH@2 INCHES WC  18.24
07-12-28 00:02:01 VAPOR CONTAINMENT LEAKAGE       CFH@2 INCHES WC  17.34
07-12-27 00:01:36 VAPOR CONTAINMENT LEAKAGE       CFH@2 INCHES WC  17.11
07-12-26 00:01:41 VAPOR CONTAINMENT LEAKAGE       CFH@2 INCHES WC  18.66
07-12-10 00:02:05 FLOW PERFORMANCE HOSE BLOCKAGE  FP 8 BLEND4       BLKD

FAILURE ALARMS
DATE     TIME     DESCRIPTION                     READING         VALUE
07-12-11 00:02:05 FLOW PERFORMANCE HOSE BLOCKAGE  FP 8 BLEND4       BLKD

SHUTDOWN & MISCELLANEOUS EVENTS
DATE     TIME     DESCRIPTION                     ACTION/NAME
07-12-11 00:02:18 FLOW PERFORMANCE BLK           DISABLED FP 08
```

Figure 36. ISD Monthly Status Report - Serial to PC Format (Example report with Veeder-Root Polisher)

```
IV0100
JAN  8, 2008  3:53 PM                                          937-13alt.eps

(SITE NAME)
(SITE STREET)
(CITY, ST)
(PHONE)

ISD ALARM STATUS REPORT

EVR TYPE: BALANCE
ISD TYPE: XX.XX
VAPOR PROCESSOR TYPE: VST VAPOR PROCESSOR


OVERALL STATUS             :PASS            EVR VAPOR COLLECTION :PASS
EVR VAPOR CONTAINMENT      :PASS
ISD MONITOR UP-TIME        :100%            STAGE I TRANSFERS:  2 of  2 PASS
EVR/ISD PASS TIME          :100%            VAPOR PROCESSOR      :PASS

WARNING ALARMS
DATE     TIME     DESCRIPTION                      READING          VALUE
07-12-30 00:02:33 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC  15.51
07-12-29 00:02:07 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC  18.24
07-12-28 00:02:01 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC  17.34
07-12-27 00:01:36 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC  17.11
07-12-26 00:01:41 VAPOR CONTAINMENT LEAKAGE        CFH@2 INCHES WC  18.66
07-12-10 00:02:05 FLOW PERFORMANCE HOSE BLOCKAGE   FP 8 BLEND4       BLKD
07-11-16 00:02:17 FLOW PERFORMANCE HOSE BLOCKAGE   FP 8 BLEND4       BLKD
07-11-13 00:02:28 FLOW PERFORMANCE HOSE BLOCKAGE   FP 8 BLEND4       BLKD
07-11-11 00:03:19 FLOW PERFORMANCE HOSE BLOCKAGE   FP 6 BLEND4       BLKD

FAILURE ALARMS
DATE     TIME     DESCRIPTION                      READING          VALUE
07-11-14 00:02:18 FLOW PERFORMANCE HOSE BLOCKAGE   FP 8 BLEND4       BLKD
07-11-12 00:02:38 FLOW PERFORMANCE HOSE BLOCKAGE   FP 6 BLEND4       BLKD
07-11-09 00:03:41 CONTAINMENT GROSS OVER PRESSURE WEEKLY 95%         4.60
07-10-31 00:02:45 VAPOR PROCESSOR STATUS
                  VP EMISSIONS FAIL                LB/1KB            0.693
07-10-15 00:03:14 FLOW PERFORMANCE HOSE BLOCKAGE   FP 2 BLEND4       BLKD
07-10-15 00:03:13 FLOW PERFORMANCE HOSE BLOCKAGE   FP 1 BLEND4       BLKD
07-10-14 00:03:11 FLOW PERFORMANCE HOSE BLOCKAGE   FP 2 BLEND4       BLKD

SHUTDOWN & MISCELLANEOUS EVENTS
DATE     TIME     DESCRIPTION                       ACTION/NAME
07-11-03 19:52:52 VAPOR PROCESSOR                 TEST MANUALLY CLEARED
07-11-18 00:02:24 READINESS ISD:PP EVR:PPP        ISD & EVR READY
07-11-17 13:09:06 READINESS ISD:PP EVR:NNN        EVR READINESS PENDING
07-11-17 13:09:06 ISD STARTUP
07-11-17 13:03:24 ISD SHUTDOWN
07-11-14 00:02:18 FLOW PERFORMANCE BLK            DISABLED FP 08 BLEND4
07-11-12 00:02:38 FLOW PERFORMANCE BLK            DISABLED FP 06 BLEND4
07-11-09 00:03:41 CONTAINMENT GROSS               DISABLED DISPENSERS
07-11-04 01:00:00 TIME CHANGE DETECTED AT:       07-11-04 02:00:13
07-11-03 00:01:25 VAPOR PROCESSOR PROBLEM         DISABLED DISPENSERS
```

Figure 37. ISD Alarm Status Report - Serial to PC Format (Example report with Veeder-Root Polisher)

Figure 38 shows an example VST Vapor Processor Runtime Diagnostic Report (not available with FFS-CAS or Hirt VCS 100).

```
IV8000
SEP 30, 2007 12:27 AM

(SITE NAME)
(SITE STREET)
(CITY,ST)
(PHONE)
(MMM DD, YYYY HH:MM XM)

VAPOR PROCESSOR
                    ELAPSED    PRESSURE INCHES H2O    RUNTIME
DATE-TIME ON        MINUTES       ON        OFF        FAULT
 5-04-07  3:31PM     8.87         0.244    -0.202        NO
 5-05-07  4:17AM     3.35         0.202    -0.212        NO
 5-07-07 10:17PM     3.50         0.206    -0.221        NO
 5-07-07 10:28PM    15.12         0.384    -0.356        NO
 5-08-07  8:16PM    21.77         0.325    -0.211        NO
 5-09-07  6:35PM    20.60         0.368    -0.276        NO
 5-10-07  8:03PM     6.18         0.226    -0.398        NO
 5-10-07  8:15PM     2.55         0.231    -0.227        NO
 5-13-07  8:55PM    18.23         0.314    -0.205        NO
```

937-35.eps

Figure 38. VST Vapor Processor Runtime Diagnostics Report - Serial to PC Format

Figure 39 shows an example V-R Vapor Polisher Runtime Diagnostic Report and Table 7 explains the `IV8000` report's event codes (not available with FFS-CAS or Hirt VCS 100).

```
IV8000                                                    937-30.eps
FEB  4, 2008  1:01 PM

TLS_350 UST
VEEDER-ROOT TEST LAB
125 POWDER FOREST DR
SIMSBURY, CT 06070

VAPOR POLISHER
VALVE EVENT          PRESSURE
DATE-TIME              "WC      EVENT CODE
 1-31-08  3:44PM      -0.700    OPEN PURGE
 1-31-08  3:47PM       0.038    CLOSE FORCE PURGE
 1-31-08  3:51PM      -0.255    OPEN PURGE
 1-31-08  8:08PM      -0.300    CLOSE PURGE Hi P
 2-01-08  1:59PM      -0.300    OPEN PURGE
 2-01-08  2:18PM      -0.263    OPEN PURGE
 2-01-08  2:33PM      -0.289    OPEN PURGE
 2-04-08 11:22AM      -0.560    NO EVENT
 2-04-08 11:28AM      -0.560    OPEN PURGE
 2-04-08 11:48AM      -0.300    OPEN PURGE
 2-04-08 12:28PM      -0.263    OPEN PURGE
 2-04-08 12:42PM      -0.299    OPEN PURGE
```

Figure 39. V-R Vapor Polisher Runtime Diagnostics Report - Serial to PC Format

Table 7. Vapor Processor Runtime Diagnostic Report Event Codes

Event Code	Cause	Event Code	Cause
NO EVENT	The valve changed state outside of the carbon canister algorithm.	CLOSE NEAR FULL	Canister load is between 80 and 100% and pressure is <1.05.
CLOSE TEST	Manual operation of the valve	OPEN PURGE	Canister load is >0% and pressure <-0.25
OPEN TEST	Manual operation of the valve	OPEN EXCESS PURGE	Canister load is 0%, Excess purge is incomplete, pressure <-1.5, time is between 6AM and 4PM.
CLOSE PURGE HI P	The canister state is in excess purge and the pressure is above -0.5.	OPEN FILL	Canister valve is open for loading: • When pressure is greater than or equal to 0.75 IWC and Canister load is less than 80%. • Pressure is greater than or equal to 1.3 IWC and Canister load is greater than 80%.
CLOSE PURGE TIME	The canister state is in excess purge and the time is outside 6AM to 4PM.	CLOSE CVLD TEST	Valve was closed to collect data for ISD contamination leak test.
CLOSE FORCE PURGE	Canister is in startup period. Loading with pressures <+1.05 is not allowed until startup period is complete.	CLOSE LIMIT	Valve closed because canister has reached allowable extended capacity loading limit.
CANISTER EMPTY	Canister was loaded above 1% and purged to 0%. No valve state change.	CANISTER FULL	No valve state change. The canister load passed from below 95% to/thru the 100% point and not yet at day's emission limit.
CLOSE EMPTY	Excess purging has completed.		

Figure 40 shows an example Vapor Processor Status Report (not available with FFS-CAS or Hirt VCS 100).

```
IV8200
DEC  8, 2010  4:29 AM

<Site Name>
<Site Address>
<Site Address>
<Site Address>

VAPOR PROCESSOR STATUS REPORT

PMC VERSION: XX.XX

ASSESSMENT TIME: DEC  7, 2010 11:59 PM


VAPOR PROCESSOR TYPE: VEEDER-ROOT POLISHER

PMC MONITORING TEST PASS/FAIL THRESHOLDS
                                              PERIOD    BELOW  ABOVE
VAPOR PROCESSOR MASS EMISSION FAIL             1DAYS     ----   0.32 LBS/1KG

EFFLUENT EMISSIONS TEST : PASS     (0.00 LBS/1KG)

DAILY THROUGHPUT  :   6989 GALS
```

Figure 40. Vapor Processor Status Report - Serial to PC Format

Figure 41 shows an example Non-Priority Alarm History Report.

```
I11200
DEC  9, 2010  4:20 AM

<Site Name>
<Site Address>
<Site Address>
<Site Address>

NON-PRIORITY ALARM HISTORY
ID  CATEGORY  DESCRIPTION          ALARM TYPE           STATE    DATE    TIME
T 3 TANK      DIESEL               LOW TEMP WARNING     CLEAR  12-08-10  3:00PM
T 3 TANK      DIESEL               LOW TEMP WARNING     ALARM  12-08-10  3:00PM
T 3 TANK      DIESEL               HIGH PRODUCT ALARM   CLEAR  12-08-10  3:00PM
T 3 TANK      DIESEL               HIGH PRODUCT ALARM   ALARM  12-08-10  2:56PM
    SYSTEM                         PRINTER ERROR        CLEAR  11-17-10 10:51AM
    SYSTEM                         PAPER OUT            CLEAR  11-17-10 10:51AM
    SYSTEM                         PAPER OUT            ALARM  11-17-10 10:50AM
    SYSTEM                         PRINTER ERROR        ALARM  11-17-10 10:50AM
```

Figure 41. Non-Priority Alarm History Report - Serial to PC Format

Figure 42 shows an example Priority Alarm History Report.

```
I11100
DEC  9, 2010  4:20 AM

<Site Name>
<Site Address>
<Site Address>
<Site Address>

PRIORITY ALARM HISTORY
ID  CATEGORY  DESCRIPTION          ALARM TYPE           STATE    DATE    TIME
T 2 TANK      91 OCTANE            PROBE OUT            CLEAR  12-08-10  7:55PM
T 2 TANK      91 OCTANE            PROBE OUT            ALARM  12-08-10  7:07PM
T 2 TANK      91 OCTANE            OVERFILL ALARM       CLEAR  11-17-10 11:46AM
T 2 TANK      91 OCTANE            OVERFILL ALARM       ALARM  11-17-10 11:45AM
```

Figure 42. Priority Alarm History Report - Serial to PC Format

Figure 43 shows an example Vapor Valve Status report.

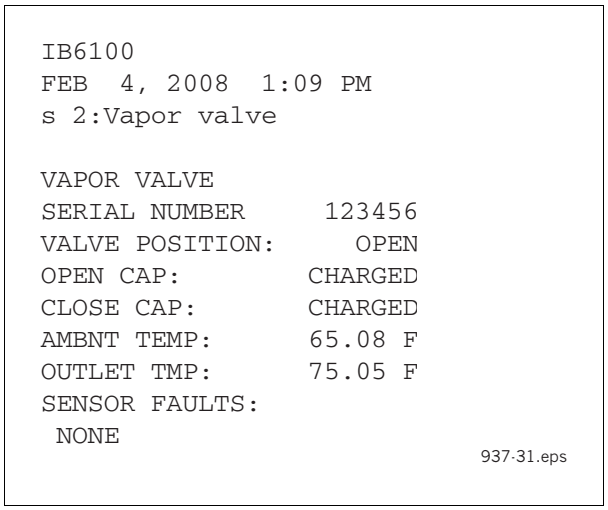


Figure 43. Vapor Valve Status Report - Serial to PC Format

The IB6100 command reports the current state of the Vapor Valve Components. The current position of the valve is reported as Open or Closed. The Capacitors are used to move the valve and are reported as Charged or Discharged. Outlet Temperature is the Canister thermal probe temperature. Ambient Temperature is the temperature at the Vapor Valve ambient temperature sensor. Sensor Faults are the active faults reported by the Vapor Valve. The IB6100 (Figure 43) command only provides active Sensor Fault conditions. Use the IB6200 command to see archived fault conditions (Figure 44).

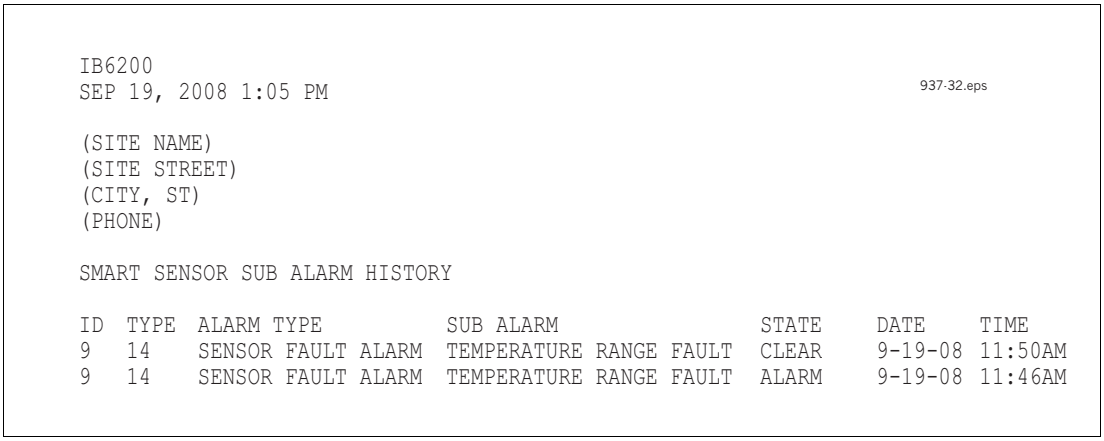


Figure 44. Smart Sensor Sub Alarm History Report - Serial to PC Format

Figure 45 shows an example PMC Daily Vapor Polisher Diagnostic Report.

```
IV8800                                                    937-33.eps
OCT 2, 2008  2:58 PM

PMC DAILY VAPOR POLISHER DIAGNOSTIC

                    LOAD    PRGE    MIN%    MAX%    SELF     EMISSION
DATE/TIME            HRS     HRS    LOAD    LOAD    TEST     TEST
08-10-02 14:58:58    3.1     2.5      15      69    WARN     FAIL
```

Figure 45. PMC Daily Vapor Polisher Diagnostic Report - Serial to PC Format

6 Maintenance

TLS Console

The TLS console, including interface modules, do not require scheduled maintenance, but the station operator is responsible to ensure printer paper is properly loaded and front panel indicator lights are operational. ISD System Self-Test Monitoring algorithms are designed to verify proper selection, setup and operation of the TLS console and sensors. Servicing should be performed in accordance with the In-Station Diagnostic System Troubleshooting Guide, Manual 577013-819 in response to warning or alarm conditions.

Vapor Flow Meter

There is no recommended maintenance, inspection nor calibration for the Air Flow Meter. Servicing should be performed in accordance with the In-Station Diagnostic System Troubleshooting Guide, Manual 577013-819 in response to warning or alarm conditions.

Vapor Pressure Sensor

There is no recommended maintenance, inspection nor calibration for the Vapor Pressure Sensor. Servicing should be performed in accordance with the In-Station Diagnostic System Troubleshooting Guide, Manual 577013-819 in response to warning or alarm conditions.

7 Diagnostic Menus

The diagnostic menus below are accessed and viewed from the TLS console front panel.

Smart Sensor Diagnostic Menu

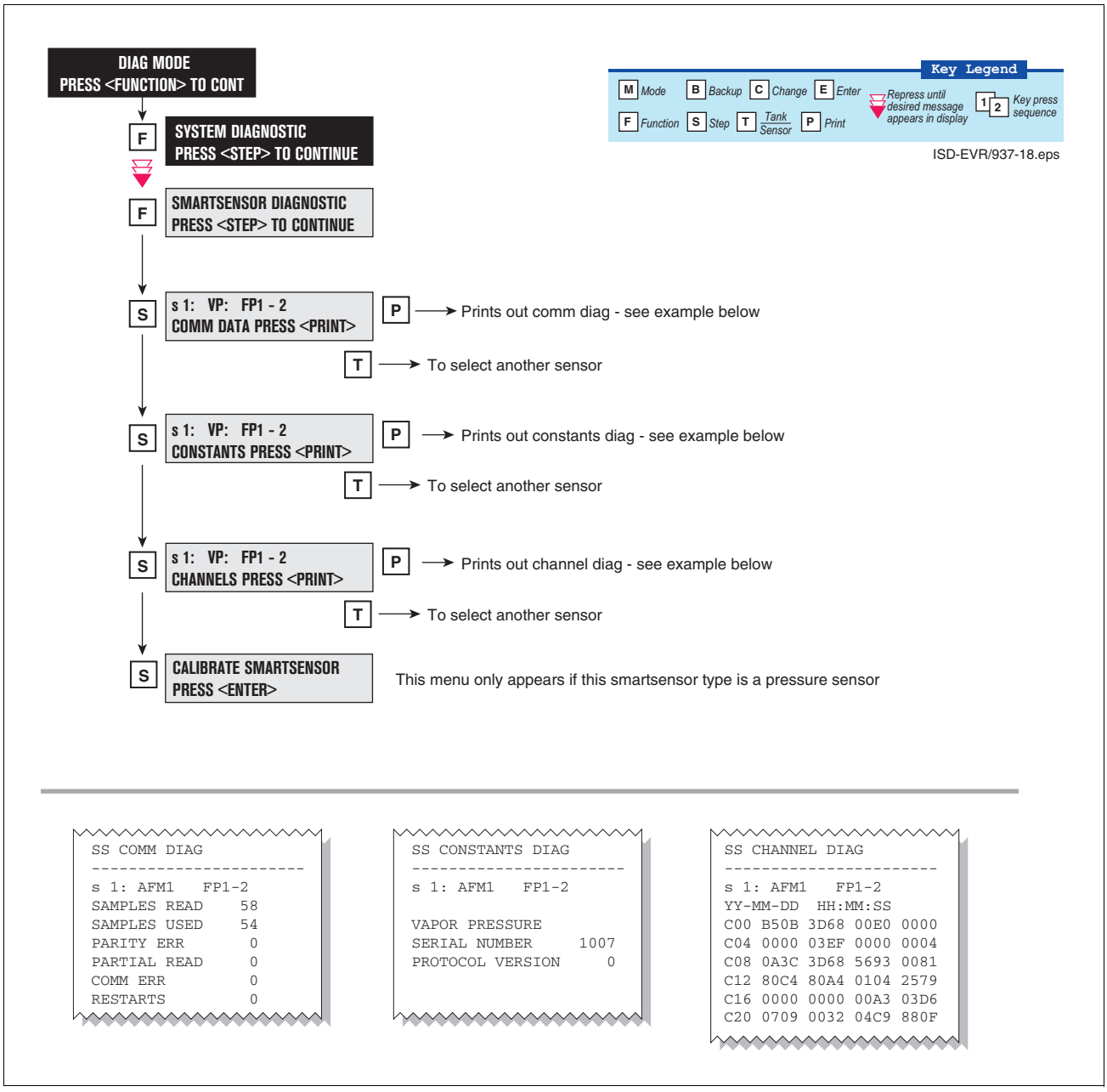


Figure 46. Smart Sensor Diagnostic Menu

Calibrate Smart Sensor Menu

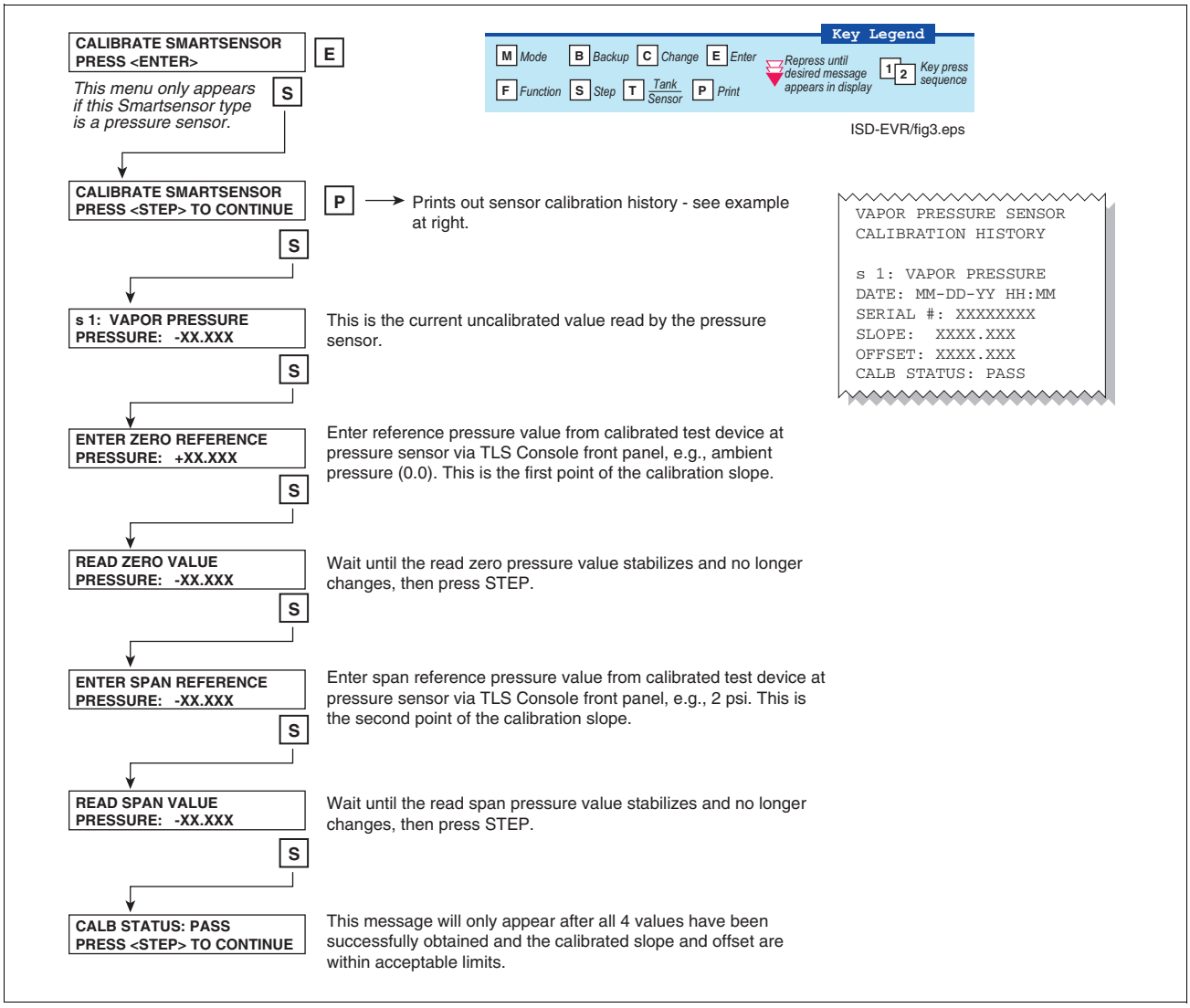
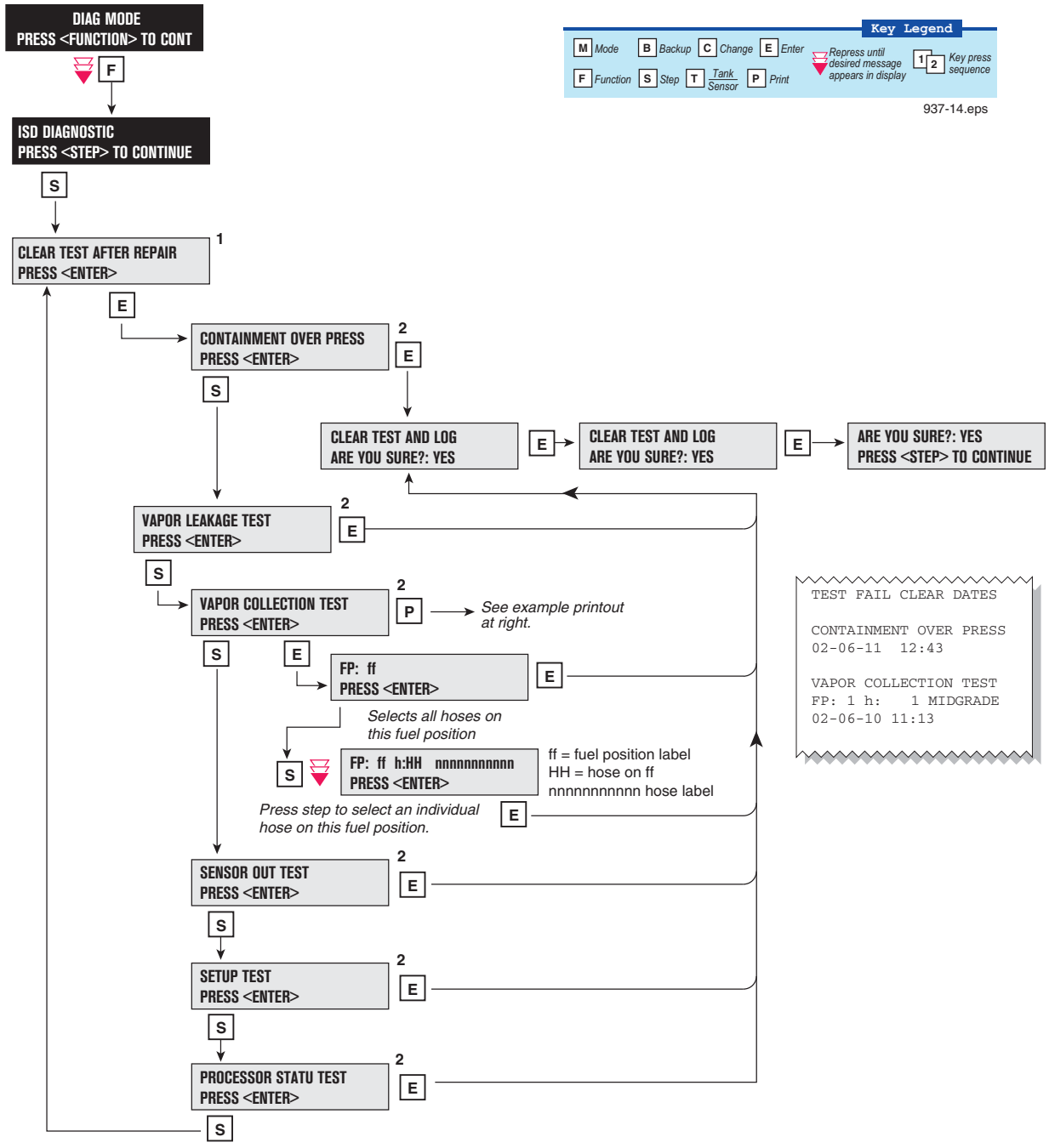


Figure 47. Smart Sensor Calibration Menu

ISD Diagnostic Menu



Notes:

1. All repair dates are saved in the Miscellaneous Event Log.
2. Reference the Clear Test Repair Menu table on the next page.

Figure 48. ISD Diagnostic Menu

Table 8. Clear Test Repair Menu

Menu Selection	Clears Alarms	Reset Dates
Containment Over Press	ISD GROSS PRESSURE WARN ISD GROSS PRESSURE FAIL ISD DEGRD PRESSURE WARN ISD DEGRD PRESSURE FAIL	Containment Test Time
Vapor Leakage Test	ISD VAPOR LEAKAGE WARN ISD VAPOR LEAKAGE FAIL	Vapor Leak Test Time
Vapor Collection Test	GROSS COLLECT WARN GROSS COLLECT FAIL DEGRD COLLECT WARN DEGRD COLLECT FAIL FLOW COLLECT WARN FLOW COLLECT FAIL AIRFLOW MTR SETUP	Hose Test Time
Sensor Out Test	ISD SENSOR OUT WARN ISD SENSOR OUT FAIL	Sensor Out Test Time
Setup Test	ISD SETUP WARN ISD SETUP FAIL	Setup Self Test Time
Processor Status Test[1]	ISD VP OVERPRESSURE WARN ISD VP OVERPRESSURE FAIL ISD VP STATUS WARN ISD VP STATUS FAIL VP EMISSIONS WARN VP EMISSIONS FAIL VP DUTY CYCLE WARN VP DUTY CYCLE FAIL	Valid Vapor Processor Test Time

[1]These tests and alarms are not available with FFS-CAS.

VST ECS Membrane Processor Diagnostic Menu

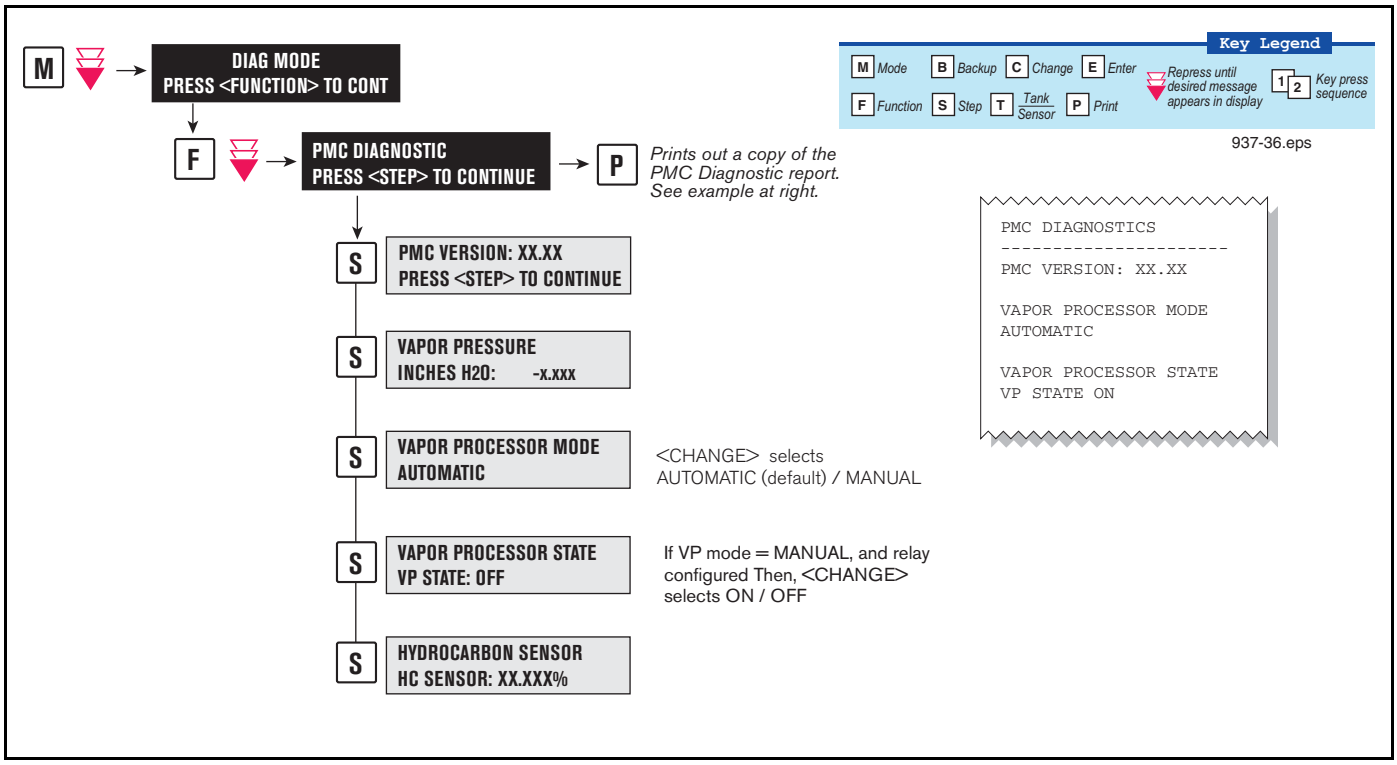


Figure 49. VST ECS Membrane Processor Diagnostic Menu

Veeder-Root Vapor Polisher Diagnostics

AUTOMATIC CONTROL

If PMC mode is in AUTOMATIC, PMC will control flow through the canister using a vapor control valve. The control algorithms will monitor tank pressure, vapor temperature and carbon temperature to monitor carbon canister loading. When the pressure is positive the valve is opened to relieve the pressure and begin loading the canister. When the UST pressure becomes negative the valve is opened and the purging process begins. The valve will close when the canister has either reached capacity or the canister is empty after purging.

MANUAL CONTROL

If PMC mode is in MANUAL, the diagnostic menu allows the valve to be opened (ON) or closed (OFF) manually. This feature is to support testing operation of the valve without waiting for canister to reach loading or purging thresholds. It also provides the necessary controls to perform 2" decay tests. The current UST ullage space vapor pressure will also be available through the diagnostic menu.

When set to Manual mode, the system will reset to Automatic mode after 4 hours.

Veeder-Root Vapor Polisher PMC Diagnostic Menu

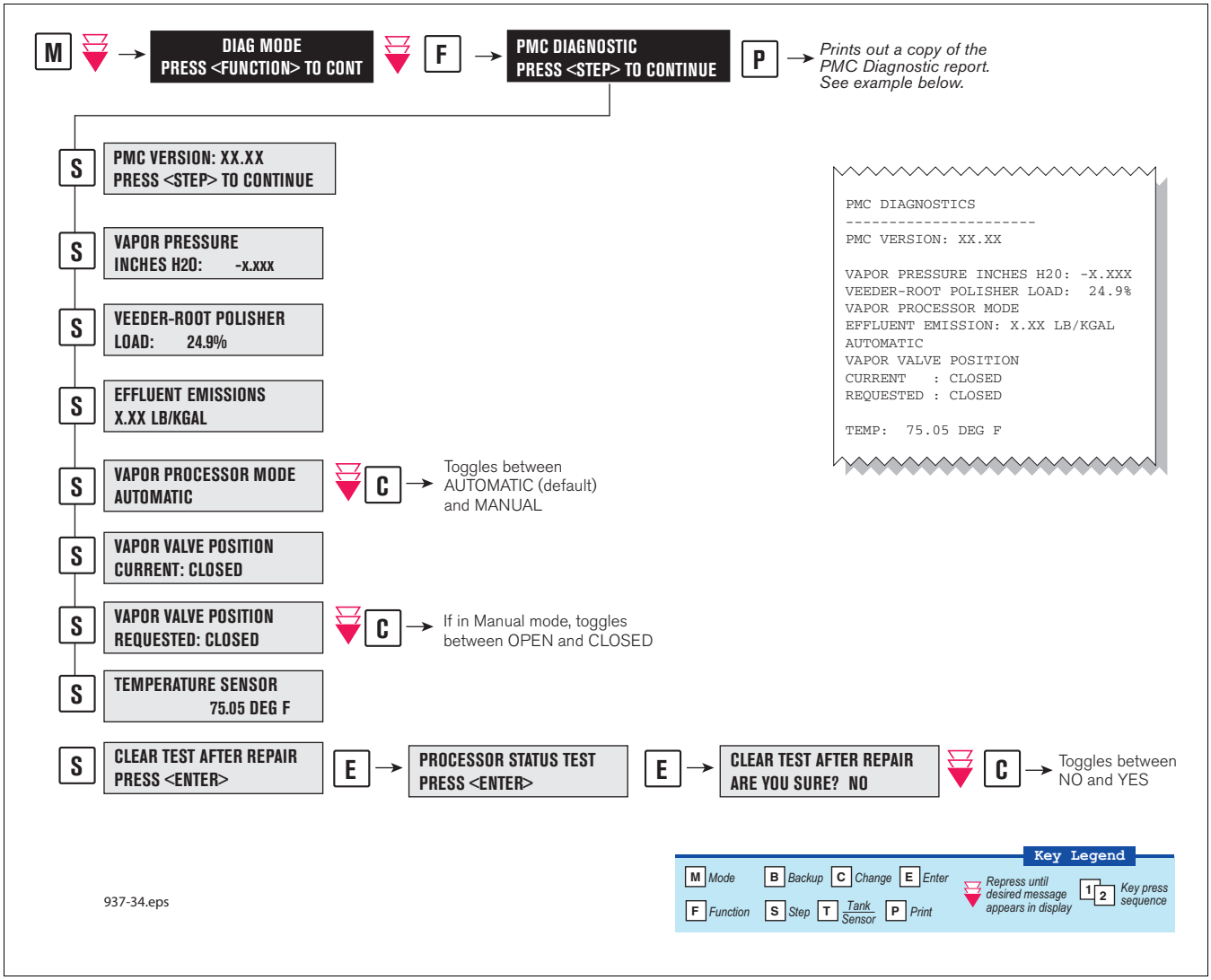


Figure 50. PMC Diagnostic Menus

Appendix A: Site EVR/ISD Equipment Location Worksheet

You should create a table listing each hose, fueling point, Air Flow Meter's serial number, etc.. This information will be required when you perform the EVR/ISD Setup hose/meter dispenses. This appendix contains blank worksheets for sites with single- and multi-hose dispensers. You are advised to fill in all of the appropriate information about your installed equipment, complete the TLS console's EVR/ISD setup, then perform the Product Meter ID dispensing procedure.

Single-Hose Fueling Position Dispensers

FILL OUT - USE TO SETUP HOSE TABLE					AUTOMAP CHECK LIST			
					Product Dispense(s)[6]			
Hose ID[1]	FP[2]	Hose Label[3]	AFM Serial Number[4]	AFM Label[5]	1st	2nd	3rd	4th
1		Blend		AFM FP__&__				
2		Blend						
3		Blend		AFM FP__&__				
4		Blend						
5		Blend		AFM FP__&__				
6		Blend						
7		Blend		AFM FP__&__				
8		Blend						
9		Blend		AFM FP__&__				
10		Blend						
11		Blend		AFM FP__&__				
12		Blend						
13		Blend		AFM FP__&__				
14		Blend						
15		Blend		AFM FP__&__				
16		Blend						

[1]Each hose must have a unique number (1 - 99).

[2]This is the Fuel Position Label which is the visible number on the outside of the dispenser (1 -2 digits).

[3]The hose label is always Blend for single-hose dispensers.

[4]This is the serial number on the Air Flow Meter (1 per dispenser).

[5]This is the AFM label entered in EVR/ISD setup (1 per dispenser and must be in the format shown, e.g., AFM FP1&2 - *where 1 and 2 refer to the one [or two] numbers on the outside of the dispenser*).

[6]After you have entered the contents of columns 1 - 5 into the TLS EVR/ISD hose table setup, you now must follow automap procedure and dispense from each gas meter AND one blend grade that feeds each hose. Enter a check beneath each product following a dispense from the hose.

FILL OUT - USE TO SETUP HOSE TABLE					AUTO MAP CHECK LIST			
					Product Dispense(s)			
Hose ID	FP	Hose Label	AFM Serial Number	AFM Label	1st	2nd	3rd	4th
17		Blend		AFM FP__&__				
18		Blend						
19		Blend		AFM FP__&__				
20		Blend						
21		Blend		AFM FP__&__				
22		Blend						
23		Blend		AFM FP__&__				
24		Blend						
25		Blend		AFM FP__&__				
26		Blend						
27		Blend		AFM FP__&__				
28		Blend						
29		Blend		AFM FP__&__				
30		Blend						
31		Blend		AFM FP__&__				
32		Blend						
33		Blend		AFM FP__&__				
34		Blend						
35		Blend		AFM FP__&__				
36		Blend						

FILL OUT - USE TO SETUP HOSE TABLE					AUTO MAP CHECK LIST			
					Product Dispense(s)			
Hose ID	FP	Hose Label	AFM Serial Number	AFM Label	1st	2nd	3rd	4th
		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
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		Blend		AFM FP__&__				
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		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
		Blend						
		Blend		AFM FP__&__				
		Blend						

Multi-Hose Fueling Position Dispensers

FILL OUT - USE TO SETUP HOSE TABLE					AUTOMAP CHECK LIST
Hose ID[1]	**FP[2]**	**Hose Label[3]**	**AFM Serial Number[4]**	**AFM Label[5]**	**Product Dispense[6]**
				AFM FP__&__	
				AFM FP__&__	

[1]Each hose must have a unique number (1 - 99).

[2]This is the Fuel Position Label which is the visible number on the outside of the dispenser (1 -2 digits).

[3]The hose label is the grade.

[4]This is the serial number on the Air Flow Meter (1 per dispenser).

[5]This is the AFM label entered in EVR/ISD setup (1 per dispenser and must be in the format shown, e.g., AFM FP1&2 - *where 1 and 2 refer to the one [or two] numbers on the outside of the dispenser*).

[6]After you have entered the contents of columns 1 - 5 into the TLS EVR/ISD hose table setup, you now must follow automap procedure and dispense from each hose. Enter a check in this column following a dispense from the hose.

FILL OUT - USE TO SETUP HOSE TABLE					AUTOMAP CHECK LIST
Hose ID	**FP**	**Hose Label**	**AFM Serial Number**	**AFM Label**	**Product Dispense**
				AFM FP__&__	
				AFM FP__&__	
				AFM FP__&__	

FILL OUT - USE TO SETUP HOSE TABLE					AUTOMAP CHECK LIST
Hose ID	**FP**	**Hose Label**	**AFM Serial Number**	**AFM Label**	**Product Dispense**
				AFM FP__&__	
				AFM FP__&__	
				AFM FP__&__	

FILL OUT - USE TO SETUP HOSE TABLE					AUTOMAP CHECK LIST
Hose ID	**FP**	**Hose Label**	**AFM Serial Number**	**AFM Label**	**Product Dispense**
				AFM FP__&__	
				AFM FP__&__	
				AFM FP__&__	

FILL OUT - USE TO SETUP HOSE TABLE					AUTOMAP CHECK LIST
Hose ID	**FP**	**Hose Label**	**AFM Serial Number**	**AFM Label**	**Product Dispense**
				AFM FP__&__	
				AFM FP__&__	
				AFM FP__&__	

VEEDER-ROOT

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