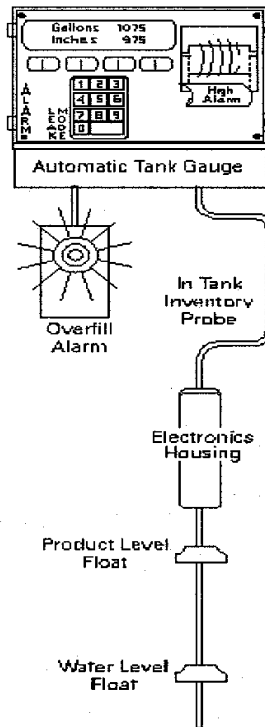




Automatic Tank Gauging Systems For Release Detection

Reference Manual For Underground Storage Tank Inspectors



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PLEASE NOTE: The information in this booklet comes from third-party evaluations and from release detection equipment vendors. These sources alone are responsible for the veracity of the information presented here. EPA does not endorse any specific release detection devices. EPA has gathered this information from third-party evaluators and vendors and is distributing it solely to provide UST inspectors and owners/operators with basic information. Each user should take the next step of contacting the vendor for further confirmation or help.

For UST Inspectors: How Can You Use This Booklet?

The following pages present “system descriptions” of automatic tank gauging (ATG) systems used to monitor release detection at underground storage tanks (USTs). As an UST inspector, you can use this information **to evaluate systems and to educate UST owners/operators**. Each description of an ATG system provides information on how the equipment works, its specifications and limitations, its operation and maintenance requirements, and how to print and read reports.

Systems Described Here Have Passed Third-Party Evaluation

All ATG systems described in the following pages are taken from the “List Of Leak Detection Evaluations For USTs,” which is maintained by the independent National Work Group on Leak Detection Evaluations, consisting of State and EPA UST program staff. All ATG systems listed here have been evaluated by third parties and certified by them to meet the federal requirements for detecting leaks at a minimum rate and within the prescribed probabilities for detection and false alarm. In short, if the system is listed here it has been evaluated and passed third-party scrutiny. You can access the most current “List” at EPA’s Web site at <http://www.epa.gov/oust/pubs/ldlist.htm>.

Use As An Inspection Tool: Look Up System Descriptions Quickly

As an UST inspector you face a wide array of release detection devices that you must evaluate to see if they are installed, operated, and maintained properly to detect leaks efficiently. For any ATG system you encounter in the field, you should be able to quickly find a system description in the following pages that will help you evaluate the system’s application at the site. Use the table on pages 4 through 6 to find what page to go to for a system description of a specific leak detection system (identified by vendor and model name and/or number).

Use As A Compliance Assistance Tool: Leave System Description With UST Owner Or Operator

You can provide valuable compliance assistance and “education” as you walk the UST owner/operator through a copy of the system description from the reference manual — note how the device is used, its limitations, the necessity of following maintenance instructions from the manufacturer, how to print and read reports, and so on. To help you in this educational task, this manual includes a two-sided handout (“For UST Owners And Operators”) you can copy and leave at the UST site (see pages 7 and 8), along with copies of other appropriate pages from the system description.

For UST Inspectors: How Can You Use This Booklet?

What's In Each System Description?

Each system description has the following headings that provide information:

- ▶ **Name:** Name of release detection device (usually a model series).
- ▶ **Equipment Type:** What kinds of release detection the device can provide.
- ▶ **Appearance:** An illustration of a representative device's console.
- ▶ **Vendor:** Vendor's name and contact information.
- ▶ **Basic System Description:** Notes unique aspects of the device not covered elsewhere in the system description.
- ▶ **Certified Leak Rates And Thresholds:** Notes certified leak rates and thresholds.
- ▶ **Applicability:** Notes types of product the device can detect.
- ▶ **Tank Capacity:** Notes the maximum capacity of the tank for which this device will work effectively; may also note how full the tank needs to be for the device to work.
- ▶ **Waiting Time:** Notes minimum waiting times, such as between delivery and testing or between dispensing and testing.
- ▶ **Test Period:** Notes the duration of the test or of various test modes that should demonstrate the device is working and capable of detecting leaks.
- ▶ **Calibration and Maintenance:** Notes basic requirements for keeping the device calibrated and maintained to detect leaks efficiently (including requirements for temperature/water sensor probes).
- ▶ **Comments and Limitations:** Notes distinct items such as "not evaluated using manifold tank systems" or "tests only the portion of tank containing product" or "requires water sensors and temperature probes."
- ▶ **Sample Reports:** Illustrates the reports the device can generate and how you can make the device print these reports; helps you know how to read and interpret the report.

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For UST Inspectors: How Can You Use This Booklet?

Want to help improve this ATG Manual?

We want to continually improve this ATG Manual with your help!

Send us your feedback.

Let us know if you find any errors, think something needs to be added or deleted, or have suggestions on format changes.

- Send feedback by e-mail to OUST.outreach@epa.gov.
- Send feedback by regular mail to OUST Outreach ATG, Mail Code 5401G, 1200 Pennsylvania Avenue, NW, Washington, DC 20460.
- Or phone your feedback to our Hotline at 1-800-424-9346

Locating Information On Specific Leak Detection Systems

VENDOR	CONSOLE MODEL (and probe as evaluated)	PAGE NUMBER
Alert Technologies, Inc.	Alert Model 2000 In-Tank Mass Measurement Probe System	9
Andover Controls Corp.	Andover Infinity/Continuum, Versions CX9900, CX9400, CX9200, CX9000, CMX240 (Magnetostrictive Probe)	10
	Versions AC8+, AC256+ (Magnetostrictive Probe)	10
Caldwell Systems Corp.	Tank Manager (Ultrasonic Probe)	16
Control Engineers	CEI 3000 Tank Level Module - Version TLP2, Normal/Rapid Test Mode (Magnetostrictive Probe)	22
EBW, Inc.	Auto-Stik II, Auto-Stik Jr. (Magnetostrictive Probe)	23
Egemin Naamloze Vennootschap	E'SPI III (Mass Buoyancy Probe)	31
	E'SPI IV (Mass Buoyancy Probe)	31
Emco Electronics, Tuthill Corp.	EECO System TLM/0.2 gph Precision Test (Q0400-4xx Magnetostrictive Probe)	32
	EECO System TLM/0.1 gph Precision Test (Q0400-4xx Magnetostrictive Probe)	32
	EECO System TLM/0.2 gph Quick Test (Q0400-4xx Magnetostrictive Probe)	32
	EECO System TLM/0.1 gph Quick Test (Q0400-4xx Magnetostrictive Probe)	32
Engineered Systems, Inc.	Image II (Magnetostrictive Probe)	39
Environment and Safety	EASI Level-Tru (Magnetostrictive Probe)	40
Gasboy International (formerly William M. Wilson's Sons)	Gasboy TMS 500 (Magnetostrictive Probe)	41
Marconi Commerce Systems (formerly Gilbarco Environmental Products)	EMC Environmental Management Console, EMC Basic Monitoring System Tank Monitors 2, 3, 2.1, 3.1, PAO238000XXXX (Capacitance Probe)	46, 54
	EMC Environmental Management Console EMC Basic Monitoring System Tank Monitors 2.1,3.1, PAO264XXX0000 (Capacitance Probe)	46, 54
	EMC Environmental Management Console EMC Basic Monitoring System Tank Monitors 2.1, 3.1, PAO265XXX0000 (Magnetostrictive Probe)	46, 54
	EMC/PC Series Monitoring Systems PA0265 and PA0300 (Magnetostrictive Probe)	54
Hasstech	Tank Compliance Center, Model 700 (7100 Series Magnetostrictive Probe)	61
INCON Intelligent Controls, Inc.	TS 1000, 1001, 2001 (Magnetostrictive Probe)	66
	TS 1000, 1001, 2001 (Incon LL2 Magnetostrictive Probe)	66
	TS 2000 (Magnetostrictive Probe)	66

Locating Information On Specific Leak Detection Systems

VENDOR	CONSOLE MODEL (and probe as evaluated)	PAGE NUMBER
Keekor Environmental Products	TankTite Leak Detection Kernel Version 1.0 with Keeprobe K7 (Magnetostrictive Probe)	79
Marley Pump Co.	Prolink System, RJE Probes # RE-400-094 thru 112-5 (Magnetostrictive Probe)	82
	Red Jacket ATM System, Version RLM 5000, 5001, 9000 (Magnetostrictive Probe)	80
	Sonic Technology (ST) 1400-1800 Series Tank Monitoring System, ATG Automatic Tank Gauging Monitor, LLM Series Liquid Level Monitor, FMS Fuel Management Monitor (Ultrasonic Probe)	85
NESCO (formerly Arizona Instrument Corp.)	Encompass MTS IPAM #17-903 (Magnetostrictive Probe #17-9300)	87
	Encompass USF IPAM #17-901 (Ultrasonic Probe #17-9100)	87
Omntec/Electro Levels Mfg., Inc.	OEL 8000 (Magnetostrictive Probe)	89
Patriot Sensors and Controls Corp. (formerly MagneTek)	7021 Digital Tank Gauge (7030 Series Magnetostrictive Probe)	61
	7021 Digital Tank Gauge (7100 Series Magnetostrictive Probe)	61
Petro Vend, Inc.	Petrosonic III (Version 4.05 Model 613, 4 inch, Magnetostrictive Probe)	97
	Site Sentinel Model II and III (Model 613, 2 inch, Magnetostrictive Probe)	97
	Site Sentinel Model II and III (Model 613, 4 inch, Magnetostrictive Probe)	97
Pneumercator Company Inc.	TMS 2000, TMS 3000 (Magnetostrictive Probe)	102
Ronan Engineering Co.	X-76 ETM, X-76 ETM-4X (Magnetostrictive Probe)	61
Tidel Engineering, Inc	Tidel Environmental Monitoring System, 3500 Series (Ultrasonic Probes #401-0009, #401-0010)	104
	Tidel Environmental Monitoring System, EMS 2000, 3000, 3500 Series (Ultrasonic Probes #401-0009 and #401-0010)	104
Universal Sensors and Devices, Inc.	TICS-1000 (Magnetostrictive Probe)	114
USTest, Inc.	UST 2001 Quick Test (Ultrasonic Probe)	121
	UST 2001(Ultrasonic Probe)	121
Veeder-Root	TLS-200, 200i, 250i, 300, 300C, 300i, 350, 350PC, 350R, 350RPC UST ATGS (Model 7842 Digital Sensing Capacitance Probe)	46, 54, 127
	TLS-200, 200i, 250i, 300, 300C, 300i, 300PC, 350, 350PC, 350R, 350RPC UST ATGS (Model 8472 Digital Sensing Capacitance Probe)	46, 54, 127

Locating Information On Specific Leak Detection Systems

VENDOR	CONSOLE MODEL (and probe as evaluated)	PAGE NUMBER
	TLS-250, 250i, 300, 300C, 300i, 300PC, 350, 350PC, 350R, 350RPC UST ATGS (Models 8473, 8493 Magnetostrictive Probes)	46, 54, 127, 128
	TLS Series 300, 350, 350R (Models 8463, 8473, 8493 Magnetostrictive Probes)	54, 128

For UST Owners And Operators: How Can You Use The “System Description” Of Your Leak Detection?

As the owner or operator of an underground storage tank (UST) system, you should make sure your vendor or installer provides you with the information and training necessary to guarantee your release detection equipment works effectively to detect leaks.

If you don't know how your system works, you will fail inspections and may find yourself with violations and penalty fees. Or even worse, you may find too late that you have had a leak and you may now have to pay for extensive cleanup of a contaminated site and for damages caused to others. It is your responsibility to know how to operate all protective devices properly so that you meet regulatory requirements that protect the environment.

The “system description” of the automatic tank gauging (ATG) system left with you will help you get started. The outline on the back of this page explains how you can understand each heading in the system description.

But to really know your equipment, you should contact the vendor listed and make sure you get full documentation for your leak detection system — such as an owner's manual or schedules for when recalibration is necessary or when regular maintenance is needed. Also, you should make use of any training provided by the vendor or someone else that would ensure that you operate and maintain your system properly.

Special Note If You Have Manifold Tanks: The information provided in the accompanying system description is largely for single tanks that are not part of a manifold system of interconnected multiple tanks. If you have a manifold UST system, you need to look carefully at your system description to see if it has been evaluated for use with manifold tanks. If you discover that the ATG system has not been evaluated for manifold tanks, there is still a possibility that it may work if you can functionally separate the tanks — basically cancelling the “manifold” interconnection of tanks — which may be possible if the tanks have a valve system or other mechanism that can isolate tanks for release testing. That's a lot of “ifs,” so you must check with your vendor, installer, or manufacturer, as well as your state regulatory agency, for help in understanding how you should act in this situation involving manifold tanks.

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How Can You Use The “System Description” Of Your Leak Detection?

What Can You Learn From The System Description?

The accompanying system description has the following headings that provide information:

- ▶ **Name:** Name of release detection device (usually a model series).
- ▶ **Equipment Type:** What kinds of release detection the device can provide.
- ▶ **Appearance:** An illustration of a representative device’s console.
- ▶ **Vendor:** Vendor’s name and contact information.
- ▶ **Basic System Description:** Notes unique aspects of the device not covered elsewhere in the system description.
- ▶ **Certified Leak Rates And Thresholds:** Notes leak rates and thresholds for the device as certified by a third party evaluation.
- ▶ **Applicability:** Notes types of product the device can detect.
- ▶ **Tank Capacity:** Notes the maximum capacity of the tank for which this device will work effectively. If your tank or tanks exceed this amount, you should not be using this device. May also note how full the tank needs to be for device to work.
- ▶ **Waiting Time:** Notes minimum waiting times, such as between delivery and testing or between dispensing and testing.
- ▶ **Test Period:** Notes the duration of the test or of various test modes that should demonstrate the device is working and capable of detecting leaks.
- ▶ **Calibration and Maintenance:** Notes basic requirements for keeping the device calibrated and maintained to detect leaks efficiently (including requirements for temperature/water sensor probes).
- ▶ **Comments and Limitations:** Notes distinct items such as “not evaluated using manifold tank systems” or “tests only the portion of tank containing product” or “requires water sensors and temperature probes.”
- ▶ **Sample Reports:** Illustrates the reports the device can generate and how you can make the device print these reports. Helps you know how to read and interpret the report.

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- Or phone your feedback to our Hotline at 1-800-424-9346.

Alert Technologies

Model 2000

Equipment Type:

Automatic tank gauging system

Vendor:

Alert Technologies, Inc.
5400 Newport Dr., Suite 13
Rolling Meadows, IL 60008
Phone: 847-392-0060

[No picture provided by vendor]

Basic System Description:

No system documentation was provided by vendor

Certified Leak Rates and Thresholds (with mass measurement probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, fuel oil, waste oil, solvents

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Tank must be between 50 and 95% full

Waiting Time:

- ▶ Minimum of 15 hours between delivery and testing
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Minimum of 2 hours
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from data determined to be valid by statistical analysis
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Mass measurement probe and water sensor must be checked and calibrated, if necessary, in accordance with manufacturer's instructions
- ▶ System is battery operated and does not automatically generate a hard copy of the leak test result; however, a hard copy of the results can be obtained by transfer of data to another unit (see manufacturer's instructions for further details)
- ▶ System is not equipped with any alarms

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product
- ▶ Alert Technologies, Inc. sold this product to an unnamed vendor, and therefore is unable to provide technical support for the Model 2000 automatic tank gauging system

[No sample reports were provided by vendor]

Andover Controls Infinity/Continuum Tank Monitoring System (TMS)

Equipment Type:

Automatic tank gauging system

Vendor:

Andover Controls Corp.
300 Brickstone Square
Andover, MA 01810
Phone: 978-470-0555
Fax: 978-470-0906
Internet: www.andovercontrols.com



Basic System Description:

The **Infinity /Continuum TMS** is a continuous monitoring system capable of providing the operator with inventory control and leak detection information. The **Infinity/Continuum TMS** consists of tank probes and a controller that displays leak detection information on either an optional liquid crystal display (LCD) or an attached personal computer. The vendor provided system documentation for the CX9000, CX9200, and CMX240 versions of the **Infinity/Continuum TMS**. The sample reports shown below are on-screen reports for these systems. Other versions of the **Infinity/Continuum TMS** include the CX9900, CX9400, AC8+, and AC256+.

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.05 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, fuel oil #4, solvents
- ▶ The AC8+ and AC256+ were also certified for fuel oil #6
- ▶ Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer

Tank Capacity:

- ▶ Maximum of 15,000 gallons; the CX9900, CX9400, CX9200, CX9000, and CMX240 are also certified at the 0.2 gph leak rate for tanks up to 30,000 gallons
- ▶ Tank must be between 50 and 95% full

Waiting Time:

- ▶ Minimum of 6 hours between delivery and testing
- ▶ Minimum of 3 hours between dispensing and testing
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Minimum of 6 hours
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated as the average of subsets of all data collected
- ▶ The AC8+ and AC256+ calculate the leak rate as the difference between first and last data collected divided by elapsed time between first and last volume changes observed
- ▶ There must be no dispensing or delivery during test

Andover Controls Infinity/Continuum TMS (continued)

Calibration and Maintenance Requirements:

- ▶ Resistance temperature detectors (RTD) and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product

Andover Controls Infinity/Continuum TMS: Sample Reports

You generate reports from the **Infinity TMS** from a main menu which lists and describes available commands. To access the main menu of the **Infinity TMS**, you must log-on to the system:

- ▶ Type WINDOW
- ▶ Enter user name and password when prompted
- ▶ Press F4; you should receive a command prompt R>
- ▶ Type LIST at the command prompt and press RETURN to view a list of available commands

The screen that lists available commands is presented below:

```
R>list
*****
      GTE- San Angelo Tank Monitoring Unit - San Angelo, Texas

ALRM                Active Alarm Summary Display
ALRMS              Active Alarm Detailed Display
COMMN              Communication Status
STAT              Tank Monitoring Unit Status Display
CLEAR              Clears System Generated Alarms
HISTORY            History Log Selection Menu
LIST              Command Menu Display

Tuesday, October 5 1993                      9:36:34

*****
R>
```

To generate basic status, leak detection test, and alarm history reports, you will use the STAT command and HISTORY command. Specific instructions for generating these reports follow.

Inventory/Status Reports

You can generate a status report from the Status (Stat) Screen. This report can tell you, among other things, how many tanks are being monitored, what type of fuel is in each tank, how much water and product are in the tanks (as well as the temperature compensated volumes), and the current leak rate of each tank.

To view the Status (Stat) Screen:

- ▶ Log in as described above
- ▶ Type STAT after the R> prompt

The Status (Stat) Screen is displayed below:

Andover Controls Infinity/Continuum TMS: Sample Reports (continued)

```
R>list
*****
      GTE- San Angelo Tank Monitoring Unit - San Angelo, Texas
ALRM           Active Alarm Summary Display
ALRMS          Active Alarm Detailed Display
COMMN          Communication Status
STAT           Tank Monitoring Unit Status Display
CLEAR          Clears System Generated Alarms
HISTORY        History Log Selection Menu
LIST           Command Menu Display

Tuesday, October 5 1993                      9:36:34

*****
R>
```

For more detailed inventory/status information you can generate a Fuel History Report, which describes the tank level, volume, ullage, and fuel usage for eleven of the most recent twelve hour periods, or a Delivery Log Report, which describes the temperature, volume, date, and time, by tank, at the beginning and end of the last eleven deliveries. You generate both of these reports from the History Menu.

To generate a Fuel History or Delivery Log Report:

Log in as described above

- ▶ Type HISTORY after the R> prompt; a list of history commands will appear
- ▶ Type FUEL HISTORY 1 or DELIVERY LOG 1, as appropriate, after the R> prompt

Change the suffix following the name of the report if you wish to view reports older than the eleven most recent. For example, type FUEL HISTORY 12 for the eleven twelve-hour periods preceding the eleven most recent. If you wish to view one of these reports for only one tank in a multi-tank system, identify the number of the tank after a space following the numerical suffix. For example, a Fuel History Report showing the eleven most recent twelve hour periods for just tank 1 would require you to type FUEL HISTORY 1 1.

Delivery reports can help you determine if leak test results might be affected by introduction of product during a test, or this data can be used to perform statistical inventory reconciliation to validate the results of in-tank leak detection tests.

Andover Controls

Infinity/Continuum TMS: Sample Reports (continued)

Leak Test Reports

The **Infinity TMS** can also generate leak test reports, which provide detailed information on the most recent leak tests performed by the system. The **Infinity TMS** will automatically attempt to perform a leak detection test daily, so unless the system has been programmed to perform differently, you should have daily leak detection test results for each tank attached to the system.

To print a Leak Test Report:

- ▶ Log on as described above
- ▶ Type LEAKLOG 1 after the R> prompt; this will display the results of the four most recent leak tests, log index numbers (LOG NBR) one through four

To get the results of preceding leak tests, change the number following LEAKLOG. For example, to obtain the results of the four leak tests that preceded LEAKLOG 1 results, enter LEAKLOG 5, which will display results for leak tests with LOG NBRs five through eight.

The Leaklog Screen is displayed below:

```
R>leaklog 1
*****
Log Tank----- START VALUES ----- END VALUES-----
Nbr Nbr Temp   Volume   Date-Time       Temp  Volume   Date-Time
1   1   67.51  2520.04  11/21/93 1:00   67.51 2520.04  11/21/93 2:37
    97 Minutes LeakRate 0.00 gph Volume Change 0.00 Invalid-Stk Float
2   1   68.25  2519.17  11/20/93 1:00   67.75 2519.74  11/20/93 7:01
    361 Minutes LeakRate 0.00gph Volume Change 0.02 Passed Test
3   1   67.90  2518.82  11/19/93 1:00   67.81 2518.96  11/19/93 7:01
    361 Minutes LeakRate -0.02gph Volume Change 0.14 Passed Test
4   1   71.76  2514.16  11/18/93 13:39   70.64 2515.55  11/18/93 19:40
    361 Minutes LeakRate 0.35 gph Volume Change 1.39 Failed Test!!
*****
R>
```

Infinity TMS leak test results and their meaning are shown below:

- ▶ PASSED: test was able to run for the minimum test time, and during the test, the temperature compensated volume remained the same or increased or decreased less than 0.1 gal/hr
- ▶ FAILED: test was able to run for the minimum test time, and during the test, the temperature compensated volume increased or decreased more than 0.1 gal/hr; such increases or decreases of greater than 0.1 gal/hr may be attributable to product leaking from the tank or the influx of groundwater into the tank
- ▶ INVALID: test stopped before completion due to delivery, dispensing, or probe hardware alarm or loss of system communication

Andover Controls Infinity/Continuum TMS: Sample Reports (continued)

If the **Infinity TMS** reports that the tank failed or that the test was invalid, you should investigate further to determine the cause of a possible leak. The system can reliably detect leakage rates of 0.2 gph or higher, and was third party certified as such, but reports that a tank failed if it detects a leak of more than 0.1 gph.

Alarm Reports

You can also generate reports that tell you what types of alarm events have occurred for a tank system in the past, or what alarms are currently triggered. The Alarmlog Screen displays the most recent alarm events.

To generate an Alarmlog Report:

- ▶ Log on to the system as described above
- ▶ Type ALARM LOG 1 at the R> prompt

Change the suffix following the name of the report if you wish to view reports older than the eleven most recent: For example type ALARM LOG 12 for the eleven alarm events preceding the eleven most recent.

The Alarmlog Screen is presented below:

```
R>alarmlog 1
*****ALARM LOG DISPLAY SCREEN*****
Log
Nbr      Date      Time      Alarm
Message      Gross      Fuel
Total      Level
1        11/22/93    10:34    High Water in Tank Alarm    2433.9    41.11
2        11/20/93    16:49    Stuck Float Alarm           2428.2    41.11
3        11/20/93     9:45    Stuck Float Alarm           2428.1    41.11
4        11/20/93     4:22    Stuck Float Alarm           2428.2    41.11
5        11/19/93    13:51    DayTank High Level Alarm    2428.2    41.10
6        11/19/93    13:50    DayTank Low Level Alarm     2428.2    41.10
7        11/19/93    13:47    Brine Sensor Trouble Alarm  2424.2    41.10
8        11/19/93    13:47    High Water in Tank Alarm    2424.2    41.10
9        11/19/93    13:44    DayTank High Level Alarm    2424.2    41.10
10       11/19/93    13:43    Brine Sensor Trouble Alarm  2424.2    41.10
11       11/19/93    13:43    High Water in Tank Alarm    2424.2    41.10
*****
R>
```

Finally, you can generate reports that differentiate between alarms generated to inform the operator that the level of the tank is too high or low, or that theft has occurred, and alarms generated to inform the operator of a leak, an incomplete leak test, or other alarms. These reports are called the Levelalarms Report and Tankalarms Report respectively.

To generate a Levelalarm or Tankalarm Report:

- ▶ Log on as described above
- ▶ Type HISTORY at the R> prompt; a list of HISTORY commands will appear
- ▶ Type LEVELALARM 1 or TANKALARM 1, as appropriate, to generate a report of the eleven most recent alarm events; if an alarm has been triggered, a time will appear beneath the heading for that type of alarm

Caldwell Systems Tank Manager

Equipment Type:

Automatic tank gauging and line leak detection system

Vendor:

Caldwell Systems Corp.
600 South Sunset Street, Unit D
Longmont, CO 80501
Phone: 303-684-8436
Fax: 303-684-8438



Basic System Description:

The **Tank Manager** system is a permanently installed inventory and leak detection system for both underground and aboveground storage tanks. The system consists of an electronic console, in-tank probes for liquid level sensing, and optional sump, interstitial, and vapor sensors. The **Tank Manager** system can display leak detection information on a liquid crystal display (LCD) screen built into the console as well as print this information directly from the console.

Certified Leak Rates and Thresholds (with ultrasonic probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.05 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, solvents
- ▶ Other liquids may be tested after consultation with the manufacturer

Tank Capacity:

- ▶ Maximum of 20,000 gallons
- ▶ Tank must be between 50 and 95% full

Waiting Time:

- ▶ Minimum of 12 hours and 25 minutes between delivery and testing
- ▶ Minimum of 15 minutes between dispensing and testing
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Minimum of 3 hours and 15 minutes
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from data determined to be valid by statistical analysis
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product
- ▶ Water sensor, temperature sensor, and product level monitor are contained in a single ultrasonic probe

Caldwell Systems

Tank Manager: Sample Reports

The **Tank Manager** system displays information on the attached LCD and allows you to print status, leak test, and inventory reports. You can use two keys on the front panel to access all of the operational displays on the screen. The STAT key brings up the current status display of all active tanks and sensors. The DSP MENU key brings up a menu from which you can select the other operational displays. Below you will find descriptions of both on-screen displays and printed reports relating to inventory/status, leak tests, and alarms.

Inventory/Status Reports

You can view the current status of all tanks connected to the **Tank Manager** system by pressing the STAT key on the keypad. In addition to the tank number, type of product, volume, depth, and temperature, this display shows various alarms, which will be discussed in more detail in the Alarm Reports section below:

The Stat Display is provided below (note: alarm indicators will flash against a dark background):

TANK	VOLUME	DPTH	WATER	TMP
1 C REGULAR HI	7456.2	85.5	.0	83.0
2 SUP UNLD	6863.8	76.6	HI 2.8	84.0
3TH REG UNLD	3719.4	45.2	.0	80.0
4 DIESEL	460.6	10.2	.0	77.6
6/16 12:23 PM	LIQ	VAP	BRN	LNE

The **Tank Manager** system can also generate a Tank Status Report, which is a record of the status of every tank connected to the system and includes the tank number, fuel type, and current values for volume, depth, water height, temperature, ullage, net volume, and maximum amount of next delivery. Below is an example of a Tank Status Report:

To generate a Tank Status Report:

- ▶ Press PRNT MENU
- ▶ Press 1
- Or
- ▶ Press [ARROW] to position the cursor over the STATUS option in the PRINT MENU and press ENTER

6/05/95	4:16AM
TANK STATUS REPORT	
TANK 1 REGULAR	
5185.4	VOLUME (GAL)
59.14	DEPTH (IN)
6.3	WATER (IN)
65.4	TEMP (F)
2835	ULLAGE (GAL)
5162.1	NET VOL (60F)
2033	MAX DLV (GAL)
TANK 2	SUP UNLD
4560.3	VOLUME (GAL)
53.17	DEPTH (IN)
3.8	WATER (IN)
61.1	TEMP (F)
3460	ULLAGE (GAL)
4553.5	NET VOL (60F)

Caldwell Systems

Tank Manager: Sample Reports (continued)

In addition to the STAT display and the Tank Status Report, you can view an inventory display that details the daily running inventory, including date, volume pumped, volume delivered, and ending volumes.

To view the Inventory Display:

- ▶ Press DSP MENU
- ▶ Press 2
- Or
- ▶ Press [ARROW] to position the cursor over the INVENTORY option in the DSP MENU and press ENTER

You can also view the Volume History Display, which plots the volume history of each tank hourly for one full week.

To view the Volume History Display:

- ▶ Press DSP MENU
- ▶ Press 4
- Or
- ▶ Press [ARROW] to position the cursor over the VOLUME HISTORY option in the DSP MENU and press ENTER

Delivery reports can help you determine if leak test results might be affected by introduction of product during a test, or this data can be used to perform statistical inventory reconciliation to validate the results of in-tank leak detection tests. Additionally, you can print Weekly and Monthly Inventory Reports. You may use this inventory data to fulfill regulatory inventory reconciliation requirements or to confirm that a tank is or is not leaking. A standardized Inventory Report is shown below:

To generate a Weekly or Monthly Inventory Report:

- ▶ Press PRNT MENU
- ▶ Press 3 for weekly inventory data, or press 4 for monthly inventory data

6/03/95		3:17 pm	
INVENTORY REPORT			
END HOUR 5			
TANK 1		REGULAR	
DATE	PUMP	DELV	END
TODAY	285	4787	5195
6/03	403	0	743
6/02	922	0	1146
6/01	1226	0	2068
5/31	1379	0	3294
5/30	1032	0	4673
5/29	1377	5014	5705
5/28	0	0	2068
5/27	1	0	2068
TANK 2		SUP UNLD	
.			
.			
.			

Leak Test Reports

The **Tank Manager** system can display leak test results graphically on screen in two ways. First, the Test Summary Display is a bar chart, one chart per tank, which displays the gallon per hour volume change rates for the last 15 tank leak tests. Each bar on the chart represents the results of one test. On the left hand axis of the bar chart on the screen, you will find the scale for the volume change rate, marked as plus (into tank) and minus (out of tank) gallons or liters per hour. To the left of the bar chart, you will see a box which displays the depth, volume, and temperature of the fuel in the tank, the volume and temperature change for the test, and the month, day, and time of the test. The Last Test Detail Display shows you only the results of the last test that was run on each tank.

To view the Test Summary or Last Test Detail Display:

- ▶ Press DSP MENU
- ▶ Press 3 (press 6 to view Last Test Detail Display)
- ▶ Use the [ARROW] keys to move between details of various tests
- Or
- ▶ Press [ARROW] to position the cursor over the TEST SUMMARY or LAST TEST DETAIL option in the DSP MENU and press ENTER

You can also print a Test Summary Report, which is a concise summary of the last 15 valid leak detection tests run on each tank. The following conditions may result in invalid test results, which are not saved: recent deliveries, large temperature changes during a test, not enough quiet time during the six hour test window, or low tank volume. A Test Summary Report is shown below:

To generate a Test Summary Report:

- ▶ Press PRNT MENU
- ▶ Press 2
- Or
- ▶ Press [ARROW] to position the cursor over the LAST TEST SUMMARY option in the PRINT MENU and press ENTER

MONTH LEAK TEST RPT			
TANK 1	REGULAR		
MM/DD	VOL	DPH	GPH
5/14	2072	29	.00
5/16	2071	29	.01
5/17	2071	29	.00
5/18	2071	29	-.01
5/19	2071	29	.00
5/20	2071	29	-.02
5/21	2070	29	-.02
5/22	2070	29	-.03
5/23	2070	29	-.02
5/24	2070	29	-.03
5/25	2069	29	.00
5/26	2069	29	.01
5/27	2068	29	.02
5/28	2068	29	.03
Tank 2 SUP UNLD			
			.
			.
			.

If the **Tank Manager** system detects an increase or decrease in volume greater than 0.2 gph, based on the results of the last complete leak test, then the system will show the test alarm indicator, TA, on the LCD. If the **Tank Manager** system reports such an event, the operator should investigate to determine the cause of a possible leak.

Alarm Reports

You can view current alarm indicators on the STAT display screen (described above). These indicators appear as text (defined below) flashing against a dark background. For example, if the last leak test showed a loss or gain in volume of 0.2 gph or more, TA will flash beside the tank number on the Stat Display. A list of alarm indicators relevant to the tank, volume, water level, and sensors follows:

Tank

- ▶ TA: last leak test showed a loss or gain in volume of 0.2 gph or more
- ▶ C: tank probe is not detecting level and may require service
- ▶ T: no tank test has been completed for 21 days

Volume

- ▶ HI: tank is filled above the high volume alarm set point
- ▶ LO: tank volume is below the low volume set point

Water

- ▶ HI: water level in the bottom of the tank exceeded the high water set point

Sensors

- ▶ LIQ: one or more defined sump or interstitial sensors are in alarm
- ▶ VAP: one or more vapor sensors are in alarm
- ▶ BRN: brine sensor shows low or high level
- ▶ LNE: 3.0 gph pressure line leak test has failed

You can view historical alarm and sensor information by requesting from the **Tank Manager** system an Alarm History Display (shown below) or an External Sensor History Display. The Alarm History Display shows the date and time, type and location, and applicable numerical details of the last seven alarm conditions detected by the system. The External Sensor History Display shows a graph of one week's liquid, vapor, and brine sensor results. The box on the left hand side of the display shows the subchannel, type of sensor, and recorded value for each of the sensors. You can change the set of sensors displayed by pressing the NEXT key, or move between days by pressing the [ARROW] keys to move the cursor on the graph.

Caldwell Systems

Tank Manager: Sample Reports (continued)

To view the Alarm History or External Sensor History Display:

- ▶ Press DSP MENU
- ▶ Press 1 for ALARM HISTORY or 2 for EXTERNAL SENSOR HISTORY
- Or
- ▶ Press [ARROW] to position the cursor over the appropriate option in the DISPLAY MENU and press ENTER

ALARM HISTORY					
5/28	7:26AM	TK 1	REGULAR	HI VOL	7081
6/02	6:12AM	TK 1	REGULAR	LO VOL	743
6/03	1:36PM	LIQ SEN 6		LIQUID	111
6/03	2:28PM	TK 1	REGULAR	HI WTR	6.31
2/04	8:51PM	BRINSEN 52		BRIN LO	0
1/18	3:58PM	LINE TST		FAILED	.0

Control Engineers

CEI Tank Level Module

Equipment Type:

Automatic tank gauging system

Vendor:

Veeder-Root
125 Powder Forest Dr.
Simsbury, CT 06070-2003
Phone: 860-651-2700
Fax: 860-651-2719
Internet: www.veeder-root.com

[No picture provided by vendor]

Basic System Description:

No product documentation was provided by the vendor for the **CEI Tank Level Module**. The rights to this system were sold to Veeder-Root; contact Veeder-Root for additional information.

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.05 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Tank must be between 50 and 95% full

Waiting Time:

- ▶ Minimum of 6 hours and 40 minutes between delivery and testing
- ▶ There must be no dispensing or delivery during waiting time

Test Period:

- ▶ Minimum of 4 hours for normal test mode and 1 hour and 12 minutes for rapid test mode
- ▶ Test data are acquired and recorded by a microprocessor
- ▶ Leak rate is calculated from data determined to be valid by statistical analysis
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Resistance temperature detectors (RTD) and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product
- ▶ Control Engineers no longer manufactures this equipment

[No sample reports were provided by vendor]

EBW

Auto/Stik II and Auto/Stik Jr

Equipment Type: Automatic tank gauging and automatic line leak detection system

Vendor:

EBW, Inc.

2814 McCracken

P.O. Box 689

Muskegon, MI 49443

Phone: 800-475-5151

Fax: 231-755-7201

Internet: www.ebw.com/products.htm



Basic System Description:

The **Auto/Stik** automatic tank gauging systems provide leak detection through a “static” test when the tank is inactive, or a continuous leak detection test when the tank is active. The **Auto/Stik Jr** system is intended for facilities with eight or fewer tanks, providing an alternative to the more complex **Auto/Stik II** system, and can accommodate a combination of up to eight interstitial, piping, sump, or hydrostatic liquid sensors. The **Auto/Stik II** system accommodates more in-tank probes and external sensors.

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.05 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, fuel oils #4 and #6, solvents
- ▶ Other liquids with known coefficients of expansion and density may be tested after consultation with the manufacturer

Tank Capacity:

- ▶ Maximum of 15,000 gallons (for static leak detection)
- ▶ Maximum of 30,000 gallons (for continuous leak detection)
- ▶ Tank must be between 50 and 95% full

Waiting Time:

- ▶ Minimum of 6 hours between delivery and testing
- ▶ Minimum of 6 hours between dispensing and testing
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Minimum of 4 hours
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from average of subsets of all data collected
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product
- ▶ Auto Stik Jr. is used with up to 4 magnetostrictive probes and can handle up to 8 input sensors
- ▶ Auto Stik II is used with up to 16 magnetostrictive probes and can handle up to 64 input sensors

When the **Auto/Stik** system is operating normally, the liquid crystal display (LCD) screen will display the word RUN and list currently available tank status information. You can view on-screen inventory/status information, leak detection test information, and alarm information by using the NEXT and PREVIOUS keys on the key pad to select desired information, and you can move between tanks by pressing the NEXT TANK key. Alternatively, you can print reports by pressing the PRINT key and selecting the desired report and tank number. Detailed discussion of the available displays and reports follows.

Inventory/Status Reports

The second line of the LCD screen displays the net and gross volume of product, fuel and water level, temperature, volume to full, and ullage to full/percent tank full. Vendor-supplied information does not specifically show what the LCD screen looks like.

To view tank status information:

- ▶ Press NEXT or PREVIOUS keys to select desired information
- ▶ Press NEXT TANK to view information on a different tank

The **Auto/Stik** system can also print the following inventory/status reports:

- ▶ Status Report (shown below): displays the current status of all active tanks
- ▶ Shift Report: updates the volume of all active tanks according to programmed shift times
- ▶ Drop Report: displays the beginning and ending product volume, fuel level, and temperature, and inventory change for the last delivery to all active tanks
- ▶ Tank Setup Report (shown below): displays specific information on the size and type of tank, type and orientation of probes, alarm and sensor set points, and type of product
- ▶ Shift Times Report: displays the programmed shift times for all active tanks
- ▶ Drop History Report: displays the time and inventory change for the last six deliveries to all active tanks

To print any of these inventory/status reports:

- ▶ Press PRINT REPORTS
- ▶ Press MORE to scroll through available reports
- ▶ Select desired report

```
WED MAY 22,96 9:49:46 AM

STATION NAME

TANK 1 PRODUCT:                LEAD FREE
CURRENT STATUS:
|CNT| | | | | | | | |

GROSS:                          615.161 gal
NET:                             608.541 gal
FUEL LEVEL:                      28.9232 in
WATER LEVEL:                     0.6443 in
TEMP:                            76.510 F
GROSS VTF:                       355.857 gal
GROSS ULLAGE:                    95%=307.307 gal
```

You can also print Tank Setup Report. This report provides specific information on the size and type of tank, type and orientation of probes, alarm and sensor set points, and type of product. The Tank Setup Report is shown below:

```
TANK SETUP REPORT
WED May 2,96 5:04:50 PM
STATION NAME:
BS2E31 Feb 15 1996 11:54:07

                TANK 1

TANK IS:                                NORMAL
TYPE OF TANK:
                OCF DWT-4 4' 1000gal
STEEL INSIDE DIAMETER:                   0.000 in
STEEL TOTAL VOLUME:                      0.000gal
TILTED:                                  NO
BETWEEN FILL & CENTER:                   NO
BETWEEN PROBE & CENTER:                  0.000

BETWEEN PROBE & FILL:                    0.000 in
FUEL LEVEL @ PROBE:                      0.000 in
FUEL LEVEL @ FILL                        0.000 in

PROBE S/N:
    PROBE SPEED-O-WIRE: 9.053 uSEC/in
VERTICAL SCALE:                          0.000 gal/IN
VERTICAL HEIGHT:                         0.000 in
INITIAL PRODUCT LEVEL:
                25.000 in
INITIAL WATER LEVEL:                    0.000 in
HIHI ALARM:                              900.000 gal
HI ALARM:                                850.000 gal
LOW ALARM:                               200.000 gal
HI WATER ALARM:                          2.000 in
THEFT ALARM:                             50.000 gal
LEAK ALARM:                              0.2000 gal/hr
PRODUCT:                                  LEAD FREE
```

Delivery reports can help you determine if leak test results might be affected by introduction of product during a test, or this data can be used to perform statistical inventory reconciliation to validate the results of in-tank leak detection tests.

Leak Test Reports

The **Auto/Stik** system will automatically leak test active tanks at programmed times. You can, however, manually conduct a tank or line leak test; the steps to manually leak test a tank are described below:

- ▶ Press the TANK LEAK key
- ▶ Press the START key; manual leak tests for all tanks displayed on the LCD will begin
- ▶ The word TEST should appear in the third line of the LCD indicating a leak test is in progress

The Leak Test Report (shown below, with the heading “Auto Leak Test”) will generally print automatically at the end of the leak test. On the **Auto/Stik Jr**, an illuminated front panel indicator tells you there is a saved report to be printed. The **Auto/Stik Jr** 1-8 Series and the **Auto/Stik II** print reports as soon as programmed leak tests have completed.

```

AUTO LEAK TEST
WED MAY 22,96 5:47:21 PM
STATION NAME:
      GENE'S SERVICE
      SHERMAN
      MESKEGON, MI

TANK 1 PRODUCT:                DIESEL

LEAK RATE:                      0.009 gal/hr
      PASS 0.2 GPH TEST

PERCENT OF TANK TESTED:        41.1%
START: SUN MAY 19,96 12:00:02 AM
BEG FUEL LEVEL:                 51.5870 in
BEG WATER LEVEL:               0.0357 in
      850.905 gal, 53.04°F
      850.917 gal, 53.02°F
      850.928 gal, 53.00°F
      850.936 gal, 52.98°F
END: SUN MAY 19,96 4:09:01 AM
END FUEL LEVEL:                 51.587 in
END WATER LEVEL:               0.0352 in
    
```

If the operator has enabled the AutoLeak Mode, the **Auto/Stik** system will print an AutoLeak Report as soon as 4 days or at least in 25 days, depending upon activity in the tank. This report details the current leak rate of each active tank in the system as determined by the continuous leak detection mode of the **Auto/Stik** system. The AutoLeak Report is shown below:

```
AUTOLEAK REPORT
THU JAN 25,96 9:46:28 AM
STATION NAME:
      EBW TEST SITE
      2814 McCracken Ave
      (800)475-5151
      MUSKEGON, MI 49441

TANK 1 PRODUCT:          NO LEAD

LEAK RATE:                -0.09 gal/hr
                          PASS 0.2 GPH TEST

LEAK TEST START:
      MON JAN 01,96 12:00:00 AM
TEST 1:                    ??? gal/hr
TEST 2:                    0.09 gal/hr
TEST 3:                    ??? gal/hr
TEST 4:                    ??? gal/hr
TEST 5:                    ??? gal/hr
TEST 6:                    ??? gal/hr
LEAK TEST END:
      SAT JAN 13,96 12:00:00 AM
```

Finally, the **Auto/Stik** system can manually or automatically conduct line leak detection tests and report results of those tests. If Line Leak Software has been installed on the unit, you can manually conduct a leak detection test by simply pressing the LINE LEAK key. Any time the line leak detector passes or fails a test, the **Auto/Stik** system will print a report that includes the line number, current status, test leak rate threshold, and historical pass/fail status. A Line Leak Report is shown below:

```
LINE LEAK TEST
WED MAY 22,96 5:48:19 PM
STATION NAME:
      GENE'S SERVICE
      SHERMAN
      MESKEGON, MI

      LINE 1

CURRENT STATUS:                NO ERRORS
0.2 GPH MONTHLY PASS           YES
0.2 GPH TEST HISTORY:
      APR:
      MAR:
      FEB:
      JAN:
      DEC:
      NOV:
LAST 0.2 GPH TEST:             PASS
      TUE MAY 21,96 7:01:52 PM
LAST 0.1 GPH TEST:             PASS
      TUE MAY 21,96 10:04:07 PM
- - - - -

LINE 2

CURRENT STATUS:                NO ERRORS
0.2 GPH MONTHLY PASS           YES
0.2 GPH TEST HISTORY:
      APR:
      MAR:
      FEB:
      JAN:
      DEC:
      NOV:
LAST 0.2 GPH TEST:             PASS
      WED MAY 22,96 4:41:51 PM
LAST 0.1 GPH TEST:             PASS
      TUE MAY 21, 96 10:09:01 PM
```

Alarm Reports

You can view current alarm conditions on the third line of the LCD screen on the **Auto/Stik** console. The following codes correspond to alarm conditions:

- ▶ TEST: leak test in progress
- ▶ LEAK: failed leak test
- ▶ DRP: delivery in progress
- ▶ CNT: contact alarm has been activated
- ▶ TFT: theft gallon threshold exceeded during leak test
- ▶ PRB: probe fault
- ▶ HHHI: programmed high-high volume set point exceeded
- ▶ HI: programmed high volume set point exceeded
- ▶ LOW: volume below low set point
- ▶ H2O: programmed high water alarm threshold exceeded
- ▶ Press NEXT TANK to view alarm conditions on other active tanks in system

The **Auto/Stik** system will automatically print a report that details the last alarm conditions for all tanks when an alarm is activated. An Alarm Report is shown below:

```
ALARM REPORT
WED MAY 22, 96 4:58:36 PM

STATION NAME:

TANK 1 PRODUCT:          PREMIUM UNLEADED

HI WATER ALARM:
                        WED MAY 22,96 5:34:51 PM
LOW ALARM:
                        WED MAY 22,96 5:34:51 PM
HIGH ALARM:
                        WED MAY 22,96 5:34:51 PM
-----
TANK 2 PRODUCT:          LEAD FREE

                        NO PREVIOUS TANK ALARMS
-----
CONTACT 3:
                        MON MAY 20,96 4:45:25 PM
```


Egemin Naamloze Vennootschap

E'SPI III and IV

Equipment Type:

Automatic tank gauging system

Vendor:

Egemin Naamloze Vennootschap
Bredabaan 1201-2900
Schoten, Belgium
Phone: 011-32-3-03/645 2790
Internet: www.egemin.com/EGEMIN/Default.asp

[No picture provided by vendor]

Basic System Description:

No information regarding this system was provided by the vendor

Certified Leak Rates and Thresholds (with mass measurement probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.0075 gph for **E'SPI III**
- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph for **E'SPI IV**

Applicability:

- ▶ Gasoline, diesel, aviation fuel, solvents

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Tank must be between 50 and 95% full

Waiting Time:

- ▶ Minimum of 7 hours between delivery and testing
- ▶ There must be no dispensing or delivery during waiting time

Test Period:

- ▶ Minimum of 5 hours and 30 minutes
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from average of subsets of all data collected
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Temperature sensor and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product

[No sample reports were provided by vendor]

Emco Electronics

EECO System TLM

Equipment Type:

Automatic tank gauging and line leak detection system

Vendor:

Emco Electronics Division, Tuthill Corp.
114-300 Mackenan Drive
Cary, NC 27511
Phone: 919-460-6000
Fax: 919-460-7595
Internet: www.emcoelectronics.com



Basic System Description:

EECO System TLM 1000, 1500 (shown here), 2000, and 3000 ATG consoles can run the EECO System Precision and Quick Tests at the leak rate selected by the operator. A continuous leak detection option, called "Segmented Leak Detection (SLD)" is also installed on new 1500 and 2000 systems, or is available as an option on existing systems. **EECO System TLM** 1500, 2000 and 3000 can also generate automatic line leak detection reports. The **EECO System TLM** 3000 allows user access to information on a personal computer through a series of touch-screens.

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.5 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, fuel oil #4, all petroleum products
- ▶ Other liquids may be tested after consultation with the manufacturer

Tank Capacity:

- ▶ Tanks less than 95% full may be tested
- ▶ Minimum product level required based on tank diameter as follows: 48" dia/min 8.5"; 64" dia/min 10.5"; 72" dia/min 11.5"; 96" dia/min 14"; 126" dia/ min 18"; for other diameters, see evaluation report

Waiting Time:

- ▶ Between delivery and testing ranges from 1 to 6 hours, depending on tank conditions
- ▶ Minimum of 6 hours between delivery and testing for leak rate of 0.1 gph
- ▶ None between dispensing and testing
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Data are acquired and recorded by a microprocessor that automatically determines test time based on tank size and product level
- ▶ There must be no dispensing or delivery during test

0.2 gph Precision Test:

- ▶ Average of 2 hours and 46 minutes during evaluation

0.1 gph Precision Test:

- ▶ Minimum of 3 hours and 45 minutes
- ▶ During the evaluation, test duration averaged 3 hours and 45 minutes at 95% full and 5 hours and 58 minutes at 50% full

0.2 gph Quick Test:

- ▶ Average of 1 hour and 9 minutes during evaluation

0.1 gph Quick Test:

- ▶ Minimum of 1 hour and 49 minutes
- ▶ During the evaluation, test duration averaged 1 hour, 48 minutes at 95% full and 2 hours and 48 minutes at 50% full

Calibration and Maintenance Requirements:

- ▶ Resistance temperature detectors (RTD) and probe must be checked regularly and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tanks
- ▶ Tests only the portion of tank containing product

Emco Electronics

EECO System TLM: Sample Reports

The **EECO System TLM** has three basic operating modes - Display Mode, Print Mode, and Change Mode. To view tank inventory/status, leak test information, or alarm information on the console, you can initiate the display mode by pressing the DISPLAY key and selecting the desired information from the on-screen menu. Similarly, you can print this information by initiating the print mode by pressing PRINT and selecting desired information from the menu. Below you can see how to display or print available information from the **EECO System TLM**.

Inventory/Status Reports

You can view on the console the Auto Display (All), which will show the product level, gross and net volume, product temperature, ullage, water level, water volume, delivery status, water removal status, alarm status, and tank and line conditions.

To view Auto Display (All):

- ▶ Press DISPLAY
- ▶ Press [ARROW] to select AUTO DISPLAY (ALL) option
- ▶ Press ENTER

You can look at individual elements of Auto Display (All) by pressing the [ARROW] keys to select the desired information and pressing ENTER. You can also print an Inventory Status Report, which shows the tank number, product, level, gross and net volume, product temperature, ullage, water and water volume. The Inventory Status Report is shown below:

To print an Inventory Status Report:

- ▶ Press PRINT
- ▶ Press STATUS
- ▶ Press ENTER twice

```
STATION NAME HERE
STREET ADDRESS
CITY, STATE, ZIP
PHONE NUMBER
V22 04

11-07-94 09:15:00

TLM INVENTORY STATUS REPORT

TANK 1 REGULAR
PRODUCT LEVEL:      28.02          "
GROSS VOLUME:      2421.70        US GAL
NET VOLUME:        2411.64        US GAL
PRODUCT TEMP:       67.18          °F
ULLAGE:            6819.21        US GAL
WATER LEVEL:        0.06          "
WATER VOLUME:       0.18          US GAL

(repeats for each tank in system)
```

In addition to the Inventory Status Report, the **EECO System TLM** will automatically print a Delivery Report approximately two minutes after the end of a delivery. This report includes the total gross and net volume added to the tank, plus the starting and ending inventory, but does not account for fuel dispensed during the delivery process. You can see historical delivery information by requesting a Delivery Status Report, which provides the date, time, gross and net volume of each tank for the last 10 deliveries. Delivery reports can help you determine if leak test results might be affected by introduction of product to the tank during a test, or you can use this data along with usage data to perform statistical inventory reconciliation to validate the results of in-tank leak detection tests.

Leak Test Reports

You can set the **EECO System TLM** to run a leak detection test, program the system to test at specified times, or set the system to run in a continuous leak detection mode, where the system will perform a test automatically after product is dispensed. The sensitivity of the leak test you run is generally set at system start-up.

To run a manual leak test:

- ▶ Press CHANGE
- ▶ Press LEAK TEST
- ▶ Press ENTER twice
- ▶ Press CHANGE; "NO" will flash
- ▶ Press [ARROW] then ENTER to start the test right away

You can view current and historical leak test information for the tank, line, or interstitial or sump monitors on the console. To view leak test information on the console:

- ▶ Press DISPLAY
- ▶ Press LEAK TEST
- ▶ Press [ARROW] to select TANK LEVEL MONITOR, LINE LEAK DETECTOR, or AUTO DISPLAY ALL

To view Event history information on the console:

- ▶ Press DISPLAY
- ▶ Press HISTORY
- ▶ Press [ARROW] to select TLM EVENTS ONLY, LS EVENTS ONLY (leak sensor events), or LLD EVENT ONLY (line leak detector events)

Each of the above on-screen displays is also available in a printed report. Each time a scheduled leak test is complete, the **EECO System TLM** will produce a Leak Test Report. This report shows the test type, leak rate threshold and confidence level, last delivery, tank capacity, test time and length, and changes in volume, product temperature, and water level. The report indicates whether the tank has passed or failed based on the leak rate derived from the data described above. You can also request this normally automatic report as a Last Test Ran Report.

Emco Electronics

EECO System TLM: Sample Reports (continued)

You can also print a combination report that details the current leak test status, the results of the last passed test, and leak test history.

To print a Combination Leak Test Report:

- ▶ Press PRINT
- ▶ Press LEAK TEST
- ▶ Press ENTER once

```
STATION NAME
STREET ADDRESS
CITY, STATE, SIP
PHONE NUMBER

V0041
4-17-95    03:32:00

LEAK TEST REPORT
TANK 1 REGULAR

TEST TYPE:                MANUAL, 0.1 GPH
THRESHOLD: 0.05
CONFIDENCE LEVEL: 96/4
LAST DELIVERY: 04-15-95 18:45
TANK CAPACITY:           548 US GAL
%FULL VOLUME:            63
TEST START TIME:         10:40
TEST LENGTH               1:45 HOURS
PROD LEVEL CHANGE:       0.0300"

PROD GROSS CHANGE:       0.050 US GAL
PROD NET CHANGE:         -0.040 US GAL
PROD TEMP CHANGE:        -0.20 °F
RTD 1 CHANGE:            0.02 °F
RTD 2 CHANGE:            0.02 °F
RTD 3 CHANGE:            0.02 °F
RTD 4 CHANGE:            0.02 °F
RTD 5 CHANGE:            0.02 °F
WAT LEVEL CHANGE:        0.0030"
WAT VOLUME CHANGE:       0.002 US GAL
COEFF 1                   0.3400
COEFF 2                   0.0540

TEST RESULT: (FAILED OR PASSED)
LEAK RATE: 0.10 GPH
(VOLUME IS DECREASING)
```

If the **EECO System TLM** reports that the tank failed, you should investigate further to determine the cause of a possible release. You can also print an Inventory Reconciliation Information Report which may be valuable in confirming results of either passed or failed leak detection tests. This report shows the opening and closing gross product volume as well as deliveries and usage. Importantly, this report does not account for product dispensed during deliveries. An Inventory Reconciliation Report is shown on the next page.

Emco Electronics

EECO System TLM: Sample Reports (continued)

To print a Reconciliation Information Report:

- ▶ Press PRINT
- ▶ Press STATUS
- ▶ Press ENTER four times
- ▶ Press ENTER

```
STATION NAME
STEET ADDRESS
CITY, STATE, ZIP
PHONE NUMBER
V22.04
```

11-07-94 09:15:00

RECONCILIATION INFORMATION REPORT

```
TANK 1 REGULAR
OPENING: 11-06-94    06:00:00
CLOSING: 11-07-94    06:00:00
OPENING (NET):      3625.03 US GAL
CLOSING (NET):      4684.60 US GAL
OPENING (GROSS):    3615.10 US GAL
CLOSING (GROSS):    4675.79 US GAL
NET DELIVERIES:     8500.65 US GAL
GROSS DELIVERIES:   8473.11 US GAL
NET USAGE:          7440.12 US GAL
GROSS USAGE:        7412.27 US GAL
```

Alarm Reports

You can obtain current and historical alarm information from the **EECO System TLM**. The Alarm Status Report gives you present alarm conditions and the tank with which they are associated. Below you will find a list of abbreviations used to represent different alarm conditions on an Alarm Status Report:

- ▶ HI PRO: product level above set point
- ▶ LO PRO: product level below set point
- ▶ HI WAT: water level above set point
- ▶ LEAK: failed leak test
- ▶ THEFT: fuel removed from tank
- ▶ ALARM: leak sensor alarm
- ▶ FUEL: leak sensor detected fuel
- ▶ WATER: leak sensor detected water

To print a TLM Alarm Status Report:

- ▶ Press PRINT
- ▶ Press STATUS
- ▶ Press ENTER
- ▶ Press [ARROW] three times
- ▶ Press ENTER

```
STATION NAME
STEET ADDRESS
CITY, STATE, ZIP
PHONE NUMBER
V22.04
```

11-07-94 09:15:00

TLM ALARM STATUS REPORT

```
TANK 1 REGULAR
NORMAL
```

```
TANK 2 PLUS
NORMAL
```

```
TANK 3 SUPER
```

The **EECO System TLM** can also print the following reports, which do not neatly fit the above categories. The first, a Water Removal Report, is generated automatically, whenever water is removed from the tank. The second, an Event History Report, is a customized report that may be useful for system servicing. You can generate the second report manually by following the steps described below:

To print an Event History Report:

- ▶ Press PRINT
- ▶ Press HISTORY
- ▶ Press ENTER to select ALL EVENTS or [ARROW] other desired history report then ENTER.

Engineered Systems Image II

Equipment Type:

Automatic tank gauging system

Vendor:

Engineered Systems, Inc
2001 W. Campus Dr.
Tempe, AZ 85282

Number disconnected; no further information available

[No picture provided by vendor]

Basic System Description:

No information regarding this system was provided by the vendor

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, solvents

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Tank must be minimum 90% full

Waiting Time:

- ▶ Minimum of 8 hours between delivery and testing
- ▶ There must be no dispensing or delivery during waiting time

Test Period:

- ▶ Minimum of 6 hours
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from average of subsets of all data collected
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Resistance temperature detectors (RTD) and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product

[No sample reports were provided by vendor]

Environment and Safety

EASI Level-Tru

Equipment Type:

Automatic tank gauging system

Vendor:

Environment and Safety
252 Welsh Pool Rd.
Exton, PA 19341-1313
Phone: Unavailable

[No picture provided by vendor]

Basic System Description:

No information regarding this system was provided by the vendor

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, fuel oil #4, antifreeze, brake fluid, transmission fluid, solvents

Tank Capacity:

- ▶ Maximum of 15,000 gallons.
- ▶ Tank must be between 50 and 95% full

Waiting Time:

- ▶ Minimum of 4 hours and 6 minutes between delivery and testing
- ▶ There must be no dispensing or delivery during waiting time

Test Period:

- ▶ Minimum of 3 hours and 36 minutes
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from data collected over the entire range of test period
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Resistance temperature detectors (RTD) and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product

[No sample reports were provided by vendor]

Gasboy International

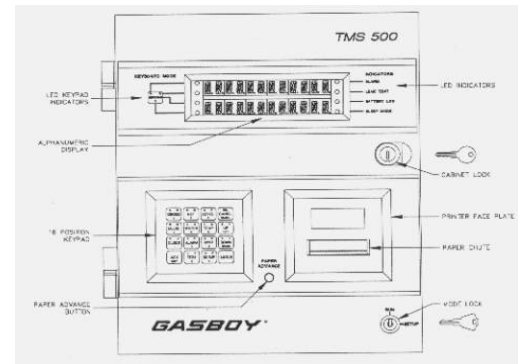
TMS 500

Equipment Type:

Automatic tank gauging system

Vendor:

Gasboy International
707 North Valley Forge Rd.
P.O. Box 309
Lansdale, PA 19446-0309
Phone: 215-855-4631
Fax: 215-855-0341
Internet: www.gasboy.com



Basic System Description:

The **TMS 500** is an inventory and leak detection system used to monitor liquid products in one to eight underground storage tanks. The system can work alone, or can share information with an on-site computer or data terminal, or a remote computer or data terminal, and is equipped with a battery back-up in case of power interruptions. The **TMS 500** allows the operator to perform periodic leak testing to the certified leak rate and threshold listed below or annual tightness testing to 0.1 gph leak rate.

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, solvents

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Tank must be between 50 and 95% full

Waiting Time:

- ▶ Minimum of 6 hours between delivery and testing
- ▶ There must be no dispensing or delivery during waiting time

Test Period:

- ▶ Minimum of 3 hours
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from data determined to be valid by statistical analysis
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Temperature sensors and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product
- ▶ System is no longer being manufactured although product support is still available

Gasboy International

TMS 500: Sample Reports

You can generate on-screen or printed reports on the **TMS 500** using the alpha-numeric keypad on the console. The system has two basic operating modes, Run and Setup Mode; you will generate reports in Run Mode. When you press a key, the function described on the key will appear on the top line of the liquid crystal display (LCD) followed by the default tank number. If you have more than one tank, the system will prompt you to enter a tank number.

Inventory/Status Reports

You can view a range of tank status/inventory information on the LCD of the **TMS 500**. To display this tank information on the display screen, press the key corresponding to the information you desire and enter the desired tank number, if applicable. A list of keys and the information they call up follows:

- ▶ GROSS: gross product volume
- ▶ NET: net product volume
- ▶ LEVEL: level of product
- ▶ ULLGE: empty space remaining in tank
- ▶ WATER: water level
- ▶ TEMP: temperature of product

To view information on the gross volume of the tank:

- ▶ Press GROSS; the display will show the following

```
TANK NO. ?  
TANK X
```

- ▶ Enter the number of the desired tank (in this example, tank Y); the display will show the tank you have selected, or if the desired tank is already selected, skip to the step below

```
TANK Y
```

- ▶ Press ENTER; the display will show the information you requested

```
GROSS Y  
8612 GAL
```

Gasboy International

TMS 500: Sample Reports (continued)

You can also print the following inventory/status reports: an Inventory Report, a Tank Setup Report, a Setup Report, a Delivery Status Report, and a Delivery Report. The Inventory Report shows the gross and net volume, product and water level, ullage, temperature, and water volume in each tank. You can also generate a Tank Setup Report for each tank, on demand. This report lists tank number, capacity, type, dimensions, product, offset, manifold, probe type, number of floats, float type, gradient, sensor length, limits (high water and low water), temperature compensation, API gravity, alpha, number and location of resistance temperature detectors (RTD), and strapping table data. The Setup Report lists the existing system configuration (for example, software version, units of measure, scheduled test rates and times). You can also print Delivery and Delivery History Reports, which show the time and date, volume, and product level at the start and end of each delivery, gross delivery, net delivery, gross usage, and net usage, for the last delivery, or for the last 10 deliveries for each tank, respectively. A Delivery History Report is shown below:

To print any of the above-described reports:

- ▶ Press RPRT; the system displays

```
REPORTS
INVENTORY
```

- ▶ Press UP or DOWN until the desired title displays
- ▶ Press ENTER
- ▶ If you selected a tank-specific report, the system queries

```
TANK NO. ?
TANK 0
```

- ▶ Press the number on the keypad for the tank desired and press ENTER

```
WILLIAM M. WILSONS SONS
SITE ADDRESS AND NUMBER

10/3/1991                01:59 PM
      DELIVERY HISTORY REPORT
TANK NO. 1                12000 GAL

BEGIN TIME                10:15 AM
BEGIN DATE                9/27/1991
BEGIN GROSS               6659.6 GAL
BEGIN NET                 6606.9 GAL
BEGIN LEVEL              52.075 IN
BEGIN WATER              0.417 IN
BEGIN WATER              5.8 GAL
BEGIN TEMP               71.2 F
END TIME                  10:15 AM
END DATE                  9/27/1991
END GROSS                 6902.6 GAL
END NET                   6852.6 GAL
END LEVEL                 53.606 IN
END WATER                 0.416 IN
END WATER                 5.8 GAL
END TEMP                  70.3 F
GROSS DEL                 243.1 GAL
NET DEL                   245.7

(REPEAT FOR PRIOR DELIVERY TO TANK)
```

Delivery reports can help you determine if leak test results might be affected by introduction of product to the tank during a test, or you can use this data along with usage data to perform statistical inventory reconciliation to validate the results of in-tank leak detection tests.

Gasboy International

TMS 500: Sample Reports (continued)

Leak Test Reports

You can program the **TMS 500** to perform leak tests automatically, or you can manually start a leak test. The steps to starting a leak test and an example of a leak test report are displayed below:

To initiate a leak test:

- ▶ Press TEST; the system queries you to select a tank as above; if you wish to select all tanks simply press ENTER, otherwise enter the tank number and the system will display:

```
TANK Y TEST
INITIATE
```

- ▶ Press ENTER; the system will query, SURE?
- ▶ If sure, press ENTER

```
WILLIAM M. WILSONS SONS
SITE ADDRESS AND NUMBER

10/3/1991                01:59 PM
                LEAK TEST REPORT
TANK NO.1                12000 GAL
UNLEADED PLS
TEST RATE                0.20 GAL/HR
TEST STARTED            12:00 AM
TEST STARTED            10/3/1991
LAST DELIVERY           10/1/1991
% GROSS CAPACITY        74.43
BEGIN GROSS              8855.9 GAL
BEGIN NET                8907.2 GAL
BEGIN LEVEL              67.035 IN
BEGIN TEMP               16.4 GAL
BEGIN WATER              0.829 IN
END TIME                 5:35 AM

END DATE                 10/3/1991
END GROSS                8955.7 GAL
END NET                  8907.3 GAL
END LEVEL                67.034 IN
END TEMP                 67.720 F
END WATER                16.4 GAL
END WATER                0.830 IN

HOURLY DATA
TIME                    DEG F            NET GAL
12:59 AM                67.752          8923.68
 1:59 AM                67.742          8923.70
 2:59 AM                67.737          8923.72
 3:59 AM                67.731          8923.75
 4:59 AM                67.724          8923.67

TEST RESULTS
+.0.01 GAL/HR          PASSED
```

The **TMS 500** reports that the tank either passed or failed. If the report shows that the tank failed, the operator should investigate further to determine the cause of a possible release. Conditions that might indicate that the test was invalid rather than leaking, include the following: delivery within 6 hours of the test, changes in temperature greater than one-half of one degree from the beginning to the end of the test, and finally, differences in water level.

You can also print a Leak Estimate Report and a Reconciliation Report. The Leak Estimate Report lists the test rate in volume/hour, percent of gross capacity, gross and net volume, level, temperature, water volume, water level, and the minimum amount of time needed to complete the test. The Reconciliation Report includes the time and date, gross and net volume, and product level at the start and end of the reconciliation period, as well as the gross and net delivery, and gross and net usage.

Gasboy International

TMS 500: Sample Reports (continued)

To print a Leak Estimate Report or a Reconciliation Report:

- ▶ Press RPRT
- ▶ Use the UP and DOWN keys to select the desired report and press ENTER

Alarm Reports

The **TMS 500** allows you to display alarm information on the LCD or print this information. A list of possible alarms and their codes, as well as instructions on how to print alarm reports follows.

- ▶ OVER FILL x: product level exceeds overflow set point
- ▶ LOW LIMIT x: product level is below low limit
- ▶ HIGH WATER x: water level is above set point
- ▶ SYS FAIL cc x: system failure tank
- ▶ SYS FAIL x: system failure outside of the tank
- ▶ x: represents the tank number in which the alarm is occurring
- ▶ cc: a two-digit failure code

To list active alarms on the LCD:

- ▶ Press ALARM; if no alarms are active, the system will display NO ALARMS
- ▶ To view additional alarms, press UP or DOWN

The system will automatically print a report when an alarm condition occurs; this is called an Alarm Report (System). You can also print, or program the **TMS 500** to print according to a schedule, an Alarm History Report which lists the date and time, alarm type, and tank number of up to the last 50 alarm conditions. The Alarm Status Report lists tank number, alarm type, status, and the alarm threshold for current alarm conditions. This report is shown below:

To print an Alarm Status Report:

- ▶ Press RPRT
- ▶ Press UP or DOWN to select ALARM STAT
- ▶ Press ENTER

WILLIAM M. WILSONS SONS SITE ADDRESS AND NUMBER		
4/18/91		02:01 pm
ALARM STATUS REPORT		
TANK NO. 1	UNLEADED PLS	12000 GAL
	HIGH LIMIT CLEARED	
HIGH LIMIT		94.000 IN
	LOW LIMIT CLEARED	
LOW LIMIT		1000 GAL
	HIGH WATER CLEARED	
WATER LIMIT		3.000 IN
	LEAK	
LEAK LIMIT		2.0 G/H
	THEFT	
THEFT LIMIT		10.0 G/H

Marconi Commerce Systems [formerly Gilbarco Environmental Products] Tank Monitor System Veeder-Root TLS-250

Equipment Type:

Automatic tank gauging
and line leak detection system

Vendor:

Marconi Commerce Systems
[formerly Gilbarco Environmental Products]
7300 West Friendly Avenue
P.O. Box 22087
Greensboro, NC 27420-2087
Phone: 336-547-5000
Fax: 336-292-8871
Internet: www.marconicommerce.com

[No picture provided by vendor]

Veeder-Root

125 Powder Forest Dr.
Simsbury, CT 06070-2003
Phone: 860-651-2700
Fax: 860-651-2719
Internet: www.veeder-root.com

Basic System Description:

The **TLS-250** and **Tank Monitor** can display full inventory information for all tanks in the system and, when equipped with the optional printer, provide a printed inventory of the following tank information: date and time, product type, ullage, water height, temperature compensated fuel volume, fuel volume, fuel height, and fuel temperature. The systems can be programmed with certain alarm limits and can conduct leak tests automatically at programmed times, or on demand. According to the vendor, the **Tank Monitor 2** and **3** series will be made obsolete this year, though they will still be used in the field. The **TLS-250** system, though still used in the field, is now obsolete. The new 300 series from Veeder-Root was designed as its replacement. No information was provided on the **TLS-200** or **TLS-200i**.

Certified Leak Rates and Thresholds (with capacitance probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.126 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.071 gph

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.093 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.071 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, solvents
- ▶ Other liquids may be tested after consultation with the manufacturer

Marconi Commerce Systems Tank Monitor System

Veeder-Root TLS-250 (continued)

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Tank must be between 50 and 95% full
- ▶ Tank must be minimum 95% full (0.1 gph leak rate)

Waiting Time:

- ▶ Minimum of 8 hours and 18 minutes between delivery and testing
- ▶ There is no dispensing or delivery during waiting time
- ▶ Minimum of 30 minutes between dispensing and testing

Test Period:

- ▶ Minimum of 2 - 8 hours, depending on leak rate and threshold
- ▶ Test data are acquired and recorded by the system's computer
- ▶ Leak rate is calculated from the difference between the first and last data collected
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Thermistors and probe must be calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Capacitance probes do not work with oxygenated fuels
- ▶ Tests only portion of tank containing product

Marconi Commerce Systems Tank Monitor System

Veeder-Root TLS-250: Sample Reports

You can gather inventory/status, leak detection, and alarm information on the liquid crystal display (LCD) of the system, or you can print this information on the in-console printer. The system has four basic operating modes, ALARM RESET, NORMAL, SETUP, and DIAG, which you select by turning a key on the face of the console. You will display and print most tank and line information in NORMAL mode, though you will use SETUP and DIAG mode to display tank and system parameters, and alarm and sensor history reports. The face of the console also has 6 buttons which have the following functions:

- ▶ PRINT: commands system to print report
- ▶ LEAK DETECT: commands system to begin and end leak test
- ▶ CURSOR: used in SETUP mode only to move cursor
- ▶ TANK: advances displayed tank on LCD
- ▶ FUNCTION: advances displayed function on LCD
- ▶ INCREMENT: used in SETUP mode only to advance digits

Inventory/Status Reports

You can display inventory/status information on the LCD or print reports containing this information. You can view the product volume, temperature compensated volume, fuel height, water height, fuel temperature, and delivery volume by taking the following steps:

- ▶ Ensure key on the face of the console is turned to NORMAL or SETUP mode
- ▶ Press FUNCTION to select the desired information
- ▶ Press TANK to select the desired tank

You can also print the following inventory/status reports from the system:

- ▶ Sensor Status Report (shown below): shows the condition of each sensor attached to the system
- ▶ Inventory Status Report (shown below): shows the station header, date and time, tank number and product, gallons of fuel, ullage, inches of fuel, inches of water, and temperature of fuel
- ▶ Automatic Inventory Increase Report: shows the station header, tank number and product, starting and ending dates, times, volumes, and temperatures, and net inventory increase
- ▶ System Setup Parameters Report: shows system parameters such as leak detection times and relay and sensor configurations
- ▶ Tank Setup Parameters Report: shows product label and code, high water limit, overfill limit, low volume limit, theft limit, thermal coefficient, delivery report, delay time, tank capacities, tank diameter, tank tilt adder, and manifold tank configuration

Marconi Commerce Systems Tank Monitor System

Veeder-Root TLS-250: Sample Reports (continued)

To print a Sensor Status Report:

- ▶ Turn key to NORMAL
- ▶ Press function until A is displayed
- ▶ Press PRINT

```
Station Name
Street
City, State Zip
Telephone Number
```

SENSOR STATUS

```
SENSOR 2A NORMAL
SENSOR 4A FUEL
SENSOR 6A NORMAL
SENSOR 8A NORMAL
```

```
EXTERNAL INP. STATUS
OPEN
```

To print an Inventory Status Report:

- ▶ Turn key to NORMAL
- ▶ Press PRINT
- ▶ This report may also be printed automatically, three times a day, using the programmable Auto-Print Time feature

```
Station Name
Street
City, State Zip
Telephone Number
```

```
INVENTORY REPORT
JUN 3, 1991
11:00 PM
```

```
TANK 1
PREMIUM UNLEADED
 4751 GALS GROSS
 8324 GALS NET
 5249 GALS ULLAGE
46.12 INCHES FUEL
  0.0 INCHES WATER
 61.9 DEGREES F
```

```
TANK 2
REGULAR UNLEADED
 2100 GALS GROSS
 2091 GALS NET
 7900 GALS ULLAGE
25.25 INCHES FUEL
  0.0 INCHES WATER
 66.1 DEGREES F
```

Marconi Commerce Systems Tank Monitor System

Veeder-Root TLS-250: Sample Reports (continued)

To print a System Setup Report:

- ▶ Turn key to SETUP
- ▶ Press FUNCTION to select the function code for any system setup parameter shown on the report
- ▶ Press PRINT

```
CALENDAR CLOCK:
JUL 4, 1991
8:31 PM

LEAK DETECT START:
11:00 PM

AUTO PRINT 1:
8:00 AM

SECURITY CODE
000000

RELAY CONFIGURATION
                RLY 1      RLY 2
LEAK ALM        YES       YES
HI WATER        NO        NO
OVERFILL        NO        YES
LO LIMIT        NO        NO
THEFT ALM       YES       NO

EXTERNAL INPUT ALARM
DISABLED

SENSOR CONFIGURATION
-----
SENSOR 2A
```

Leak Test Reports

You can program the system to conduct regularly scheduled leak detection tests, or you can manually start a leak detection test.

To manually conduct a leak detection test:

- ▶ Ensure key on the face of the console is turned to the NORMAL position
- ▶ Press LEAK DETECT; ----- (dashes) will appear on the display
- ▶ Press TANK; tank number will appear
- ▶ Press LEAK DETECT again to start the leak detection test; the system will automatically print an Inventory Report (shown above) followed by a Start Leak Monitor Report, which shows tank number, product label, and pre-test tank conditions that may affect test results, such as probe segments out of range, delivery mix errors, temperature out of range, recent deliveries, or low tank level

At completion of a leak detection test, the system will print a Leak Monitor Report, which provides the results of the most recently conducted leak detection test. You can also manually print this report as shown below:

Marconi Commerce Systems Tank Monitor System

Veeder-Root TLS-250: Sample Reports (continued)

To print a Leak Monitor Report:

- ▶ Ensure key on the face of the console is turned to the NORMAL position
- ▶ Press FUNCTION until LEAK RATE is displayed on the LCD
- ▶ Press PRINT

```

STOP LEAK MONITOR

JUN 4, 1991
6:00 AM

LEAK MONITOR REPORT

TEST START TIME
JUN 3, 1991
11:00 PM

TEST HOURS 1 - 6
-----
TNK 1          TNK 2          TNK 3          TNK 4

                DEGREES F
61.9           66.1           55.9           55.4

                GALLONS
0.0            0.0           -0.3           0.0
0.3            0.0           -2.1           0.1
0.7            0.0           -4.0           0.1
1.2            0.1           -5.6           0.0
1.5            0.0           -7.1           0.0
1.8            0.0           -9.3           0.1

                DEGREES F
57.0           65.9           55.6           55.3

TEST HOURS 1 - 6
-----
FINAL LEAK RATES:

                                0.20
                                GAL/HR
TANK          GAL/HR          TEST
1             0.30          INVALID
2             0.00          PASSED
3            -1.55          FAILED
4             0.01          PASSED
    
```

Leak test results will show whether each tank in the system passed or failed, or if the test was short or invalid. A tank passed if the volume change (if any) was less than +/- 0.2 gph. A tank failed if the volume change was greater than +/- 0.2 gph. Short test results indicate that the test duration was too short to yield valid test results. Invalid test results indicate that the system detected a leak rate greater than +/- 0.2 gph, but that one or more of the tank conditions was outside of acceptable parameters. Invalid tests will cause the system to print at the end of the test a report which shows which conditions were unacceptable.

Marconi Commerce Systems Tank Monitor System

Veeder-Root TLS-250: Sample Reports (continued)

Alarm Reports

- ▶ Indicator Report: shows exceedance of programmable theft, leak, overfill, low product level, or high water limits; this report prints automatically when alarm conditions occur
- ▶ Alarm History Report (shown below): shows history of alarm events
- ▶ Sensor Alarm History Report (shown below): shows the dates and times of the last three occurrences of each type of sensor alarm for all sensors in the system
- ▶ Sensor Setup Parameters Report: shows the status of the water audible alarm and water alarm delay time for each sensor in the system

To print an Alarm History Report:

- ▶ Turn key on console to DIAG; for security reasons this report is only available in DIAG (diagnostic mode)
- ▶ Press FUNCTION to advance display to ALARM HISTORY REPORT (Code 8); the display will show ----- (dashes)
- ▶ Press TANK to select the desired tank
- ▶ Press PRINT

```
ALARM HISTORY REPORT

      - - EXT. INPUT ON - - -
JUN 17, 1991
9:09 PM

JUN 9, 1991
4:25 PM

JUN 6, 1991
10:25 AM
      - - - EXT INPUT OFF - - -
JUN 17, 1991
9:09 PM

JUN 9, 1991
4:25 PM

JUN 6, 1991
10:25 AM
      - - - - LEAK - - - -
JUN 4, 1991
2:00 AM

JUN 1, 1991
3:00 AM

      - - - -HIGH WATER - - - -
JUN 25, 1991

      - - - OVERFILL- - - -
JUN 21, 1991
5:38 PM

      - - - - LOW LIMIT - - - -
JUN 21, 1991
9:14 AM

      - - - - THEFT- - - -
JUN 20, 1991
3:36 AM
```

Marconi Commerce Systems Tank Monitor System

Veeder-Root TLS-250: Sample Reports (continued)

To print a Sensor Alarm History Report:

- ▶ Turn key to DIAG mode; for security reasons the Sensor Alarm History Report is available only in DIAG (diagnostic) mode
- ▶ Press FUNCTION to advance the display to Sensor Alarm History Report (Code 8A); the display will show - - - - (dashes)
- ▶ Press PRINT

```
ALARM HISTORY REPORT
. . . . .
SENSOR CHANNEL 4
. . . . .
- - - - - SENSOR - - - - -

SENSOR 4A
      FUEL DETECT
MAY 26, 1989
      8:15 AM

SENSOR 4A
      OPEN SENSOR
MAY 12, 1989
      11:47 PM
```

Marconi Commerce Systems [formerly Gilbarco Environmental Products] Environmental Management Console (EMC) Veeder-Root TLS-300, TLS-300C, and TLS-300i

Equipment Type:

Automatic tank gauging and line leak detection system

Vendor:

Marconi Commerce Systems
[formerly Gilbarco Environmental Products]
7300 West Friendly Avenue
P.O. Box 22087
Greensboro, NC 27420-2087
Phone: 336-547-5000
Fax: 336-292-8871
Internet: www.marconicommerce.com

Veeder-Root

125 Powder Forest Dr.
Simsbury, CT 06070-2003
Phone: 860-651-2700
Fax: 860-651-2719
Internet: www.veeder-root.com



Basic System Description:

The basic systems from Marconi and Veeder-Root are essentially identical. Each system is an inventory and line leak detection system consisting of a console with liquid crystal display, alphanumeric keypad, and in-console printer. The systems can monitor up to eight single-wall, underground storage tanks (UST) and can be configured with various monitoring, reporting, warning, and alarm capabilities. The systems are equipped with audible and visual alarms, triggered by in-tank alarm conditions. Any of the in-tank alarm limits can also be tied to relays to trigger on-site devices, such as overfill alarms, or to shut down submersibles. The Marconi **EMC/PC** utilizes the same leak detection software attached to a personal computer. The Veeder-Root **TLS-300C** is capable of monitoring one or two double-wall tanks, while the **TLS-300i** system monitors up to four double-wall tanks.

Certified Leak Rates and Thresholds:

Using capacitance probes:

(Marconi's Basic Monitoring System Tank Monitors 2, 3, 2.1, 3.1 PAO238000XXXX):

- ▶Leak rate of 0.2 gph with leak threshold of 0.126 gph

(Marconi's Basic Monitoring System Tank Monitors 2.1, 3.1, PAO264XXX0000):

- ▶Leak rate of 0.2 gph with leak threshold of 0.126 gph
- ▶Leak rate of 0.1 gph with leak threshold of 0.071 gph

[Veeder-Root's Model 7842 (Digital Sensing)]:

- ▶Leak rate of 0.2 gph with leak threshold of 0.1 gph

[Veeder-Root's Model 8472 (Digital Sensing)]:

- ▶Leak rate of 0.2 gph with leak threshold of 0.126 gph
- ▶Leak rate of 0.1 gph with leak threshold of 0.071 gph

Marconi Commerce Systems Environmental Management Console (EMC) Veeder-Root TLS, 300, TLS-300C, and TLS-300i (continued)

Using magnetostrictive probes:

(Marconi's Basic Monitoring System Tank Monitors 2.1, 3.1, PAO265XXX0000):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.093 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.071 gph

(Marconi's PAO265 and PAO300):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.126 gph

(Veeder-Root's Model 8473 (Digital Sensing):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.093 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.071 gph

(Veeder-Root's Model 8473, 8493):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.126 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.071 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, solvents
- ▶ Other liquids may be tested after consultation with the manufacturer

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Maximum of 20,000 gallons (EMC/PC)
- ▶ Tank must be between 50 and 95% full
- ▶ Tank must be minimum 95% full (0.1 gph leak rate and EMC/PC)

Waiting Time:

- ▶ Minimum of 8 hours and 18 minutes between delivery and testing
- ▶ There is no dispensing or delivery during waiting time
- ▶ Minimum of 30 minutes between dispensing and testing

Test Period:

- ▶ Minimum of 2 - 8 hours, depending on leak rate and threshold
- ▶ Test data are acquired and recorded by the system's computer
- ▶ Leak rate is calculated from the difference between the first and last data collected
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Thermistors and probe must be calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Capacitance probes do not work with oxygenated fuels
- ▶ Tests only portion of tank containing product

Marconi Commerce Systems Environmental Management Console (EMC)

Veeder-Root TLS, 300, TLS-300C, and TLS-300i: Sample Reports

The console keypad has operating keys and alphanumeric keys. The operating keys allow you to display and print information, start and stop tests, program the system, test system operation, and review diagnostics. The alphanumeric keys are used for entering information when prompted by the system.

The ALARM/TEST key silences the alarm. It does not clear the message from the display or disable the alarm. FUNCTION accesses functions within a mode (operating, setup, or diagnostic). STEP moves from one procedure to the next within a Function. BACKUP lets you move backward through Steps, Functions, and Modes to access past data or entries.

Inventory/Status Reports

In-Tank Inventory lets you view and print information about how much product is contained in each tank.

- ▶ To select In-Tank Inventory, press FUNCTION until the following message is displayed:

```
IN-TANK INVENTORY  
PRESS <STEP> TO CONTINUE
```

- ▶ Press STEP to view the tank inventory for the first tank:

```
T1: (PRODUCT NAME)  
VOLUME = XX,XXX (UNITS)
```

The system displays the fuel volume in gallons or liters

- ▶ To view how much inventory is in the next tank, press TANK
- ▶ To print an Inventory report for all tanks in a system, press PRINT while the monitor is displaying the status message:

```
DATE      TIME  
ALL FUNCTIONS NORMAL
```

You may also print an Inventory Report while viewing the inventory information:

```
T1: (PRODUCT NAME)  
VOLUME = XX,XXX (UNITS)
```

Marconi Commerce Systems Environmental Management Console (EMC)

Veeder-Root TLS, 300, TLS-300C, and TLS-300i:

Sample Reports (continued)

- ▶ Press PRINT and the system will begin printing the report

```
MMM DD, YYYY HH:MM XM

INVENTORY REPORT

T 1: UNLEADED GASOLINE
VOLUME      = 8518 GALS
ULLAGE      = 1482 GALS
90% ULLAGE  = 482 GALS
TC VOLUME   = 8492 GALS
HEIGHT      =76.26 INCHES
WATER VOL   = 0 GALS
WATER       = 0.00 INCHES
TEMP        = 64.6 DEG F

T 2: SUPER UNLEADED
VOLUME      = 7545 GALS
ULLAGE      = 2455 GALS
90% ULLAGE  = 1455 GALS
TC VOLUME   = 7569 GALS
HEIGHT      =67.76 INCHES
WATER VOL   = 0 GALS
WATER       = 0.00 INCHES
TEMP        = 64.4 DEG F
```

Leak Test Reports

An In-Tank Leak Test is a 0.10 gph (Annual) or 0.20 gph (Periodic) leak test to determine if the tank is leaking. If averaging was selected during In-Tank setup, the system will generate Average Leak Test Reports instead of In-Tank Test Reports. Averaging takes the last five test rates and averages them to determine the leak rate.

To print In-Tank Test Results for all tanks:

- ▶ Press FUNCTION until the following message is displayed:

```
IN-TANK TEST RESULTS
PRESS <STEP> TO CONTINUE
```

Marconi Commerce Systems Environmental Management Console (EMC)

Veeder-Root TLS, 300, TLS-300C, and TLS-300i: Sample Reports (continued)

► Press PRINT

The report shows whether or not the tanks passed or failed the leak test.

```
MMM DD, YYYY HH:MM XM  
  
LEAK TEST REPORT  
  
T 1: REGULAR UNLEADED  
PROBE SERIAL NUM 105792  
  
TEST STARTING TIME:  
MM DD, YYYY HH:MM XM  
  
TEST LENGTH = 4.3 HRS  
STRT VOLUME = 3725 GALS  
  
LEAK TEST RESULTS  
0.2 GAL/HR TEST PASS
```

Periodic Test Results

A Periodic Test is a 0.20 gph leak test. To view Periodic Test Results:

► Press STEP until you see the message:

```
T#: (Product Name)  
PER: (Date)(Results)
```

The system prints the date the test ran and the results (PASS or FAIL) for the selected tank.

- Press PRINT to print the Periodic Test Results
- Press TANK to view the Periodic Test Results for other tanks in the system

Annual Test Results

An Annual Test is a 0.10 gph leak test. The Annual Test Results show the starting time, test length, starting volume, and test results (PASS or FAIL). Note: Annual Test Results only appear when the tank is equipped with a 0.1 mag probe.

► To view Annual Test Results, press STEP until you see the message:

```
T#: (Product Name)  
ANN: (Date)(Results)
```

Marconi Commerce Systems Environmental Management Console (EMC)

Veeder-Root TLS, 300, TLS-300C, and TLS-300i:

Sample Reports (continued)

- ▶ To print the Annual Test Results, press PRINT

```
MMM DD, YYYY HH:MM XM

LEAK TEST REPORT

T 1: REGULAR UNLEADED
PROBE SERIAL NUM 105792

TEST STARTING TIME:
MM DD, YYYY HH:MM XM

TEST LENGTH = 4.3 HRS
STRT VOLUME = 3725 GALS

LEAK TEST RESULTS
0.1 GAL/HR TEST PASS
```

In-Tank Leak Results

To access the In-Tank Leak Test Results:

- ▶ First access the Diagnostic Mode by pressing MODE until the following message is displayed:

```
SYSTEM ALARM HISTORY
PRESS <PRINT> FOR REPORT
```

To print a complete In-Tank Leak Test Results Report for each tank in the system:

- ▶ Press PRINT
- ▶ Pressing STEP will give the user the option of printing results from 0.20 gph leak tests, 0.10 gph leak tests, leak rates, and leak histories for each tank
- ▶ Once the desired information is displayed, press PRINT
- ▶ To view and print information for other tanks press TANK until the information is displayed for the requested tank

Alarm Reports

Alarm History Reports provide a record of the last three occurrences of each type of alarm or warning condition.

- ▶ Press MODE to select Diagnostic Mode
- ▶ Press FUNCTION until you display the message:

```
ALARM HISTORY REPORT
PRESS <STEP> TO CONTINUE
```

Marconi Commerce Systems Environmental Management Console (EMC)

Veeder-Root TLS, 300, TLS-300C, and TLS-300i:

Sample Reports (continued)

- ▶ Press STEP to continue; the system displays the message:

```
SYSTEM ALARM HISTORY  
PRESS <PRINT> FOR REPORT
```

- ▶ Press PRINT; the system generates the report

In-Tank Alarm History Report

In-Tank Alarm History Reports record alarms for the tank selected.

To print an In-Tank Alarm History Report:

- ▶ Press STEP until you display the message:

```
T#: ALARM HISTORY  
PRESS <PRINT> FOR REPORT
```

- ▶ Press PRINT to print the report for the tank displayed
- ▶ Press TANK to access other tanks in the system

Hasstech Tank Compliance Center Model 700 Patriot Sensors and Controls Corp. [formerly MagneTek] 7021 Digital Tank Gauge Ronan Engineering Co. X-76 ETM, X-76 ETM-4X

Equipment Type:

Automatic tank gauging system

Vendor:

Hasstech

6985 Flanders Dr.

San Diego, CA 92121

Phone: 619-457-5880

Fax: 619-457-8115

Internet: www.hasstech.com

Patriot Sensors and Controls Corp.

[formerly MagneTek]

1080 N. Crooks Rd.

Clawson, MI 48017-1097

Phone: 248-435-0700 or 800-635-0289

Fax: 248-435-8120

Internet: www.patriotsensors.com

Ronan Engineering Co.

21200 Oxnard Street

Woodland Hills, CA 91367

Phone: 800-327-6626

Fax: 818-992-6435

Internet: www.ronan.com



Basic System Description:

No information regarding the Hasstech system was provided by the vendor. The **Patriot Sensors 7021** and **Ronan** systems are virtually identical in terms of appearance and operation. **Patriot Sensors 7021** can be set up utilizing either the 7030 or the 7100 series magnetostrictive probes, though most newer systems utilize the 7100 series. Operation of the **7021** console is not dependent on the probe type. Both systems utilize an alphanumeric liquid crystal display (LCD) that provides instant feedback for up to eight tanks, including product gallons, depth in inches and temperature, as well as alarm warnings and reports. All reports can also be generated in hard copy with the system printer.

Certified Leak Rates and Thresholds (with magnetostrictive probes):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.05 gph

HasstechTank Compliance Center Model 700

Patriot Sensors and Controls Corp. 7021 Digital Tank Gauge

Ronan Engineering Co. X-76ETM-4X (continued)

Applicability:

- ▶ Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, solvents,
- ▶ Other substances with a specific gravity > 0.6 and a viscosity < 1500 cp

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Tank must be between 50 and 95% full

Waiting Time:

- ▶ Minimum of 2 hours between delivery and testing
- ▶ Minimum of 2 hours between dispensing and testing
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Minimum of 2 hours; minimum of 6 hours for 0.1 gph leak rate
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from data determined to be valid by statistical analysis
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions
- ▶ Resistance temperature detectors (RTD) and probe must be checked and calibrated in accordance with manufacturer's instructions (7030 series and **X-76ETM-4X**)

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product
- ▶ Patriot Sensors and Controls Corp. will no longer manufacture the 7021 Digital Tank Gauge, but will continue to manufacture the sensors
- ▶ **Patriot Sensors 7021** housing may bear the names B/W Controls or McGraw Edison
- ▶ **X-76ETM-4X** console has different housing that allows it to be mounted outside
- ▶ System is not a precision test; users should call for a precision leak test to confirm a suspected leak before taking remedial action

Hasstech Tank Compliance Center Model 700

Patriot Sensors and Controls Corp. 7021 Digital Tank Gauge

Ronan Engineering Co. X-76 ETM, X-76 ETM-4X: Sample Reports

The console for both of these systems is not menu based, thus you can access most features and reports directly from the keypad. The alphanumeric LCD readout displays information such as product gallons, depth in inches, and temperature for each tank in the system. To advance the LCD readout from the current tank to the next consecutive tank in the system, press the TANK NO. key. You can generate system reports by pressing the PRINT key. After pressing the PRINT key, select the number corresponding to the desired report followed by the ENT (enter) key:

1. Inventory status
2. Shift report
3. Product delivery (drop)
4. Alarm status
5. Last leak test report

Inventory/Status Reports

The Inventory Status Report displays the company site (station) name and address, the measured values in selected tanks (including gallons to full (GTF) and gallons to 95% full (95% FULL)), and the time and date.

To initiate the report:

- ▶ Press Print
- ▶ Press 1
- ▶ Press ENT
- ▶ Enter the number of the tank for which the report is needed, followed by ENT (0 = All tanks, 1-8=Individual tanks)

```
ABC PRODUCTS
123 GRAND RIVER
DUKE, MO 12345

STATUS REPORT

TANK 1
JP4
    12130 GROSS GALLONS
    12270 NET GALLONS
    68.20 INCHES FUEL
    2.0 INCHES WATER
    33.3 °F
    2676 GTF
    1928 G TO 95% FULL
2:47PM 3/10/92
```

**Hasstech Tank Compliance Center Model 700
Patriot Sensors and Controls Corp. 7021 Digital Tank Gauge
Ronan Engineering Co. X-76 ETM, X-76 ETM-4X: Sample Reports
(continued)**

Leak Test Reports

The Leak Detect Report lists the last leak test on each tank and records the leak threshold, results, time, and date for each tank.

Patriot Sensors

```

LAST LEAK DETECT REPORT
      7:53 AM   3/10/92

TANK 1
0.20 GPH LD INVALID DUE
TO UNSTABLE TEMPERATURE

TANK 2
0.20 GPH LD PASSED

TANK 3
0.20 GPH LD PASSED
    
```

To initiate a
Leak Test
Report:
▶ Press PRINT
▶ Press 5
▶ Press ENT

Ronan

```

*****
LAST LEAK DETECT REPORT
3:45 PM 12/27/94

TANK 1
0.20 GPH LD PASSED

5:00 AM 12/25/94

GAL/HR CHANGE = -0.07

*****
    
```

The Manual Leak Test Report (shown below) prints after the manual leak test has been started and stopped.

To start the Manual Leak Test:

- ▶ Press F
- ▶ Press 85
- ▶ Press ENT
- ▶ Enter the tank(s) to be tested (1-ENT=Tank 1)

To stop the Manual Leak Test:

- ▶ Press F
- ▶ Press 86
- ▶ Press ENT

Once automatic leak detection has been programmed, an Automatic Leak Test Report will print after each test is completed at the programmed intervals. In this example, the system shows no leak rate for Tank 1, thus the tank has passed the leak test.

```

*****LEAK DETECT*****

*****MANUAL MODE*****
END:      5:00 AM   3/11/92

TANK 1
0.20 GPH LD PASSED
GAL/HR CHANGE = 0.00

TANK 1
JP4

HOUR           GALLONS
2:00 AM        2692.73
3:00 AM        2692.73
4:00 AM        2692.73
5:00 AM        2692.73
*****
    
```

Hasstech Tank Compliance Center Model 700
Patriot Sensors and Controls Corp. 7021 Digital Tank Gauge
Ronan Engineering Co. X-76 ETM, X-76 ETM-4X: Sample Reports
(continued)

Alarm Reports

The Manual Alarm Report records the last high, high-high, low, water, theft, leak, and contact alarms, and lists the time and date for each.

To initiate the report:

- ▶ Press PRINT
- ▶ Press 4
- ▶ Press ENT

*****LAST HIGH ALARM*****		
TANK 1	2:00 PM	3/10/92
TANK 2	1:18 PM	3/10/92
TANK 3	1:49 PM	3/10/92
*****LAST LOW ALARM*****		
TANK 1	2:03 PM	3/10/92
TANK 3	1:35 PM	3/10/92
*****LAST WATER ALARM*****		
TANK 3	2:00 PM	3/10/92
*****LAST THEFT ALARM*****		
NO PREVIOUS ALARMS		
LAST CONTACT ALARM		
CNT1	7:51 AM	3/10/92
CNT2	7:51 AM	3/10/92
CNT3	2:42 PM	3/10/92
*****LAST HI-HI ALARMS*****		
NO PREVIOUS ALARMS		
*****LAST LEAK ALARM*****		
NO PREVIOUS ALARM		

The system can also generate the following automatic reports: theft, water alarm, high level alarm, high-high level alarm, low level alarm, contact alarm, and leak alarm. These printed reports are accompanied by a flashing letter on the left side of the LCD display. The flashing letter (T = Theft, W = Water, H = High, L = Low, C = Contact, I = leak, h = High-high) will go to a steady display once the SILENCE key has been pressed and will disappear when the alarm condition is removed.

INCON Intelligent Controls Tank Sentinel Series

Equipment Type:

Automatic tank gauging and line leak detection system

Vendor:

INCON Intelligent Controls, Inc.
74 Industrial Park Road
P.O. Box 638
Saco, ME 04072
Phone: 800-872-3455
Fax: 207-238-0158
Internet: www.intelcon.com



Basic System Description:

The **Tank Sentinel** can perform static tank leak detection tests or Statistical Continuous Automatic Leak Detection (SCALD), which continuously monitors product level between product dispensing. The **Tank Sentinel** can also generate a Regulatory Report that shows the hardware status of the tank system, what type of equipment has been installed and if it is operational, as well as the results of the last 12 months of one-time and SCALD tank leak detection tests. The **Tank Sentinel** 1001 is suitable for up to 4 tanks, while the **Tank Sentinel** 2001 can accommodate up to 8 tanks.

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.05 gph
- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph (INCON LL2 probe)
- ▶ Leak rate of 0.2 gph with leak threshold of 0.058 gph (TS 2000)

Applicability:

- ▶ Gasoline, diesel, aviation fuel, fuel oil #4, waste oil (TS 2000 only)
- ▶ Other liquids may be tested after consultation with the manufacturer

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Maximum of 30,000 gallons (INCON LL2 probe)
- ▶ Tanks less than 95% full may be tested
- ▶ Tank must be between 50 and 95% full (TS 2000)
- ▶ Minimum product level required based on tank diameter as follows: 48" dia/min 12"; 64" dia/min 14"; 72" dia/min 15"; 96" dia/min 17.5"; 126" dia/min 21.5"; for other diameters, see evaluation report

Waiting Time:

Leak rate of 0.2 gph with a leak threshold of 0.1 gph

- ▶ Minimum of 6 hours between delivery and testing
- ▶ None between dispensing and testing
- ▶ There must be no delivery during waiting time

Leak rate of 0.1 gph with a leak threshold of 0.05 gph

- ▶ Minimum of 5 hours and 18 minutes between delivery and testing
- ▶ None between dispensing and testing
- ▶ There must be no delivery during waiting time

INCON Intelligent Controls Tank Sentinel Series (continued)

Leak rate of 0.2 gph with a leak threshold of 0.1 gph (INCON LL2 probe)

- ▶ Minimum of 4 hours between delivery and testing
- ▶ Minimum of 2 hours between dispensing and testing
- ▶ There must be no delivery during waiting time

Leak rate of 0.2 gph with a leak threshold of 0.058 gph (TS 2000)

- ▶ Minimum of 6 hours between delivery and testing
- ▶ Minimum of 2 hours between dispensing and testing
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Length of test is determined automatically based on the quality of test data
- ▶ Test data are acquired and recorded by a microprocessor
- ▶ Leak rate is calculated from data determined to be valid by statistical analysis
- ▶ There must be no dispensing or delivery during the test

Leak rate of 0.2 gph with a leak threshold of 0.1 gph

- ▶ Average data collection time during evaluation was 5 hours and 10 minutes

Leak rate of 0.1 gph with a leak threshold of 0.05 gph

- ▶ Average data collection time during evaluation was 5 hours and 44 minutes

Leak rate of 0.2 gph with a leak threshold of 0.1 gph (INCON LL2 probe)

- ▶ Average data collection time during the evaluation was 6 hours and 51 minutes

Leak rate of 0.2 gph with a leak threshold of 0.058 gph (TS 2000)

- ▶ Minimum of 3 hours

Calibration and Maintenance Requirements:

- ▶ Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ TS1000 and 1001 can support up to 4 tanks
- ▶ Tests only portion of tank containing product

INCON Intelligent Controls

Tank Sentinel Series: Sample Reports

The **Tank Sentinel** system displays status/inventory, leak detection, and alarm information on a liquid crystal display (LCD), and can print reports that specifically detail such information. You can access available information by punching in commands on an alphanumeric keypad built into the console. Generally, you will select the desired function by pressing a key and selecting from options displayed on the LCD.

Inventory/Status Reports

You can view a range of tank inventory/status information on the LCD of the **Tank Sentinel** system. To display this information, you will press the key corresponding to the information you desire and press the DOWN key to view information for other tanks, if applicable. A list of keys and the information they call up follows:

- ▶ GROSS: gross product volume
- ▶ LEVEL: level of product
- ▶ ULLAGE: empty space remaining in tank
- ▶ WATER: water level

Alternatively, you can press the TANK key and select the desired tank by pressing the M1 through M4 buttons, then scroll through a list of data options, including gross, net and water volume, ullage, product level, water level, temperature, and percent full.

Additionally, you can print a number of reports which detail the inventory/status of the tank. Below you will find a list of available inventory/status reports and the information they contain.

- ▶ Product Inventory Detail Report (shown below): shows the type of product, total tank capacity, tank name, gross product volume, net product volume, days supply remaining (based on use over the last seven days), ullage, and water volume
- ▶ Product Inventory Summary Report: shows the combined total gross volume of all products at the site by product type
- ▶ Tank Inventory Detail Report: shows the complete and current inventory detail of a tank; tank name, tank number, capacity, product name, gross product volume (not temperature compensated), net product volume, product level, percent full, ullage, temperature of product, water level, and water volume
- ▶ Tank Inventory Summary Report (shown below): shows the gross product volume of each tank
- ▶ Product Delivery Detail Report (shown below): shows product name, tank capacity, tank name, beginning time, and tank conditions before delivery (BEGIN data) and after delivery (END data)
- ▶ Product Delivery Summary Report: shows the delivery date and gross volume that was delivered to a given tank
- ▶ Product Delivery History Report: shows product delivery data for the last 10 deliveries
- ▶ Product Usage Detail Report: shows the gross and net inventory, days supply remaining, ullage, and last usage (per day, week, and month if so selected by operator)
- ▶ Tank Setup Report: shows tank name, alarm limits, liquid probe data, product data, and a strapping table chart
- ▶ System Setup Report: shows the full configuration of the **Tank Sentinel**, including most of the information found in a tank setup report except for special tank strapping tables and information on special tanks or products

INCON Intelligent Controls

Tank Sentinel Series: Sample Reports (continued)

To print a Product Inventory Detail Report:

- ▶ Press REPORT
- ▶ Press DOWN to view report type
- ▶ Press M1 - M4 to select desired report
- ▶ Press M1 to send the report to the printer
- ▶ Press M2 to send the report to a remote fax machine

INCON INTELLIGENT CONTROLS INC P.O. BOX 638 SACO ME 040722	
08/11/1998	7:26 PM
PRODUCT INVENTORY DETAIL	
UNLD REG	11882.3 GAL
TANK 1	
GROSS	7125.3 GAL
NET	7067.0 GAL
DAYS SUPPLY	3.7 DAYS
ULLAGE	4150.1 GAL
WATER VOLUME	12.7 GAL
UNLD PLUS	5092.7 GAL
TANK 2	
GROSS	2033.3 GAL
NET	2015.9 GAL
DAYS SUPPLY	5.3 DAYS
ULLAGE	2804.8 GAL
WATER VOLUME	0.0 GAL

To print a Tank Inventory Summary Report:

- ▶ Press REPORT
- ▶ Press DOWN to view report type
- ▶ Press M1 - M4 to select desired report
- ▶ Press M1 to send the report to the printer
- ▶ Press M2 to send the report to a remote fax machine

INCON INTELLIGENT CONTROLS INC P.O. BOX 638 SACO ME 040722	
08/11/1998	7:26 PM
TANK INVENTORY SUMMARY	
(GROSS VOLUME)	
TANK 1	11498.6 GAL
TANK 2	4097.6 GAL
TANK 3	4016 GAL

INCON Intelligent Controls

Tank Sentinel Series: Sample Reports (continued)

To print a Product Delivery Detail Report:

- ▶ Press REPORT
- ▶ Press DOWN to view report type
- ▶ Press M1 - M4 to select desired report
- ▶ Press M1 to send the report to the printer
- ▶ Press M2 to send the report to a remote fax machine

INCON INTELLIGENT CONTROLS INC	
P.O. BOX 638	
SACO ME 040722	
08/13/1998	10:16 AM
PRODUCT DELIVERY DETAIL	
UNLD REG	11882.3 GAL
TANK 1	
BEGIN TIME	11:17 PM
BEGIN DATE	08/11/1998
BEGIN GROSS	2010.3 GAL
BEGIN NET	1995.0 GAL
BEGIN ULLAGE	9264.5 GAL
BEGIN LEVEL	21.091 IN
BEGIN WATER	0.708 IN
BEGIN WATER	13.4 GAL
BEGIN TEMP	70.786 F
END TIME	11:42 PM
END DATE	08/11/1998
END GROSS	9391.3 GAL
END NET	9313.7 GAL
END ULLAGE	1884.7 GAL
END LEVEL	68.652 IN
END WATER	0.662 IN
END WATER	12.1 GAL
END TEMP	71.728 F
GROSS DEL	7381.0 GAL
NET DEL	7318.7 GAL

Delivery reports can help you determine if leak test results might be affected by introduction of product during a test, or you can use this data along with usage data to perform statistical inventory reconciliation to validate the results of in-tank leak detection tests.

Leak Test Reports

Using the **Tank Sentinel** system, you can manually start a leak detection test, program the system to conduct tests according to a schedule, or you can program the system to conduct a continuous leak detection function, called statistical continuous leak detection (SCALD). You can view the status of a tank or line leak test in progress on the LCD.

To see the status of a tank or line leak test:

- ▶ Press TEST
- ▶ Press M1; use the DOWN key to view the status of other tank or line leak tests

INCON Intelligent Controls

Tank Sentinel Series: Sample Reports (continued)

To manually conduct a leak detection test:

- ▶ Press TEST then M2; the LCD screen above the menu select keys (M1 - M4) will display tank leak detection test options
- ▶ Press M1 - M4 under the type of test you want to start
- ▶ Select the tank or line number by using the M1 - M4 keys
- ▶ Press DOWN to see other tank or line numbers from which to choose
- ▶ If Report Leak is enabled in system setup, the Leak Test Report will print automatically at the end of the leak detection test

You can print reports of varying levels of detail which show the results of tank and line leak detection tests. A list of available reports and the information they contain follows:

- ▶ Leak Estimate Report: shows the estimated amount of time to complete a standard tank leak test, as well as the leak rate threshold, confidence level, gross capacity and volume, net volume, product level, product temperature, water volume, and water level
- ▶ Leak Test Report: (described and shown below)
- ▶ SCALD Test Report: (described and shown below)
- ▶ Line Compliance Report: (described and shown below)
- ▶ Line Test Report: shows the latest line leak tests of a selected line or all lines; 3 gph test results print first and are followed by the most recent 0.1 gph or 0.2 gph line leak test results of the present day
- ▶ Regulatory Compliance Report: (described and shown below)

INCON Intelligent Controls

Tank Sentinel Series: Sample Reports (continued)

The Leak Test Report shows the date and time that the report is produced, tank name, volume capacity, product name, leak test threshold and confidence level, test start time and date, gross capacity/percent full, beginning and ending gross and net volume, product level, product temperature, water volume and level, and the hourly product temperature and volume; SLOPE figures at the bottom of the report show the calculated leak rate.

To print a LEAK TEST REPORT:

- ▶ Press REPORT
- ▶ Press DOWN to view report types
- ▶ Press M1 - M4 to select desired report
- ▶ Press M1 to print report
- ▶ Press M2 to send the report to a remote fax machine

If the test results line on the Leak Test Report shows that the tank failed or the test was indeterminate you should investigate further to determine the cause of the unfavorable results in order to confirm a suspected release.

INCON INTELLIGENT CONTROLS INC		
P.O. BOX 638		
SACO ME 040722		
08/13/1998	10:16 AM	
LEAK TEST REPORT		
(TANK NAME)	5014.3 GAL	
(PRODUCT NAME)		
LEAK TEST	0.100 G/H	
LEAK THRESHOLD	0.050 G/H	
CONFIDENCE LEVEL	99.0%	
TEST STARTED	21:45	
TEST STARTED	10/17/98	
GROSS CAPACITY	56.12%	
BEGIN GROSS	2814.2 GAL	
BEGIN NET	2808.8 GAL	
BEGIN LEVEL	52.630	
BEGIN TEMP	62.720 F	
BEGIN WATER	0.0130 IN	
END TIME	2:39	
END DATE	10/19/98	
END GROSS	2814.3 GAL	
END NET	2808.6 GAL	
END LEVEL	52.632 IN	
END TEMP	62.878 F	
END WATER	0.4 GAL	
END WATER	0.131 IN	
HOURLY DATA		
TIME	DEG F	GAL
22:44	62.721	2809.23
23:44	62.751	2808.78
0:44	62.885	2809.07
1:44	62.883	2809.9
SLOPE	-0.04 GAL/HR	
SLOPE LOW	-0.04 GAL/HR	
SLOPE HIGH	-0.04 GAL/HR	
TEST RESULTS	PASSED	
SLOPE EQUALS CALCULATED LEAK RATE		

INCON Intelligent Controls

Tank Sentinel Series: Sample Reports (continued)

The Line Compliance Report shows up to a year's worth of passed 0.2 gph monthly compliance tests for a selected line, or for all lines.

To print a Line Compliance Report:

- ▶ Press REPORT
- ▶ Press DOWN to view report types
- ▶ Press M1 - M4 to select desired report
- ▶ Press M1 to print report
- ▶ Press M2 to send the report to a remote fax machine

```
INCON INTELLIGENT CONTROLS INC
P.O. BOX 638
SACO ME 040722

08/13/1998                10:16 AM

LINE COMPLIANCE REPORT

LINE NO. 1                REGULAR

PASSED MONTHLY TESTS

TEST TIME                1:42 AM
TEST DATE                08/12/1998
LINE TEST                0.20 GPH
LEAK RATE                0.00 GPH

TEST TIME                11:12 PM
TEST DATE                07/14/1998
LINE TEST                0.20 GPH
LEAK RATE                0.00 GPH

LINE NO. 2                MID GRAD

PASSED MONTHLY TESTS

TEST TIME                8:15 AM
TEST DATE                08/11/1998
LINE TEST                0.20 GPH
LEAK RATE                0.00 GPH

TEST TIME                4:41 AM
TEST DATE                07/14/1998
LINE TEST                0.20 GPH
LEAK RATE                0.00 GPH
```

INCON Intelligent Controls

Tank Sentinel Series: Sample Reports (continued)

The SCALD Test Report records results of SCALD tests conducted between product dispenses. The report shows the date and time that the report was produced, tank name, volume capacity, product name, extent of time (minimum) between dispenses for statistical data collection (called "extent"), minimum percent full before SCALD test will run (called "vol qualify"), test start time and date, sales or product usage rate, amount of product evaporated, amount of product lost out of vent stack, ratio of EXTENT to total test time (called "duty factor"), time and date of the most recently completed SCALD test, and leak rate. Generally, this option is used on tanks which operate 24 hours a day. If Report SCALD is enabled in System Setup, then the **Tank Sentinel** system will automatically print a Scald Test Report when a new report is available.

To manually print a SCALD Test Report:

- ▶ Press REPORT
- ▶ Press DOWN to view report types
- ▶ Press M1 - M4 to select desired report
- ▶ Press M1 to print report
- ▶ Press M2 to send the report to a remote fax machine

If the site employs Stage II vapor recovery, the "evaporated" line will not appear on this report. If you receive test results of increase or failed you should investigate further to determine the cause of the unfavorable results in order to confirm a suspected release.

```
INCON INTELLIGENT CONTROLS INC
P.O. BOX 638
SACO ME 040722

08/13/1998                      10:16 AM

SCALD TEST REPORT

TANK 1                            11882.3 GAL
      (PRODUCT NAME)

LEAK TEST                          0.200 GPH
LEAK THRESHOLD                      0.100 GPH
EXTENT                              18.0 HRS
VOL QUALIFY                          0.0%
TEST STARTED                        12:22 PM
TEST STARTED                        08/07/1998
SALES RATE                          54.731 GPH
EVAPORATED                          1.781 GAL
LOST                                0.327 GAL
DUTY FACTOR                          0.31
UPDATED                             12:40 AM
UPDATED                             08/10/1998

SLOPE                               -0.002 GAL/HR
TEST RESULT                          PASSED
SLOPE EQUALS CALCULATED LEAK RATE
```

INCON Intelligent Controls

Tank Sentinel Series: Sample Reports (continued)

The Regulatory Compliance Report shows the hardware status of the tank system, the last 12 months of passed static and SCALD tests, and passed 0.2 gph line leak detection tests.

To print a Regulatory Compliance Report:

- ▶ Press REPORT
- ▶ Press DOWN to view report types
- ▶ Press M1 - M4 to select desired report
- ▶ Press M1 to print report
- ▶ Press M2 to send the report to a remote fax machine

This report will show only passed leak detection test results. If the test results fail to show that a tank or line passed for any of the 12 months prior to the report, then the operator of the site should have taken appropriate action to confirm the suspected release.

```
INCON INTELLIGENT CONTROLS INC
P.O. BOX 638
SACO ME 040722

08/13/1998                                10:16 AM

REGULATORY REPORT

HARDWARE STATUS

TS-CIM                                     NOT INSTALLED
TS-ROM                                     NOT INSTALLED
TS-SEM 1                                  NOT INSTALLED
IO MOD 1                                  NOT INSTALLED
PRINTER                                   OPERATIONAL
FAX/MOD                                   OPERATIONAL

PROBES

PROBE 1                                   OPERATIONAL
PROBE 2                                   OPERATIONAL

SENSORS

SENSOR 1                                  OPERATIONAL
SENSOR 2                                  OPERATIONAL
SENSOR 3                                  OPERATIONAL

LINES

LINE NO. 1                                OPERATIONAL
LINE NO. 2                                OPERATIONAL

AUXILIARY INPUTS

AUX IN 1                                  OPERATIONAL
AUX IN 2                                  OPERATIONAL

PASSED LEAK TESTS

TANK 1
08/26/1998                                7:42 PM
LEAK TEST                                  0.20
SLOPE                                       -0.03

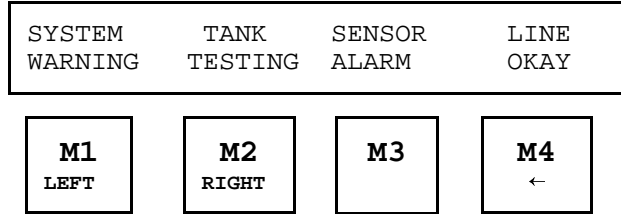
(PASSED LEAK TESTS, PASSED SCALD
TESTS, and PASSED LINE TEST REPORT
results are all presented in the
format used for the PASSED LEAK TEST
for TANK 1, shown above)
```

INCON Intelligent Controls

Tank Sentinel Series: Sample Reports (continued)

Alarm Reports

The **Tank Sentinel** system can show alarm status on the LCD or print reports that detail current or historical alarm conditions. Alarm indicators will automatically appear on the LCD, above the menu command keys (M1 - M4), as shown below:



To view details of alarm indicators:

- ▶ Press M1 - M4 under the warning or alarm listed on the LCD
- ▶ Press UP or DOWN to view other alarms in the alarm list

You can also print reports of active, cleared, and historical alarm conditions for the system itself, the tank, sensors, or lines. ALL reports show active, cleared, or historical alarm conditions for the system, tank, sensors, and lines. A list of available reports and their contents appears below:

System Alarm Reports

- ▶ Active System Alarms Report: shows active system alarms and warnings, including software or hardware failures and faults
- ▶ Cleared System Alarms Report: shows cleared system alarms
- ▶ System Alarm History Report: shows all active, cleared, or transient alarms

Tank Alarm Reports

- ▶ Active Tank Alarms Report: shows active tank alarms by tank
- ▶ Cleared Tank Alarms Report: shows cleared tank alarms
- ▶ Tank Alarm History Report: shows all active cleared and transient tank alarms

Sensor Alarm Reports

- ▶ Active Sensor Alarms Report: shows all active sensor alarms
- ▶ Cleared Sensor Alarms Report: reports all cleared sensor alarms
- ▶ Sensor Alarm History Report: shows all active, cleared, and transient sensor alarms

Line Alarms Reports

- ▶ Active Line Alarms Report: reports active line alarms
- ▶ Cleared Line Alarms Report: shows line alarms and faults that have cleared
- ▶ Line Alarm History Report: reports all active, cleared, and transient line alarms

INCON Intelligent Controls

Tank Sentinel Series: Sample Reports (continued)

All Alarms Reports

To print an (All) Active Alarms Report:

- ▶ Press REPORT
- ▶ Press DOWN to view report types
- ▶ Press M1 - M4 to select desired report
- ▶ Press M1 to print report
- ▶ Press M2 to send the report to a remote fax machine

```
                                INCON
                                INTELLIGENT CONTROLS, INC
                                SACO, ME 04072

08/11/1998                                8:27 PM

ACTIVE ALARMS

08/11/1998                                8:26 PM
LOW BRINE LEVEL
SENSOR 8
SENSOR NO. 8

08/11/1998                                8:26 PM
PRINTER OUT OF PAPER

08/11/1998                                8:26 PM
STANDARD SENSOR
SENSOR 7
SENSOR NO. 7

08/11/1998                                7:05 PM
HIGH PRODUCT LIMIT
TANK NO. 1
```

If no alarms are currently active, the **Tank Sentinel** will report NO ALARMS, as shown below:

```
                                INCON
                                INTELLIGENT CONTROLS, INC
                                SACO, ME 04072

08/13/1998                                8:27 PM

                                ACTIVE ALARMS

                                NO ALARMS
```

INCON Intelligent Controls

Tank Sentinel Series: Sample Reports (continued)

You can see a history of up to 50 of the most recent active, cleared, and transient alarms for alarm types. This report is called an (All) Alarm History Report and is shown below.

- ▶ Press REPORT
- ▶ Press DOWN to view report types
- ▶ Press M1 - M4 to select desired report
- ▶ Press M1 to print report
- ▶ Press M2 to send the report to a remote fax machine

INCON INTELLIGENT CONTROLS SACO ME 04072	
08/12/1998	9:51 AM
ALARM HISTORY	
08/11/1998	5:49 PM
LOW LOW PRODUCT LIMIT TANK NO. 1	
08/09/1998	8:46 AM
POWER UP	
08/09/1998	8:46 AM
POWER DOWN	
08/06/1998	1:48 PM
0.10 GPH LINE TEST ABORTED REGULAR LINE NO. 1	
08/06/1998	1:47 PM
0.10 GPH LINE TEST ABORTED REGULAR LINE NO. 1	
08/06/1998	1:19 PM
POWER UP	
08/06/1998	1:18 PM
CONTROL UNIT COMM FAIL SUPER LINE NO. 3	
08/06/1998	1:18 PM
CONTROL UNIT COMM FAIL MID GRAD LINE NO. 2	

Keekor Environmental Products

TankTite

Equipment Type:

Automatic tank gauging system

Vendor:

Keekor Environmental Systems
14806 N. 74th St.
Scottsdale, AZ 85267
Phone: No longer doing business

[No picture provided by vendor]

Basic System Description:

No information regarding this system was provided by the vendor

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, solvents

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Tank must be between 50 and 90% full

Waiting Time:

- ▶ Minimum of 8 hours and 6 minutes between delivery and testing
- ▶ Minimum of 15 minutes after a maximum dispensing rate of 50 gallons per minute
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Minimum of 3 hours
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated as the average of subsets of all data collected
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Execution of probe check diagnostic routine is recommended prior to leak detect tests to ensure sensor is fully operational and in calibration
- ▶ Annual preventative maintenance should be performed per manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product

[No sample reports were provided by vendor]

Marley Pump Red Jacket RLM System

Equipment Type:

Automatic tank gauging system

Vendor:

Marley Pump Co.
500 East 59th Street
P.O. Box 3888
Davenport, IA 52807
Phone: 319-391-8600
Fax: 319-391-3619
Internet: www.marleypump.com

[No picture provided by vendor]

Basic System Description:

Automatic computerized system which utilizes in-tank magnetostrictive probe technology to monitor underground storage tanks for inventory control and tank tightness.

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.058 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, solvents

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Tank must be between 50 and 95% full

Waiting Time:

- ▶ Minimum of 6 hours between delivery and testing
- ▶ There must be no dispensing or delivery during waiting time

Test Period:

- ▶ Minimum of 3 hours
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from all data collected
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Temperature sensors and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product

Marley Pump

Red Jacket RLM System: Sample Reports

The RLM system will store and print the last attempted test results. To access this report the following keystrokes should be used:

1. Press the 3 or the "REPRT" key.
2. Scroll through the print menu using the down key located immediately right of the "REPRT" key
3. When "LEAK" is displayed press the "ENTER" key.
4. Reports may be printed for all tanks by entering a zero then pressing the "ENTER" key again.

```

      RETAIL FUEL OUTLET
      1234 MAIN STREET
      ANY TOWN, USA
      SITE NUMBER 1

04/18/2000                11:23 AM
      LEAK TEST REPORT

TANK NO. 1                1000 GAL
      UNLEADED

THRESHOLD                0.20 GAL/HR
CONFIDENCE LEVEL        95.0%
TEST STARTED            1:00 AM
TEST STARTED            04/17/2000
LAST DELIVERY           7:25 PM
LAST DELIVERY           04/17/2000
%GROSS CAPACITY        87.66
BEGIN GROSS             8631.8 GAL
BEGIN NET               8689.4 GAL
BEGIN LEVEL             74.101 IN
BEGIN TEMP              50.477 F
BEGIN WATER             0.0 GAL
BEGIN WATER             0.000 IN
END TIME                4.59 AM
END DATE                04/18/2000
END GROSS               8631.8 GAL
END NET                 8689.3 GAL
END LEVEL               74.101 IN
END TEMP                50.507 F
END WATER               0.0 GAL
END WATER               0.000 IN
  
```

```

Print-Out Continued

      HOURLY DATA

TIME          DEG F          GAL
1:59 AM      50.484          8689.41
2:59 AM      50.493          8689.24
3:59 AM      50.500          8689.31
4:59 AM      50.507          8689.29

SLOPE                    -0.05 GAL/HR
SLOPE LOW                 -0.05 GAL/HR
SLOPE HIGH                -0.05 GAL/HR
TEST RESULTS              PASSED
  
```

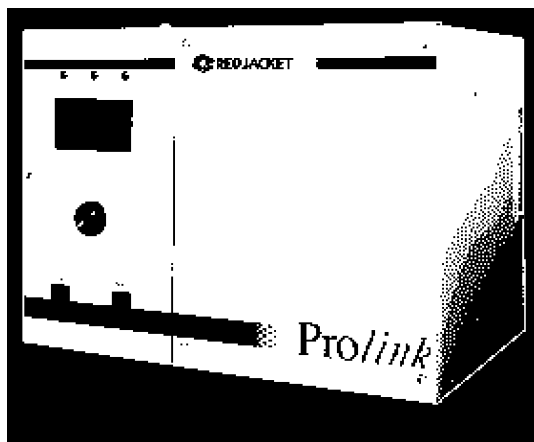
Marley Pump ProLink System

Equipment Type:

Automatic tank gauging system

Vendor:

Marley Pump Co.
500 East 59th Street
P. O. Box 3888
Davenport, IA 52807
Phone: 319-391-8600
Fax: 319-391-3619
Internet: www.marleypump.com



Basic System Description:

An automated sensor network which is capable of utilizing in-tank Ultrasonic or Magnetostrictive Probe Technology to monitor Underground Storage Tanks for inventory control and tank tightness. A ProLink system may contain one or both types of nodes or cards [i.e., Magnetostrictive Sensor Node (part no. RE125-155); Ultrasonic Sensor Node (part no. RE125-189)].

Certified Leak Rates and Thresholds:

Using magnetostrictive probe:

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.05 gph

Using ultrasonic probe:

- ▶ Leak rate of 0.2 gph with leak threshold of -0.116 gph to declare a leak or 0.084 to declare gain
- ▶ Leak rate of 0.1 gph with leak threshold of -0.065 gph to declare a leak or 0.035 gph to declare a gain

Applicability:

Using magnetostrictive probe:

- ▶ Gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, solvents
- ▶ Other liquids may be tested after consultation with the manufacturer

Using ultrasonic probe:

- ▶ Gasoline, diesel fuel
- ▶ Other liquids may be tested after consultation with the manufacturer

Tank Capacity:

Using magnetostrictive probe:

- ▶ Tank must be between 25% and 95% full
- ▶ Minimum product level required is based on tank diameter as follows: 48" dia./ min. 16"; 64" dia./ min. 21"; 72" dia./ min. 24"; 126" dia./ min. 41"
- ▶ For other diameters, see evaluation report

Using ultrasonic probe:

- ▶ Maximum tank size of 73,530 gallons for 0.2 test
- ▶ Maximum of 18,000 gallons for 0.1 test
- ▶ Tanks must have a minimum of 15 inches of product and 25% full in order to test

Marley Pump Prolink System (continued)

Waiting Time:

Using magnetostrictive probe:

- ▶ 0.1 minimum of 19 hours and 33 minutes between delivery and testing
- ▶ 0.2 minimum of 16 hours and 24 minutes between delivery and testing

Using ultrasonic probe:

- ▶ Computer tests following a delivery, minimum wait of 9.1 hrs.

Test Period:

Using magnetostrictive probe:

- ▶ Minimum of 4 hours and 31 minutes (6 hours and 39 minutes for 0.1 gph leak rate)
- ▶ Test data are acquired and recorded by the system's computer
- ▶ Leak rate is calculated from all the data collected during entire test period
- ▶ There must be no dispensing or delivery during testing

Using ultrasonic probe:

- ▶ Minimum of 2 hours and 15 minutes (test time determined by the computer)

Calibration and Maintenance Requirements:

- ▶ Temperature sensors and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

Using magnetostrictive probe:

- ▶ System has a bias of -0.016 gph (-0.015 at 0.1 gph leak rate)
- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product

Using ultrasonic probe:

- ▶ Recently evaluated for continuous test capabilities as well as application to manifold tank configurations. Currently being evaluated by the National Work Group on Leak Detection Evaluations.

Marley Pump ProLink System: Sample Reports

ProLink is a modular system. Depending on the options desired by the computer, reports may be printed on site if the system has a remote printer. Reports may also be available if the system utilizes a PC, either remotely or connected directly. Sample test reports of both types follow.

```
Station Status Report

RETAIL FUEL OUTLET
1234 MAIN STREET
ANY TOWN, USA
SITE NUMBER 1
Phone: 555-1212

*****
04/18/2000 08:48

*****Current Status*****

UNLEADED Regular

Height  Gross  Net      Water  Temp
57.4    7706.2  7669.6   0.9    67.1

Last Test

Date      End Time  Rate    Result
04-17-00  04:33    -0.01   PASS ATG
```

*****Notes***** Remote printer reports may be configured differently depending on customer requirements

Marley Pump Red Jacket ST

Equipment Type:

Automatic tank gauging system

Vendor:

Marley Pump Co.
500 East 59th Street
P. O. Box 3888
Davenport, IA 52807
Phone: 319-391-8600
Fax: 319-391-3619
Internet: www.marleypump.com

**Basic System Description:**

Automatic computerized system, which uses in-tank ultrasonic probe technology to monitor underground storage tanks for inventory control and tank tightness.

Certified Leak Rates and Thresholds (with ultrasonic probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.05 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, solvents
- ▶ Other liquids may be tested after consultation with the manufacturer

Tank Capacity:

- ▶ 0.2 gph: maximum of 73,530 gallons: tanks must be between 50 and 95% full
- ▶ 0.1 gph: maximum of 18,000 gallons: tanks must be a minimum of 25% full

Waiting Time:

- ▶ Minimum of 10 hours between delivery and testing (12 hours for 0.1 gph leak rate)
- ▶ None between dispensing and testing
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Minimum of 2 hours and 21 minutes
- ▶ Test data are acquired and recorded by the system's computer
- ▶ Leak rate is calculated from all the data collected during entire test period
- ▶ Operating software should terminate a test if a delivery occurs

Calibration and Maintenance Requirements:

- ▶ Temperature sensors and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ 0.2 gph (ATGS): certified for manifold tanks
- ▶ Tests only portion of tank containing product

Marley Pump

Red Jacket ST System: Sample Reports

The ST series automatic tank gauge can store and print up to 400 of the last test attempts. This will usually constitute several months of individual tank tests depending on system setup and site activity.

Systems running version 4.0 meg software can easily print out the last passed tests for all configured tanks using the following keystrokes:

1. From "SELECT DISPLAY" press the right arrow key ⇒ "Print Menu" will be displayed.
2. Press the down arrow key ↓ "Last Pass Test" will be displayed.
3. Press the "P" key, "Tanks?" will be displayed.
4. Press the "O" key twice, all configured tanks will be listed.
5. Press the "P" key again and the report will print as follows.

```
RED JACKET LEAK DETECTION SYSTEMS
VERSION ST4MEG_1.0J

RETAIL FUEL OUTLET
1234 MAIN STREET
ANY TOWN, USA
SITE NUMBER 1

                LAST PASS TEST
*****
18JAN00          14:32:43

*****
TANK 1 UNLEADED REG
-----

CONTINUOUS TEST
ALARM LEAK RATE    0.200 GAL/H
PROBABILITY OF DETECTION 99.9%

PRODUCT HEIGHT          42.23 INCHES
PRODUCT VOLUME          5180.2 GALLONS
LEAK DET START TIME     14APR00 18:50:30
LEAK DET END TIME       15APR00 05:46:48
LEAK DET PERIOD         10 HRS 56 MINS
LEAK DET START WATER    0.00 INCHES
LEAK DET END WATER      0.02 INCHES
LAST DELIVERY           17APR00 17:52:11

LINE 1 UNLEADED
-----
TEST NOT AVAILABLE
-----

                END OF REPORT
```

```
***Note*** Last Pass Test
Report is available only
on units with 4.0 MEG
version J or higher
software. Units with 1
MEG, 14.0 - 14.4 software
will print, "Test not
available", if this
report is requested.
HISTORY tank reports are
available on 1 MEG units,
however dates must be
specified.
```


NESCO [formerly Arizona Instrument Corp.] Encompass MTS and USF

Equipment Type:

Automatic tank gauging system

Vendor:

NESCO [formerly Arizona Instrument Corp.]
4720 S. Ash Street
Tempe, AZ 85282
Phone: 800-229-2930
Internet: www.nesco-usa.com

[No picture provided by vendor]

Basic System Description:

The Encompass ATG system is a Windows™ PC based inventory and leak detection system that provides graphical display of current and historical tests.

Certified Leak Rates and Thresholds:

- ▶ **Magnetostrictive probe (MTS):** leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ **Ultrasonic probe (USF):** leak rate of 0.2 gph with leak threshold of 0.1 gph. Leak rate of 0.1 gph with threshold of 0.05 gph available for non-manifold tanks

Applicability:

- ▶ **Magnetostrictive probe:** gasoline, diesel, aviation fuel, fuel oils #4 and #6, waste oil, solvents
- ▶ **Ultrasonic probe:** gasoline, diesel, aviation fuel
- ▶ Other liquids may be tested after consultation with the manufacturer

Tank Capacity:

- ▶ **Magnetostrictive probe:** maximum of 15,000 gallons
- ▶ **Ultrasonic probe:** maximum of 15,000 gallons (single tank), 40,500 gallons (manifold tank pair)
- ▶ Tank must be between 50 and 95% full

Waiting Time:

- ▶ **Magnetostrictive probe:** minimum of 2 hours between delivery and testing
- ▶ **Ultrasonic probe:** minimum of 6 hours between delivery and testing
- ▶ There must be no dispensing or delivery > 500 gph during waiting time

Test Period:

- ▶ **Magnetostrictive probe:** 4 hours
- ▶ **Ultrasonic probe:** 4 hours for 0.2 gph leak rate; 7 hours for 0.1 gph leak rate
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from data determined to be valid by statistical analysis
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ The probes require no periodic calibration
- ▶ Maintenance must be performed in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ The Magnetostrictive probe is not used in manifold tanks
- ▶ The Ultrasonic probe has been evaluated for use with manifold tank systems
- ▶ Encompass software provides for remote access capabilities
- ▶ Tests only portion of tank containing product

Leak Test Reports:

Leak test reports may be displayed by selecting “Reports” and then “Completed Tank Test Results” from the Windows™ menu bar. A list of completed tests is then presented which may be displayed by clicking the desired test and then the “View” button with the mouse.

Omntec/Electro Levels Mfg., Inc.

OEL 8000

Equipment Type:

Automatic tank gauging and interstitial leak detection system

Vendor:

For technical information:

Omntec/Electro Levels Mfg., Inc.

1993 Pond Rd.

Ronkonkoma, NY 11779

Phone: 516-981-2001

Fax: 516-981-2007

For sales information:

XERXES Corporation

7901 Xerxes Avenue South

Minneapolis, Minnesota 55431

Phone: 612-887-1890

Fax: 612-887-1882

Internet: www.xerxescorp.com



Basic System Description:

The **OEL 8000** is a comprehensive tank gauging and leak detection system that can simultaneously monitor product levels, water levels, temperatures, and leaks in up to 8 tanks. Typical uses of the system are aboveground and underground tank gauging, monitoring of interstitial spaces, sumps, double-wall piping, dispenser pans, containment dikes and observation wells. Up to 8 magnetostrictive tank gauging probes and 24 leak detection sensors can be monitored. The **OEL 8000** indicates system functions and alarm conditions via a 4-line by 40 character backlit liquid crystal display (LCD). Standard features are an audible horn and a series of lights on the controller that indicate system status. The optional printer can be programmed to print a report automatically when an alarm occurs or on command.

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.05 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, fuel oil #4, waste oil, solvents
- ▶ Other liquids may be tested after consultation with the manufacturer

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Tank must be between 50 and 95% full

Waiting Time:

- ▶ Minimum of 6 hours and 30 minutes between delivery and testing
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Minimum of 4 hours
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from data determined to be valid by statistical analysis
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Thermistors and probes must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product

Omntec/Electro Levels Mfg., Inc.

OEL 8000: Sample Reports

The **OEL 8000** LCD displays a number of menus that provide different types of information and options for you to select. Because some menus have too many options to fit on the LCD, they are divided into separate screens. You can advance from one screen to the next by pressing the arrow beneath MORE. To select a function from any menu, press the arrow key beneath it.

The Main Menu is divided into four screens, and provides access to all other menus and functions. Screen #1 provides access to the sub-menus.

To access Screen #2, press the arrow key beneath MORE on Screen #1. Screen #2 allows the generation of two reports, Print All (a complete system report), and Alarm Log (detailing up to 125 alarm events). Screen #2 is shown below:

```
FR 07/17/98 15:30:00          *STATUS: NORMAL

TIME          PRINT ALL      ALARM LOG      MORE
```

Inventory/Status

Print All:

- ▶ Press the arrow beneath PRINT ALL and the system will print the current date and time, product type, water height, temperature compensated product volume, gross volume, water volume, present temperature, and ullage for each tank

```
FR 01/12/96      15:30:00
Tank 1
Product Type: DIESEL
H2O: 2.39 in.
Product: 26.74 in.
T.C.: 636.17 Gal.
Gross: 639.28 Gal.
H2O: 66.28
Temp. 70.55 deg F
Ullage: 360.72 Gal.
-----
FR 01/12/96      15:30:00
Level Probe 2 Disabled
-----
FR 01/12/96      15:30:00
Level Probe 3 Disabled
```

Omntec/Electro Levels Mfg., Inc.

OEL 8000: Sample Reports (continued)

From Screen #1 of the Main Menu, press the arrow beneath STATUS. The Status Sub-menu is divided into five screens, providing information about the contents of each tank in systems utilizing magnetostrictive probes. On each Status Sub-menu screen selecting NEXT will display the same information for the next tank in the system. Selecting MORE will display other status information for a particular tank.

You can see the product type and the height of the product in inches on Sub-screen #1:

```
FR 07/17/98 15:30:00      *STATUS: NORMAL
Tank 1  Product Type: DIESEL
HEIGHT PRODUCT: 26.17"   WATER: 4.17"
NEXT      PREV          PRINT      MORE
```

You can see product and water volume data on Sub-screen #2:

```
FR 07/17/98 15:30:00      *STATUS: NORMAL
VOLUME  Prod: 1641.15 Gal.
Tank 1  Water: 161.17 Gal.  Gross: 1802.32
NEXT      PREV          PRINT      MORE
```

You can see ullage and volumetric leak detection data on Sub-screen #3. LT: DONE shows that a volumetric leak test (LT) was completed. DELTA is the difference in product gallons between the time the test was started. ST shows the start time of the test shown as day, date, and time:

```
FR 07/17/98 15:30:00      *STATUS: NORMAL
Tank 1 Ullage: 363.65 Gal. LT: DONE
Delta: 0.000  ST: WE 07/15/98  13:11:54
NEXT      PREV          PRINT      MORE
```

You can see data from the last Volumetric Leak Detection (VLD) Test that was run on the tank on Subscreen #4. ET refers to the elapsed time (i.e., how long it took for the test to be completed). The third line shows if that specific tank has passed or failed based on leak rates of 0.1 gph and 0.2 gph:

```
FR 07/17/98 15:30:00      *STATUS: NORMAL
LT: DONE  ET: 04:30:00 -0.040 G/H
.1 Test: PASSED  .2 Test: PASSED
NEXT      PREV          PRINT      MORE
```

You can see information on the present temperature of the tank being viewed and the temperature compensated (TC) product volume on Subscreen #5 (not shown).

Omntec/Electro Levels Mfg., Inc.

OEL 8000: Sample Reports (continued)

While in the Status Sub-menu, you can print any of the information displayed on the LCD by selecting the arrow beneath PRINT. To return to the Main Menu press the MENU (DEL) key.

Leak Test Reports

From Screen #3 of the Main Menu, selecting the arrow beneath VLD will display the Volumetric Leak Detection (VLD) Sub-menu:

```
FR 07/17/98 15:30:00      *STATUS: NORMAL
Set Leak Test Tank#, (1-8, 0 for All)

ENTER      PRNT LOG      PRNT LAST      EXIT
```

- ▶ Select ENTER to run the VLD test once a tank number (1-8, or 0) has been entered on line 3
- ▶ Select PRNT LOG to generate a printout of the last 32 system-wide VLD tests
- ▶ Select PRNT LAST to print the last VLD test for a specific tank

Tank 1 in this example has a leak rate of -0.051 gph. Since this is below the limits of 0.1 gph (annual) and 0.2 gph (monthly) the report indicates that the system has passed the leak test.

```
VLD Results Tank 1
WE 01/10/96
Start Time 11:13:54
Elapsed Time 04:00:02
Start Temp. 70.76 Deg.
End Temp. 70.76 Deg.
Start Water: 7.787 Gal.
End Water: 7.787 Gal.
Start Level: 32.407 In.
End Level: 32.352 In.
Start Vol.: 646.486 Gal.
End Vol.: 646.286 Gal.
Delta Gals. 0.400 Gal.
Rate: -0.051
.1 GPH Test
PASSED
.2 GPA Test
PASSED
```

Alarm Reports

While in Screen #1 of the Main Menu, you can select the arrow beneath ALARMS to display the Alarms Sub-menu. The display will provide information pertaining to any warning or alarm situations that might exist:

```
FR 07/17/98 15:30:00      *STATUS: NORMAL

PRINT ALRM
```

Omntec/Electro Levels Mfg., Inc.

OEL 8000: Sample Reports (continued)

To view current alarm information:

- ▶ Press the arrow beneath PRINT ALARM; if no alarm conditions exist, the system will provide a printout of the site information

```
SITE INFORMATION:
ABC GAS CO.
1234 MAIN ST.
RONKONKOMA, NY
11779
SITE MANAGER:
JOE SMITH
PHONE:
555-1234
IDENTIFICATION #
135790
```

If an alarm condition exists, the LCD will first display a screen indicating how many alarm conditions exist:

```
FR 07/17/98 15:30:00      *STATUS: ALARM
1 ALARM CONDITION(S) EXISTS

PRINT
```

The system will then display a separate screen for each alarm. After displaying the last alarm, it repeats the cycle:

```
FR 07/17/98 15:30:00      *STATUS: ALARM
HIGH WATER LEVEL ALARM IN TANK 1
5.1 IN. ALARM POINT 5 IN.

PRINT
```

- ▶ Press the arrow beneath PRINT and the system will provide a printout detailing the current alarms, and the date and time the report was requested
- ▶ To obtain a printout of all events and when they occurred, go to Screen #2 of the main menu and press the arrow beneath ALARM LOG
- ▶ Press the ACK key to silence the horn and return to the Main Menu

```
ALARM !!!
5/30/95 11:24:56
ALARM POINT 5 IN.
5.1 INCHES
HIGH WATER IN TANK 1
SITE INFORMATION:
ABC GAS CO.
1234 MAIN ST.
RONKONKOMA, NY
11779
SITE MANAGER:
JOE SMITH
PHONE:
555-1234
IDENTIFICATION #
```


Omntec/Electro Levels Mfg., Inc.
OEL 8000: Sample Reports (continued)

Alarm Log:

- ▶ Press the arrow beneath ALARM LOG and the system will print data on over 125 alarm entries. The entries will show if an alarm occurred, if it was acknowledged, and the date and time when it occurred.
- ▶ Pressing any key immediately after selecting ALARM LOG will abort printing the log

```
Time of Event  
MO 12/14/95 10:49:55  
Leak Alarm  
Conductance  
Sensor Number 2  
Tank Number 1  
Gas
```

```
Time of Event  
MO 12/14/95 10:50:25  
ALARM ACKNOWLEDGE
```

Patriot Sensors and Controls Corp. 7021 Digital Tank Gauge

See system description on page 61

Petro Vend, Inc.

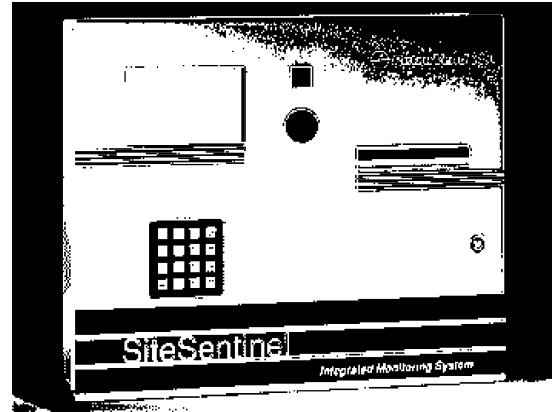
Site Sentinel Model II and III

Equipment Type:

Automatic tank gauging and interstitial leak detection system

Vendor:

Petro Vend, Inc.
6900 Santa Fe Dr.
Hodgkins, IL 60525-9909
Phone: 708-485-4200
Fax: 708-485-7137
Internet: www.petrovend.com



Basic System Description:

The **Site Sentinel II** manages up to 128 probes or sensors connected to a series of up to eight Smart Modules. The system can provide continuous leak detection and accept input from a variety of sensors: liquid, vapor, sump, reservoir, liquid phase, and interstitial. The system also interfaces with cathodic protection and line leak detection systems, and provides an audible alarm in addition to a visual alarm indicator on the controller face panel. The **Site Sentinel II** is operated via a built-in keypad and display, an on-site terminal or PC, or with a modem, via an off-site terminal or PC. The system may include a factory installed printer for generating hard copy reports. The **Site Sentinel III** offers the same capabilities, but utilizes a compact desktop controller, instead of a built-in keypad and display. This configuration is designed for remote and unattended monitoring applications. No information on the **Petrosonic III** model was provided by the vendor.

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.06 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, solvents

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Tank must be between 50 and 95% full (minimum of 90% full for 0.1 gph leak rate)

Waiting Time:

- ▶ Minimum of 12 hours between delivery and testing
- ▶ There must be no dispensing or delivery during waiting time

Test Period:

- ▶ Minimum varies from 2 hours to 4 hours
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from the difference between the first and last data collected
- ▶ There must be no dispensing or delivery during test

Petro Vend, Inc.

Site Sentinel Model II and III (continued)

Calibration and Maintenance Requirements:

- ▶ Resistance temperature detectors (RTD) and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ The **Petrosonic III** system is obsolete
- ▶ Tests only portion of tank containing product

The functionality of both models is nearly identical. The main differences are in the hardware. The **Model II** utilizes a backlit, liquid crystal screen to display tank information, while the **Model III** displays tank information on a normal computer monitor. You will see the same menu screens and reports regardless of the type of display. You will generate printed reports on the built-in printer (**Model II**), if it has been installed, or a printer attached to the PC or terminal controller.

The keypad (**Model II**) has several multi-function keys. The CLEAR/NO key either erases an entry or field, or answers NO to a prompt. The ENTER/YES key either finishes an entry or answers YES to a prompt. The HELP key may not be functional on some models. The CANCEL key will back you out of the current menu, or cancel the previous command. You print most screens by pressing the ?*-/0 key on the keypad, or by typing P at the terminal. Only screens with PRINT on the bottom can be printed.

Selecting REPORTS (option 3) from the Main Menu will access the Reports Menu:

```
SITE SENTINEL   OCT 25, 1994   8:36 AM
                REPORTS MENU

1. REPORT OUTPUT SETUP

CURRENT
2. CONTROLLER STATUS
3. TANK, PROBE & SENSOR STATUS GRAPHS
4. TANK INVENTORY
5. SENSOR LEVELS
6. WARNINGS IN PROGRESS

SAVED EVENTS
7. SENSOR, PROBE, INPUT, & HW FAILURE
8. SENSOR, PROBE, & INPUT
9. HARDWARE FAILURE
10. INDIVIDUAL

11. SAVED TANK INVENTORIES

12. I/O MODULE STATUS REPORT

Enter #, C/CANCEL, H/HELP or 0/PRINT:
```

The Reports Menu allows you to print numerous current and saved event reports. The Individual Events Menu (Option 10) allows you to view reports on 17 specific events: overflow, low product, high water, bad temperatures, thefts, deliveries, sales, timed leak test, high sensor levels, low sensor levels, I/O module inputs, input #1 contact closures, input #2 contact closures, probe failures, module failures, printer failures, and power failures. Once you have made a selection from the Reports Menu or Individual Events Menu, the system will display the appropriate report. To print the displayed report, you should press “?*/0” on the keypad or type “P” at the terminal.

Inventory/Status Reports

An Inventory Report (option 4) can be displayed and printed for each tank, showing the current values of gross measured product, water, and tank levels; temperature-corrected product, water, and tank volumes; amount of product needed to fill the tank completely (ullage); and average product temperature. When a level reading is not applicable to a type of measurement, it is noted as NA.

To generate an Inventory Report:

- ▶ Type 4 at the Reports Menu prompt
- ▶ Press Enter
- ▶ Press ?*/0 on the keypad or type P at the terminal to print the report

```
SITSENTINEL
INTEGRATED MONITORING SYSTEM
BY PETRO VEND, INC.
708/485-4200

TANK INVENTORY REPORT

TANK INVENTORY
MODULE: 1 POSITION: A PROBE #: 1
DESCRIPTION: NORTH.TANK
PRODUCT: GASOLINE

MEASURED                HEIGHT  VOLUME
                        (IN)    (GAL)
PRODUCT                 : 26.83  1093.45
WATER                   : 0.00   0.00
TOTAL TANK              : 26.84  1093.45
TEMPERATURE CORRECTED
PRODUCT                 :          1081.22
WATER                   :          0.00
TOTAL TANK              :          1081.22
ULLAGE - TO FILL TANK
ADD                     :          906.55
TO 90 PERCENT ADD      :          802.46
AVERAGE TEMPERATURE: 76.3 F

END OF REPORT
```

Leak Test Reports

The Individual Events Menu (option 10) allows you to view reports on 17 specific events: overflow, low product, high water, bad temperatures, thefts, deliveries, sales, timed leak test, high sensor levels, low sensor levels, I/O module inputs, input #1 contact closures, input #2 contact closures, probe failures, module failures, printer failures, power failures. Option 8 will generate the timed leak test report. This report provides both the leak rate of a particular tank and an indication of whether a leak has been detected.

To generate a Timed Leak Test Report:

- ▶ Type 8 at the Individual Events Menu prompt
- ▶ Press Enter
- ▶ Press ?*/0 on the keypad or type P at the terminal to print the report

```

TIMED LEAK TEST
MODULE : 1 POSITION : A PROBE # : 1
DESCRIPTION: NORTH.TANK
PRODUCT : GASOLINE
START MEASUREMENT
JAN 7, 1999 9:15 AM
PRODUCT LEVEL : 31.8763 IN
WATER LEVEL : -0.0341 IN
AVG PRODUCT TEMP : 76.9824 F
NET CORRECTED PROD : 1330.0675 GAL
GROSS MEASURED PROD : 1345.7399 GAL
NET CORRECTED TANK : 1330.0675 GAL
GROSS MEASURED TANK : 1345.7399 GAL
VOLUME LEFT IN TANK : 654.2601 GAL
GROSS WATER : 0.0000 GAL
END MEASUREMENT
JAN 7, 1999 11:15 AM
PRODUCT LEVEL : 31.8739 IN
WATER LEVEL : -0.0349 IN
AVG PRODUCT TEMP : 75.5379 F
NET CORRECTED PROD : 1331.2882 GAL
GROSS MEASURED PROD : 1345.6223 GAL
NET CORRECTED TANK : 1331.2882 GAL
GROSS MEASURED TANK : 1345.6223 GAL
VOLUME LEFT IN TANK : 654.3777 GAL
GROSS WATER : 0.0000 GAL
LEAK RATE
NET TANK LEAK RATE : 0.6104 GAL/HR
TEMPERATURE CHANGE : -1.4445 F
TEST DURATION : 2 HRS 0 MINS
LEAK INDICATED

END OF REPORT
```

This example report indicates a leak rate of 0.6104 gph for the tank in question. Since the leak rate exceeds the 0.2 gph regulatory limit, the tank has failed the leak test and the report displays LEAK INDICATED. You should not excavate your tank based only on the evidence of the timed leak test. Further testing should be conducted to confirm the results of the timed leak test. The owner and operator must also comply with the procedures of 40 CFR Section 280.50 for reporting suspected releases.

Pneumercator Company, Inc.

TMS 2000, TMS 3000

Equipment Type:

Automatic tank gauging, line leak detection, and interstitial leak detection system

Vendor:

Pneumercator Company, Inc.
120 Finn Court
Farmingdale, NY 11735
Phone: 516-293-8450
Fax: 516-293-8533
Internet: www.pneumercator.com



Basic System Description:

The **TMS 2000** can support 1 or 2 precision, dual float magnetostrictive level probes, and monitor up to 8 discrete sensor inputs including interstitial, overfill, and line leak devices. The **TMS 3000** can support up to 12 precision, dual float magnetostrictive level probes, and monitor up to 40 discrete sensor inputs. Both systems can be remotely monitored and programmed, and may include an optional printer for generating automatic and on-demand reports.

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.05 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel
- ▶ Other liquids may be tested after consultation with the manufacturer

Tank Capacity:

- ▶ Maximum of 20,000 gallons
- ▶ Tank must be between 20 and 95% full

Waiting Time:

- ▶ Minimum of 8 hours between delivery and testing
- ▶ Minimum of 20 minutes between dispensing and testing
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Minimum of 2 - 7 hours depending on configuration
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from data determined to be valid by statistical analysis
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Thermistors and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product

[No sample reports were provided by vendor]

Ronan Engineering Co.
X-76 ETM, X-76 ETM-4X

See system description on page 61

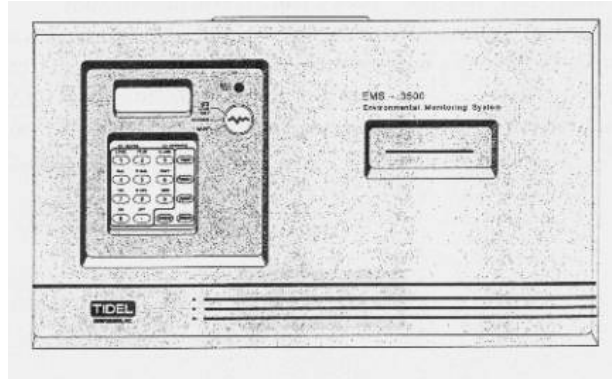
Tidel Engineering, Inc. Environmental Monitoring System

Equipment Type:

Automatic tank gauging, line leak detection, and interstitial leak detection system

Vendor:

Tidel Engineering, Inc.
2310 McDaniel Dr.
Carrollton, TX 75006
Phone: 800-678-7577
Fax: 972-484-1014
Internet: www.tidel.com



Basic System Description:

The **EMS-3500** controller enables the user to read or print inventory data, and review both current and historical system information. The system can monitor up to eight tanks, and can receive input from a wide array of probe applications: automatic tank gauging (ATG) probes; line integrity probes; interstitial monitoring probes; sump, pipe trench and dispenser pan probes; and monitoring well probes. The system can be used in three modes: normal mode consists of day-to-day operating functions, ATG leak test mode is used to manually start and stop leak checks, and maintenance mode is used to program tank parameters, alarm thresholds, and automatic leak test start and stop times. A key switch on the front panel toggles between these three modes. Only information on the **EMS-3500** was provided by the vendor.

Certified Leak Rates and Thresholds (with ultrasonic probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph

Applicability:

- ▶ Fuel oil #2
- ▶ Other liquids may be tested after consultation with the manufacturer

Tank Capacity:

- ▶ Maximum of 15,000 gallons
- ▶ Tank must be between 50 to 95% full

Waiting Time:

- ▶ Minimum of 2 hours and 29 minutes between delivery and testing
- ▶ Minimum of 15 minutes after dispensing
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Varies from 2 to 4 hours minimum
- ▶ Test data are acquired and recorded by the microprocessor contained within the EMS console
- ▶ Leak rate is calculated from data determined to be valid by statistical analysis
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Temperature sensors and ultrasonic probe must be checked and calibrated in accordance with manufacturer's instructions

Tidel Engineering, Inc.

Environmental Monitoring System (continued)

Comments and Limitations:

- ▶ Water sensor, temperature sensor, and product level monitor are contained in a single ultrasonic probe
- ▶ Not evaluated using manifold tank systems
- ▶ Tidel no longer manufactures the Environmental Monitoring Systems
- ▶ Tests only portion of tank containing product

Tidel Engineering, Inc.

Environmental Monitoring System: Sample Reports

The keypad of the **EMS-3500** consists of control keys (gray or red background) and data entry keys (white background). The control keys are used to display information for selected tank(s) or a manifold group of tanks, and to obtain printed reports. The data entry keys are used for requesting information on a particular tank or event. The CLEAR key is used to remove data entered into the system and to silence audible alarms. The FUNCT. key is used to shift the data entry keys from numeric to data for viewing tank information on the liquid crystal display (LCD). The TANK key is used to designate a specific tank for viewing information, or starting ATG leak checks.

The key switch on the **EMS-3500** control panel is used to select one of the three operating modes of the system: Normal, ATG Leak Test, and Maintenance. When the **EMS-3500** is in the normal operating mode, the LCD will continuously display the current time in hours, minutes, and seconds using a 24-hour format. When requested, the LCD can display the current tank readings, last delivery information, current alarm conditions, and the time and date.

To display tank information:

- ▶ Press TANK, followed by the tank number (using the number keys)
- ▶ Press FUNCT., followed by the function key (the number keys) corresponding to the desired tank information (e.g., product level, temperature, alarms)

Inventory/Status Reports

The Status Report contains the current information on the status of all the probes in the system. It will also contain current inventory information if the system utilizes ATG probes, as well as any current alarm/warning conditions. You may print a Status Report any time the console is in the normal mode of operation.

To print a Status Report:

- ▶ Press PRINT

Level indicates inches of product in the tank. Net gallons indicates the temperature compensated volume of product. Ullage is the amount of fuel in gross gallons that can be added to the tank.

STATUS REPORT	
ID # 54321	
12:16:20	03/12/93
TANK 1	
PRODUCT GRADE SUL	
CURRENT STATUS	
LEVEL	47.41
GROSS GALLONS	4741
NET GALLONS	4703
ULLAGE	5258
AVERAGE TEMPERATURE	72.0°F
WATER	0.11
=====	

Sample Status Report (continued)

Current tank status information will be printed in succession.

```

=====
=====
LAST DELIVERY

DATE          03/11/93
TIME          12:08:35
GROSS GALLONS    5196
NET GALLONS     5168
INITIAL LEVEL   43.18
END LEVEL       87.00

CURRENT IN-TANK ALARMS

WATER 1.25 IN

-----

TANK 2
PRODUCT GRADE   DSL

CURRENT STATUS

LEVEL          47.81
GROSS GALLONS  5025
NET GALLONS    4998
ULLAGE         5050
AVERAGE TEMPERATURE
68.5°F

=====
=====

MANIFOLD GROUP 1 UNL
TANKS 3,4
GROSS GALLONS    6540
NET GALLONS     6510
ULLAGE           13610

LAST DELIVERY

DATE          01/22/93
TIME          08:57:02
GROSS GALLONS    8434
NET GALLONS     8329
-----
=====
=====

```

Sample Status Report (continued)

```
EXTERNAL PROBE STATUS

Channel 1-----
Sump           -Pr:01*
  Alarm/Fuel   -REG
Well Monitor   -Pr:02
  Normal
Channel 4-----
Line Monitor   -Pr:01
  Normal2
  .1PASS      CT=1
  Prev Mo     CT=2

END OF REPORT  (-012r)
```

*Designates probe in alarm condition

Leak Test Reports

The **EMS-3500** provides four methods in which the console may run automatic tank gauge leak tests: manual, timed leak test (TLT), automatic leak test (ALT), and remote. Regardless of the means of activation, the leak test will be terminated automatically by the the **EMS-3500** console.

Manual Leak Test

When you put a tank into leak check mode from the console keypad, the test for each tank must be started individually. This allows some tanks to remain in operation while other tanks are being tested. The system will automatically end and print out the results of the leak tests once they have been started. The user may also choose to manually end the leak test, though this may lead to inconclusive results.

To start the Manual Leak Test:

- ▶ Turn the key switch to the ATG LEAK TEST position
- ▶ Press TANK, followed by the desired tank number; the display will show the tank number, followed by an N overlaid by a blinking cursor
- ▶ Press the 0(ON) key; Y will appear on the display and a Leak Test Enable Report will be printed; if the automatic leak test or timed leak test features are enabled, the message, ALT ACTIVE or TLT ACTIVE, will be displayed and no other action will be taken by the system; these automatic and timed tests will test the system during quiet (down) time and at regular intervals; reports will be printed by the system at the completion of these tests
- ▶ Return the key switch to the NORMAL position; if the automatic or timed test features have not been enabled, the system will run the leak test and automatically end the test once completed; examples of the Leak Test Enable Report and Disable Report (printed at the completion of the test or when the test has been disabled) are shown below:

**LEAK TEST ENABLE
REPORT**

ID # 4701
23:00:00 03/15/93
TANK 1
PRODUCT GRADE SUL
LEAK TEST ON
LEVEL 69.710
GROSS GALLONS 7985.6
NET GALLONS 7891.0
TEMPERATURE 77.5°F
WATER LEVEL 0.576
END OF REPORT (-012R)

LEAK TEST DISABLE REPORT

ID # 4701
23:00:00 03/15/93
TANK 1
PRODUCT GRADE SUL
LEAK TEST OFF
LEAK TEST ENDED
AUTOMATICALLY
LEVEL 69.698
GROSS GALLONS 7984.2
NET GALLONS 7890.7
TEMPERATURE 77.3°F
WATER LEVEL 0.573
DURATION 5:21
LEVEL CHANGE -0.012
TEMP. CHANGE -0.18°F
LEAK RATE -0.050
LEAK RATE BY HOUR
-0.049
-0.093
-0.086
-0.087
-0.050
DIAG DATA
0.0092-0.0111 -0.575
-0.0002-0.0004 -0.0070
0.1/0.2 GALLON/HOUR TEST
NO LEAK DETECTED
END OF REPORT (-012R)

In this example, the leak rate of -0.050 for the tank in question is below the regulatory thresholds of 0.1 gph (annual) and 0.2 gph (monthly), thus the system indicates that no leak has been detected.

You can program the **EMS-3500** to run leak tests at defined start and stop times (TLT), or to automatically begin leak tests during quiet times when no fuel is being dispensed or delivered (ALT). If the system has been unable to perform an automatic test, you can configure the system to notify the operator that a conclusive leak test has not been performed on a particular tank and that adequate down time must be provided to allow a test to run.

The system can also generate theft detection reports based on programmed time intervals, self test reports (detailing the internal diagnostic routine), and an automatic power outage report.

Alarm Reports

The **EMS-3500** does not produce a unique alarm report, but does generate alarm information with the History Report. History Reports provide seven categories of historical data for each tank: delivery history, ATG probe alarm history, external probe alarm/warning history, ATG leak test history, power off/on history, theft mode history, and self test history.

To print a History Report:

- ▶ Press TANK, followed by the desired tank number
- ▶ Press FUNCT., followed by the ON key; a history report for the tank selected will automatically be printed

The first section of the history report shows the last 10 deliveries received into the tank.

HISTORY REPORT

ID # 54321

10:04:29 03/19/93

TANK 1

PRODUCT GRADE SUL

LAST 10 DELIVERIES

DATE 03/18/93

TIME 08:52:11

GROSS GALLONS 4368

NET GALLONS 4343

INITIAL LEVEL 46.32

END LEVEL 80.75

INITIAL TEMP 60.02

END TEMP 65.73

The second section indicates the last three occurrences for each warning or alarm condition.

IN-TANK PROBE HISTORY

WATER DETECT WARNING

NONE

LOW PRODUCT WARNING

12:26:18 03/12/93

08:22:39 01/26/93

01:08:09 12/25/92

LEAK ALARM

NONE

HIGH PRODUCT ALARM

10:23:15 03/14/93

THEFT ALARM

NONE

History Report (continued)

The external probe section contains the last three alarm conditions for each probe.

```
EXTERNAL PROBES  
  
Channel 1  
Probe 01  
None  
Probe 02  
04:14:33    01/01/93  
Alarm/Wet  
12:22:09    11/22/92  
Alarm/Fuel  
16:51:00    10/11/92  
Error-1
```

Channel four supports the systems line integrity probes. The History Report shows the number of 0.1 gph tests passed during the last 12 months.

```
Channel 4  
Probe 01 - SUL  
Yr.  .1 PassCt=3  
Jan 3  
Dec 5  
Nov 9  
Oct 0  
Sep 0  
Aug 0  
Jul 0  
Jun 0  
May 0  
Apr 0  
Mar 0  
Feb 0  
02:22:31    11/01/92  
Alarm/Leak Pr  
Probe 02 - UNL  
Yr.  .1 PassCt=9  
Jan 9  
Dec 14  
Nov 10  
Oct 0  
Sep 0  
Aug 0  
Jul 0  
Jun 0  
May 0  
Apr 0  
Mar 0  
Feb 0
```

The ATG leak test history will show a summary of the number, as well as the results, of the tests run during the current month. It will also show the last 3 tests and a history of the tests run during the prior twelve months.

```
AUTOMATIC TANK GAUGE
LEAK TEST HISTORY

1 LEAK TEST(S) HAVE
BEEN PERFORMED ON THIS
TANK IN JAN
0 INFLOWS      0.0%
1 PASSED      100.0%
0 LEAKS       0.0%

--- LAST 3 TESTS ---
START: 01/01/93
      01:00:00
END:   01/01/93
      02:02:00
PERFORMED AT 47%
CAPACITY
NO LEAK DETECTED
```

```
PRIOR YTD SUMMARY
MO. YR. PASS ALARM ATV
Feb      0      0
Mar      0      0
Apr      0      0
May      0      0
Jun      0      0
Jul      0      0
Aug      0      0
Sep      0      0
Oct      0      0
Nov      9      0
Dec      5      0

SAVE THIS REPORT FOR
YOUR REGULATORY AGENCY
```

The power off/on section shows the time and date that power was interrupted to the console and the time and date power was restored.

```
POWER OFF/ON LOG

On  -01/11/93 20:59:54
Off -01/11/93 20:59:53
On  -01/11/93 01:05:00
Off -01/11/93 01:04:52
On  -01/11/93 01:03:42
Off -01/11/93 00:40:06
```

History Report (continued)

The theft mode history shows the last theft condition recognized by the system.

```
THEFT MODE HISTORY  
  
BEGAN: 23:00:00  
        12/28/92  
ENDED: 06:30:34  
        12/29/92  
  
INITIAL LEVEL    46.32  
END LEVEL       46.00  
BEGIN VOLUME    6115.1  
END VOLUME      6099.5  
THEFT DETECT TIME  
02:15:92    12/29/92  
GALLONS LOST    015.6  
  
-----
```

The self test history section shows the time, date, and results of the last system self test. The manufacturer recommends performance of a self test at least once a month to maintain system integrity.

```
SELF TEST HISTORY  
  
LAST TESTED  
08:32:20    01/11/93  
  
MEMORY TEST PASS  
  
IN-TANK PROBE TEST  
PROBE 1 PASS  
PROBE 2 PASS  
PROBE 3 PASS  
PROBE 4 PASS  
  
EXTERNAL PROBE TEST  
Channel 1  
Probe 01 PASS  
Probe 02 PASS  
Probe 03 PASS  
Probe 04 PASS  
Probe 05 PASS  
Probe 06 PASS  
Probe 07 PASS  
Probe 08 PASS  
Probe 09 PASS  
  
Channel 2  
Probe 01 PASS
```

```
END OF REPORT
```

Universal Sensors and Devices, Inc.

TICS-1000

Equipment Type:

Automatic tank gauging system

Vendor:

Universal Sensors and Devices, Inc.
9205 Alabama Ave., Unit C
Chatsworth, CA 91311
Phone: 800-899-7121
Fax: 818-998-7147
Internet: members.aol.com/unisensors



Basic System Description:

The **TICS-1000** gathers information on system leaks, product level, water level, delivery, and inventory status for up to eight tanks. Information for each tank monitored can be viewed on a 32 character liquid crystal display (LCD), printed on an optional built-in printer, and/or transferred to a remote printer or computer. The **TICS-1000** can also monitor up to 16 sensors including in-ground hydrocarbon detectors, interstitial tank monitors, fuel line leak detectors, and pump/generator status.

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.1 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel, solvents

Tank Capacity:

- ▶ Maximum of 15,000 gallons for a single tank
- ▶ Tank must be minimum 90% full

Waiting Time:

- ▶ Minimum of 8 hours between delivery and testing
- ▶ No wait time between dispensing and testing
- ▶ There must be no delivery during testing

Test Period:

- ▶ Minimum of 6 hours
- ▶ Test data are acquired and recorded by a microprocessor
- ▶ Leak rate is calculated from average of subsets of all data collected
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Resistance temperature detectors (RTD) and probe must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Universal Sensors and Devices no longer manufactures the **TICS-1000**
- ▶ Tests only portion of tank containing product

Universal Sensors and Devices, Inc.

TICS-1000: Sample Reports

Once the system is set up properly, all standard system reports (e.g., inventory, leak alarm) can print automatically. You can view tank and fuel information at any other time by using the keypad. The system display typically shows no activity (for which the system displays the current date and time, an alarm condition, or a command in progress). While in the no activity or normal mode, you can display information on tank levels, volume, etc. While an alarm condition is being displayed, the system will accept no commands other than ALARM RESET.

The keypad is organized with the command keys in the right-most column. When you need system information (e.g., tank levels), press DATA. When you want to begin or end a leak test, press LEAK CHECK. Press ALARM RESET to clear the alarm being displayed. The * key is reserved for special functions and will otherwise be ignored by the monitor.

To use the keypad, press and hold the desired key until the system recognizes it. The keypad will function better if the keys are held down longer.

Press the DATA key to access one of the modes of operation. The system will request a category number between 1 and 5:

1. Display commands
2. Print commands
3. Report commands
4. Profile commands
5. Diagnostic commands

You can view tank information on the local display by selecting mode 1. This mode of operation will enable you to select from the following information for each tank to display:

1. Product level
2. Water level
3. Average temperature
4. Product volume
5. Combined tank data
6. Contact monitor status

The system will prompt you for the tank number for which the data is requested.

You can print tank information on the internal strip printer by selecting mode 2 (print mode). The system will accept two commands in this mode (depending on software version, the system may not accept Command 1):

1. Combined tank information
2. Tank volume table

When you select either command, the system will request the tank number for which the information is requested. When selected, the combined tank information command will prompt the system to continuously print new tank information (product volume, water volume, ullage, product level, water level, and temperature) for the selected tank. You must press CLEAR or ENTER to stop printing. The key must be pressed and held down until the system recognizes it (the system stops printing or the screen goes blank).

Universal Sensors and Devices, Inc.

TICS-1000: Sample Reports (continued)

When you select the tank volume table command, the system prints a table showing the adjusted volume of the tank at inch increments. The system adjusts the volume to compensate for tank tilt. It is suggested that you print this report for each tank immediately after startup, and file the report as a permanent reference, which can be used if the system is unavailable for any reason or the system is reconfigured.

You can print all system reports at any time by issuing commands in Mode 3: Report Mode.

- ▶ From the default display, press DATA; the system will prompt the user for a mode number
- ▶ Press 3; the display will then prompt the user for a command:

```
Report Mode
Enter Command: ?
```

The system will accept commands for the following reports:

1. Inventory (Current)
2. Delivery
3. Product Thruput
4. Leak Test
5. Alarm History
6. Inventory (Captured)

Inventory/Status Reports

To generate the Inventory Report, first put the system in Report Mode (see above):

- ▶ Enter 1 at the command prompt
- ▶ Press ENTER; the system will indicate that it is printing the inventory report

After the report finishes, the system will prompt you for the next command. You can use the CLEAR key to exit the Report Mode, or you can select the next Report Mode command.

```
*****
TICS-1000
Station 85282
Phone (818) 998-7121
September 15, 1986
10:05:31 PM

Inventory as of
September 15
10:05 PM

*****Tank 1: Regular
10,000 gallons size
 6,832 gallons product
 3,126 gallons ullage

*****Tank 2: Unleaded
10,000 gallons size
 9,634 gallons product
   63 gallons ullage

**Gross Product Totals

Regular    6,832 galls
           3,126 ullage

Unleaded   9,634 galls
           63 ullage

*****
```

Leak Test Reports

You can configure the system to run leak tests automatically, or you can manually start a leak test. To start the leak test manually, ensure the system is displaying the default screen (system time and date) and press the LEAK CHECK key. The system may prompt you for a PIN code if the system has been set up to prevent unauthorized access. After you enter a PIN code and press ENTER, the system begins the leak test. The display shows a running clock to indicate proper system function in place of the system date and time.

The leak test will run until either 24 hours elapse, or the test is stopped manually. If the test has been started manually, you must stop it manually. Once a leak test has been started manually, the system disables scheduled automatic testing until the next day (midnight).

After the leak test finishes, the Leak Report will print automatically. The information in this report represents the results of the last leak test completed and will not be released until another leak test completes. An example Leak Report is shown below.

```
*****  
  
TICS-1000  
Station 85282  
Phone (818) 998-7121  
September 15, 1986  
10:37:21 PM  
  
Leak Test Data:  
  
September 14  
09:30 PM  
  
*****Tank 1: Regular  
9,128.40 product net  
31.80 water net  
54.60 F  
  
*****Tank 2: Unleaded  
9,630.40 product net  
25.80 water net  
53.40 F  
  
Tank1 Tank2 Tank3 Tank4  
-0.10 -0.20 -0.00 -0.00  
-0.32 -0.10 -0.00 -0.00  
+0.12 -0.10 -0.00 -0.00  
-0.24 -0.10 -0.00 -0.00  
-0.16 -**** -0.00 -0.00  
-0.00 -9.80 -0.00 -0.00  
+0.16 -0.10 -0.00 -0.00  
+0.24 -0.10 -0.00 -0.00
```

Test results are given on an hourly basis (gallons leaked for one hour)(+x.xx = gallons into the tank, -x.xx = gallons out of tank, **** = out of range (more than 9.99)).
Note: The test in the example shown was run for only eight hours, thus only eight lines of data are displayed.

Universal Sensors and Devices, Inc.

TICS-1000: Sample Reports (continued)

Following the hourly data, the system prints the end values for the test, including the end date and time, and a test summary detailing the highest leak rate per minute, the average leak rate per hour for the entire test, and the test status.

```
September 16, 1986
05:45 AM

*****Tank 1: Regular
9,128.10 product net
31.80 water net
53.60 F

*****Tank 2: Unleaded
9,602.40 product net
25.80 water net
51.40 F

***Gallons

      High/   Avg/  Test
Tank Minute Hour Stat
  1   -0.30 -0.04  01
  2   -**** -3.50  90

*****
```

Once the report is printed, you should verify that it appears correct.

You should:

- ▶ Check the start and stop times. Are they correct?
- ▶ Verify that the start and end volumes and temperatures for each tank appear correct.
- ▶ Check the number of hours the test ran (if the test ran for more than 55 minutes during any hour, that should be considered an hour. The number of lines printed in the hourly data section should equal the number of hours. If the wrong amount of lines are present, check if the power failed (check the test status).
- ▶ Check the test status listed at the end of the report. If the status is other than 01, the test may be invalid for small leaks. Status codes of 90 (product loss), 91 (product gain), or 92 (water change), may still indicate a leak if the code cannot be explained by a condition which occurred during the test (such as product was dispensed).
- ▶ Check each line of hourly data per tank to verify that all the hourly leak rates appear reasonable. (If a line shows -9.55 gallons for that hour, product was either dispensed, which invalidates the test, or a major leak occurred).
- ▶ Check the high leak rate per minute listed at the end of the test. If it is much different than any of the hourly leak rates, then fuel may have been delivered or dispensed during the test, which invalidates the test.
- ▶ If all test data appear normal, the average leak rate at the end of the test and the test status should be used as a leak indicator.

Universal Sensors and Devices, Inc. TICS-1000: Sample Reports (continued)

In the sample report above, Tank 1 shows an average leak rate of -0.04 gallons per hour during the 8 hour test. Since this is within the limits of a 0.2 gph test, this tank is probably not leaking. Since this is not guaranteed, further testing should be used to verify the results (by running the same test again and/or looking at other leak indicators). Tank 2, however, shows an average leak rate of -3.50 gallons per hour for 8 hours or a loss of 28 gallons from the tank. This would indicate that either a very large leak exists or that 28 gallons of fuel was dispensed (or stolen) during the test. The user must resolve the reason for the loss.

Positive leaks can exist. A leak of +0.10 for 8 hours may indicate that 0.8 gallons of water leaked INTO the tank. This can occur if the tank leak is below the groundwater level.

During the leak test, the system will monitor conditions which can invalidate the test. These conditions will be printed in the form of status codes at the end of the test. The possible test status codes are:

- 01 = No test errors detected
- 20 = Calculation overflow error (during leak rate calculations)
- 90 = Product loss error
- 91 = Product gain error (a delivery was detected)
- 92 = Water change error
- 93 = Power failed during test

If the following errors occur, the gallons/hour high and average information will not be printed on the report:

- 94 = Not used
- 95 = Temperature deviation error
- 96 = Level deviation error
- 97 = Level probe fail
- 98 = Tank profile error
- 99 = Test did not run for more than 1 hour

You can also request a Leak Report while in report mode. At the command prompt, enter 4 and press ENTER. The system will print a leak report detailing the results of the last leak test completed. Regardless of how it is generated (following a leak test, or manually), all leak reports are identical in appearance.

Alarm Reports

Up to eight alarms per tank, four alarms per contact monitor input, and ten general system alarms can be stored into the monitor memory for summary via the Alarm History Report. This report identifies the alarm and the time it occurred, but not the date. You should erase alarms daily to prevent confusion. You can only do this by running the Automatic Alarm History Report.

To select the report manually:

- ▶ Press 5 while the system is in report mode
- ▶ Press ENTER

```
*****  
TICS-1000  
Station 85282  
Phone (818) 998-7121  
September 15, 1986  
10:36:43 PM  
  
Alarm History:  
  
***** Tank 1: Regular  
01:25 *Product loss *  
06:32 *Low product *  
07:15 *Lo-Lo product*  
  
***** Tank 2: Unleaded  
22:23 *High water *  
22:31 *High product *  
  
***** Tank 3: Premium  
no alarms  
  
***** Monitors:  
22:32 *Contact 1 on *  
22:33 *Contact 1 off*  
  
***** System:  
00:00 *Clock invalid*  
  
*****
```

USTest, Inc.

USTest2001

Equipment Type:

Automatic tank gauging system

Vendor:

USTest, Inc.

100 Mineral Rd.

Broussard, LA 70518

Phone: 337-839-1070

Fax: 337-839-8378

Internet: www.ustest.com



Basic System Description:

The **USTest2001** Site Monitor combines ultrasonic precision tank level measurement, precision leak detection, external sensor monitoring, alarm monitoring, and remote management access. The system is configured with an embedded 486 DX/2 66 PC, and includes a monitor and keyboard that allows the user to access and view the information maintained by the system. The **USTest2001** is capable of monitoring up to 16 tanks and 48 external sensors. The automatic tank gauging (ATG) software that enables the user to operate the system is written as both a Windows 3.1 and DOS program. Users can navigate the system using either a mouse or a combination of the Alt key and the first letter of the main menu selection.

Certified Leak Rates and Thresholds (with ultrasonic probe):

- ▶ Leak rate of 0.1 gph with leak threshold of 0.05 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel
- ▶ Other liquids may be tested after consultation with the manufacturer

Tank Capacity:

- ▶ Maximum of 15,000 gallons for a single tank
- ▶ Tank must be between 50 and 95% full

Waiting Time:

- ▶ Minimum of 4 hours between delivery and testing
- ▶ Minimum of 15 minutes between dispensing and testing
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Minimum of 1 hour
- ▶ Test data are acquired and recorded by a computer
- ▶ Leak rate is calculated from data determined to be valid by statistical analysis
- ▶ There must be no dispensing or delivery during test

Calibration and Maintenance Requirements:

- ▶ Probe must be checked regularly in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product

USTest, Inc.

USTest2001: Sample Reports

The Site Monitor system software starts automatically when the Site Monitor's power switch is turned on. If at any time the software is not running, you can restart it at the DOS prompt by following the steps below:

- ▶ From the C:\ prompt, change directories by typing CD\UST2001D
- ▶ Press enter
- ▶ Type ATG, then press enter; the tanks inventory screen will appear

Inventory/Status Reports

The tanks inventory screen will be displayed on the system monitor for the majority of the time the system is operating. This screen has been designed to display various tank and system information at a single glance. Information will be provided on the inventory screen for each tank in the format below:

TANK 1 - UNLEADED	
Level	Water
163.7	3.7
Volume	Ullage
34318.8	19581.2
TC Volume	Sales
34605.6	0.0
OK	

In addition to the numeric information on the right, the system displays a graphical representation of the fluid volume in the tank on the left hand side of each frame. The colors used to represent the fluid follow the conventions of a stop light. When the tank is in normal range, the fluid is shown as green. If the volume reaches the reorder or high level thresholds, the fluid will be shown as yellow. Should the fluid reach the overfill or low inventory thresholds, the fluid is depicted as red and the computer will sound an audible alarm. Water appears at the bottom of the tank illustration as blue.

At the bottom of the frame for each tank, the tank and probe alarm status message will be displayed. If the tank is at a normal level and the probes are responding correctly, the OK message will be displayed. Other messages that may be displayed include:

- ▶ Faulty Probe: wire connecting the ATG board or probe has been disconnected
- ▶ No Water Re.: probe is unable to detect bottom of tank
- ▶ Water Present: water has been detected at the tank bottom
- ▶ Overfill: overfill threshold has been exceeded
- ▶ High Level: high level threshold has been exceeded
- ▶ Reorder: reorder threshold has been exceeded
- ▶ Low Inventory: low inventory threshold has been exceeded

To access the system reporting functions:

- ▶ Select the REPORT (ALT+R) option from the main menu

USTest, Inc.

USTest2001: Sample Reports (continued)

A pull-down menu will appear with the following options: CURRENT INVENTORY, MONTHLY INVENTORY, RAW INVENTORY, PRECISION TEST, EXTERNAL SENSORS, SYSTEM SETUP. The first selection on the report pull-down menu is CURRENT INVENTORY. A Current Inventory Report can be generated by pressing the F2 key (when the system is displaying the tanks inventory screen), using the down arrow keys or clicking on the Current Inventory selection. An example screen displaying a Current Inventory Report is shown below:

John's Quick Serve		Phone: 804-448-0666					
1234 Pinhook Rd.							
Lafayette, VA 22546							
Tank Inventory Report							
Date: 07/31/96							
Time: 08:50 AM							
<u>Tank Inventory:</u>							
<u>TK</u>	<u>Description</u>	<u>Level</u> <u>(in)</u>	<u>Volume</u> <u>(gal)</u>	<u>Ullage</u> <u>(gal)</u>	<u>Capacity</u> <u>(gal)</u>	<u>Water</u> <u>(in)</u>	<u>Sales</u> <u>(gal)</u>
1	Diesel	47.30	4982	14965	19947	0.18	462594
2	Diesel	47.83	5054	14893	19947	0.00	95397
3	Diesel	44.17	4561	15386	19947	0.15	55012
4	Diesel	28.91	880	19067	19947	0.04	42004
5	Kerosene	0.00	0	4034	4034	0.00	0
<u>Tank Status:</u>							
<u>TK</u>	<u>Status</u>	<u>Message</u>					
1	OK						
2	OK						
3	OK						
4	OK						
5	Faulty	Probe					

OK			PRINT				

The next selection on the reports pull-down menu is Monthly Inventory. From the Monthly Inventory Reports dialog box, you can generate three different reports: Inventory, Delivery, and Down Time. For each report, you must select the tank and month for which the information is requested.

Leak Test Reports

The Precision Test program generates leak rates for each monitored tank. The software can generate three different reports: monthly, yearly, and combined. The reports display all tank particulars and test results.

To generate a Precision Test Report:

- ▶ Select REPORTS from the main menu (Alt+R)
- ▶ Select PRECISION TEST from the pull-down menu; after selecting PRECISION TEST, a dialogue box will appear
- ▶ To generate and view a monthly Precision Test Report, select the desired month with the mouse or tab key; although a tank selection is available, no selection is necessary since the system will generate leak rates for all the tanks
- ▶ Click the MONTHLY command button to generate the report; an example screen displaying a sample monthly Precision Test Report is shown below:

John's Quick Serve		Phone: 804-448-0666		
1234 Pinhook Rd.				
Lafayette, VA 22546				
MONTHLY PRECISION TANK TIGHTNESS TEST REPORT (V 2.20c)				
<u>Tank Information:</u>				
Tank Number	1	2	3	4
Description	Regular Unle	Plus Unleade	Super Unlead	Diesel
Fuel Type	Gasoline-Low	Gasoline-Med	Gasoline-Hi	Diesel
Diameter (in)	96	96	96	96
Capacity (gal)	9980	9954	6016	6016
Fuel Level (in)	62.96	29.86	36.14	55.41
Percent Full	70	27	34	60
<u>Tank Results:</u>				
Start Date	12/07/96	12/08/96	12/07/96	12/04/96
Start Time	03:31:28	06:18:58	08:38:49	11:10:44
Duration	01:15:00	01:24:04	01:21:05	01:29:58
Temp Rate (F/hr)	-0.009	-0.000	0.006	-0.004
Threshold(gal/hr)	+/-0.10	+/-0.10	+/-0.10	+/-0.10
Leak Rate(gal/hr)	-0.049	-0.013	0.003	-0.002
Pass/Fail	Passed	Passed	Passed	Passed
Operator: _____ Signature: _____ Date: 12/09/96				

OK		PRINT		

In order to pass a monthly test, a tank's leak rate may be no higher than +/-0.2 gallons per hour. In the example above, all leak rates are below this threshold; therefore, all the tanks have passed. If N/A appears on the report, not enough data was collected to successfully run a valid precision leak rate test.

At any time during the month, the system may replace a previous precision test. A test will only be replaced if the tank's leak rate is within the set threshold and the product volume is higher than that of the previous test. At the beginning of each new month, the previous monthly report will be saved.

Veeder-Root TLS-250

See system description on page 46

Veeder-Root TLS-300, TLS-300C, and TLS-300i

See system description on page 54

Veeder-Root

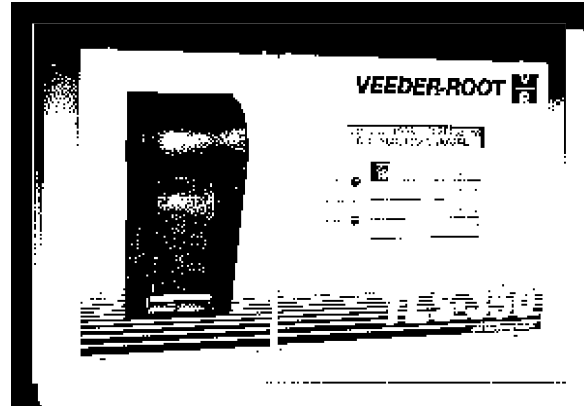
TLS-350, TLS-350R

Equipment Type:

Automatic tank gauging, interstitial leak detection, and line leak detection system

Vendor:

Veeder-Root
125 Powder Forest Dr.
Simsbury, CT 06070-2003
Phone: 860-651-2700
Fax: 860-651-2719
Internet: www.veeder-root.com



Basic System Description:

The **TLS-350** utilizes advanced magnetostrictive probe technologies offering 0.2 gph monthly monitoring and 0.1 gph volumetric tank testing for up to eight tanks. The system is also capable of providing automatic line leak detection, as well as monitoring double-wall tanks, containment sumps, and wet and dry wells. The system can manage up to 64 sensors for interstitial and sump leak detection, and up to 40 wells for vapor and groundwater monitoring. The system is also capable of conducting Continuous Statistical Leak Detection (CSLD), which provides 24-hour automatic leak detection without shutting the tank down. The **TLS-350R** has all the operating, reporting, leak detection, and alarm features of the **TLS-350**, but adds a business inventory reconciliation capability.

Certified Leak Rates and Thresholds (with magnetostrictive probe):

- ▶ Leak rate of 0.2 gph with leak threshold of 0.126 gph
- ▶ Leak rate of 0.1 gph with leak threshold of 0.071 gph

Applicability:

- ▶ Gasoline, diesel, aviation fuel
- ▶ Other liquids may be tested after consultation with the manufacturer

Tank Capacity:

- ▶ Maximum of 20,000 gallons for a single tank (30,000 gallons for some configurations)
- ▶ Tanks less than 95% full may be tested
- ▶ Minimum product level required is based on tank diameter as follows: 48" dia./min. 18"; 64" dia./min. 21"; 72" dia./min. 24"; 96" dia./min. 30"; 126" dia./min. 39"; 132" dia./min. 39"; for other diameters, see evaluation report

Waiting Time:

- ▶ Minimum of 8 to 11 hours between delivery and testing depending on configuration
- ▶ Minimum of 30 minutes between dispensing and testing
- ▶ There must be no delivery during waiting time

Test Period:

- ▶ Minimum of 2 hours
- ▶ Test data are acquired and recorded by the system's computer
- ▶ Leak rate is calculated from the difference between the first and last data collected
- ▶ There must be no dispensing or delivery during test

Veeder-Root TLS-350, TLS-350R (continued)

Calibration and Maintenance Requirements:

- ▶ Thermistors and probes must be checked and calibrated in accordance with manufacturer's instructions

Comments and Limitations:

- ▶ Not evaluated using manifold tank systems
- ▶ Tests only portion of tank containing product

Veeder-Root TLS-350, TLS-350R: Sample Reports

The console keypad has operating keys and alphanumeric keys. The operating keys allow you to display and print information, start and stop tests, program the system, test system operation, and review diagnostics. You can use the Alphanumeric keys to enter information when prompted by the system.

The ALARM/TEST key silences the alarm. It does not clear the message from the display or disable the alarm. FUNCTION accesses functions within a mode (operating, setup, or diagnostic). STEP moves from one procedure to the next within a Function. BACKUP lets the user move backward through Steps, Functions, and Modes to access past data or entries.

Inventory/Status Reports

The In-Tank Inventory feature lets you view and print information about how much product is contained in each tank.

To select In-Tank Inventory:

- ▶ Press FUNCTION until the following message is displayed:

```
IN-TANK INVENTORY  
PRESS <STEP> TO CONTINUE
```

- ▶ Press STEP to view the tank inventory for the first tank:

```
T1: (PRODUCT NAME)  
VOLUME = XX,XXX (UNITS)
```

The system displays the fuel volume in gallons or liters.

To view how much inventory is in the next tank:

- ▶ Press TANK

To print an Inventory Report for all tanks in a system:

- ▶ Press PRINT while the monitor is displaying the status message:

```
DATE      TIME  
ALL FUNCTIONS NORMAL
```

You may also print an Inventory Report while viewing the inventory information.

```
T1: (PRODUCT NAME)  
VOLUME = XX,XXX (UNITS)
```

- ▶ Press PRINT to begin printing the Inventory Report

MMM DD, YYYY HH:MM XM

INVENTORY REPORT

T 1: UNLEADED GASOLINE
VOLUME = 8518 GALS
ULLAGE = 1482 GALS
90% ULLAGE = 482 GALS
TC VOLUME = 8492 GALS
HEIGHT = 76.26 INCHES
WATER VOL = 0 GALS
WATER = 0.00 INCHES
TEMP = 64.6 DEG F

T 2: SUPER UNLEADED
VOLUME = 7545 GALS
ULLAGE = 2455 GALS
90% ULLAGE = 1455 GALS
TC VOLUME = 7569 GALS
HEIGHT = 67.76 INCHES
WATER VOL = 0 GALS
WATER = 0.00 INCHES
TEMP = 64.4 DEG F

Leak Test Reports

An In-Tank Leak Test is a 0.10 gph (annual) or 0.20 gph (periodic) leak test to determine if the tank is leaking. Note: If Averaging was selected during In-Tank setup, the system generates Average Leak Test Reports instead of In-Tank Test Reports. Averaging takes the last five test rates and averages them to determine the leak rate.

To print In-Tank Test Results for all tanks:

- ▶ Press FUNCTION until you display the message:

IN-TANK TEST RESULTS
PRESS <STEP> TO CONTINUE

MMM DD, YYYY HH:MM XM

LEAK TEST REPORT

T 1: REGULAR UNLEADED
PROBE SERIAL NUM 105792

TEST STARTING TIME:
MM DD, YYYY HH:MM XM

TEST LENGTH = 4.3 HRS
STRT VOLUME = 3725 GALS

LEAK TEST RESULTS
0.2 GAL/HR TEST PASS

- ▶ Press PRINT

The report shows whether or not the tanks passed or failed the leak test.

Gross Test Results

A Gross Test is a 3.0 gph leak test.

To view Gross Test results:

- ▶ Press STEP until you see the message:

```
T#: (Product Name)
GRS: (Date)(Results)
```

Periodic Test Results

A Periodic Test is a 0.20 gph leak test.

To view Periodic Test Results:

- ▶ Press STEP until you see the message:

```
T#: (Product Name)
PER: (Date)(Results)
```

The system displays the date the test ran and the results (PASS or FAIL) for the selected tank.

- ▶ Press PRINT to print the Periodic Test Results
- ▶ Press TANK to view the Periodic Test Results for other tanks in the system

Annual Test Results

An Annual Test is a 0.10 gph leak test. The Annual Test Results show the starting time, test length, starting volume, and test results (PASS or FAIL). Note: Annual Test Results only appear when the tank is equipped with a 0.1 magnetostrictive probe.

To view Annual Test Results:

- ▶ Press STEP until you see the message:

```
T#: (Product Name)
ANN: (Date)(Results)
```

Veeder-Root

TLS-350, TLS-350R: Sample Reports (continued)

To print the Annual Test Results:

- ▶ Press PRINT

```
MMM DD, YYYY HH:MM XM

LEAK TEST REPORT

T 1: REGULAR UNLEADED
PROBE SERIAL NUM 105792

TEST STARTING TIME:
MM DD, YYYY HH:MM XM

TEST LENGTH = 4.3 HRS
STRT VOLUME = 3725 GALS

LEAK TEST RESULTS
0.1 GAL/HR TEST PASS
```

CSLD Test Results

CSLD Tests calculate a leak rate statistically using data accumulated between dispensing cycles. The system constantly evaluates all new and existing data to get a highly accurate 0.20 gph leak test. CSLD is an option and may not be installed on all systems. Test results are provided automatically every 24 hours. Users may also obtain current CSLD leak test results by pressing PRINT from within the CSLD Test Results function.

To view CSLD Leak Results:

- ▶ Press FUNCTION until you display the message:

```
CSLD TEST RESULTS
PRESS <STEP> TO CONTINUE
```

To print out a CSLD Report for tanks specified during system setup:

- ▶ Press PRINT

```
CSLD TEST RESULTS
-----
DD-MM-YY HH:MM XM

T 2: SUPER UNLEADED

PROBE SERIAL NUM 123002
0.2 GAL/HR TEST
PER: DD-MM-YY PASS
```

The system can also provide information on and generate reports for the following tests: pressurized line leak detection test (gph test report and history report), wireless pressurized line leak detection test, volumetric line leak detection test (TLS-350R only), liquid status reports, vapor sensor status, groundwater sensor status, and 2-Wire and 3-Wire CL (Current Loop) sensor status. Each of these tests or status reports can be accessed by pressing FUNCTION until the requested feature is displayed.

Alarm Reports

Alarm History Reports provide a record of the last three occurrences of each type of alarm or warning condition.

- ▶ Press MODE to select Diagnostic Mode
- ▶ Press FUNCTION until you display the message:

```
SYSTEM ALARM HISTORY  
PRESS <STEP> TO CONTINUE
```

- ▶ Press STEP to continue.
The system displays the message:

```
SYSTEM ALARM HISTORY  
PRESS <PRINT> FOR REPORT
```

- ▶ Press PRINT to generate the report

In-Tank Alarm History Report

In-Tank Alarm History Reports record alarms for the tank selected. To print an In-Tank Alarm History Report:

- ▶ Press STEP until you display the message:

```
T#: ALARM HISTORY  
PRESS <PRINT> FOR REPORT
```

- ▶ Press PRINT to print the report for the tank displayed
- ▶ Press TANK/SENSOR to access other tanks in the system