PNEUMERCATOR
Liquid Level Control Systems

Multi Tank Monitoring System

INSTRUCTION MANUAL

MODEL LDE 740

(Revised July 8, 2017)

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NOTICE: PNEUMERCATOR CO., INC. reserves the right to make improvements to the product described in these instructions at any time and with no notice.

WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart B of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

IMPORTANT: Installation of this equipment must be in accordance with these instructions as adopted from the following codes:

ISA RP12.6, "Installation of Intrinsically Safe Instrument Systems in Class I Hazardous Locations".

NFPA 70, "National Electrical Code".

Alteration, modification or replacement with non-factory components could impair the intrinsic safety of this equipment.

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Section 1: Introduction

The Pneumercator LDE-740 is an advanced inventory management and control system. Drawing upon Pneumercator's more than 99 years of experience in liquid level controls and measurement systems, the LDE-740 is designed to help simplify the inventory process, and to be extremely easy to operate.

This 16-bit microprocessor controlled system continuously monitors the level of product in up to 4 storage tanks. The product level is available on the daylight visible display in units of either inches of product height, or in gallons.

The LDE-740 easily accommodates different sizes of underground and aboveground storage tanks, and is suitable for all types of fluids. Some of the fluids that are suitable for monitoring with the LDE-740 are petroleum products, waste oil, conductive fluids, water, alcohols, solvents, lubricants, and corrosive chemicals. The gauge offers conversion of level to volume pre-programmed to match the geometry of the storage tank used. Pneumercator's many years of experience help guarantee an accurate conversion of height to gallons for all types and configurations of storage tanks.

The gauge provides audible, visible and (optional) printed outputs for high (overfill), critical and low level alarms, and 8 switch input alarms. Alarms are also provided for theft detection, and high water (if the optional water detection is ordered with the model 2-412 tank level transmitter only). The LDE-740 also provides 8 channels of precision leak detection. Visible alarms are continuously on until the conditions are corrected. The audible alarm may be silenced for a particular condition by pressing the HORN RESET pushbutton on the front panel and may be programmed from the integral keypad to automatically shut off after a specified period of time. The audible alarm may be disabled for all conditions, by using a command in programming mode.

The gauge has 8 relays with dry contacts that will activate on programmed conditions. The relay contacts are available at the terminal block as Form C contacts that may be programmed for normally energized or normally unenergized states. The relay contacts are rated at 5 amps at 120 VAC.

Printed hard-copy inventory reports of product level and volume in the tanks may be requested at any time by pressing the PRINT pushbutton on the front panel if the optional printer is present. Hard-copy records of alarms and deliveries are automatically printed on occurrence.

The system features self-diagnostics that test the audible alarm, visual alarms, clock, relay operation, and data storage memory. These tests are available from the keypad, and help to ensure reliable and trouble-free operation of the LDE-740.

Set-up parameters for the storage tanks, and for the system as a whole may be printed at any time by a keypad command. This allows for hard-copy verifications and records of the conditions that the system is operating under.

Variations in tank installations, fitting tolerances, and tank tilts may be compensated for by entering an installation offset adjustment. This allows the system to maintain maximum accuracy in its measurements.

The LDE-740 can take inputs from 8 leak detection sensors designed to monitor collection sumps and the annular spaces of double wall tanks for leakage of hydrocarbons. The system provides indications for detection of dry, water, and hydrocarbons. Detection of air (dry condition) is indicated by a Green light. Detection of hydrocarbons is indicated by a Red light. Detection of water is indicated by an Amber light. The leak detection capabilities meet EPA requirements for annual testing and monthly monitoring.

The LDE-740 will retain memory of a hydrocarbon or water alarm even if the alarm condition later disappears. The alarm memory is battery backed up, so the memory will remain in the event of a power failure. The alarm memory may be cleared by using the Clear Leak Detection Latch keypad command.

The adjustable volume system horn will sound an audible alarm when the selected alarm conditions are present. Audible alarm silencing may be done manually by pressing the HORN RESET button on the cover of the console, or may be automatically timed for a selectable automatic time delay reset. Time delay periods of 1 to 7 minutes in 1-minute increments are available. Relay outputs may be programmed to actuate on selected conditions and may be programmed to shut off after time delays of from 1 to 15 minutes, or be programmed to manually shut off by pressing the HORN RESET button on the cover of the console.

Sensors may be tested and calibrated by keypad programming. The switch inputs may be programmed to accept normally open or normally closed mechanical contacts. The LDE-740 can also be programmed to accept switch inputs at any leak detection inputs. Sensors for both sump and annular space detection may be mixed in a system with no limitations. Switch inputs may also be programmed to act as standby generator inputs, which notify the system when a standby generator is in operation. Standby generator-run reports are then automatically generated.

The system console may be mounted in any non-hazardous area where it can be provided with 120 VAC ±10% at 60 Hz. The standard enclosure is NEMA 1 with a NEMA 4 console optionally available (printer not available with NEMA 4 option).

The system level transmitters and sensors are designed for intrinsically safe operation in Class I, Division 1, Group A, B, C, D areas. The level transmitters may be separated from the console by 3 wire #18 AWG runs of up to 2200 feet. Leak sensors may be separated from the console by 3 wire #18 AWG runs of up to 1000 feet. Switch sensors may be separated from the console by 2 wire #18 AWG runs of up to 2200 feet.

The system is designed to provide safe and reliable operation when installed as instructed in the Installation section of this manual. All requirements of the National Electrical Code (NEC) as well as local electrical and fire codes should be followed in the installation procedures. It is recommended that the user read and understand ANSI / ISA RP12.6, "Installation of Intrinsically Safe Instrument Systems in Class I Hazardous Locations".

If additional information is needed concerning equipment selection, system planning, installation, operation, servicing or maintenance, please contact:

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Section 2: Specifications

Power - 120 VAC ± 10%, 60 hertz, 50 Watts, MOV differential and common-mode surge protection, under voltage detection and protection.

Fuse - 3 A.G. SLO-BLO, 1/4 Amp, 250 VAC or equivalent.

Operating Temperature - -40º F to 122º F (-40º C to 50º C).

Enclosure - NEMA 1 standard, NEMA 4 optional.

Installation - Wall mount.

Calibrations - Alarm points and programming set by keypad maintained for 10-year data retention on power failure.

Gauging Resolution - 0.1% of tank height.

Gauging Accuracy - ±0.12% of tank height or ±1/8" w/2-412 or ±1/4" w/2-501, whichever is greatest.

Gauging Repeatability - ±0.1% of tank height.

Displays – Red, 0.8 inch high, seven segment displays. Display mode, Tank / Channel select, Theft mode and Data Recall switches.

Alarm Indications - Tank Level Alarm and Leak Alarm Channel indications always visible while alarm condition is present. Individual level alarm indications for selected tank and Individual leak alarm Indications In leak status display mode.

Horn - Min. 85 dB at 3 meters on axis, manual horn reset (silence) pushbutton, automatically timed horn silence.

Relay Outputs - 8 SPDT dry relay contacts, rated at 5 Amps at 120 VAC, individually keypad programmable for actuating condition(s) and normally energized or normally unenergized.

Clock - The clock maintains the time and date and year for (optional) printer functions. It automatically compensates for Leap Year corrections and Daylight Savings Time. The time is maintained with an accuracy of ±11 sec / day. 10-year data retention on power failure.

Level Transmitters - Standard: 2-412 or 2-501. Intrinsically safe for Class I, Division 1, Groups A, B, C, D, 5 VDC @45 mA.
Optionally from isolated self-powered 4 to 20 mA transducer capable of driving 500Ω (not intrinsically safe).

Switch Inputs - 8 from any mechanical switch input.
Intrinsically safe for Class I, Division 1, Groups A, B, C, D, 5 VDC @25 mA. Individually programmable for normally open or normally closed switch inputs.

Output Signals - standard RS-232 Port.
Optional 20-column dot matrix printer.

Leak Detection Sensors - 8 from 9-901, 9-902, and 9-903 sensors.
Intrinsically safe for Class I, Division 1, Groups A, B, C, D, 5 VDC @45 mA. Can be individually programmed to alternately accept normally open or normally closed mechanical switch inputs.

Leak Detection Testing - Meets EPA requirements for annual testing and monthly monitoring.

Hydrocarbon Detection -
Products that are to be detected must be non-conductive fluids having a dielectric value of between 2 and 12.
9-901: 0.33”, 100% pfd, 0% pfa @ 0.1 gph.
9-902: 0.35", 100% pfd, 0% pfa @ 0.1 gph.
9-903: 0.68", 100% pfd, 0% pfa @ 0.1 gph.

Leak Detection Response Time - Less than 1 second for detection, 1 minute for alarm latch.

Leak Detection Indicators -
Red led indicates oil detection.
Amber led indicates water detection.
Green led indicates dry (normal condition).

Level Transmitter/Sensor Operating Temperature -
2-412, 2-501 Level Transmitters: -20 ºF to 180 ºF (-29 ºC to 82 ºC).
9-901, 9-902, 9-903 Sensors: -40 ºF to 130 ºF (-40 ºC to 55 ºC).
LS600 Switch Sensors: -20 ºF to 180 ºF (-29 ºC to 82 ºC).
LS600LD Leak Sensors: -40 ºF to 160 ºF (-40 ºC to 71 ºC).

Level Transmitter/Sensor Operating Pressure -
2-412 Level Transmitter: to 50 psi.
2-501 Level Transmitter: to 15 psi.
9-901, 9-902, 9-903 Sensors: ambient (vented).
LS600 Switch Sensors: to 150 psi.
LS600LD Leak Sensors: to 100 psi.

Level Transmitter/Sensor Cable -
2-412, 2-501, 9-901, 9-902, 9-903: Standard 3 conductor #18 AWG,
2-412 and 2-501 up to 2200 feet. 9-900 sensors up to 1000 feet.
Switch sensors: Standard 2 conductor #18 AWG, up to 2200 feet.

Section 3: Installation

NOTE: INSTALLATION MUST BE DONE BY QUALIFIED PERSONNEL, FAMILIAR WITH LOCAL WIRING CODES AND EXPLOSION HAZARD ELECTRICAL SAFETY PRACTICES.

Section 3.1: Mechanical Installation

The LDE-740 console is a NEMA 1 enclosure intended for indoor installation. An optional NEMA 4 enclosure intended for indoor or outdoor installation is available and offers protection against splashing water, seepage of water, falling of hose directed water, and severe external condensation. The NEMA 4 enclosure is also sleet resistant. Either enclosure has mounting flanges, which allow permanent fastening to wells, panels, etc.

The console should be located in an area that is easily accessible to the personnel responsible for operating the system. This is to allow easy maintenance access, and access to the console for operation and testing. The console must be located in a non-hazardous area, as close as possible to the demarcation point of the hazardous area, with available 120 VAC power brought to the console through a dedicated metal wiring conduit. The metal conduits for level transmitters, sensors, and power should be weather tight. Bottom entrance holes are provided for 1/2" NPT pipe or rigid metal conduit, with level transmitters and sensors entering on the bottom left and power entering on the bottom right.

Consult the local electrical codes for specific requirements.

Section 3.2: Level Transmitter/Sensor Installation

Section 3.2.1: Tank Level Transmitters

There are two different tank-level transmitters available for the LDE-740. The model 2-412 is designed for installation in 4" minimum tank openings. The model 2-501 is designed for installation in 2" minimum tank openings and is designed for use with heavy viscous fluids like #6 oil. Self-powered transducers that provide an isolated 4 to 20 mA output may be used for tank gauging if the LDE-740 is ordered from the factory with this option. If a 4 to 20 mA transducer is used, two (2) 18 AWG wires are required.

Three (3) 18 AWG wires are required for each model 2-412 and model 2-501 level transmitter. The wiring should be run through NEMA 4 or better junction boxes and 1/2" weatherproof liquid tight metal conduit. All splices should be waterproofed. The metal conduit and junction boxes should be sealed against entry of water. If required, vapor seals may be installed to prevent gas vapors from propagating back to the console. The transmitter wiring to the console should be run in a dedicated metal wiring conduit. No non-intrinsically safe wires should be in the same conduit

unless a metal barrier is provided. All Pneumercator level transmitters and sensors may be run in the same conduit.

The tank level transmitters are wired to TB2 on the circuit board. The Red wires are connected to position R, the White wires are connected to position W and the Black wires are connected to position B. If a 2 wire transducer is used, the (+) wire is connected to position W and the (-) wire is connected to position B. Position R is not used with a 2 wire transducer. If the optional water detection is present (2-412 only), the 2 water detection wires are run to the W+ and W- positions for the respective tank.

Figure 1 - Tank Level Transmitter Wiring - TB2

	Terminal #			Water	
Tank	R	W	B	W+	W-
1	1	2	3	4	5
2	7	8	9	10	11
3	13	14	15	16	17
4	19	20	21	22	23

The wiring and terminal block (TB2) are intrinsically safe and are physically separated from the AC power and relay contact wiring and terminal blocks on the right side (TB5, 6, 7). This separation must be maintained.

See Figure 16, System Wiring Diagram: LDE-740, Page 89.

2-412 Installation (*see Figure 9, Pages 80, 81*)
2-501 Installation (*see Figure 10, Pages 82, 83*)

Section 3.2.2: Switch Sensors

Pneumercator makes a number of different LS600 series switch sensors, which may be used with the LDE-740. See the appropriate LS600 bulletins for details on these. Any other mechanical switch closure may also be used as switch inputs. The LDE-740 may also be programmed to accept switch inputs at any LEAK input. If this feature is used, the two (2) wires of the switch are connected to TB4 positions R and W of that LEAK input.

Two (2) 18 AWG wires are required for each switch sensor. The wiring should be run through NEMA 4 or better junction boxes and 1/2" weatherproof liquid tight metal conduit. All splices should be waterproofed. The metal conduit and junction boxes should be sealed against entry of water. If required, vapor seals may be installed to prevent gas vapors from propagating back to the console. The switch sensor wiring to the console should be run in a dedicated metal wiring conduit. No nonintrinsically safe wires should be in the same conduit unless a metal barrier is provided. All Pneumercator level transmitters and sensors may be run in the same conduit.

The switch sensors are wired to TB3 on the circuit board. Each switch sensor is wired to positions + and – for that switch.

Figure 2 - Switch Sensor Wiring TB3

	Terminal #	
Switch	+	–
1	1	2
2	3	4
3	5	6
4	7	8
5	9	10
6	11	12
7	13	14
8	15	16

The Wiring and terminal block (TB3) are intrinsically safe and are physically separated from the AC power and relay contact wiring and terminal blocks on the right side (TB5, 6, 7). This separation must a maintained.

See Figure 16, System Wiring Diagram: LDE-740, Page 89.

Section 3.2.3: Leak Detection Sensors

There are three leak detection sensors available for the LDE-740. The model 9-901 is designed for installation in a horizontal position in the annular space of F.R.P. double wall tanks or piping. The model 9-902 and 9-903 are designed for installation in a vertical position in collection sumps, monitoring pipes and steel double-wall tank sumps.

Three (3) 18 AWG wires are required for each sensor. The wiring should be run through NEMA 4 or better junction boxes and 1/2" weatherproof liquid tight metal conduit. All splices should be waterproofed. The metal conduit and junction boxes should be sealed against entry of water. If required, vapor seals may be installed to prevent gas vapors from propagating back to the console. The sensor wiring to the console should be run in a dedicated metal wiring conduit. No non-intrinsically safe wires should be in the same conduit unless a metal barrier is provided. All Pneumercator level transmitters and sensors may be run in the same conduit.

The sensors are wired to TB4 on the circuit board. The Red wire is connected to position R, the White wire is connected to position W, and the Black wire is connected to position B.

Figure 3 - Leak Sensor Wiring - TB4

	Terminal #		
Sensor	R	W	B
1	1	2	3
2	4	5	6
3	7	8	9
4	10	11	12
5	13	14	15
6	16	17	18
7	19	20	21
8	22	23	24

The wiring and terminal block (TB4) are intrinsically safe and are physically separated from the AC power and relay contact wiring and terminal blocks on the right side (TB5, 6, 7). This separation must be maintained.

9-901 Installation (*see Figure 11, Page 83 for drawing*)

Figure 4 - 9-901 Cable Lengths

Tank size	Measurement length
4’	81"
6'	118"
8’	149.5"
10’	193.5"
12’	222"

1. Use the chart above to determine the cable measurement length for the size of the tank being monitored.

2. Unroll the sensor / cable assembly and measure from the sensor bottom to the cable measurement length. Mark the cable at that point.

3. Feed the cable through the bottom of the mounting bushing and cord connector until the mark on the cable is even with the top of the mounting bushing. Insert the sensor and cable through the 2” NPT opening and into the annular space.

4. Screw in the mounting bushing and connector.

5. Tighten the connector with the cable mark in the correct position.

6. Wire the sensor cable end to three 18 AWG wires in a NEMA 4 or better junction box or in an optional splice kit, part number 10585-3.

9-902 Installation (*see Figure 12, Page 84 for drawing*)

1. Measure the distance from the top of the 2" opening to the bottom of the area being monitored. This is the mounting height.

2. Add 2 and 3/16 inches to this dimension to find the cable length measurement.

3. Unroll the sensor / cable assembly and measure from the sensor bottom to the cable measurement length. Mark the cable at that point.

4. Feed the cable through the bottom of the mounting bushing and cord connector until the mark on the cable is even with the top of the mounting bushing. Insert the sensor and cable through the 2" NPT opening.

5. Screw in the mounting bushing and connector.

6. Tighten the connector with the cable mark in the correct position.

7. Wire the sensor cable end to three 18 AWG wires in a NEMA 4 or better junction box or in an optional splice kit, part number 10585-3.

9-903 Installation (*see Figure 13, Page 85 for drawing*)

1. Measure the distance from the top of the opening to the bottom of the area being monitored. This is the mounting height.

2. If using the optional Pneumercator leak monitor tube assembly for Convault tanks (assembly #900379-1), add 1 inch to this dimension to find the cable length measurement.

3. Unroll the sensor / cable assembly and measure from the sensor bottom to the cable measurement length. Mark the cable at that point.

4. Feed the cable through the bottom of the tube cover and cord connector until the mark on the cable is visible. Insert the sensor and cable through the monitoring opening.

5. Screw the cord connector into the tube cover and place back on the tube.

6. Tighten the connector with the cable mark in the correct position.

7. Wire the sensor cable end to three 18 AWG wires in a NEMA 4 or better junction box or in an optional splice kit, part number 10585-3.

Section 3.3: Electrical Installation

WARNING: Do not connect 120 VAC or turn on 120 VAC until all other connections have been made, all equipment has been installed, and final inspection has been completed.

The LDE-740 requires a power input of 120 VAC, ±10%, 60 Hz. The unit is fused with a 1/4 Amp, 3AG Slo-Blo fuse. Total power usage is less than 60 Watts. The power input is protected against common and differential-mode power surges with 3 metal oxide varistors (MOVs). The power line for the alarm console should not share a breaker circuit with any motors, compressors, or other sources of power surges or voltage sags. The power wiring to the alarm console should be run in a dedicated metal wiring conduit. No other wires should be in the same conduit unless a metal barrier is provided. Three wires make up the power input to the LDE-740: Black (hot), White (neutral), and Green (ground). If power surges or lightning are local problems, the 120 VAC power line should be protected with an external (not supplied by Pneumercator) surge protector or lightning arrestor.

The A.C. power wires run to the terminal block labeled TB7, to positions 1, 2 and 3. Position 1, labeled HOT is the hot lead. Position 2, labeled N is the neutral lead. Position 3, labeled GND is the ground lead. The terminal blocks will accept wire sizes up to 14 AWG stranded wire. The wiring and terminal block on the left side (TB1, 2, 3, 4) are intrinsically safe and are physically separated from the AC power and relay contact output wiring and terminal blocks on the right side (TB5, 6, 7). This separation must be maintained.

IMPORTANT

Connect a 12 AWG copper wire from the terminal block TB1 (labeled Earth Ground) to a good earth ground. The ground connection must be within 1 OHM of true ground and must be made at only one point for the system to maintain intrinsic safety.

Properly dress all wires inside the wiring sections and securely clamp down the enclosure door and tighten all conduit entrances to seal the system watertight. Install vapor seals in accordance with local codes for hazardous locations if applicable.

Section 3.4: Installation Checklist

Do not apply power to the LDE-740 until its installation has been checked and found to be in accordance with the instructions in this manual; the National Electrical Code; federal, state and local codes; and other applicable safety codes.

1. Check to be sure that the level transmitter and sensor wires are contained in a dedicated, separate metal wiring conduit. No wires other than Pneumercator level transmitter and sensor wires should be in the conduit.

2. Verify that all conduits enter the alarm console through the proper conduit openings on the bottom of the console. Do not make any other openings in the console.

3. Verify that a 12 AWG copper wire has been connected between TB1 (labeled Earth Ground) and a good earth ground.

4. Verify that the power supply terminals are correctly wired.

5. Verify that system power is properly wired to a separate, dedicated circuit breaker.

6. Verify that all level transmitters and sensors have been properly wired with color-coded or marked 18 AWG wires and that the proper color-coding or marking has been maintained throughout the wiring runs.

7. Verify that all wiring splices are waterproof. Pneumercator part #10585-3 (splice kit) or equivalent or NEMA 4 or better junction box should be used for all wiring splices.

8. The probe map located on the inside cover of the LDE-740 console should be filled out to indicate the location of level transmitters and sensors and usage of the various tank gauging, aux / switch and leak inputs.

9. The system map and setup sheet on the next page should be filled out to indicate the location of level transmitters and sensors and usage of the various tank gauging, aux / switch and leak inputs.

10. Securely clamp down the enclosure door.

Section 3.4.1: System Map and Setup

Tank	Product	High	Low	Critical	Offset
1					
2					
3					
4					

Chnl	Aux / Switch Input Usage	Sensor
1		
2		
3		
4		
5		
6		
7		
8		

Chnl	Leak Input Usage	Sensor
1		
2		
3		
4		
5		
6		
7		
8		

Relay	Alarms	Usage
1		
2		
3		
4		
5		
6		
7		
8		

Section 4: Operation

IMPORTANT: Before operating the system, make sure that all items on the installation checklist in the Installation section of this manual have been checked out and complied with.

Main Circuit Board layout (*see Figure 14, Page 87*)

Section 4.1: Normal Operation

The system will continuously monitor the levels of product in all tanks and the operation of all leak and switch inputs no matter what display mode the system is operating in. Alarms will actuate the appropriate lights and relays and the horn (if a relay or horn is programmed for that alarm). Alarm conditions and levels may be individually programmed from the keypad or the RS-232 communications port.

The Tank Level Alarm and Channel Leak Alarm lights will indicate alarms for any tank or channel no matter what display mode is selected. Tank Level Alarm lights can indicate high (overfill), low, critical, and high water alarms for a tank. The critical alarm may be programmed to act as a high-high or low-low level alarm with a field programmable setpoint. The default setting for a critical alarm is as a high-high alarm. Channel Leak Alarm lights can indicate hydrocarbon leak, water leak and Aux / Switch alarms for a channel.

The system map located on the inside cover of the LDE-740 console should be filled out to indicate the location of level transmitters and sensors and usage of the various tank gauging, aux / switch and leak inputs.

Section 4.1.1: Display Mode

The DISPLAY button on the cover of the LDE-740 is used to cycle through the four display modes - Volume, Inches, Water, and Leak Status. Pressing the DISPLAY button will shift the display mode to the next lower display mode indication. If the DISPLAY button is pressed in the Leak Status mode, the display mode will shift to Volume mode.

The display may be set to indicate Volume, Inches, Water, or Leak Status. Volume mode indicates the product level in gallons for the selected tank. Inches mode indicates the product height for the selected tank. Water mode indicates the water level, if any, in the product for the selected tank. Leak status mode will indicate the status of the Aux / Switch and Leak inputs for the selected channel. Aux / Switch and Leak input channels do not necessarily have to be associated with any particular tank.

In Volume, Inches, and Water display modes the High, Low, Critical, and Water lights at the lower right of the display indicate the status of those particular alarms for the selected tank. The Tank Level Alarm lights at the bottom of the display will indicate a fault with a particular tank no matter what display mode is selected, or tank is displayed.

In Leak Status display mode the Dry, Oil, Water, and Aux Alarm lights at the upper right of the display indicate the status of those particular leak and switch alarms for the selected channel. The Channel Leak Alarm lights at the top of the display will indicate a fault with a particular channel no matter what display mode is selected, or channel is displayed.

Leak and Aux / Switch input channels are independent in usage of each other, and are independent of any particular tank. They may be used in any groupings, and may be used for sensors not associated with any tank in the system.

Section 4.1.2: Tank / Channel Selection

The TANK / CHANNEL button on the cover of the LDE-740 is used to cycle through the tanks and channels installed in the system. Pressing the TANK / CHANNEL button will shift the display mode to the next tank or channel.

In Volume, Inches, or Water display mode the TANK / CHANNEL button will cycle through the installed tanks in the system, starting with Tank 1 and going to the highest numbered installed tank (Tank 4 maximum). Pressing the button while displaying the highest numbered tank will cycle the display to Tank 1.

In Leak Status display mode the TANK / CHANNEL button will cycle through channels 1 to 8. Pressing the button while displaying Channel 8 will cycle the display to Channel 1. Leak Inputs and Aux / Switch inputs are both displayed in Leak Status display mode.

Section 4.1.3: System Defaults

The LDE-740 has default settings that apply when the system is shipped from the factory, and when a cold reset command has been performed. If these settings are suitable for the application, no field programming of these functions has to be done.

System Settings

Header Lines 1, 2, 3	Blank
Alarm Actuation Delay	10 Minutes
Automatic Inventory Printouts 1,2,3	Disabled

Tank Settings:	
High (overfill) Level Alarm	90% of tank capacity
Critical Level Alarm (High-High)	95% of tank capacity
Low Level Alarm	20% of tank capacity
Delivery Threshold	50 Gallons
Theft Threshold	50 Gallons
Offset Adjustment	0.00 Inches
Product Code	00
Tank Name	Product #
Switch Input Settings	
Switch State	Normally Open
Standby Generator Operation	Disabled
Switch Name	Aux / Switch
Leak Input Settings	
Leak State	Leak Input
Leak Name	Leak #
Relays	
Relay State	Normally Unenergized
Automatic Shutoff	Disabled
Remote Reset	Disabled
Relay Delay	0 Minutes (Disabled)
Latching Relay Operation	Disabled
Relay Alarm Conditions	See Appendix B
Horn	
Horn State	Enabled
Automatic Shutoff	Disabled
Horn Alarm Conditions	See Appendix B
RS-232 Port	
Baud Rate	2400
Port Mode	Local Port, no echo
RS-232 Port when in modem mode	
Autoanswer Ring Count	2 Rings (Enabled)
Dialing Mode	Tone
Alarm Autodial	Disabled
Automatic Inventory Autodial 1, 2, 3	Disabled
Phone Number	Blank

Section 4.2: Leak Detection

Leak detection testing with 9-901, 9-902 and 9-903 meets EPA requirements for annual testing and monthly monitoring. These sensors are intrinsically safe for use in Class I, Division 1, Groups A, B, C, D areas. Products that are to be detected must be non-conductive fluids having a dielectric value of between 2 and 12.

Leak detection response time is less than 1 second for detection of product or water at the threshold level. The system will latch a leak detection alarm after 1 minute of continuous detection. This is to ensure that an alarm state is not ignored or bypassed. A leak detection alarm latch may be cleared by keypad or RS-232 communications port command or by re-calibrating the leak input channels.

Calibration may be done either from the keypad or the RS-232 communications port. The sensors must be clean and dry and in air. If the sensors are in oil or water, clean and dry them off before calibrating.

Leak Detection Indicators:
Red led indicates oil detection.
Amber led indicates water detection.
Green led indicates dry (normal condition).

Any leak input channels may be programmed as extra switch inputs from the keypad or the RS-232 communications port. Using a leak channel as a switch input disables it for use as a leak input channel. Switches and leak sensors may not be mixed on the same input.

Section 4.3: Theft Mode

Theft mode may be entered by opening the cover of the console and toggling S1 on the display circuit board to the THEFT position. When theft mode is entered the system records the product levels of all tanks in battery-backed memory. Any removal of product from a tank over the programmed theft threshold will trigger the Theft alarm for that tank and cause the display to flash. Theft alarms can be programmed to actuate the horn and relays, and will produce an alarm printout with the optional, printer.

The threshold for triggering a theft alarm is individually programmable for each tank in the system. If a tank is programmed for standby generator operation, a theft alarm will <u>not</u> be triggered when the standby generator is in operation.

The original product level before the theft may be displayed by pressing the Data Recall momentary pushbutton switch (labeled S2) on the display circuit board in either Volume or Inches display mode. Releasing the Data Recall pushbutton will resume display of the current product level. Examination of any tank may be performed by cycling the displayed tank with the Tank / Channel selector switch. Toggling S1 to the NORMAL position will exit theft mode.

This mode is intended to detect only unauthorized removal of product. It is not intended to comply with EPA or other regulations in regard to leak detection.

Display Circuit Board layout (*see Figure 15, Page 88*)

Section 4.4: The Horn

The volume of the audible alarm may be controlled by rotating the louver on the face of the horn. The maximum volume of the horn is a minimum of 85 dB at two feet, and the loudness may be varied by about 40 dB.

The horn may be reset (silenced) after detection of an alarm condition by pressing the HORN RESET button on the cover of the system console. This will silence the horn, but the alarm condition light will remain on.

The system is normally set at the factory to only actuate the horn on selected alarm conditions. These conditions may be changed by programming the horn with the keypad or RS-232 communications port. The horn may also be programmed to be completely disabled. *See Appendix B: Relay and Horn Alarm Conditions* for a list of the alarm conditions that can be programmed to actuate the horn and the default actuation conditions.

The system is normally set at the factory to disable the automatic horn silence function. This will let the horn sound on detection of the programmed alarm conditions until it is manually silenced by pressing the HORN RESET button on the system console cover. The automatic horn reset function may be programmed to silence the horn after a period of from 1 to 7 minutes in 1-minute increments.

The horn has a delay built-in, so that the same repeating alarm condition will not re-energize the audible alarm before the alarm condition has been off for a default 10 minutes. The alarm delay may be programmed to be anywhere from 1 to 10 minutes in 1 minute increments, or may be disabled entirely. Different alarm conditions will activate the horn regardless of the delay state for a particular condition.

Section 4.5: The Relay Contacts

There are 8 relays in the system that provide SPDT Form C dry contacts. The relay contacts are brought out to TB5 and TB6, and are labeled as Outputs 1 through 8, NC (Normally Closed), C (Common), and NO (Normally Open) positions. These contacts are rated to 5 Amps at 120 VAC. Wire sizes up to 14 AWG stranded wire may be used to connect to these relay contact outputs. If the load on the relay contacts exceeds this rating then the relay should be used to actuate an external power relay of appropriate rating (not supplied by Pneumercator).

Figure 5 - Relay Contact Wiring TB5

	Terminal #		
Relay	NC	C	NO
1	1	2	3
2	4	5	6
3	7	a	9
4	10	11	12

Figure 6 - Relay Contact Wiring TB6

	Terminal #		
Relay	NC	C	NO
5	1	2	3
6	4	5	6
7	7	8	9
8	10	11	12

See Appendix B: Relay and Horn Alarm Conditions for a list of the alarm conditions that can be programmed to actuate the relays and the default actuation conditions.

In the default state, the relays are normally unenergized in a non-alarm condition, i.e. there is no continuity between the Normally Open (NO) and Common (C) contacts and there is continuity between the Normally Closed (NC) and Common (C) contacts. When a programmed alarm condition is detected the relay actuates. This gives continuity between the Normally Open (NO) and Common (C) contacts, and breaks continuity between the Normally Closed (NC) and Common (C) contacts. The relays may be individually programmed to be in a normally energized state, which will toggle the states of the contacts. In this case, the relay(s) will de-energize on a programmed alarm condition. This may also be used to give indication of a power failure, since the relay will de-energize when the power is off.

The system is set at the factory to actuate the relays for the duration of an alarm condition. Relays may be individually programmed to deactivate after a preselected time period of from 1 to 15 minutes in 1-minute increments. A relay so programmed will not reactivate until a new alarm condition appears. This can provide an automatic cutoff function for a relay.

The relays may be individually programmed to have a delay of 0 to 5 minutes in 1-minute increments from the time an alarm is detected and maintained until relay actuation. The default is that there is no delay from alarm recognition to relay actuation.

Relays may also be individually programmed to deactivate when the HORN RESET button on the cover of the system console is pressed (remote reset operation). A relay so programmed will not reactivate until a new alarm condition appears. This provides a manual bypass function for relay operation.

All relay programming may be done from the keypad or from the RS-232 communication port.

Section 4.5.1: Latching Relays

Relays may be individually programmed to act as latching relays to perform functions such as pump control. Latching relays are programmed for fill or drain functions for a tank. The high (overfill) and low level alarm setpoints for that tank control the activation and deactivation points for that latching relay.

A relay programmed for fill will activate at the low-level alarm setpoint, and will deactivate at the high (overfill) level alarm setpoint. A relay programmed for drain will activate at the high (overfill) level alarm setpoint, and will deactivate at the low-level alarm setpoint.

Latching relays may be programmed for normally unenergized or normally energized operation. Latching relays will only respond to the fill or drain condition as an alarm condition. Functions such as timed shutoff, delayed actuation and remote reset may also be utilized, providing full pump control.

If the load on the latching relay contacts exceeds the 5 Amps at 120 VAC relay rating, then the latching relay should be used to actuate an external power relay of appropriate rating for the load (not supplied by Pneumercator).

Section 4.6: System Tests

The system LEDs, horn, RAM (memory), clock and relays may be tested from the keypad. The LEDs test will light all the LEDs on the cover until a key press cancels the test and returns to normal mode. The horn test will sound the horn until a key press cancels the test and returns to normal mode. The RAM and clock tests w ill return to normal mode automatically unless a fault is detected. In that case an error code will be displayed. The relay test will first activate the relays and then deactivate then after a key press.

Section 4.7: Maintenance

The time between maintenance periods is a variable that will depend upon the environment in which the level transmitters, sensors, and system console are operating. The console should be tested every six months by using the keypad self-diagnostic commands.

The leak detection sensors should be visually inspected for fouling or clogging at least once a year. A fouled or clogged leak sensor can give false alarms. If the leak sensor is fouled or clogged, it should be cleaned with soap and water or a mild solvent, and unclogged with compressed air. After visual inspection, the leak sensors should be reinstalled, and recalibrated.

If an actual leak occurs, after corrective action is taken, the leak sensors should be cleaned and inspected and recalibrated before reinstallation.

Section 5 Keypad Commands

Figure 7 – Key Definitions

Key	Meaning
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	Null (reserved)
B	Backspace
C	Cancel
D	Dash (Minus Sign)
E	Enter
F	Function

Section 5.1 How to Enter Keypad Commands

FUNCTION: The FUNCTION key, which is labeled ‘F’, precedes all commands given in PROGRAM mode.

- (MINUS): The minus sign, which is labeled 'D' (for DASH), is used in the entry of installation-offset adjustments.

BACKSPACE: The BACKSPACE key, which is labeled ‘B', is used to correct an error in key entry in PROGRAM mode. The BACKSPACE will erase the mistaken key entry and correct the display.

ENTER: The ENTER key, which is labeled 'E' is used to terminate ALL command entries In PROGRAM mode. A command will not be performed until the ENTER key is pressed. Until the ENTER key is pressed, the command line can be edited with the BACKSPACE and CANCEL LINE keys.

CANCEL LINE: The CANCEL LINE key, which is labeled 'C', can be used to cancel a command line at any time until the ENTER key is pressed.

NULL: The NULL key, which is labeled 'A', has no defined use at the present time. Entry of the NULL key should be corrected by use of the BACKSPACE or CANCEL LINE keys.

**** Where braces { } are shown bracketing parameters in the commands, they are shown for reasons of clarity only, and must not be entered into the command line entered into the LDE-740.****

**** When PROGRAMMING mode is entered by pressing the FUNCTION key on the keypad, the front panel display is cleared, and the function symbol is displayed. The function symbol is a box in the bottom right of the display window. As command numbers and parameters are entered, the characters displayed move left. Characters that scroll off the left end of the display are not lost, merely past the display window. They may be reshown when the backspace key is used. During PROGRAMMING mode all normal gauging and alarm functions are performed. If no key has been pressed for two minutes, PROGRAMMING mode is automatically canceled, and the normal display is resumed. When a display command has been given, normal display will resume when any key is pressed or two minutes have elapsed. ****

Section 5.2: Keypad Commands – Grouped by Function

Function	Command Number
Clock	
Display Time	00
Enter Time	01
Display Date	02
Enter Date	03
Display Weekday	04
Enter Weekday	05
Print Clock	06
Level Alarms	
Display High Alarm Setting	07
Print High Alarm Setting	08
Enter High Alarm Setting	09
Display Low Alarm Setting	10
Print Low Alarm Setting	11
Enter Low Alarm Setting	12
Display Critical Alarm State	64
Enter Critical Alarm State	65
Display Critical Alarm Setting	66
Enter Critical Alarm Setting	67
Print Critical Alarm State and Setting	68
Tank	
Print Tank Parameters	13
Display Offset Adjustment	14
Print Offset Adjustment	15
Enter Offset Adjustment	16
Enter Product Code	24
Print Product Name	25
Display Theft Threshold	69
Enter Theft Threshold	70
Deliveries	
Print Latest Delivery	58
Print Stored Deliveries	59
Clear Stored Deliveries	60

Section 5.3: Keypad Commands - Numerical Order

Function	Command Number
Display Time	00
Enter Time	01
Display Date	02
Enter Date	03
Display Weekday	04
Enter Weekday	05
Print Clock	06
Display High Alarm Setting	07
Print High Alarm Setting	08
Enter High Alarm Setting	09
Display Low Alarm Setting	10
Print Low Alarm Setting	11
Enter Low Alarm Setting	12
Print Tank Parameters	13
Display offset Adjustment	14
Print Offset Adjustment	15
Enter Offset Adjustment	16
Test LEDs	17
Test Horn	18
Test RAM (memory)	19
Test Clock	20
Test Relays	21
Enter Automatic Inventory Print Time	22
Print Automatic Inventory Print Times	23
Enter Product Code	24
Print Product Name	25
Clear Printer Buffer	26
Display Baud Rate	27
Print Baud Rate	28
Enter Baud Rate	29
Print System Setup	30
Print Current Alarm Status	31
Program Horn Alarm Conditions	32
Program Horn Shutoff	33
Print Horn Setup	34
Program Relay Alarm Conditions	35
Program Relay Shutoff	36
Program Relay State	37
Program Relay Delay	38
Print Relay Setup	39
Program Switch State	40
Print Switch Setup	41
Program Leak Channel State	42
Calibrate Leak Detection	43
Clear Leak Detection Latch	44
Print Leak Detection Setup	45
RESERVED	46
RESERVED	47
RESERVED	48

Section 5.4: Keypad Command Entry

**** NOTE: All character positions shown in the command definition, except for braces { }, must be entered, i.e. 'nnnnn' calls for the entry of 5 digits. Braces enclose optional parameters.

Display Time (**00**): **F 00 E**

Displays time until any key press or timeout.

Enter Time (**01**): **F 01 *hh mm* E**

hh is the hours (in military time), i.e. *15* is 3 PM.

mm is the minutes, i.e. *20* is 20 after the hour.

Entry of leading zeroes is required for both hours and minutes, i.e. 5 A.M. must be entered as *0500*. 6 P.M. must be entered as *1800*.

Display Date (**02**): **F 02 E**

Displays the date until any key press or timeout.

Enter Date (**03**): **F 03 *mm dd yy* E**

mm is the month, i.e. *04* is April.

dd is the date, i.e. *03* is the third day of the month.

yy is the year, i.e. *94* is 1994, *00* is 2000, *01* is 2001.

Entry of leading zeroes is required for days and months, i.e. June must be entered as *06*, and the third day of the month must be entered as *03*.

Display Weekday (**04**): **F 04 E**

Displays the day of the week until any key press or timeout.

Enter Weekday (**05**): **F 05 *d* E**

d is the day of the week.

1 = Sunday.
2 = Monday.
3 = Tuesday.
4 = Wednesday.
5 = Thursday.
6 = Friday.
7 = Saturday.

Print Clock (**06**): **F 06 E**

Prints clock date and time settings.

Display High Alarm Setting (**07**): **F 07 *T* E**

T is the tank number (*1 to 4*).

Displays the level set for high (overfill) alarm until any key press or timeout. Default setting is 90% of tank capacity.

Print High Alarm Setting (**08**): **F 08 *T* E**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints high (overfill) alarm setting.

Enter High Alarm Setting (**09**): **F 09 *T nnnnn* E**

T is the tank number (*1 to 4*).

nnnnn is the level to set the alarm (5 digits required).

Leading zeroes are required, i.e. 6000 gallons must be entered as *06000*. Default setting is 90% of tank capacity.

Display Low Alarm Setting (**10**): **F 10 *T* E**

T is the tank number (*1 to 4*).

Displays the level set for low alarm until any key press or timeout. Default setting is 20% of tank capacity.

Print Low Alarm Setting (**11**): **F 11 *T* E**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints low alarm setting.

Enter Low Alarm Setting (**12**): **F 12 *T nnnnn* E**

T is the tank number (*1 to 4*).

nnnnn is the level to set the alarm (5 digits required).

Leading zeroes are required, i.e. 600 gallons must be entered as *00600*. Default setting is 20% of tank capacity.

Print Tank Parameters (**13**): **F 13 *T* E**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints the setup parameters for the tank. The parameters printed are: Tank number, tank product name, tank product code, critical level alarm state (high-high or low-low), critical level alarm setting, high level alarm setting, low level alarm setting, tank capacity, tank diameter, offset adjustment setting, theft threshold and delivery threshold.

Display Offset Adjustment (**14**): **F 14 *T* E**

T is the tank number (*1 to 4*).

Displays the level set for the offset adjustment until any key press or timeout.

Print Offset Adjustment (**15**): **F 15 *T* E**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints the offset adjustment for the tank.

Enter Offset Adjustment (**16**): **F 16 *T {-} nnn* E**

T is the tank number (*1 to 4*).

nnn is the level to set the offset to (this level is entered in hundredth's of an inch, i.e. 2 inches is entered as *200*. The offset for a tank may range from -9.99 inches to +9.99 inches.

Leading zeroes are required, i.e. 0.50 inches of positive offset must be entered as *050*.

If a negative offset is desired, it is preceded by a minus (–) sign. This is accomplished by pressing the key labeled 'D'. No sign is required or allowed for a positive offset.

The offset for the tank is derived as follows:

1. First remove any pressurized or vapor recovery tubes from the dipstick measurement opening. These tubes can cause a reading to vary by as much as 3 inches depending upon the pressure in the tank.
2. Take a very careful dipstick reading with an accurate dipstick. Write down the reading.
3. Write down the fuel height in inches shown by the Gauge.
4. Subtract the Gauge reading from the dipstick reading (Dipstick -Gauge = Difference) to get the Installation Offset and record it for reference.

Test LEDs (**17**): **F 17 E**

Lights all the system LEDs, any key press turns off the LEDs.

Test Horn (**18**): **F 18 E**

Turns on the horn, any key press turns off the horn.

Test RAM (memory) (**19**): **F 19 E**

Tests the scratchpad memory, if an error is found, an error code is displayed (error code #4). If no error is found, no message is presented.

Test Clock (**20**): **F 20 E**

Tests the clock, if an error is found, an error code is displayed (error code #2). If no error is found, no message is presented.

Test Relays (**21**): **F 21 E**

Toggles the state of all the relays, any key press toggles the relay states again and ends the test.

Enter Automatic Inventory Print Time (**22**): **F 22 *N hh mm d* E**

N is the number of the automatic print time. There are 3 automatic print times. The printout will be the normal inventory printout.

hh is the hours (in military time), i.e. *15* is 3 PM.

mm is the minutes, i.e. *20* is 20 after the hour.

Entry of leading zeroes is required for both hours and minutes, i.e. 5 A.M. must be entered as *0500*.

d is the day of the week.

1 = Sunday.
2 = Monday.
3 = Tuesday.
4 = Wednesday.
5 = Thursday.
6 = Friday.
7 = Saturday.
If *0* is entered as the day of the week, all days are selected.
If the command is entered in the form: F22*N*E that automatic print time will be disabled.
The most recent of each of the 3 automatic printouts are stored in non-volatile memory and are available with the command to Print Stored Inventory (command #83).

Print Automatic Inventory Print Times (**23**): **F 23 E**
Prints the times selected for automatic inventory printouts.
If an automatic print time is not in effect for one of the 3 times, the return message will be "Auto Print # n Disabled", where n is a number from 1 to 3. If none of the automatic print times is in effect, the message will be repeated for all three times.

Enter Product Code (**24**): **F 24 *T nn* E**
T is the tank number (*1 to 4*).
nn is the 2-digit number, which represents the name of the product in the tank. *See Appendix C: Tank Product Codes* for a list of the built-in product codes and names.
Custom product names may be entered from the RS-232 port and assigned to product codes 60, 61, 62 and 63. These custom product names may then be assigned to tanks the same as the built-in product names.

Print Product Name (**25**): **F 25 *T* E**
T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.
Prints the name assigned to the tank contents.

Clear Printer Buffer (**26**): **F 26 E**
Clears the printer buffer and cancels any print commands in progress, or in the printer queue.

Display Baud Rate (**27**): **F 27 E**
Displays the baud rate set for the RS-232 communications port until any key press or timeout.
1 = programmed for 300 baud.
2 = programmed for 1200 baud.
3 = programmed for 2400 baud. default setting.
4 = programmed for 4800 baud.
5 = programmed for 9600 baud.

Print Baud Rate (**28**): **F 28 E**
Prints the baud rate setup condition for the RS-232 communications port.

Enter Baud Rate (**29**): **F 29 *n* E**

n is a number from *1 to 5* for the baud rate desired.
1 = programmed for 300 baud.
2 = programmed for 1200 baud.
3 = programmed for 2400 baud. default setting.
4 = programmed for 4800 baud.
5 = programmed for 9600 baud.

Print System Setup (**30**): **F 30 E**

Prints system setup parameters. These parameters are: Serial number of system, system software revision, clock settings (time, date, day of week), alarm actuation delay time, leak channel programming, aux / switch input programming, automatic inventory printout times and RS-232 port setup.

Print Current Alarm Status (**31**): **F 31 E**

Prints the status of all alarms that are currently active in the system. Critical Level, High Level, Low Level, High Water, Theft, Aux / Switch, Hydrocarbon Leak and Water Leak alarms are profiled.

Program Horn Alarm Conditions (**32**): **F 32 *{-} cc* E**

cc is the 2-digit number of the condition(s) that will actuate the horn. More than one condition may be set to actuate the horn. If more than one condition is set for the horn, the programming must be repeated for each condition. *See Appendix B: Relay and Horn Alarm Conditions* for a list of the alarm condition code numbers and the default actuation conditions.

A minus sign (DASH) before a condition number disables that condition.

If *cc* is entered as *99*, the horn programming is set to the default conditions. If cc is entered as *-99*, all enabling conditions for the horn are cleared.

If cc is entered as *00*, the horn is disabled. All previously programmed enabling conditions are retained. If cc is entered as *-00*, the horn is enabled. All previously programmed enabling conditions for the horn are retained.

Program Horn Shutoff (**33**): **F 33 *t* E**

t is the time for automatic horn shutoff after alarm actuation. There is a 10-minute default delay built-in between horn actuations for the same condition. This is programmable with the Alarm Actuation Delay setting (command #72).

0 = manual horn shutoff (must be silenced with RESET HORN pushbutton on enclosure cover). This is the default state.

1 to 7 = the horn will automatically silence after the programmed number of minutes (may be manually silenced with RESET HORN pushbutton on enclosure cover). This setting is available in 1-minute increments.

Print Horn Setup (**34**): **F 34 E**

Prints the setup and enabling conditions for the horn.

Program Relay Alarm Conditions (**35**): **F 35 *N cc* E**

N is the number of the relay that is being programmed. This is relay *1* to relay *8*.

cc is the 2-digit number of the condition(s) that will actuate the relay. More than one condition may be set to actuate the relay. If more than one condition is set for the relay, the programming must be repeated for each condition. *See Appendix B: Relay and Horn Alarm Conditions* for a list of the alarm condition code numbers and the default actuation conditions.

A minus sign (DASH) before a condition number disables that condition.

If *cc* is entered as *99*, the relay programming is set to the defaults for that relay. If *cc* is entered as *-99*, all enabling conditions for that relay are cleared.

Program Relay Shutoff (**36**): **F 36 *N tt* E**

N is the number of the relay that is being programmed. This is relay *1* to relay *8*.

tt is the time for automatic relay shutoff after alarm actuation. This setting is available in 1-minute increments.

00 = no automatic shutoff (relay remains actuated as long as alarm condition exists).

01 to 15 = will automatically toggle the relay state after the programmed number of minutes.

Program Relay State (**37**): **F 37 *N s* E**

N is the number of the relay that is being programmed. This is relay *1* to relay *8*.

s is the state for an inactive relay output.

0 = normally unenergized (relay energizes after alarm). Relay will stay on as long as the alarm condition is present.

1 = normally energized (relay de-energizes after alarm). Relay will stay off as long as the alarm condition is present.

This state can also be used as a power failure indication on a relay not in alarm condition, or a relay programmed for no alarm conditions.

2 = normally unenergized with reset (relay energizes after alarm). Relay will stay on as long as the alarm condition is present, or until the horn reset key on the cover is pressed.

3 = normally energized with reset (relay de-energizes after alarm). Relay will stay off as long as the alarm condition is present, or until the horn reset key on the cover is pressed.

This state can also be used as a power failure indication on a relay not in alarm condition, or a relay programmed for no alarm conditions.

Program Relay Delay (**38**): **F 38 *N t* E**

N is the number of the relay that is being programmed. This is relay *1* to relay *8*.

t is the time for relay actuation after alarm condition. This setting is available in 1-minute increments.

0 = no delay after alarm before relay actuates.

1 to 5 = minute(s) of delay after alarm is recognized before relay actuates.

Print Relay Setup (**39**): **F 39 E**

Prints the setup conditions for all 8 relays.

Program Switch State (**40**): **F 40 *N s* E**

N is the number of the switch that is being programmed. This is switch *1* to switch *8*.

s is the state of the switch input in a non-alarm condition.

0 = programmed as normally open switch input. Alarm will activate when the switch closes.

1 = programmed as normally closed switch input. Alarm will activate when the switch opens.

Print Switch Setup (**41**): **F 41 E**

Prints the setup conditions for all 8 switches.

Program Leak Channel State (**42**): **F 42 *N s* E**

N is the number of the leak channel that is being set-up. This is leak input *1* to leak input *8*.

s is the state of the leak channel.

0 = programmed as leak channel.

1 = programmed as normally open switch input. Alarm will activate when the switch closes. Sensor must be wired to the R and W (Red and White) terminals.

2 = programmed as normally closed switch input. Alarm will activate when the switch opens. Sensor must be wired to the R and W (Red and White) terminals.

Calibrate Leak Detection (**43**): **F 43 E**

Calibrates the leak detection sensors. The sensors must be clean and dry and in air. If the sensors are in oil or water, clean and dry them off before calibrating. Any leak channel without a sensor attached will be recorded as disabled. If a leak sensor is added, this command must be used. When the system is first started up, this command must be used to tell the system how many leak sensors are connected.

Clear Leak Detection Latch (**44**): **F 44 E**

Clears the alarm memory latch for all leak detector channels.

Print Leak Detection Setup (**45**): **F 45 E**

Prints the setup and status conditions for all leak channels.

Reserved (**46**): **F 46 E** Reserved for future use.
Reserved (**47**): **F 47 E** Reserved for future use.
Reserved (**48**): **F 48 E** Reserved for future use.

These commands will return an unimplemented command error (Error Code #1).

Calibrate Zero (**49**): **F 49 *T* E : E**

T is the tank number (*1 to 4*).

Calibrates the minimum gaugeable point of the tank level transmitter. The first press of E will set the display to 49. The tank level transmitter can then be adjusted to give its minimum output (float at the bottom of travel with the 2-412 and 2-501 transmitters). Wait 10-15 seconds before pressing E a second time to ensure an accurate reading. This will lock this reading into the system as the minimum gaugeable point. This calibration is retained in battery backed system memory, and will be retained for up to 10 years in the event of power failures or shutoffs.

This calibration is made at the factory, No user adjustment is normally needed,

It is very important that this command only be used with the float at the bottom of travel. If the float is at any other position, that position will be used as the minimum gaugeable point.

Calibrate Span (**50**): **F 50 *T* E : E**

T is the tank number (*1 to 4*).

Calibrates the maximum gaugeable point of the tank level transmitter. The first press of E will set the display to 50. The tank level transmitter can then be adjusted to give its maximum output (float at the top of travel with the 2-412 and 2-501 transmitters). Wait 10-15 seconds before pressing E a second time to ensure an accurate reading. This will lock this reading into the system as the maximum gaugeable point. This calibration is retained in battery backed system memory, and will be retained for up to 10 years in the event of power failures or shutoffs.

This calibration is made at the factory. No user adjustment is normally needed.

It is very important that this command only be used with the float at the top of travel. If the float is at any other position, that position will be used as the maximum gaugeable point.

Warm Reset System (**51**): **F 51 E**

Warm resets the system and performs all self-diagnostic system checks. No system setup parameters are changed by this command. This command is used to return the system to a known state. This is the equivalent of powering off the system and then powering it on.

Cold Reset System (**52**): **F 52 E**

Cold resets the system and performs all self-diagnostic system checks. Restores all system programming defaults.

*****WARNING***** All system setup parameters are reset to their default conditions. All stored data is cleared from the system memory. Tank charts, tank diameters, tank capacities and gauge calibrations remain as factory programmed.

**** After cold resetting the system, the system will be in a memory loss state (Error Code 8). This necessitates pressing any key of the keypad to clear ERROR #8, which is displayed on the system front panel display, in order to restart normal operation.

Test LEDs and Horn (**53**): **F 53 E**

Lights all the system LED's and turns on the horn, any key press turns off the LED's and the horn.

Enter Auto Answer Ring Count (**54**): **F 54 *n* E**

Sets the modem auto answer ring counter register (S0) to the number of rings before the modem answers the call.

n is the number of rings. The modem may be set to answer on *1 to 6* rings. A setting of *0* will disable the modem auto answer function. The modem is initialized to the setup, and the setup is stored to the modem power-on default setup. This command only applies if the RS-232 port is set as a modem port (see command #86, Enter RS-232 Port Mode).

The default setting is *2* (auto answer enabled on 2 rings).

Display Auto Answer Setup (**55**): **F 55 E**

Displays the modem auto answer ring count until any key press or timeout.

Print Auto Answer Setup (**56**): **F 56 E**

Prints the modem auto answer ring count. If the count is 0, the auto answer count is printed as disabled.

Test RS-232 Port (**57**): **F 57 E**

Sends the word 'Hello' 25 times to the RS-232 Port. A breakout box or computer set up in terminal mode may then be used to verify data flow through the RS-232 Port.

Print Latest Delivery (**58**): **F 58 *T* E**

T Is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints the latest stored delivery for the selected tank(s).

Print Stored Deliveries (**59**): **F 59 *T* E**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints all stored deliveries for the selected tank(s). The system will store the 6 latest deliveries for each tank.

Clear Stored Deliveries (**60**): **F 60 E**

This command will clear the storage memory of all but the latest delivery for each tank.

Display Delivery Threshold (**61**): **F 61 *T* E**

T is the tank number (*1 to 4*).

Displays the number of gallons that the inventory level in the tank must rise in a 2 minute period in order to trigger a delivery report. Displays until any key press or timeout.

Print Delivery Threshold (**62**): **F 62 *T* E**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints the number of gallons that the inventory level in the tank must rise in a 2 minute period in order to trigger a delivery report.

Enter Delivery Threshold (**63**): **F 63 *T nnn* E**

T is the tank number (*1 to 4*).

nnn is the number of gallons increase in inventory level in a 2 minute period to set as the threshold for recognizing a delivery for that tank (3 digits required). The number of gallons may range from *010 to 250* gallons. The threshold set should take into account the resolution of the level transmitter, the smallest delivery expected and the possibility of wave action in the tank triggering false deliveries.

Leading zeroes are required, i.e. 50 gallons must be entered as 050.

Display Critical Alarm State (**64**): **F 64 *T* E**

T is the tank number (*1 to 4*).

Displays the state of the critical alarm for that tank until any key press or timeout. If the critical alarm is set as a high-high alarm, the display will show a *1*. If the critical alarm is set as a low-low alarm, the display will show a *0*.

Enter Critical Alarm State (**65**): **F 65 *T s* E**

T is the tank number (*1 to 4*).

s is the state of the critical alarm for that tank.

0 = low-low alarm.

1 = high-high alarm. (default)

Display Critical Alarm Setting (**66**): **F 66 *T* E**

T is the tank number (*1 to 4*).

Displays the level set for the critical alarm until any key press or timeout. Default setting is 95% of tank capacity.

Enter Critical Alarm Setting (**67**): **F 67 *T nnnnn* E**

T is the tank number (*1 to 4*).

nnnnn is the level to set the alarm (5 digits required).

Leading zeroes are required, i.e. 6000 gallons must be entered as *06000*. Default setting is 95% of tank capacity.

Print Critical Alarm State and Setting (**68**): **F 68 *T* E**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints the critical alarm setting and state (low-low or high-high).

Display Theft Threshold (**69**): **F 69 *T* E**

T is the tank number (*1 to 4*).

Displays the level threshold set for a theft alarm for that tank until any key press or timeout.

Enter Theft Threshold (**70**): **F 70 *T nnn* E**

T is the tank number (*1 to 4*).

nnn is the number of gallons decrease in inventory level to set as the threshold for recognizing a theft from that tank (3 digits required). The number of gallons may range from *010 to 250* gallons. The threshold set should take into account the resolution of the level transmitter and the possibility of wave action in the tank triggering false theft alarms.

Leading zeroes are required, i.e. 50 gallons must be entered as *050*.

Display Alarm Actuation Delay (**71**): **F 71 E**

Displays the time delay set for recognizing repeated activations of the same alarm condition. This delay affects only the horn and alarm printouts. The default setting is 10 minutes. Displays until any key press or timeout.

Enter Alarm Actuation Delay (**72**): **F 72 *tt* E**

tt is the time delay set for recognizing repeated activations of the same alarm condition. This delay affects only the horn and alarm printouts. The default setting is *10* minutes. This setting is available in 1-minute increments.

00 = no delay.

01 to 10 = will delay the activation of the horn and alarm printouts for a repeat of an alarm until that alarm has been off for the specified time period. Relay activations are not affected by this command. If a delay is desired in relay activation after an alarm occurs, use command #38, Program Relay Delay.

Display Relay Latch Status (**73**): **F 73 *N* E**

N is the number of the relay to display. This is relay *1* to relay *8*.

Displays the status of the relay as a latching relay until any key press or timeout.

0 = Latch disabled. default
1 = Tank 1 fill.
2 = Tank 1 drain.
3 = Tank 2 fill.
4 = Tank 2 drain.
5 = Tank 3 fill.
6 = Tank 3 drain.
7 = Tank 4 fill.
8 = Tank 4 drain.

Enter Relay Latch Status (**74**): **F 74 *N s* E**

N is the number of the relay to program. This is relay *1* to relay *8*.

s is a number from *0 to 8*. If the relay is used as a latching relay, it may not be used for any other alarm function. If the latching state is disabled, the relay may be programmed for the usual alarm conditions.

0 = Latch disabled. default
1 = Tank 1 fill.
2 = Tank 1 drain.
3 = Tank 2 fill.
4 = Tank 2 drain.
5 = Tank 3 fill.
6 = Tank 3 drain.
7 = Tank 4 fill.
8 = Tank 4 drain.

The latching relay will use the high and low alarm setpoints for that tank to determine when to activate and deactivate. The relay may still be programmed to be normally unenergized or normally energized. A relay programmed for fill will activate at the low-level alarm setpoint, and stay activated until the high-level alarm setpoint. A relay programmed for drain will activate at the high-level alarm setpoint, and stay activated until the low-level alarm setpoint.

The latching relay will be most useful in controlling pumps and motors. Each relay is rated at 5 Amps @120 VAC maximum load. If the load exceeds the relay rating, the relay may be interfaced to an external power relay rated for that load. The relay may be used to control A.C. or D.C. voltages as long as the maximum rating is not exceeded.

When a relay is programmed as a latching relay, other alarm actuation conditions do not apply. Timed shutoff, delayed actuation and remote reset still apply. Previous programming is retained and will be used again if the latch state is set to disabled (condition *0*).

Display Named Switch Alarms (**75**): **F 75 *N* E**

N is the number of the switch input to display. This is switch input *1* to switch input *8*. Displays until any key press or timeout.

The default for all switch inputs is identification only by number. If a name is assigned, that switch input is identified by both number and name. Assigning the name 'Generator' to a switch input does not program it as a standby generator switch input. See command #81, Enter Generator Switch Status for standby generator switch programming.

0 = none. Switch is only identified by number.
1 = Sump.
2 = Piping.
3 = Containment.
4 = Interstitial.
5 = Leak.
6 = Reservoir.
7 = Well.
8 = Generator.
9 = custom name.

A custom name (up to 20 characters long) may be entered for any switch input from the RS-232 Port. See RS-232 Port command #51, Enter Custom Switch Name for further information.

Enter Named Switch Alarms (**76**): **F 76 *N n* E**

N is the number of the switch input a name is being assigned. This is switch input *1* to switch input *8*.

n is a number from *0 to 9* that identifies the name. There are 8 pre-assigned names, and a fully custom name may also be assigned. The default assignment for all switch inputs is *n=0* (no name).

0 = none. Switch is only identified by number.
1 = Sump.
2 = Piping.
3 = Containment.
4 = Interstitial.
5 = Leak.
6 = Reservoir.
7 = Well.
8 = Generator.
9 = custom name.

A custom name (up to 20 characters long) may be entered for any switch input from the RS-232 Port. See RS-232 Port command #51, Enter Custom Switch Name for further information.

Display Named Leak Alarms (**77**): **F 77 *N* E**

N is the number of the leak input to display. This is leak input *1* to leak input *8*. Displays until any key press or timeout.

The default for all leak inputs is identification only by number. If a name is assigned, that leak input is identified by both number and name,

0 = none. Leak input is only identified by number.
1 = Sump.
2 = Piping.
3 = Containment.
4 = Interstitial.
9 = custom name.

A custom name (up to 20 characters long) may be entered for any leak input from the RS-232 Port. See RS-232 Port command #53, Enter Custom Leak Name for further information.

Enter Named Leak Alarms (**78**): **F 78 *N n* E**

N is the number of the leak input a name is being assigned. This is leak input *1* to leak input *8*.

n is a number from *0 to 4, or 9* that identifies the name. There are 4 pre-assigned names, and a fully custom name may also be assigned. The default assignment for all leak inputs is *n=0* (no name).

0 = none. Leak input is only identified by number.
1 = Sump.
2 = Piping.
3 = Containment.
4 = Interstitial.
9 = custom name.

A custom name (up to 20 characters long) may be entered for any leak input from the RS-232 Port. See RS-232 Port command #53, Enter Custom Leak Name for further information.

Print Named Alarms (**79**): **F 79 E**

Prints the names assigned to all 8 switch inputs and all 8 leak inputs. If no name is assigned to an input, it will be designated by number only.

Display Generator Switch Status (**80**): **F 80 *N* E**

N is the number of the switch input to display. This is switch input *1* to switch input *8*. Displays until any key press or timeout.

The default for all switch inputs is as normal switch Inputs.

0 = normal switch input.
1 = Standby Generator switch input.

Enter Generator Switch Status (**81**): **F 81 *N s T* E**

N is the number of the switch input that is being designated as a Standby Generator Switch. This is switch input *1* to switch input *8*.

s is either *0 or 1*.
0 = normal switch input.
1 = Standby Generator switch input.

T is the tank number (*1 to 4*) to which the switch input is assigned.

When a switch input is assigned as a Standby Generator switch for a tank, it is only used for that purpose. When the input goes to an active state (as determined by the normally open or closed programming, command #40, Program Switch State) no alarm is activated. Instead, a Generator On Report is printed. When the input deactivates, a Generator Run Report Is printed.

The Generator Run Report lists the starting and ending times, dates, volumes and product heights as well as the amount of fuel used and the amount left in the tank (ullage).

The last 3 Generator Run Reports for each tank are stored for future reference. See command #84, Print Generator Run History.

Print Alarm History (**82**): **F 82 E**

Prints the last 3 occurrences of each alarm. The system records the time and date of all High Level, Low Level, Critical Level, Theft, High Water, Switch Input, Hydrocarbon Leak, and Water Leak alarms.

Print Stored Inventory (**83**): **F 83 E**

Prints the last stored Inventory report for each of the 3 automatic inventory printout times. See command #22, Enter Automatic Inventory Print Time.

Print Generator Run History (**84**): **F 84 *T* E**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints the last 3 Standby Generator Run Reports for the selected tank(s).

Display RS-232 Port Mode (**85**): **F 85 E**

Displays the operating mode of the RS-232 Port. Displays until any key press or timeout. The default mode for the RS-232 Port is as a local port with no echo.

0 = local port, no echo.
1 = local port, with echo.
2 = modem port.

Enter RS-232 Port Mode (**86**): **F 86 *s* E**

s is a number from *0 to 2* that sets the operating mode for the RS-232 Port.

0 = local port, no echo. In this mode, the RS-232 Port operates independently of the printer. It may be accessed with a computer connected through a null modem cable.

1 = local port, with echo. In this mode, the RS-232 Port echoes all output directed to the printer. All alarm reports, inventory reports, and other printouts are echoed to the RS-232 Port. It may be used with a computer connected through a null modem cable or a printer connected with a standard RS-232 cable. Any RS-232 commands and their output do not echo to the printer.

2 = modem port. In this mode, modem autoanswer and originate functions are enabled. Automatic dialout to a phone number may be enabled for alarms and / or automatic inventory printouts. Regular printouts are not echoed to the RS-232 Port. The port will adapt its baud rate to the modem connection speed.

When RS-232 Port modes are switched, any programming for inactive modes is retained.

Display Dialing Mode (**87**): **F 87 E**

Displays the dialing mode of the RS-232 Port when the port is programmed as a modem port. Displays until any key press or timeout. The default dialing mode for the port is Tone (Touch Tone) dialing.

0 = Tone dialing.

1 = Pulse.

Enter Dialing Mode (**88**): **F 88 *s* E**

s is either *0 or 1* for the dialing mode for the RS-232 Port when in modem port mode.

0 = Tone dialing (Touch Tone).

1 = Pulse dialing.

Display Alarm Dialout (**89**): **F 89 E**

Displays whether the RS-232 Port in modem mode will automatically dial a phone number when an alarm occurs. Displays until any key press or timeout.

0 = alarm dialout disabled.

1 = alarm dialout enabled.

Enter Alarm Dialout (90): **F 90 *s* E**

s is either *0 or 1* for automatic dialout of a stored phone number when an alarm occurs. Dialouts will be attempted every 10 minutes for 1 hour until a connection is made.

0 = alarm dialout disabled.

1 = alarm dialout enabled.

Display Automatic Inventory Dialout (**91**): **F 91 E**

Displays whether the RS-232 Port in modem mode will automatically dial a phone number when an automatic Inventory printout occurs. Displays until any key press or timeout.

0 = automatic inventory dialout disabled.

1 = automatic inventory dialout enabled for automatic inventory printout #1.

2 = automatic inventory dialout enabled for automatic inventory printout #2.

3 = automatic inventory dialout enabled for automatic inventory printout #3.

More than one automatic inventory dialout may be enabled at a time. In that case, the display will show all the printouts that automatic dialout is enabled for.

Enter Automatic Inventory Dialout (**92**): **F 92 *s* E**

s is a number from *0 to 3* that sets automatic dialout of a stored phone number when an automatic inventory printout occurs.

0 = alarm dialout disabled.

1 = automatic inventory dialout enabled for automatic inventory printout #1.

2 = automatic inventory dialout enabled for automatic inventory printout #2.

3 = automatic inventory dialout enabled for automatic inventory printout #3.

A minus sign (DASH) before a number disables that condition.

Dialouts will be attempted every 10 minutes for 1 hour until a connection is made.

Enter Phone Number (**93**): **F 93 *xxx...xxx* E** (up to 20 numbers)

xxx...xxx is a phone number to use for alarm and inventory dialouts. This may be up to 20 numbers long. This command will accept numbers from 0 to 9 only. If a delay is desired between digits of a phone number, a DASH may be entered by pressing the 'D' key. Typically, this delay will be for 1 second (see your modem documentation). The DASH will be stored as a comma, which is the standard modem delay character. Any access codes, country codes, extensions and long distance codes should be part of the phone number string.

If characters other than these are desired, they may be entered from the RS-232 port (operating in local mode). See RS-232 Port command #63, Enter Phone Number.

Print RS-232 Port Setup (**94**): **F 94 E**

Prints the setup for the RS-232 Port. The information printed is: Baud rate, parity, start bit, stop bit, word length, port operating mode, dialing type, autoanswer mode, phone number, alarm dialout mode and automatic inventory dialout mode.

Program Switch Alarm Printout (**96**): **F 96 *N s* E**

Allows enabling or disabling printer reports when an Aux / Switch alarm occurs. The enabling / disabling is done on a per switch basis.

N is the number of the switch that is being programmed. This is switch *1-8*.

s is the state of the printer when the switch alarm occurs.

0 = setting will enable a printout for the selected switch. (This is the default). If the AUTOMATIC ALARM DIALOUT feature (Keypad command #90, or RS-232 command #61) is enabled, the occurrence of a switch alarm will be transmitted over the RS-232 port.

1 = setting will disable a printout for the selected switch. The switch alarm occurrence will not be transmitted over the RS-232 port.

Section 6 : RS-232 Communications

The Pneumercator Model LDE-740 comes with an RS-232 communications port, which may be used to transfer data to a remote computer system or terminal. The RS-232 port is configured as a DTE, for connection to a modem. If a direct connection to a computer or terminal is desired, a null modem cable must be used. The RS-232 port is located on the case of the LDE-740, and is supplied with a standard DB-25 female connector (*see Appendix D for pinouts*).

The RS-232 port is normally an answer only port, which will respond to commands from a remote computer or terminal. It will not normally initiate communication on its own. The default setup conditions for the RS-232 port are: 1 start bit, 1 stop bit, 7 data bits, 2400 baud, even parity, no echo, DTR true, RTS true, and asynchronous communications (*see Appendix E for setup options*).

Communication with the RS-232 port uses the ASCII character set (7 data bits, with the 8th bit clear). Parity is handled internally and will not affect the high data bit, which is always clear.

If the communications interface between the system and the remote computer system or terminal does not work, check the cabling and connector pinouts to the modem and make sure they are correct (*see Appendix D*). If a null modem cable is used, check for correct wiring. Test for data flow by using keypad command #57, *Test RS-232 Port*. Also make sure that all RS-232 setup parameters are the same for the system and the remote computer system or terminal (*see Appendix E*). Make sure that any communications software that is used has the capability of sending a SOH (start of header or Ctrl-A) character at the beginning of every command. If your communications software has the capability of using pre-defined macros, you may wish to define macros for either all commands or the most commonly used commands (see the instruction manuals for your communications software, computer system or terminal, and modem).

Section 6.1: RS-232 Command Format

All commands are entered in a similar format, starting with SOH (start of header, which is Ctrl-A on a computer keyboard), then the two digit number of the command, followed by any parameter or parameters required by the command, ended by a carriage return or any other control character.

The system will respond by performing the desired command. If a response message is called for by the command, it will be sent immediately. All response messages begin and end with at least one blank line. A blank line from the system is generated by sending a carriage return and line feed (this forms a new line character). If no response message is called for, the system will echo the command number followed by "O.K.". Any errors detected by the system will result in a return message which consists of the command number and parameter(s) up to the error, followed by "*ERROR*".

Section 6.2: How to Enter RS-232 Commands

Figure 8 – RS-232 Special Characters

Name	Hex code	Keyboard entry
SOH-start of header	01H	Ctrl-A
LF-line feed	0AH	Ctrl-J
CR-carriage return	0DH	Ctrl-M
New line	0D0AH	Ctrl-M, Ctrl-J

**** To enter a control character from a computer or Teletype keyboard, hold down the key marked Ctrl, and press the desired alphabetic key, then release both keys.

**** Any multi-line responses will terminate each line with a new line character, which is a compound ASCII character consisting of a carriage return and line feed (CR,LF - 0D0AH). Line terminations sent to the system may consist of only a carriage return, in which case the system will supply the line feed.

**** Where commas or braces { } are shown separating parameters in the commands, they are shown for reasons of clarity only, and must not be entered into the command string sent to the LDE-740.

**** The start of every command is shown as {SOH}, which represents a Ctrl-A character.

**** The end of every command is shown as {^}, which represents any control character. Normally, the control character chosen by the user will be a carriage return (Ctrl-M), but any control character may be used.

**** If there is no error, your computer or terminal will respond by displaying the result of the specific command entry or request.

Section 6.3: RS-232 Commands - Grouped by Function

Function	Command Number
Clock	
Print Clock	00
Enter Time	01
Enter Date	02
Enter Weekday	03
Level Alarms	
Print High Alarm Setting	06
Enter High Alarm Setting	07
Print Low Alarm Setting	08
Enter Low Alarm Setting	09
Print Critical Alarm State and Setting	41
Enter Critical Alarm State	42
Enter Critical Alarm Setting	43
Tank	
Print Tank Parameters	11
Print Offset Adjustment	12
Enter Offset Adjustment	13
Print Product Name	14
Enter Product Code	15
Print Theft Threshold	44
Enter Theft Threshold	45
Enter Custom Tank Name	65
Deliveries	
Print Latest Delivery	36
Print Stored Deliveries	37
Clear Stored Deliveries	38
Print Delivery Threshold	39
Enter Delivery Threshold	40
Switch Inputs	
Print Switch Setup	26
Program Switch State	27

Section 6.4: RS-232 Commands - Numerical Order

Function	Command Number
Print Clock	00
Enter Time	01
Enter Date	02
Enter Weekday	03
Print Automatic Inventory Print Times	04
Enter Automatic Inventory Print Time	05
Print High Alarm Setting	06
Enter High Alarm Setting	07
Print Low Alarm Setting	08
Enter Low Alarm Setting	09
Print Current Alarm Status	10
Print Tank Parameters	11
Print Offset Adjustment	12
Enter Offset Adjustment	13
Print Product Name	14
Enter Product Code	15
Print Inventory Report	16
Print System Setup	17
Print Horn Setup	18
Program Horn Alarm Conditions	19
Program Horn Shutoff	20
Print Relay Setup	21
Program Relay Alarm Conditions	22
Program Relay Shutoff	23
Program Relay State	24
Program Relay Delay	25
Print Switch Setup	26
Program Switch State	27
Print Leak Detection Setup	28
Program Leak Channel State	29
Calibrate Leak Detection	30
Clear Leak Detection Latch	31
RESERVED	32
RESERVED	33
Warm Reset System	34
Cold Reset System	35
Print Latest Delivery	36
Print Stored Deliveries	37
Clear Stored Deliveries	38
Print Delivery Threshold	39
Enter Delivery Threshold	40
Print Critical Alarm State and Setting	41
Enter Critical Alarm State	42
Enter Critical Alarm Setting	43
Print Theft Threshold	44

Section 6.5: RS-232 Command Entry

Print Clock (**00**): **{SOH} 00 {^}**

Prints the date, time, and day of the week.

Enter Time (**01**): **{SOH} 01 *hh mm* {^}**

hh is the hours (in military time), i.e. *15* is 3 PM.

mm is the minutes, i.e. *20* is 20 after the hour.

Entry of leading zeroes is required for both hours and minutes, i.e. 5 A.M. must be entered as 0500. 6 P.M. must be entered as 1800.

Enter Date (**02**): **{SOH} 02 *mm dd yy* {^}**

mm is the month, i.e. *04* is APRIL.

dd is the date, i.e. *03* is the third day of the month.

yy is the year, i.e. *92* is 1992, *00* is 2000, *01* is 2001.

Entry of leading zeroes is required for days and months, i.e. June must be entered as *06*, and the third day of the month must be entered as *03*.

Enter Weekday (**03**): **{SOH} 03 *d* {^}**

d Is the day of the week.

1 = Sunday.

2 = Monday.

3 = Tuesday.

4 = Wednesday.

5 = Thursday.

6 = Friday.

7 = Saturday.

Print Automatic inventory Print Times (**04**): **{SOH} 04 {^}**

Prints the times selected for automatic inventory printouts.

If an automatic print time is not in effect for one of the 3 times, the return message will be "AUTO PRINT # n DISABLED", where n is a number from 1 to 3. If none of the automatic print times is in effect, the message will be repeated for all three times.

Enter Automatic Inventory Print Time (**05**): **{SOH} 05 *N hh mm d*{^}**

N Is the number of the automatic print time. There are 3 automatic print times. The printout will be the normal inventory printout.

hh is the hours (in military time), i.e. *15* is 3 PM.

mm is the minutes, i.e. *20* is 20 after the hour.

Entry of leading zeroes is required for both hours and minutes, i.e. 5 A.M. must be entered as *0500*.

d is the day of the week.

1 = Sunday.

2 = Monday.

3 = Tuesday.

4 = Wednesday.
5 = Thursday.
6 = Friday.
7 = Saturday.
If *0* is entered as the day of the week, all days are selected.
If the command is entered in the form: {SOH} 05 *N* {^}, that automatic print time will be disabled.
The most recent of each of the 3 automatic printouts are stored in non-volatile memory and are available with the RS-232 command to Print Stored Inventory (command #57).

Print High Alarm Setting (**06**): **{SOH} 06 *T* {^}**
T Is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.
Prints high (overfill) alarm setting.

Enter High Alarm Setting (**07**): **{SOH} 07 *T nnnnn* {^}**
T is the tank number (*1 to 4*).
nnnnn is the level to set the alarm (5 digits required).
Leading zeroes are required, i.e. 6000 gallons must be entered as *06000*. Default setting is 90% of tank capacity.

Print Low Alarm Setting (**08**): **{SOH} 08 *T* {^}**
T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.
Prints low alarm setting.

Enter Low Alarm Setting (**09**): **{SOH} 09 *T nnnnn* {^}**
T is the tank number (*1 to 4*).
nnnnn is the level to set the alarm (5 digits required),
Leading zeroes are required, i.e. 600 gallons must be entered as *00600*. Default setting is 20% of tank capacity.

Print Current Alarm Status (**10**): **{SOH} 10 {^}**
Prints the status of all alarms that are currently active in the system. Critical Level, High Level, Low Level, High Water, Theft, Aux / Switch, Hydrocarbon Leak, and Water Leak alarms are profiled.

Print Tank Parameters (**11**): **{SOH} 11 *T* {^}**
T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.
Prints the setup parameters for the tank. The parameters printed are: Tank number, tank product name, tank product code, critical level alarm state (high-high or low-low), critical level alarm setting, high level alarm setting, low level alarm setting, tank capacity, tank diameter, offset adjustment setting, theft threshold, and delivery threshold.

Print Offset Adjustment (**12**): **{SOH} 12 *T* {^}**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints the offset adjustment for the tank.

Enter Offset Adjustment (**13**): **{SOH} 13 *T* {-} *nnn* {^}**

T is the tank number (*1 to 4*).

nnn is the level to set the offset to (this level is entered in hundredth's of an inch, i.e. 2 Inches is entered as *200*. The offset for a tank may range from -9.99 inches to +9.99 inches.

Leading zeroes are required, i.e. 0.50 inches of positive offset must be entered as *050*.

If a negative offset is desired, it is preceded by a minus (–) sign. No sign is required or allowed for a positive offset.

The offset for the tank is derived as follows:

1. First remove any pressurized or vapor recovery tubes from the dipstick measurement opening. These tubes can cause a reading to vary by as much as 3 inches depending upon the pressure in the tank.

2. Take a very careful dipstick reading with an accurate dipstick. Write down the reading.

3. Write down the fuel height in inches shown by the Gauge.

4. Subtract the Gauge reading from the dipstick reading (Dipstick - Gauge = Difference) to get the Installation Offset and record it for reference.

Print Product Name (**14**): **{SOH} 14 *T* {^}**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints the name assigned to the tank contents.

Enter Product Code (**15**): **{SOH} 15 *T nn* {^}**

T is the tank number (*1 to 4*).

nn is the 2-digit number, which represents the name of the product in the tank. *See Appendix C: Tank Product Codes* for a list of the built-in product codes and names.

Custom product names may be entered from the RS-232 port and assigned to product codes 60, 61, 62 and 63. These custom product names may then be assigned to tanks the same as the built-in product names.

Print Inventory Report (**16**): **{SOH} 16 {^}**

Prints the current inventory status of the tanks for levels in inches, and volumes in gallons as well as ullages (empty space in the tanks) in gallons. Also prints the assigned tank names, a 3-line system header, and a time and date stamp.

Print System Setup (**17**): **{SOH} 17 {^}**

Prints system setup parameters. These parameters are: Serial number of system, system software revision, clock settings (time, date, day of week), alarm actuation delay time, leak channel programming, aux / switch input programming, automatic inventory printout times and RS-232 port setup.

Print Horn Setup (**18**): **{SOH} 18 {^}**

Prints the setup and enabling conditions for the horn.

Program Horn Alarm Conditions (**19**): **{SOH} 19 {-} *cc* {^}**

cc is the 2-digit number of the condition(s) that will actuate the horn. More than one condition may be set to actuate the horn. If more than one condition is set for the horn, the programming must be repeated for each condition. *See Appendix B: Relay and Horn Alarm Conditions* for a list of the alarm condition code numbers and the default actuation conditions.

A minus sign before a condition number disables that condition.

If *cc* is entered as *99*, the horn programming is set to the default conditions. If *cc* is entered as *-99*, all enabling conditions for the horn are cleared.

If *cc* is entered as *00*, the horn is disabled. All previously programmed enabling conditions are retained. If *cc* is entered as *-00*, the horn is enabled. All previously programmed enabling conditions for the horn are retained.

Program Horn Shutoff (**20**): **{SOH} 20 *t* {^}**

t is the time for automatic horn shutoff after alarm actuation. There is a 10-minute default delay built-in between horn actuations for the same condition. This is programmable with the Alarm Actuation Delay setting (RS-232 command #47).

0 = manual horn shutoff (must be silenced with RESET HORN pushbutton on enclosure cover). This is the default state.

1 to 7 = the horn will automatically silence after the programmed number of minutes (may be manually silenced with RESET HORN pushbutton on enclosure cover). This setting is available in 1-minute increments.

Print Relay Setup (**21**): **{SOH} 21 {^}**

Prints the setup conditions for all 8 relays.

Program Relay Alarm Conditions (**22**): **{SOH} 22 *N cc* {^}**

N is the number of the relay that is being programmed. This is relay *1* to relay *8*.

cc is the 2-digit number of the condition(s) that will actuate the relay. More than one condition may be set to actuate the relay. If more than one condition is set for the relay, the programming must be repeated for each condition. *See Appendix B: Relay and Horn Alarm Conditions* for a list of the alarm condition code numbers and the default actuation conditions.

A minus sign before a condition number disables that condition.

If *cc* is entered as *99*, the relay programming is set to the defaults for that relay. If *cc* is entered as *-99*, all enabling conditions for that relay are cleared.

Program Relay Shutoff (**23**) : **{SOH} 23 *N tt* {^}**

N is the number of the relay that is being programmed. This is relay *1* to relay *8*.

tt is the time for automatic relay shutoff after alarm actuation. This setting is available in 1 minute Increments.

00 = no automatic shutoff (relay remains actuated as long as alarm condition exists.

01 to 15 = will automatically toggle the relay state after the programmed number of minutes.

Program Relay State (**24**): **{SOH} 24 *N s* {^}**

N is the number of the relay that is being programmed. This is relay *1* to relay *8*.

s is the state for an inactive relay output.

0 = normally unenergized (relay energizes after alarm). Relay will stay on as long as the alarm condition is present.

1 = normally energized (relay de-energizes after alarm). Relay will stay off as long as the alarm condition is present.

This state can also be used as a power failure indication on a relay not in alarm condition, or a relay programmed for no alarm conditions.

2 = normally unenergized with reset (relay energizes after alarm). Relay will stay on as long as the alarm condition is present, or until the horn reset key on the cover is pressed.
.

3 = normally energized with reset (relay de-energizes after alarm). Relay will stay off as long as the alarm condition is present, or until the horn reset key on the cover is pressed.

This state can also be used as a power failure indication on a relay not in alarm condition, or a relay programmed for no alarm conditions.

Program Relay Delay (**25**): **{SOH} 25 *N t* {^}**

N is the number of the relay that is being programmed. This is relay *1* to relay *8*.

t is the time for relay actuation after alarm condition. This setting is available in 1-minute increments.

0 = no delay after alarm before relay actuates.

1 to 5 = minute(s) of delay after alarm is recognized before relay actuates.

Print Switch Setup (**26**): **{SOH} 26 {^}**

Prints the setup conditions for all 8 switches.

Program Switch State (**27**): **{SOH} 27 *N s* {^}**

N is the number of the switch that is being programmed. This is switch *1* to switch *8*.

s is the state of the switch input in a non-alarm condition.

0 = programmed as normally open switch input. Alarm will activate when the switch closes.

1 = programmed as normally closed switch input. Alarm will activate when the switch opens.

Print Leak Detection Setup (**28**): **{SOH} 28 {^}**

Prints the setup and status conditions for all leak channels.

Program Leak Channel State (**29**): **{SOH} 29 *N s* {^}**

N is the number of the leak channel that is being set-up. This is leak input *1* to leak input *8*.

s is the state of the leak channel.

0 = programmed as leak channel.

1 = programmed as normally open switch input. Alarm will activate when the switch closes. Sensor must be wired to the R and W (Red and White) terminals.

2 = programmed as normally closed switch input. Alarm will activate when the switch opens. Sensor must be wired to the R and W (Red and White) terminals.

Calibrate Leak Detection (**30**): **{SOH} 30 {^}**

Calibrates the leak detection sensors. The sensors must be clean and dry and in air. If the sensors are in oil or water, clean and dry them off before calibrating. Any leak channel without a sensor attached will be recorded as disabled. If a leak sensor is added, this command must be used. When the system is first started up, this command must be used to tell the system how many leak sensors are connected.

Clear Leak Detection Latch (**31**): **{SOH} 31 {^}**

Clears the alarm memory latch for all leak detector channels.

Reserved (32): {SOH}32{^} Reserved for future use.
Reserved (33): {SOH}33{^} Reserved for future use.

These commands will return an unimplemented command error (Error Code #1).

Warm Reset System (**34**): **{SOH} 34 {^}**

Warm resets the system and performs all self-diagnostic system checks. No system setup parameters are changed by this command. This command is used to return the system to a known state. This is the equivalent of powering off the system and then powering it on.

Cold Reset System (**35**): **{SOH} 35 {^}**

Cold resets the system and performs all self-diagnostic system checks. Restores all system programming defaults. The system will respond with "35 O.K."

*****WARNING***** All system setup parameters are reset to their default conditions. All stored data is cleared from the system memory. Tank charts, tank diameters, tank capacities and gauge calibrations remain as factory programmed.

**** After cold resetting the system, the system will be in the same state as if a cold reset is performed at the keypad. This necessitates pressing any key of the keypad to clear ERROR #8, which is displayed on the system front panel display, in order to re-start normal operation.

Print Latest Delivery (**36**): **{SOH} 36 *T* {^}**

T Is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints the latest stored delivery for the selected tank(s).

Print Stored Deliveries (**37**): **{SOH} 37 *T* {^}**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints all stored deliveries for the selected tank(s). The system will store the 6 latest deliveries for each tank.

Clear Stored Deliveries (**38**): **{SOH} 38 {^}**

This command will clear the storage memory of all but the latest delivery for each tank.

Print Delivery Threshold (**39**): **{SOH} 39 *T* {^}**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints the number of gallons that the inventory level in the tank must rise in a 2 minute period in order to trigger a delivery report.

Enter Delivery Threshold (**40**): **{SOH} 40 *T nnn* {^}**

T is the tank number (*1 to 4*).

nnn is the number of gallons increase in inventory level in a 2 minute period to set as the threshold for recognizing a delivery for that tank (3 digits required). The number of gallons may range from *010 to 250* gallons. The threshold set should take into account the resolution of the level transmitter, the smallest delivery expected and the possibility of wave action in the tank triggering false deliveries.

Leading zeroes are required, i.e. 50 gallons must be entered as *050*.

Print Critical Alarm State and Setting (**41**): **{SOH} 41 *T* {^}**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints the critical alarm setting and state (low-low or high-high).

Enter Critical Alarm State (**42**): **{SOH}42*Ts*{^}**

T is the tank number (*1 to 4*).

s is the state of the critical alarm for that tank.

0 = low-low alarm.

1 = high-high alarm. (default)

Enter Critical Alarm Setting (**43**); **{SOH} 43 *T nnnnn* {^}**

T is the tank number (*1 to 4*).

nnnnn is the level to set the alarm (5 digits required).

Leading zeroes are required, i.e. 6000 gallons must be entered as *06000*. Default setting is 95% of tank capacity.

Print Theft Threshold (**44**): **{SOH} 44 *T* {^}**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints the level threshold set for a theft alarm for that tank.

Enter Theft Threshold (**45**): **{SOH} 45 *T nnn* {^}**

T is the tank number (*1 to 4*).

nnn is the number of gallons decrease in inventory level to set as the threshold for recognizing a theft from that tank (3 digits required). The number of gallons may range from *010 to 250* gallons. The threshold set should take into account the resolution of the level transmitter and the possibility of wave action in the tank triggering false theft alarms.

Leading zeroes are required, i.e. 50 gallons must be entered as *050*.

Print Alarm Actuation Delay (**46**): **{SOH} 46 {^}**

Prints the time delay set for recognizing repeated activations of the same alarm condition. This delay affects only the horn and alarm printouts. The default setting is 10 minutes.

Enter Alarm Actuation Delay (**47**): **{SOH} 47 *tt* {^}**

tt is the time delay set for recognizing repeated activations of the same alarm condition. This delay affects only the horn and alarm printouts. The default setting is *10* minutes. This setting is available in 1-minute increments.

00 = no delay.

01 to 10 = will delay the activation of the horn and alarm printouts for a repeat of an alarm until that alarm has been off for the specified time period. Relay activations are not affected by this command. If a delay is desired in relay activation after an alarm occurs, use RS-232 command #25, Program Relay Delay.

Print Relay Latch Status (**48**): **{SOH} 48 *N* {^}**

N is the number of the relay to print. This is relay *1* to relay *8*. If *0* is entered as the tank number, all tanks are printed.

Prints the status of the relay as a latching relay.

Enter Relay Latch Status (**49**): **{SOH} 49 *N s* {^}**

N is the number of the relay to program. This is relay *1* to relay *8*.

s is a number from *0 to 8*. If the relay is used as a latching relay, it may not be used for any other alarm function. If the latching state is disabled, the relay may be programmed as usual for any alarm conditions.

0 = Latch disabled. default
1 = Tank 1 fill.
2 = Tank 1 drain.
3 = Tank 2 fill.
4 = Tank 2 drain.
5 = Tank 3 fill.
6 = Tank 3 drain.
7 = Tank 4 fill.
8 = Tank 4 drain.

The latching relay will use the high and low alarm setpoints for that tank to determine when to activate and deactivate. The relay may still be programmed to be normally unenergized or normally energized. A relay programmed for fill will activate at the low-level alarm setpoint, and stay activated until the high-level alarm setpoint. A relay programmed for drain will activate at the high-level alarm setpoint, and stay activated until the low-level alarm setpoint.

The latching relay will be most useful in controlling pumps and motors. Each relay is rated at 5 Amps @120 VAC maximum load. If the load exceeds the relay rating, the relay may be interfaced to an external power relay rated for that load. The relay may be used to control A.C. or D.C. voltages as long as the maximum rating is not exceeded.

When a relay is programmed as a latching relay other alarm actuation conditions do not apply. Timed shutoff, delayed actuation and remote reset still apply. Previous programming is retained and will be used again if the latch state is set to disabled (condition *0*).

Enter Named Switch Alarms (**50**): **{SOH} 50 *N n* {^}**

N is the number of the switch input a name is being assigned. This is switch input *1* to switch input *8*.

n is a number from *0 to 9* that identifies the name. There are 8 pre-assigned names, and a fully custom name may also be assigned. The default assignment for all switch inputs is *n=0* (no name).

0 = none. Switch is only identified by number.
1 = sump.
2 = Piping.
3 = Containment.
4 = Interstitial.
5 = Leak.
6 = Reservoir.
7 = Well.
8 = Generator.
9 = custom name.

A custom name (up to 20 characters long) may be entered for any switch input from the RS-232 Port. See next RS-232 Port command, Enter Custom Switch Name for further information.

Enter Custom Switch Name (**51**): **{SOH} 51 *N xxx...xxx* {^}**

N is the number of the switch name buffer a custom name is being assigned to. This is switch name buffer *1* to switch name buffer *8*.

xxx...xxx is a custom name that can be up to 20 characters long. Once a name is assigned to the name buffer, it may be assigned to the switch input by using RS-232 command #50.

Enter Named Leak Alarms (**52**): **{SOH} 52 *N n* {^}**

N is the number of the leak input a name is being assigned. This is leak input *1* to leak input *8*.

n is a number from *0 to 4*, *or 9* that identifies the name. There are 4 pre-assigned names, and a fully custom name may also be assigned. The default assignment for all leak inputs is *n=0* (no name).

0 = none. Leak input is only identified by number.
1 = Sump.
2 = Piping.
3 = Containment.
4 = Interstitial.
9 = custom name.

A custom name (up to 20 characters long) may be entered for any leak input from the RS-232 Port. See next RS-232 Port command, Enter Custom Leak Name for further information.

Enter Custom Leak Name (**53**): **{SOH} 53 *N xxx...xxx* {^}**

N is the number of the leak name buffer a custom name is being assigned to. This is leak name buffer *1* to leak name buffer *8*.

xxx...xxx is a custom name that can be up to 20 characters long. Once a name is assigned to the name buffer, it may be assigned to the leak input by using RS-232 command #52.

Print Named Alarms (**54**): **{SOH} 54 {^}**

Prints the names assigned to all 8 switch inputs and all 8 leak inputs. If no name is assigned to an input, it will be designated by number only.

Enter Generator Switch Status (**55**): **{SOH} 55 *N s T* {^}**

N is the number of the switch input that is being designated as a Standby Generator Switch. This is switch input *1* to switch input *8*.

s is either *0 or 1*.
0 = normal switch input.
1 = Standby Generator switch input.

T is the tank number (*1 to 4*) to which the switch input is assigned.

When a switch input is assigned as a Standby Generator switch for a tank, it is only used for that purpose. When the input goes to an active state (as determined by the normally open or closed programming, RS-232 command #27, Program Switch State) no alarm is activated. Instead, a Generator On Report is printed. When the input deactivates, a Generator Run Report is printed.

The Generator Run Report lists the starting and ending times, dates, volumes and product heights as well as the amount of fuel used and the amount left in the tank (ullage).

The last 3 Generator Run Reports for each tank are stored for future reference. See RS-232 command #58, Print Generator Run History.

Print Alarm History (**56**): **{SOH} 56 {^}**

Prints the last 3 occurrences of each alarm. The system records the time and date of all High Level, Low Level, Critical Level, Theft, High Water, Switch Input, Hydrocarbon Leak, and Water Leak alarms.

Print Stored Inventory (**57**): **{SOH} 57 {^}**

Prints the last stored inventory report for each of the 3 automatic inventory printout times. See RS-232 command #05, Enter Automatic Inventory Print Time.

Print Generator Run History (**58**): **{SOH} 58 *T* {^}**

T is the tank number (*1 to 4*). If *0* is entered as the tank number, all tanks are printed.

Prints the last 3 Standby Generator Run Reports for the selected tank(s).

Enter RS-232 Port Mode (**59**): **{SOH} 59 *s* {^}**

s is a number from *0 to 2* that sets the operating mode for the RS-232 Port.

0 = local port, no echo. In this mode, the RS-232 Port operates independently of the printer. It may be accessed with a computer connected through a null modem cable.

1 = local port, with echo. In this mode, the RS-232 Port echoes all output directed to the printer. All alarm reports, inventory reports, and other printouts are echoed to the RS-232 Port. It may be accessed with a computer connected through a null modem cable or a printer with a standard RS-232 cable. RS-232 commands and their output do not echo to the printer.

2 = modem port. In this mode, modem autoanswer and originate functions are enabled. Automatic dialout to a phone number may be enabled for alarms and / or automatic inventory printouts. Regular printouts are not echoed to the RS-232 Port. The port will adapt its baud rate to the modem connection speed.

When RS-232 Port modes are switched, any programming for inactive modes is retained.

Enter Dialing Mode (**60**): **{SOH} 60 *s* {^}**

s is either *0 or 1* for the dialing mode for the RS-232 Port when in modem port mode.

0 = Tone dialing (Touch Tone).

1 = Pulse dialing.

Enter Alarm Dialout (**61**): **{SOH} 61 *s* {^}**

s is either *0 or 1* for automatic dialout of a stored phone number when an alarm occurs. Dialouts will be attempted every 10 minutes for 1 hour until a connection is made.

0 = alarm dialout disabled.

1 = alarm dialout enabled.

Enter Automatic Inventory Dialout (**62**): **{SOH} 62 *s* {^}**

s is a number from 0 to 3 that sets automatic dialout of a stored phone number when an automatic inventory printout occurs.

0 = alarm dialout disabled.

1 = automatic inventory dialout enabled for automatic inventory printout #1.

2 = automatic inventory dialout enabled for automatic inventory printout #2.

3 = automatic inventory dialout enabled for automatic inventory printout #3.

A minus sign before a number disables that condition.

Dialouts will be attempted every 10 minutes for I hour until a connection is made.

Enter Phone Number (**63**): **{SOH} 63 *xxx...xxx* {^}**

xxx...xxx is a phone number to use for alarm and inventory dialouts. This may be up to 20 characters long. If a delay is desired between digits of a phone number, a COMMA may be entered in the phone number string. Typically, this delay will be for 1 second (see your modem documentation). Any access codes, country codes, extensions and long distance codes should be part of the phone number string.

Print RS-232 Port Setup (**64**): **{SOH} 64 {^}**

Prints the setup for the RS-232 Port. The information printed is: Baud rate, parity, start bit, stop bit, word length, port operating mode, dialing type, autoanswer mode, phone number, alarm dialout mode and automatic inventory dialout mode.

Enter Custom Tank Name (**65**): **{SOH} 65 *NN xxx...xxx* {^}**

NN is the 2-digit number that represents the code that is being assigned to the custom product name. It must be either *60 or 61 or 62 or 63*.

xxx...xxx is a custom product name. Custom product names (up to 20 characters long) may be entered from the RS-232 port and assigned to product codes 60, 61, 62 and 63. These custom product names may then be assigned to tanks the same way as the built-in product names. See RS-232 command #15, Enter Product Code.

Enter Custom Site Header Line 1 (**66**): **{SOH} 66 *xxx...xxx* {^}**
Enter Custom Site Header Line 2 (**67**): **{SOH} 67 *xxx...xxx* (^)**
Enter Custom Site Header Line 3 (**68**): **{SOH} 68 *xxx...xxx* {^}**

Custom site header lines (up to 20 characters each) may be entered from the RS-232 Port. There can be up to 3 header lines. Any header lines not entered are left blank when printed. All printouts from both the RS-232 Port and the printer start with the custom site header lines.

Program Switch Alarm Printout (**69**): **{SOH} 69 *N s* {^}**

Allows enabling or disabling printer reports when an Aux / Switch alarm occurs. The enabling / disabling is done on a per switch basis.

N is the number of the switch that is being programmed. This is switch *1-8*.

s is the state of the printer when the switch alarm occurs.

0 = setting will enable a printout for the selected switch. (This is the default). If the AUTOMATIC ALARM DIALOUT feature (Keypad command #90, or RS-232 command #61) is enabled, the occurrence of a switch alarm will be transmitted over the RS-232 port.

1 = setting will disable a printout for the selected switch. The switch alarm occurrence will not be transmitted over the RS-232 port.

Section 6.6: Packed Data Format

Packed Data Dump (**99**): **{SOH} 99 {^}**

The data transmitted is sent in ASCII-coded format with the information in the following order: header, clock info, alarm statuses, relay statuses, horn status, volume measurements, product heights, checksum, and footer.

Header (3 bytes):

3 bytes ASCII consisting of 01H (SOH), 0DH and 0AH (new line). The header is not included in the checksum.

Clock Info (13 bytes):
Month (2 bytes) - 1 to 12, coded as 30H, 31H to 31H, 32H
Day (2 bytes) - 1 to 31, coded as 30H, 31H to 33H, 31H
Year (2 bytes) - 00 to 99, coded as 30H, 30H to 39H, 39H
Hours (2 bytes) - 00 to 23, coded as 30H, 30H to 32H, 33H
Minutes (2 bytes) - 00 to 59, coded as 30H, 30H to 35H, 39H
Seconds (2 bytes) - 00 to 59, coded as 30H, 30H to 35H, 39H
Weekday (1 byte) - 1 to 7, coded as 31H to 37H
(Sunday = 1)

Alarm Statuses (45 bytes):
Each byte is a 0, coded as 30H for OFF, or 1, coded as 31H for ON.
Bytes for non-active tanks or channels are always 0.
The bytes are in the following order:

1. Low alarms (1 to 4)	4 bytes
2, High (overfill) alarms (1 to 4)	4 bytes
3. Critical alarms (1 to 4)	4 bytes
4. High Water alarms (1 to 4)	4 bytes
5. Switch alarms (1 to 8)	8 bytes
6. Hydrocarbon Leak alarms (1 to 8)	8 bytes
7. Water Leak alarms (1 to 8)	8 bytes
8. Theft alarms (1 to 4)	4 bytes
9. Diagnostic Failure alarm	1 bytes

Relay Statuses (8 bytes):
Each byte is a 0, coded as 30H for OFF, or 1, coded as 31H for ON.
OFF designates an unenergized relay,
ON designates an energized relay.

1. Relays (1 to 8):	8 bytes

Horn Status (1 byte):
Byte is a 0, coded as 30H for OFF, or 1, coded as 31H for ON.

Measurements for the Tanks (32 bytes):

4 Volume measurements and 4 Height measurements are always sent.

Volume (4 bytes for each Tank) - volume is stored in gallons as a hex number 0000H to 0FFFFH (ranging from 0 to 65535 gallons), which is converted into 4 nibbles, which are sent as ASCII (9H is sent as 39H).

Inches (4 bytes for each Tank) - level is stored as inches times 100 (ranging from 0.00 inches to 655.35 inches). Data is sent the same way as with volume.

Checksum (4 bytes):

4 bytes ASCII. Each ASCII byte transmitted is added to a 16-bit accumulator with no overflow or carry or wraparound. The final sum is converted into 4 hex nibbles, which are converted into ASCII. The header (01H, 0DH, 0AH) and the footer (0DH, 0AH, 03H) are not included in the checksum.

Footer (3 bytes):

3 bytes ASCII consisting of 0DH, 0AH (new line) and 03H. The footer is not included in the checksum.

Section 7: Troubleshooting & Servicing

PNEUMERCATOR CO., INC.
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The Pneumercator LDE-740 system and all components are factory warranted for a period of 1 year from the date of shipment. No materials should be returned to the factory without first getting a Returned Materials Authorization number from Pneumercator. All materials returned should be marked with this R.M.A. number.

Because of the intrinsically safe operation of the system no field repairs other than fuse changing should be attempted. All repairs should be done only at the factory or at a factory authorized repair center.

SYMPTOM: Display blank and no lights are on.

ACTION: Make sure that 120 VAC power is connected to the power connection terminal block and that the power is turned on. With power off, check the fuse labeled 1/4 AMP SLOW BLOW to make sure that it is not blown. If the fuse is blown, replace only with a 1/4 Amp, 3AG Slo-Blo fuse. There should be +5 VDC open circuit (with no wires attached) between TB4 position 1 and position 3. If system still does not respond call factory for servicing.

SYMPTOM: Display flashes.

ACTION: Move the theft switch labeled S1 on the display circuit board to the NORMAL position.

SYMPTOM: System always displays the minimum or maximum gaugeable setting no matter how much product is in the tank.
SYMPTOM : System displays a negative reading or Error Code 9 (volume measurement under range).
SYMPTOM : System displays a reading greater than full capacity or Error Code 7 (volume measurement over range).

ACTION: Make sure that all wires are connected properly from the tank level transmitter to the tank input (TB2). Make sure that there are no shorted or open wires. Make sure that there is no water in a wire splice or in a transmitter housing. See the transmitter troubleshooting section. Make sure that the gauge calibrations are set properly (see keypad commands numbers 49 and 50).
If system still does not respond call factory for servicing.

SYMPTOM: Switch light is always on, or goes on when it shouldn't.

ACTION: Make sure that Switch is working properly and that the switch input is programmed for the proper state. Make sure that the switch has no current leakage in an open state.
If system still does not respond call factory for servicing.

SYMPTOM: Leak detection channel gives false water alarm.

LIGHT INDICATIONS

Dry	Water	Hydrocarbon	Meaning
off	on	off	water alarm

ACTION: Check to make sure that the sensor is in contact only with air. Make sure that the ground wire (marked B) and the sensor input wire (marked W) have continuity from the sensor to the alarm console. Make sure that the sensor input wire (marked W) is not shorted to power. Place system in Calibrate mode with the sensor in air. If sensor still does not work properly call factory for servicing.

SYMPTOM: Leak detection channel shows no lights.

LIGHT INDICATIONS

Dry	Water	Hydrocarbon	Meaning
off	off	off	no sensor attached

ACTION: This condition indicates that when the leak sensors were calibrated either no sensor was connected to that input or a defective or miswired sensor was connected to that input. If a new sensor is connected to the input, use the keypad or RS-232 command to calibrate the leak detection channels. If a leak input still shows no lights, the connected sensor is probably wired incorrectly or is defective.

SYMPTOM: Leak detection channel shows all 3 lights on.

LIGHT INDICATIONS

Dry	Water	Hydrocarbon	Meaning
on	on	on	sensor failure

ACTION: This condition indicates that when the leak sensor was calibrated it was working correctly and either has now failed, or the wiring has become defective. Use the keypad or RS-232 command to calibrate the leak detection channels. If that leak input now shows no lights, the connected sensor is probably wired incorrectly or is defective.

SYMPTOM: Leak detection channel gives false alarms.

ACTION: Check to make sure that the sensor is in contact only with air. Pull sensor from installation and make sure that it is not fouled or clogged. If sensor is fouled or clogged, clean with soap and water solution or a mild solvent and dry and unclog with compressed air. Place system in Calibrate mode with the sensor in air. Check all wiring for continuity, proper connections and make sure that there are no shorts. If sensor still does not work properly call factory for servicing.

When the sensor has been immersed in water it takes a period of time for the sensor to drain completely and dry. During this time the sensor will oscillate between water / hydrocarbon and hydrocarbon / air readings. This may cause the hydrocarbon or water alarm to latch into the system memory. This may be cleared when the sensor is dry and in air by calibrating the leak detection sensor.

Testing the Gauge

In order to verify that the gauge is properly reading the tank unit first shut off power to the gauge. Then disconnect the tank unit from the barrier block. A

potentiometer (variable resistor) of a value of about one thousand to ten thousand ohms (the exact value is not critical) should be connected to the barrier block. One end terminal of the potentiometer is connected to terminal R (Red), the other end terminal is connected to terminal B (Black), and the middle terminal of the potentiometer (the wiper) is connected to terminal W (White). The gauge should then be powered up again. The gauge readings will vary as the position of the potentiometer wiper is changed. At the extreme ends of the potentiometer's rotational angle the gauge readings may show a negative reading or a reading greater than the tank's capacity, but the potentiometer can be used to move the gauge readings over the full span of possible volumes.

*** The readings from the potentiometer should not be used to calibrate the gauge, or to judge the accuracy of the gauge, as the potentiometer is only an approximation of the tank unit, which is custom made and calibrated for the particular tank.

Testing the Tank Level Transmitter

In order to test the tank level transmitter, it must be disconnected from the gauge unit. Always shut off power to the gauge when connecting or disconnecting the tank units, the power cable, and any wires to the optional switches. With the tank unit disconnected from the gauge, use an ohmmeter to measure the resistance between the Red and the Black wires of the tank unit. The measurement should be 2000Ω on the 2-501 tank transmitter. The resistance of the 2-412 is 72.5Ω per inch of sensing length. If the readings are incorrect, they should be repeated where the tank unit is joined to the conduit wires. These readings should be made with the conduit wires disconnected from the tank unit. If the readings are now correct, then there is a problem with the conduit wires. Always make sure that the wires running through the conduit follow the proper color-coding. Incorrect readings will result if the color-coding is not followed.

2-412: With the float at the bottom and the top of travel, the reading between White to Black and White to Red respectively is 0Ω. The reading between the Black and White wires will increase as the float moves up, and will be a ratio of the percentage of float travel to overall sensing length.

Example: Sensing length = 80 inches.
Float travel = 20 inches.
Overall resistance = 5800Ω (Red to Black).
Answer: Black to White resistance = 1450Ω.
Red to White resistance = 4350Ω.

If the float has been removed from the tube of the 2-412, make sure that it is replaced facing in the same orientation. The magnet in the float will only work if it is facing in the correct orientation.

The interior of the 2-412 is hermetically sealed and no field repairs can be made on it. The 2-501 contains no parts that can be field repaired.

2-501: With the float arm at bottom of travel, Black to White is 0Ω. Black to Red is always 2000Ω. The Black to White reading will increase as the float moves up, and will be a ratio of the percentage of float arm travel to overall float arm travel. The Red to White resistance will vary from unit to unit, and should be measured with the float arm at the top of travel.

Example: Overall float arm travel = 80 inches.
Example float arm travel = 20 inches.
Overall resistance = 2000Ω.
Red to White (at top of travel) = 280Ω (measured).
Black to White span = 1720Ω (calculated).

Answer Black to White resistance = 430Ω.
Red to White resistance = 1290Ω.

Make sure that all splices are contained in waterproof junction boxes or are potted or sealed to be waterproof. Part number 10585-3 is an available wiring waterproofing kit. Make sure that no water can enter the housing of the 2-412 tank unit.

Figure 9 - 2-412 Installation

STEPS FOR A TROUBLE FREE INSTALLATION

STEP 1 - EXAMINE THE SHIPMENT

1.1 Each system consists of two main components, which are packed separately, the transmitter float assembly and the indicator unit. Make sure you have both parts. If cartons are missing or damaged, have the fact noted on the delivery receipts to permit a claim to be filed against the transportation company.

1.2 Match the transmitter float assembly Serial No. with the Serial No. on indicating unit to insure compatibility.

1.3 The transmitter float assembly should be checked for damage, which may have occurred during shipping. The float switch should move freely from the bottom stop to the top stop on the rod. If the float can be rotated on the rod, then the float guides have been damaged. If any problems arise, contact the factory.

DO NOT ATTEMPT TO INSTALL DAMAGED UNITS.

STEP 2 - MAKE SURE THE SYSTEM MATCHES YOUR JOB

2.1 Compare the actual tank dimensions and capacity with the tank dimensions and capacity on the packing slip and the transmitter mounting tag to insure compatibility.

2.2 Standard construction is suitable for most petroleum products.

2.3 For potentially corrosive liquids, verify the liquid's compatibility with stainless steel and Teflon. When the unit is supplied with a water switch, verify the compatibility of the liquid with nitrophyl.

2.4 Verify that the tank is set level. To obtain accurate readings from a tilted tank, the indicator must be ordered with a special calibration.

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Figure 9 - 2-412 Installation (Continued)

STEP 3 - SELECT THE CORRECT LOCATION FOR THE INSTALLATION OF THE TRANSMITTER FLOAT ASSEMBLY

3.1 The transmitter float assembly should be installed through a 4” NPT half coupling in the top of the tank as shown in figure 9-1. It is recommended that a strike plate be situated directly below the coupling. If the unit is to be standpipe mounted, it should have been ordered for the special mounting height (*) and installed as shown in figure 9-2.

3.2 When the tank is indoors, sufficient clearance must be provided between tank and ceiling to permit installation and removal of the transmitter float assembly.

3.3 When the tank is underground, a suitable chamber and cover should be provided to permit installation and removal of the transmitter float assembly should it ever be required. This is especially important when the tank is to be covered with pavement or concrete. Do not bury tank unit.

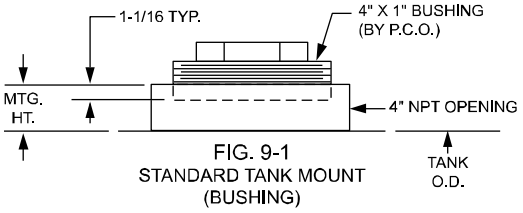

FIG. 9-1
STANDARD TANK MOUNT
(BUSHING)

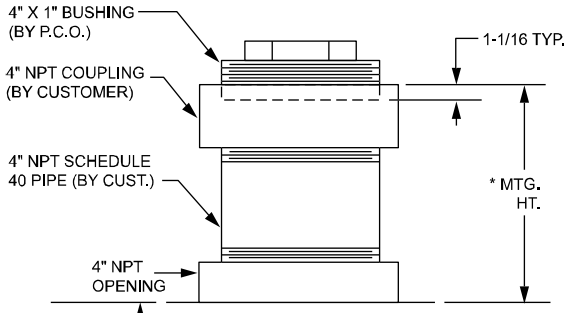

FIG. 9-2
STANDPIPE MOUNT
(BUSHING)

STEP 4 - INSTALL WITH CARE

4.1 Screw the mounting bushing 1-1/16” into the proper opening in the top of the tank (see figure 9-1). There should be a clearance of at least 2.0" between the bottom of the probe and the bottom of the tank (see figure 9-3).

4.2 When using a standpipe, screw the mounting bushing 1-1/16” into the 4” NPT coupling on top of the standpipe (see figure 9-2). There should be a clearance of at least 2.0” between the bottom of the probe and the bottom of the tank (see figure 9-3).

FIG. 9-3

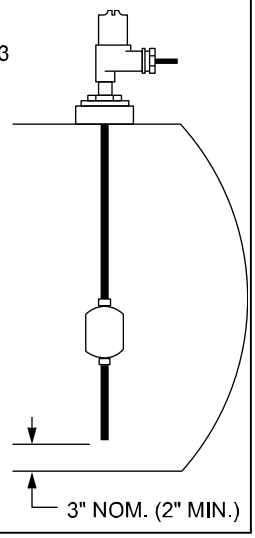

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Figure 10 - 2-501 Installation

STEPS FOR A TROUBLE FREE INSTALLATION

1. Examine the shipment
2. Make sure the system matches your job
3. Select the correct location for the transmitter
4. Install the transmitter float assembly with care

STEP 1 - EXAMINE THE SHIPMENT

1.1 The system consists of two components, which are packed separately, the transmitter and the indicator. Make sure you have both parts. If cartons are missing or damaged note the delivery receipts to permit a claim to be filed against the transportation company.

DO NOT ATTEMPT TO INSTALL DAMAGED UNITS.

1.2 Match the serial no.'s on the transmitter and indicator to insure compatibility.

STEP 2 - MAKE SURE THE SYSTEM MATCHES YOUR JOB

2.1 Compare the dimensions and capacity on the packing slip with the tank drawing to insure compatibility.
2.2 Check that the tank is vented to atmosphere unless the order shows the system was designed for a pressurized tank.
2.3 Verify that the tank contents will not corrode the unit's wetted parts (Alum., Brass, Buna-N, nylon, 303 Stainless). Standard construction is suitable for most petroleum products.
2.4 Verify that the tank is set level. (Tilted tanks require special calibration.)

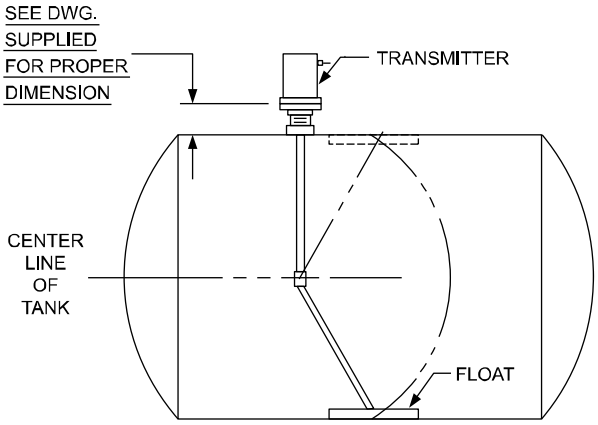

FIG 10-1

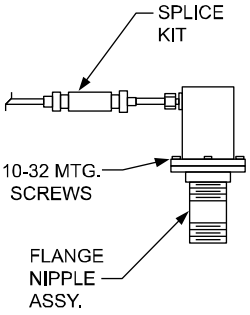

FIG 10-1A

NOTE: THE FLOAT ARM SHOULD SWING UPWARDS TOWARDS THE CONNECTOR ON THE HOUSING.

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Figure 10 - 2-501 Installation (Continued)

STEP 3 - SELECT THE CORRECT LOCATION FOR THE TRANSMITTER

3.1 Standard installation requires a 2" half coupling in the top of the tank. The fulcrum pipe will then reach the mid-point of tank as required for accurate measurement If the transmitter is to be installed through a manway or a riser, it must be ordered with an extra long fulcrum pipe. THERE IS NO WAY TO ADJUST THE SYSTEM FOR ACCURATE GAUGING IF THE PIVOT LEVER IS NOT CORRECTLY POSITIONED. (See Figure 10-1 & 10-2)

3.2 The float arm must swing in an arc along the axis of the tank without hitting the end of the tank or other obstructions and not extend under manways or fill lines.

3.3 When tank is indoors, sufficient clearance must be provided to permit installation of the fulcrum pipe, which is approximately one-half the tank diameter plus 11 inches.

3.4 When the tank is underground or covered by pavement, a chamber should be provided to permit access to the transmitter. Covers to access chambers should provide clearance for installation and removal of the fulcrum pipe. (See 3.3 above).

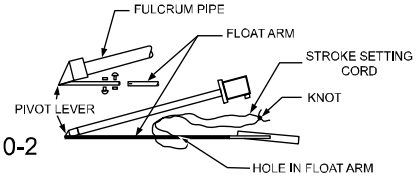

Fig. 10-2

Fig. 10-2A

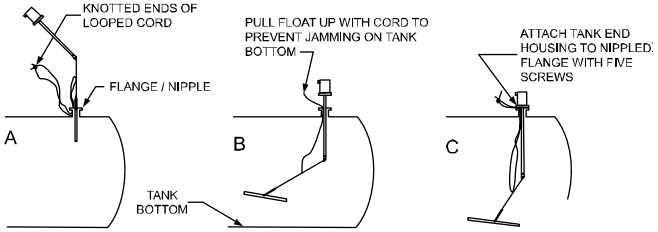

Fig. 10-3

STEP 4 - INSTALL THE TRANSMITTER WITH CARE

4.1 The transmitter should be installed when the tank is empty. Although it is possible to install when the liquid is below the tank mid-point, there is no way to verify factory settings and adjustments.

4.2 The flange / nipple has been pre-removed to protect the float arm assembly during installation. DO NOT re-attach until after the float arm assembly is in the tank.

4.3 Screw the flange / nipple into the proper tank opening. Align flange so float will rise and fall along the centerline of tank when transmitter assembly is installed. (Flange must be level). *Position gasket on flange using a suitable sealing compound on both sides.

NOTE: THE DIMENSION BETWEEN THE TANK TOP AND TOP OF THE FLANGE (SEE ATTACHED TAG) MUST BE EXACT FOR THE PIVOT TO REACH THE MIDPOINT OF THE TANK AS REQUIRED FOR ACCURATE GAUGING.

4.4 Attach the float am to the pivot lever using the two bolts furnished. Insert the stroke setting cord through hole in float arm, then through hole in the nipple and knot ends together. (NOTE: MUST BE RE-INSTALLED UPON COMPLETION OF INSTALLATION.) (See Figures. 10-2 & 10-2A)

4.5 Insert the transmitter float assembly through the flange / nipple. (See Figure 10-3.) Note: the direction of float travel is toward the cable in the transmitter housing. DO NOT LET FLOAT ARM SWING BACKWARDS DURING INSTALLATION!

4.6 Attach the transmitter float assembly to the flange / nipple using the screws from 4.2. Tighten all five screws evenly to assure a tight seal. (See Fig. 10-1A).

4.7 Raise and lower the float arm with the stroke setting cord. Make certain that the float and arm move freely (DO NOT FORCE) from bottom to top of the tank unobstructed.

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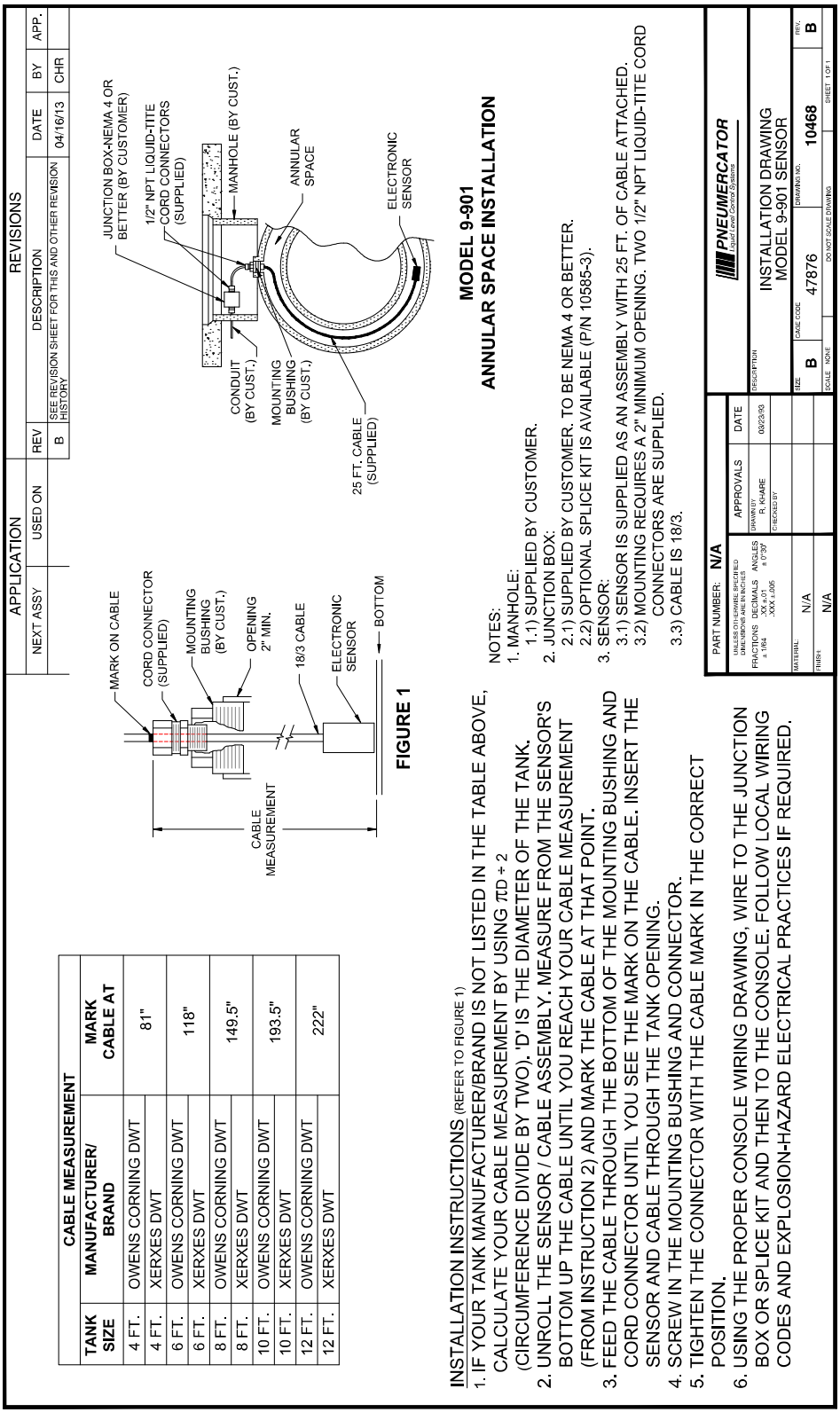
Figure11 - 9-901 Installation



CABLE MEASUREMENT		
TANK SIZE	MANUFACTURER/ BRAND	MARK CABLE AT
4 FT.	OWENS CORNING DWT	81"
4 FT.	XERXES DWT	
6 FT.	OWENS CORNING DWT	118"
6 FT.	XERXES DWT	
8 FT.	OWENS CORNING DWT	149.5"
8 FT.	XERXES DWT	
10 FT.	OWENS CORNING DWT	193.5"
10 FT.	XERXES DWT	
12 FT.	OWENS CORNING DWT	222"
12 FT.	XERXES DWT	

INSTALLATION INSTRUCTIONS (REFER TO FIGURE 1)

1. IF YOUR TANK MANUFACTURER/BRAND IS NOT LISTED IN THE TABLE ABOVE, CALCULATE YOUR CABLE MEASUREMENT BY USING $\pi D \div 2$ (CIRCUMFERENCE DIVIDE BY TWO). "D" IS THE DIAMETER OF THE TANK.
2. UNROLL THE SENSOR / CABLE ASSEMBLY. MEASURE FROM THE SENSOR'S BOTTOM UP THE CABLE UNTIL YOU REACH YOUR CABLE MEASUREMENT (FROM INSTRUCTION 2) AND MARK THE CABLE AT THAT POINT.
3. FEED THE CABLE THROUGH THE BOTTOM OF THE MOUNTING BUSHING AND CORD CONNECTOR UNTIL YOU SEE THE MARK ON THE CABLE. INSERT THE SENSOR AND CABLE THROUGH THE TANK OPENING.
4. SCREW IN THE MOUNTING BUSHING AND CONNECTOR.
5. TIGHTEN THE CONNECTOR WITH THE CABLE MARK IN THE CORRECT POSITION.
6. USING THE PROPER CONSOLE WIRING DRAWING, WIRE TO THE JUNCTION BOX OR SPLICE KIT AND THEN TO THE CONSOLE. FOLLOW LOCAL WIRING CODES AND EXPLOSION-HAZARD ELECTRICAL PRACTICES IF REQUIRED.

NOTES:

1. MANHOLE:
   1.1) SUPPLIED BY CUSTOMER.
2. JUNCTION BOX:
   2.1) SUPPLIED BY CUSTOMER. TO BE NEMA 4 OR BETTER.
   2.2) OPTIONAL SPLICE KIT IS AVAILABLE (P/N 10585-3).
3. SENSOR:
   3.1) SENSOR IS SUPPLIED AS AN ASSEMBLY WITH 25 FT. OF CABLE ATTACHED.
   3.2) MOUNTING REQUIRES A 2" MINIMUM OPENING. TWO 1/2" NPT LIQUID-TITE CORD CONNECTORS ARE SUPPLIED.
   3.3) CABLE IS 18/3.

Figure 12 - 9-902 Installation

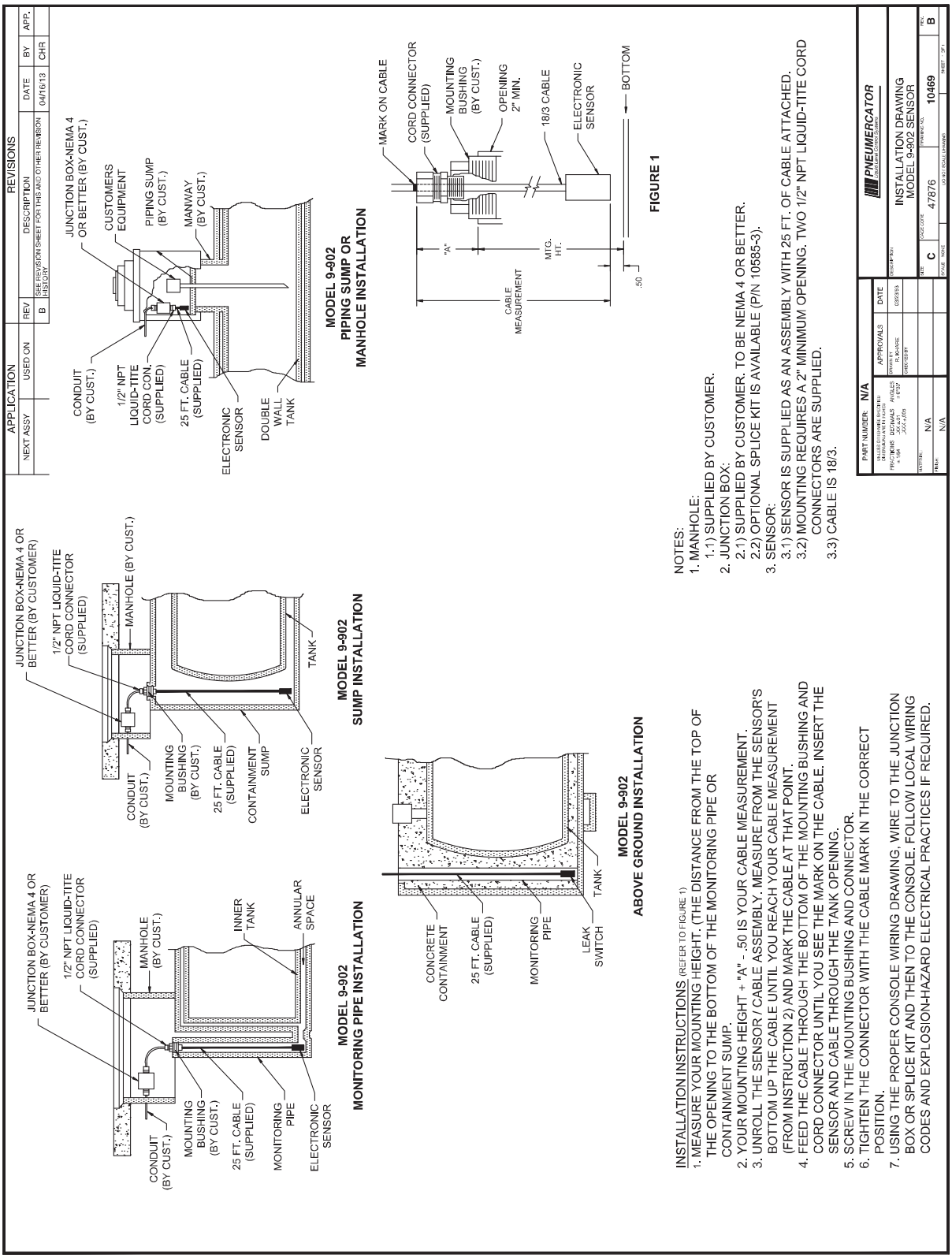


Figure 13 - 9-903 Installation

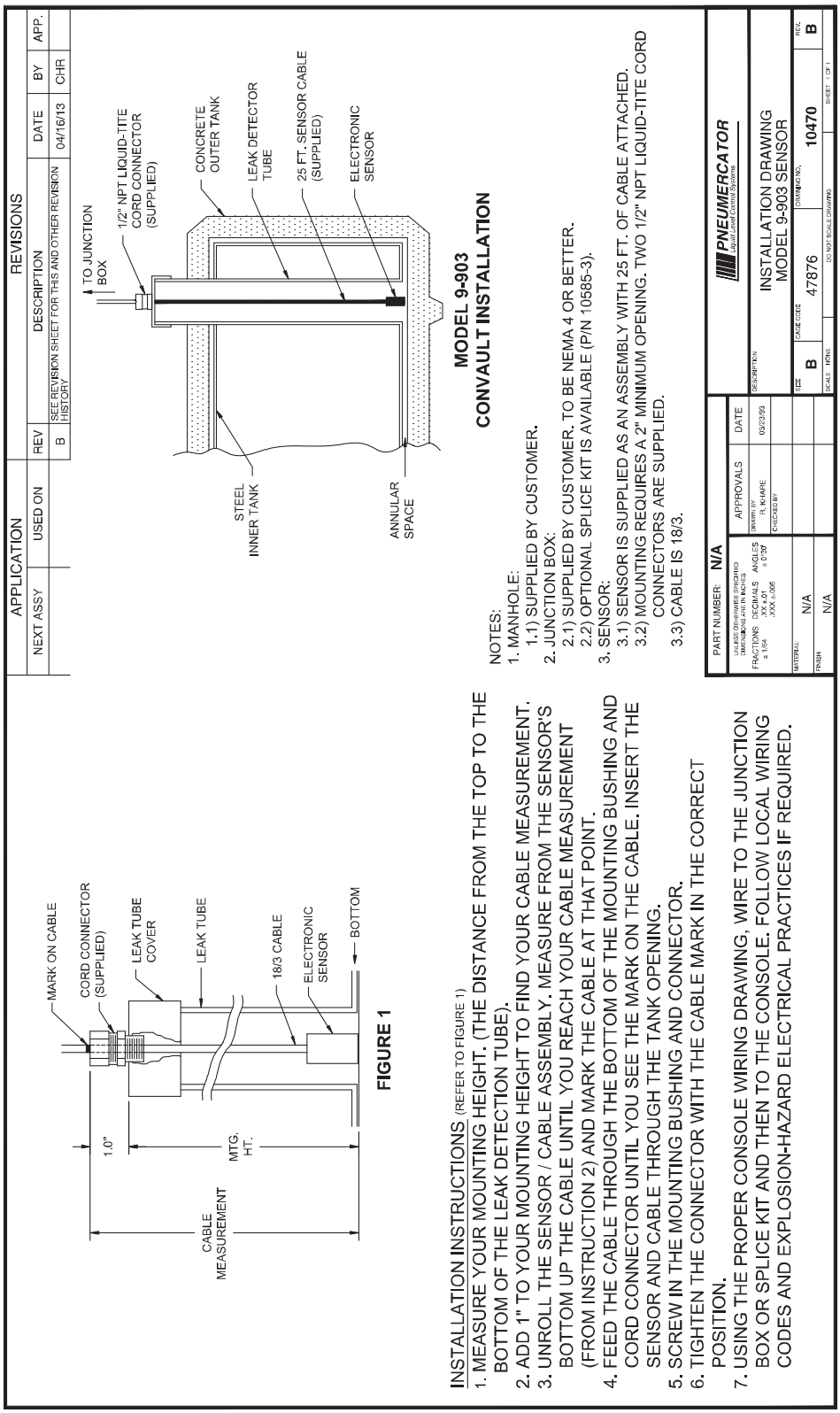


Figure 14 - Main Circuit Board Layout

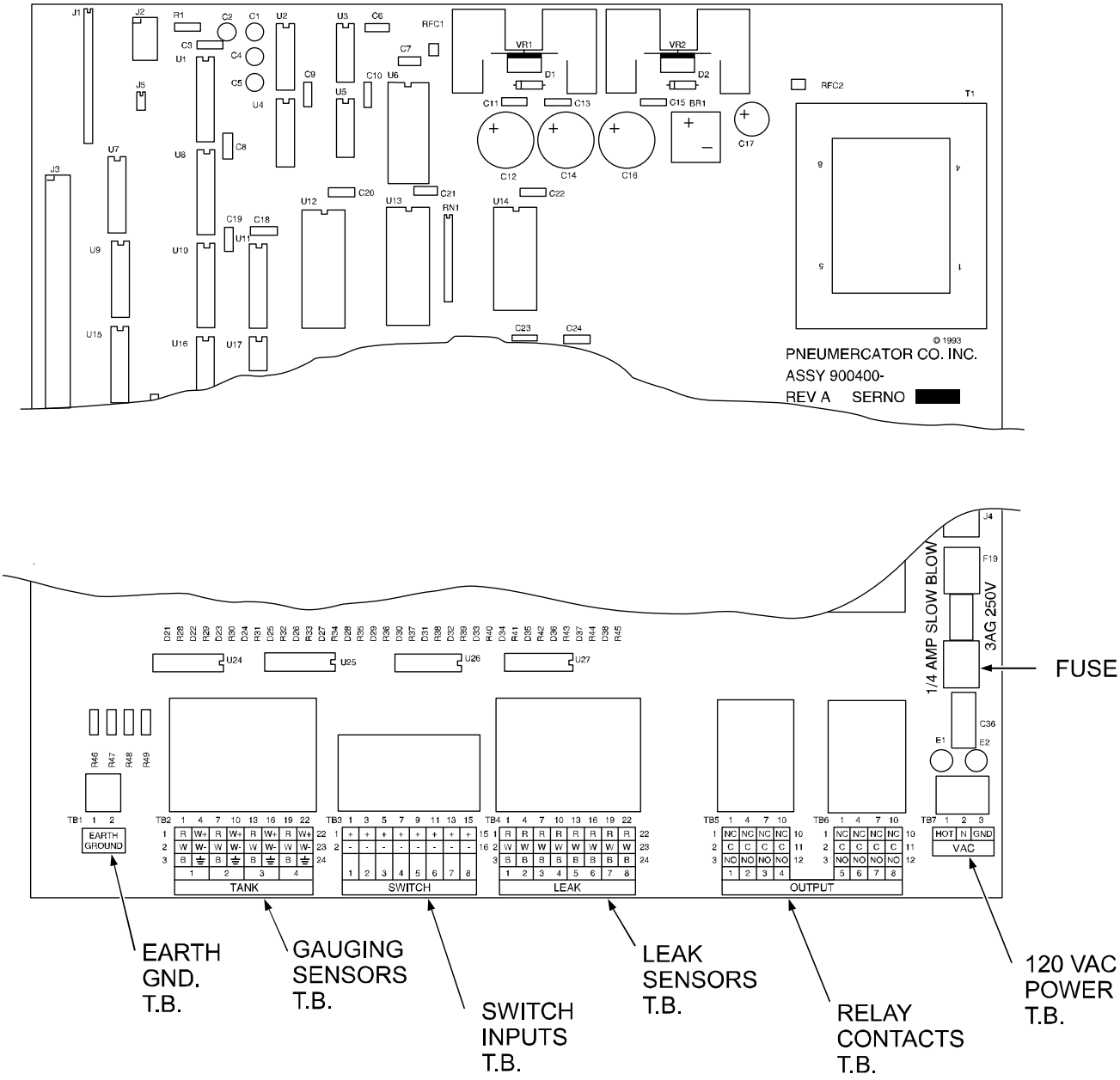


Figure 15 - Display Circuit Board Layout

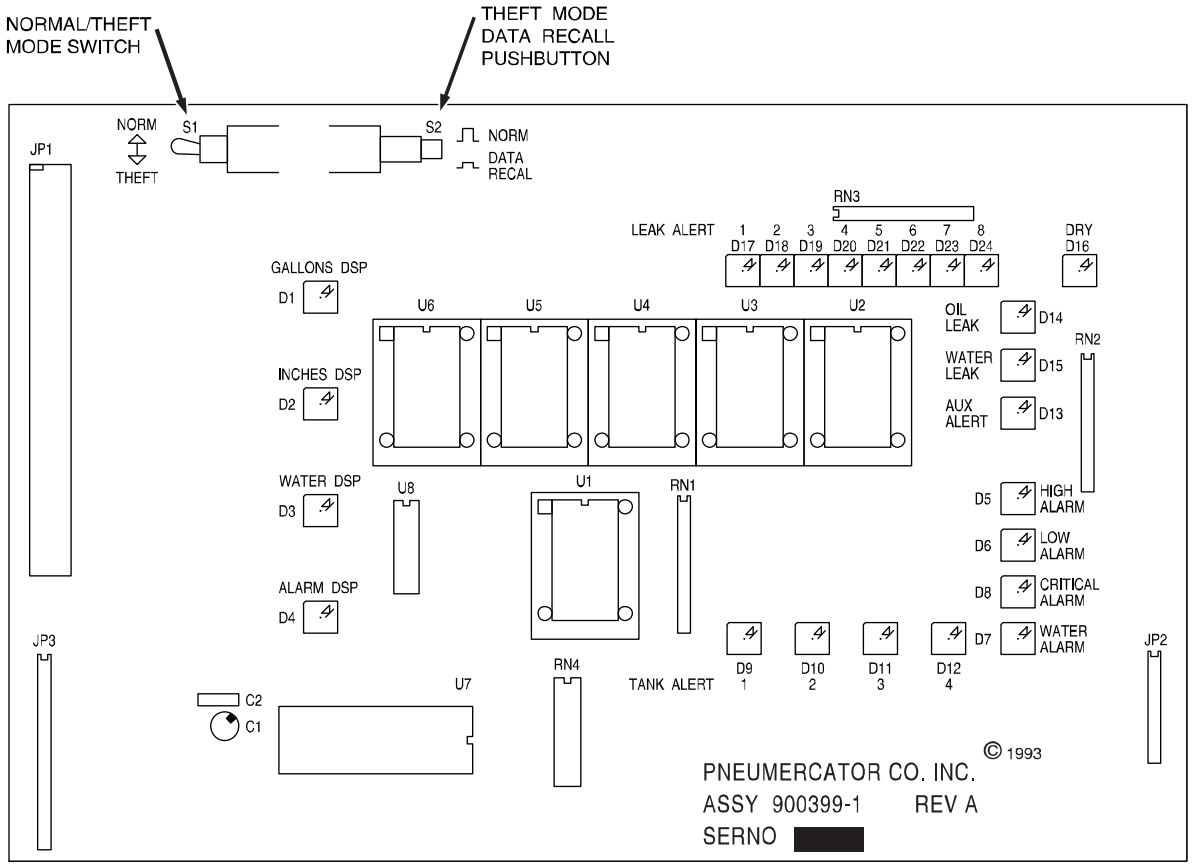


Figure 16 – System Wiring Diagram

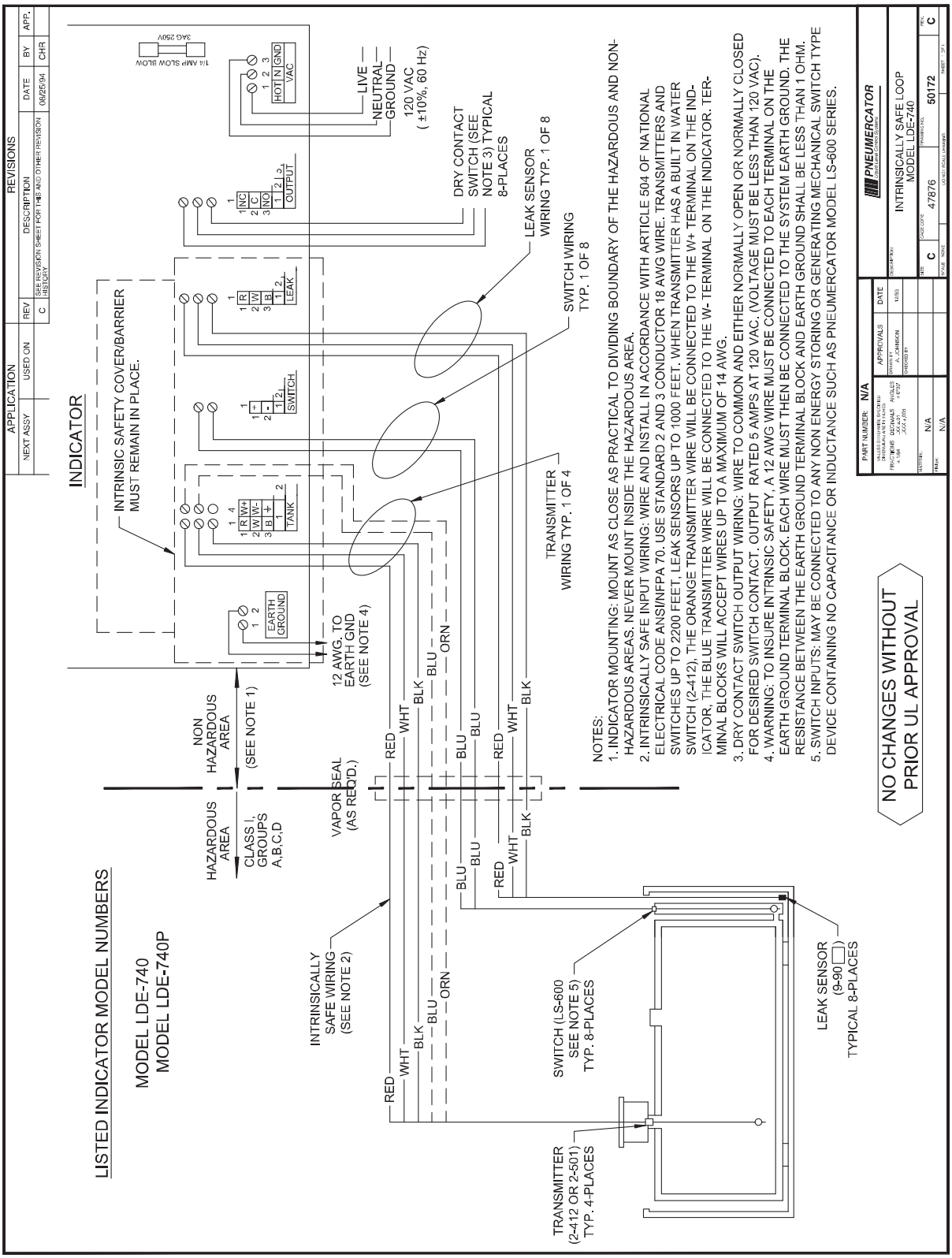
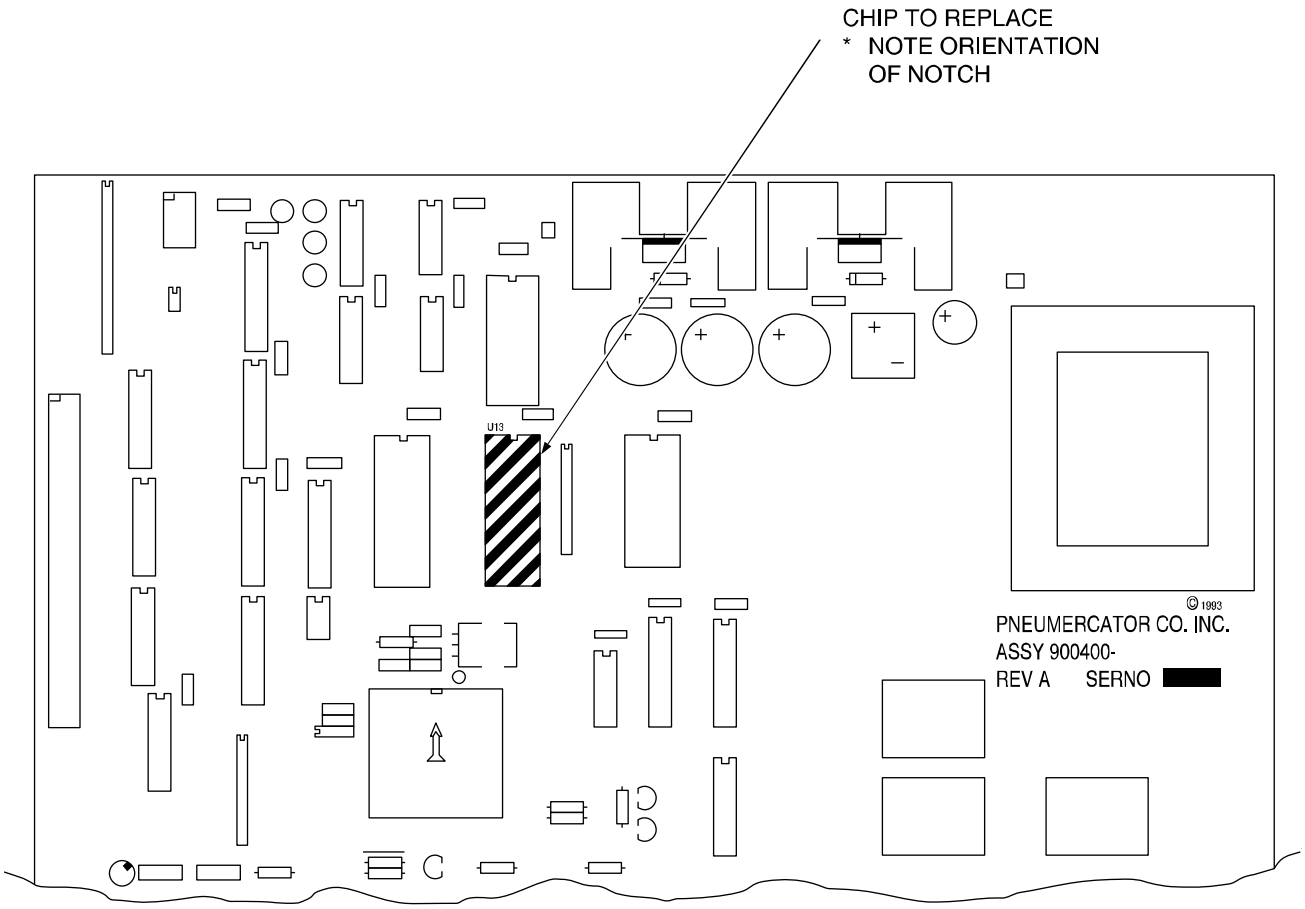


Figure 17 - Program Chip Replacement



NOTES:
1. POWER MUST BE OFF FOR THIS PROCEDURE.
2. NOTCH ON CHIP MUST BE ORIENTED PROPERLY.
3. CHIP PULLER SHOULD BE USED.
4. ANY DAMAGE TO THE UNIT FROM THIS PROCEDURE IS NOT THE RESPONSIBILITY OF PNEUMERCATOR CO.

Figure 18 - Printer Paper and Ribbon Replacement

a) Set the inked ribbon spools as Figure 18-1 shows. Place the spools onto the ribbon feed mechanism and then push downward until it stops with a click.

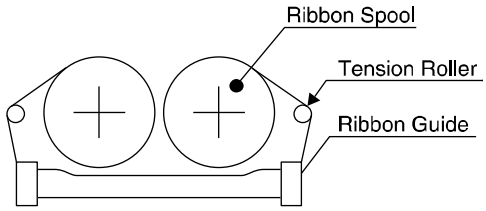


Fig. 18-1 - Ribbon Path

Do not force the spools onto the shafts.

Turn a spool and wind the ribbon to eliminate loosing. Also, make a few turns to check if there is irregular tension.

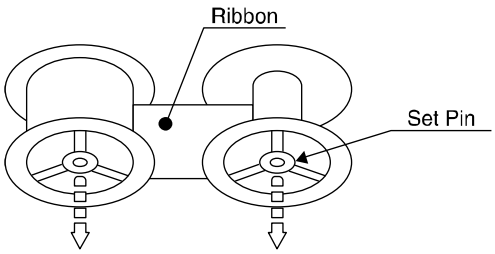


Fig. 18-2

b) For removal, pull up both spools and take off the inked ribbon from the ribbon path.

PAPER LOADING / UNLOADING

a) Before inserting, fold the paper end aslant as Figure 18-3 shows and advance the paper

It is suggested to print on the outer side of tape. See Figure 18-4.

Be careful not to operate without paper.

b) For removal, pull it out from either the inlet or the outlet.

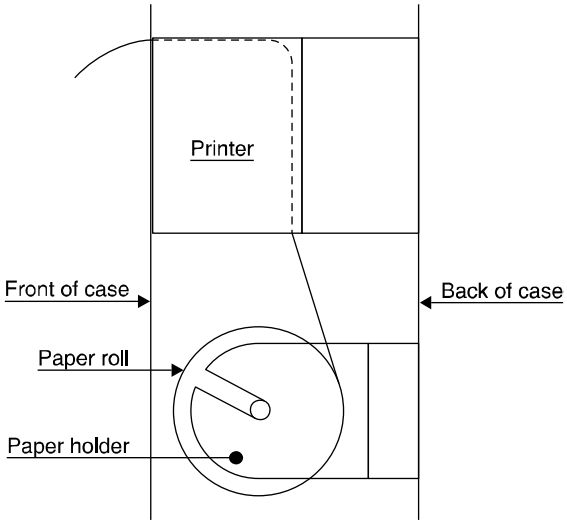
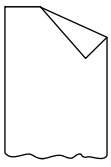


Fig. 18-4

Fig. 18-3



PRINTER PAPER (PCO P/N 183600-1) – ADDING MACHINE PAPER ROLL 2.25" WIDE

PRINTER RIBBON (PCO P/N 183500-1) - 13MM X 6MM 35MM DIA. SPOOL

Figure 19 - LS600 LD Installation

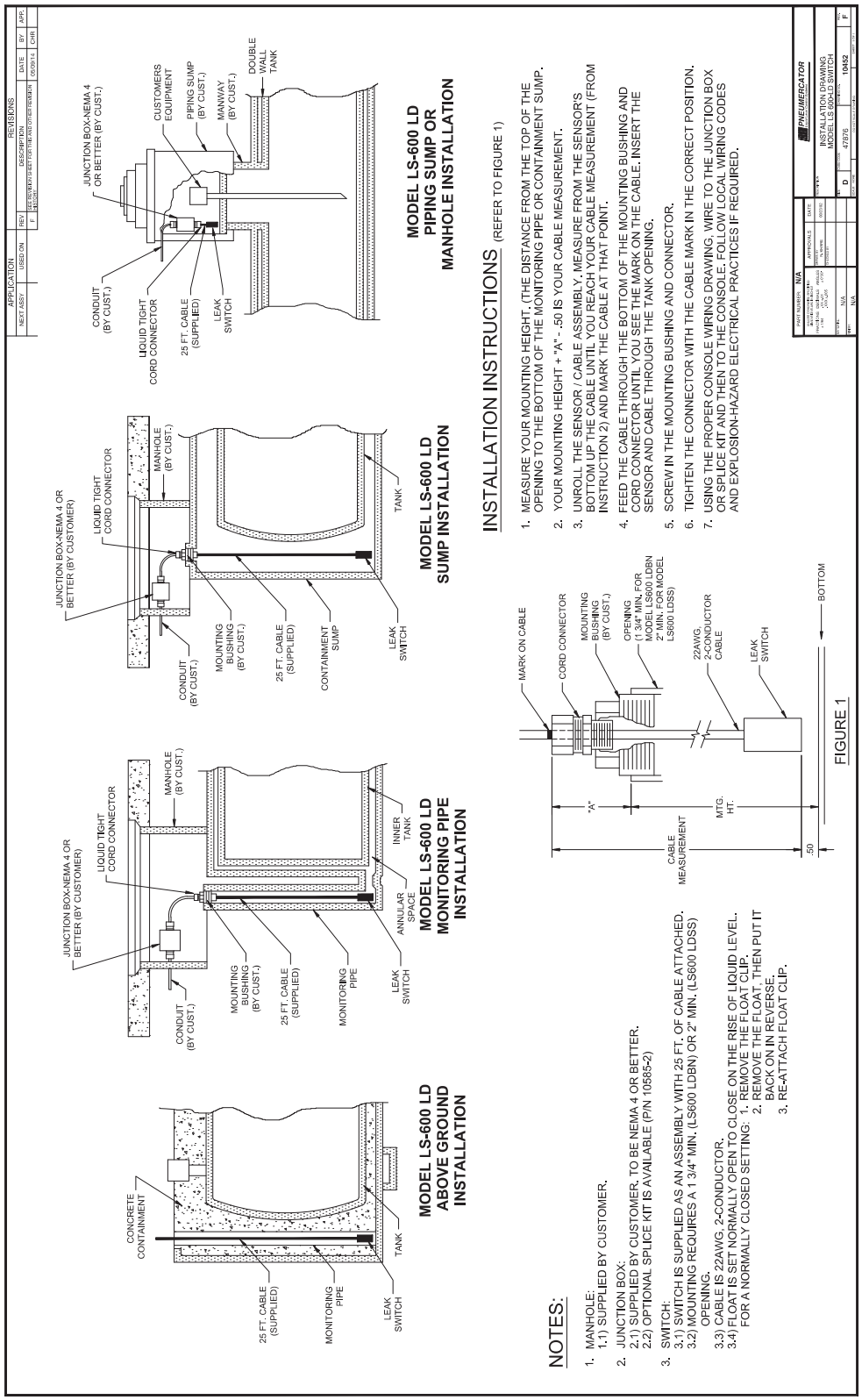


Figure 20 - RSU-800 Installation

DESCRIPTION:

The Reservoir Sensing Unit MODEL RSU 800 is designed for Hydrostatic Monitoring of Double Wall Fiberglass Tanks. It is installed in the reservoir chamber at the top of the tank and monitors the fluid level therein. The chamber between walls of the tank is filled with a brine solution until the reservoir is half full.

The MODEL RSU 800 has dual floats that sense a High or Low Liquid Level within the chamber. If a leak occurs through either wall of the tank, the liquid level in the reservoir changes. When it reaches the upper or lower limits of the unit, an alarm sounds at the monitor.

INSTALLATION:

The sensing unit is mounted in the reservoir. A four (4) inch riser or standpipe (not supplied) is prepared to accept a 3/8 N.P.T. fitting (part no. 278113-1) and a cable strain relief (part no. 278112-1) (supplied). Install fittings and apply sealing compound where required. The standpipe is then threaded into the top of the reservoir using the four (4) inch N.P.T. threads. The 16-foot cable from the sensing unit is then routed out of the standpipe through the fitting and strain relief bushing to an acceptable electrical junction box (not supplied). Adjust the sensor depth, and tighten the strain relief bushing collar to clamp the cable.

WIRING:

The reservoir sensing unit is wired differently for various control panels. Figures 3 through 6 show wiring connections.

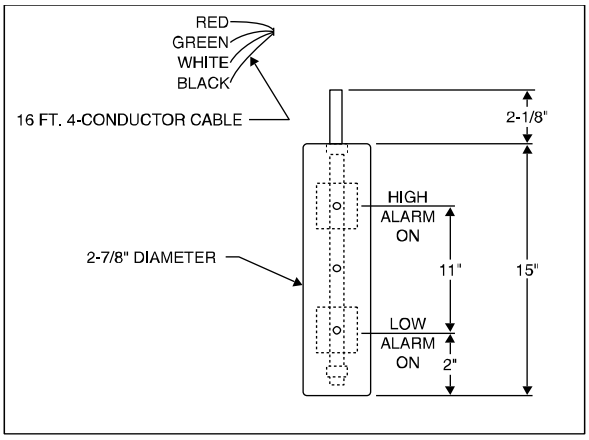


FIGURE 20-1

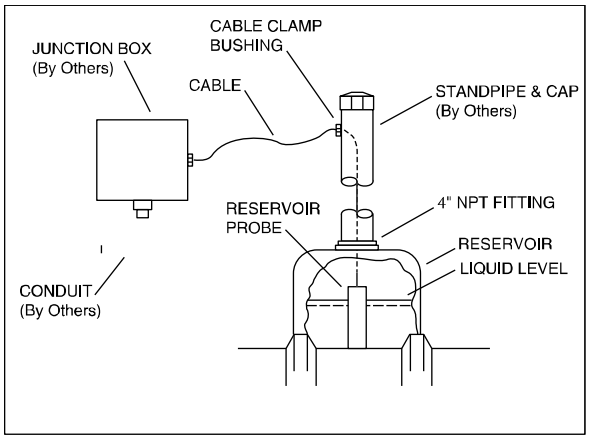


FIGURE 20-2

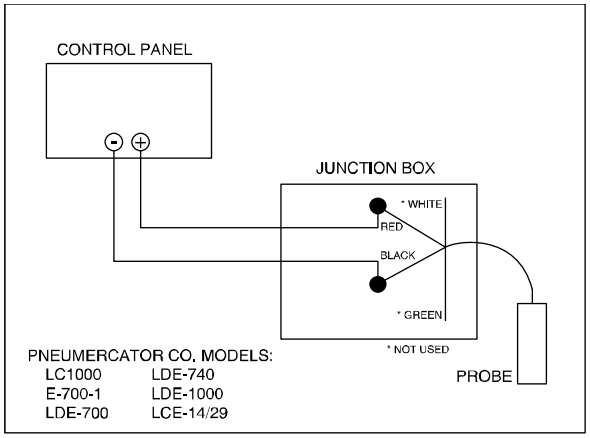


FIGURE 20-3

Figure 20 - RSU-800 Installation (continued)

All conduit and electrical junction boxes must be water-tight. Ensure that wiring meets all local, state and national codes.

TESTING:

Test the sensing unit prior to installation.

Periodically test to ensure proper operation by performing the following steps.

1. Remove the sensing unit from the reservoir. This should activate alarm (due to the float dropping), indicating a Low Liquid Level.

2. Place the sensing unit in a vessel having approximately five (5) inches of water; reset any alarms on the control panel. The system should now be in a normal condition.

3. Add water until the sensing unit activates the alarm (due to the float rising), indicating a High Liquid Level.

4. Remove the sensing unit from the test vessel and return it to the reservoir on the tank. Follow the installation procedures.

NOTE:

In normal operation, the reservoir level fluctuates only due to temperature and barometric pressure changes. The alarm should not trip due to these normal fluctuations.

Only a breach in either tank wall would cause a fluctuation in liquid level great enough to trigger the alarm.

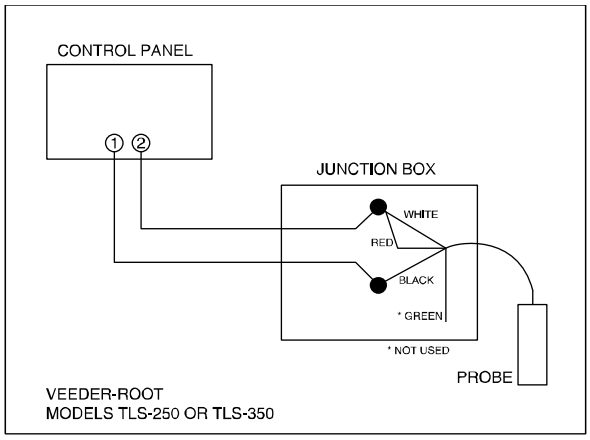


FIGURE 20-4

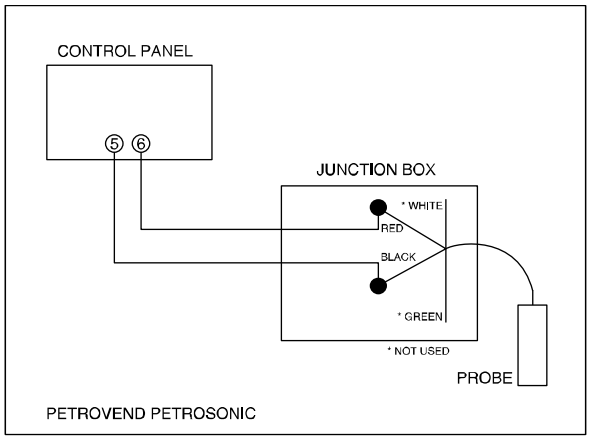


FIGURE 20-5

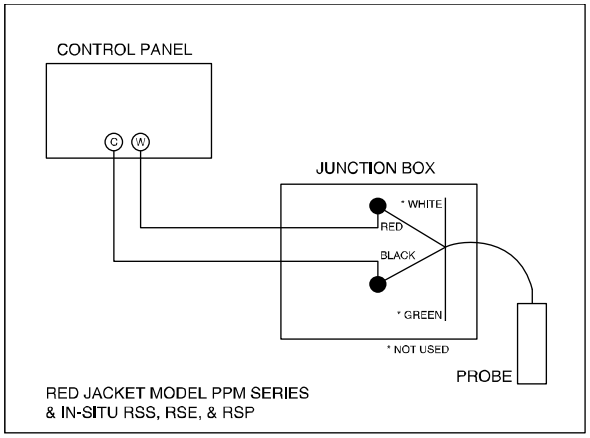


FIGURE 20-6

Appendix A

Keypad Error Codes:

0 – Print Buffer Overflow
1 – Unimplemented Command
2 – Clock has Lost Time (battery failure)
3 – Range Error
4 – RAM (memory) Error
5 – Keypad Buffer Overflow
6 – Syntax Error
7 – Probe (Volume) Measurement Over range
8 – Cold Reset
9 – Probe (Volume) Measurement Under range
10 – Clock Timeout (box in lower part of display)

*** To cancel the display of an error code, press any key on the keypad.

Appendix B

*** The relay listed for the alarm condition is the factory default. Relay programming may be changed by keypad or RS-232 command. A check mark (✓) under the Horn heading indicates that the factory default is that the alarm condition actuates the horn. Horn programming may be changed by keypad or RS-232 command.

Code	Condition	Relay	Horn
01	Low Alarm Tank 1	5	✓
02	Low Alarm Tank 2	5	✓
03	Low Alarm Tank 3	5	✓
04	Low Alarm Tank 4	5	✓
05	High Alarm Tank 1	1	✓
06	High Alarm Tank 2	2	✓
07	High Alarm Tank 3	3	✓
08	High Alarm Tank 4	4	✓
09	Critical Alarm Tank 1	8	✓
10	Critical Alarm Tank 2	8	✓
11	Critical Alarm Tank 3	8	✓
12	Critical Alarm Tank 4	8	✓
13	High Water Tank 1	8	✓
14	High Water Tank 2	8	✓
15	High Water Tank 3	8	✓
16	High Water Tank 4	8	✓
17	Aux / Switch 1 Actuation	6	✓
18	Aux / Switch 2 Actuation	6	✓
19	Aux / Switch 3 Actuation	6	✓
20	Aux / Switch 4 Actuation	6	✓
21	Aux / Switch 5 Actuation	6	✓
22	Aux / Switch 6 Actuation	6	✓
23	Aux / Switch 7 Actuation	6	✓
24	Aux / Switch 8 Actuation	6	✓
25	Oil Leak Channel 1	7	✓
26	Oil Leak Channel 2	7	✓
27	Oil Leak Channel 3	7	✓
28	Oil Leak Channel 4	7	✓
29	Oil Leak Channel 5	7	✓
30	Oil Leak Channel 6	7	✓
31	Oil Leak Channel 7	7	✓
32	Oil Leak Channel 8	7	✓

Code	Condition	Relay	Horn
33	Water Leak Channel 1	8	
34	Water Leak Channel 2	8	
35	Water Leak Channel 3	8	
36	Water Leak Channel 4	8	
37	Water Leak Channel 5	8	
38	Water Leak Channel 6	8	
39	Water Leak Channel 7	8	
40	Water Leak Channel 8	8	
41	Theft Tank 1	8	
42	Theft Tank 2	8	
43	Theft Tank 3	8	
44	Theft Tank 4	8	
45	Diagnostic Failure	8	

Appendix C

Product Code	Product Name
00	Product
01	#2 Oil
02	#3 Oil
03	#4 Oil
04	#5 Oil
05	#6 Oil
06	Fuel Oil
07	Heating Oil
08	Diesel
09	Kerosene
10	Motor Oil
11	Waste Oil
12	Hydraulic Oil
13	Cutting Oil
14	Quench Oil
15	Mineral Spirits
16	Steering Fluid
17	Transmission Oil
18	ATF
19	Gasoline
20	Unleaded
21	Unleaded Gasoline
22	Unleaded Regular
23	Regular Unleaded
24	Unleaded Premium
25	Premium Unleaded
26	Unleaded Super
27	Super Unleaded
28	Leaded Gasoline
29	Leaded Regular
30	Leaded Premium
31	Leaded Super
32	Regular
33	Premium
34	Super
35	Gasohol
36	Methanol
37	Methanol Blend
38	Ethanol
39	Alcohol
40	Antifreeze
41	Glycol
42	Acetone
43	Toluene
44	MEK
45	Solvent

Product Code	Product Name
46	Waste Product
47	Used Oil
48	Waste Water
49	Water
50	AV Gas
51	Jet Fuel
52	Jet A
53	JP-4
54	JP-5
55	JP-6
56	JP-8
57	JP-10
58	Rocket Fuel
59	Special

* Codes 60, 61, 62, 63 are for custom names

Appendix D

RS-232 Connector Pinouts:

DB-25 Connector pin	Signal	Direction
1	Protective Ground	----------
2	TxD	to modem
3	RxD	to gauge
4	RTS	to modem
5	CTS	to gauge
6	DSR	to gauge
7	Signal Ground	----------
8	DCD	to gauge
20	DTR	to modem
22	RING	to gauge

NOTE: DTR is actively pulled to a true state. If DTR is not used, it may be left unconnected. DSR, DCD and RING are ignored by the LDE-740.

RTS / CTS are used as hardware handshaking signals.

TxD	Transmitted data
RxD	Received data
RTS	Request to Send
CTS	Clear to Send
DTR	Data Terminal Ready
DSR	Data Set Ready
DCD	Data Carrier Detected
RING	Ring Indicator

Null modem cables at a minimum will cross wires for TxD / RxD and RTS / CTS. Some communications software will require also crossing the DTR wire to the DSR and / or the DCD wire(s). RING may also have to be terminated. See your communications software for exact requirements. Communications using a null modem cable should be set as Direct Connect in the communications software

Appendix E

RS-232 Setup:

**** Baud rate changes must be entered from LDE-740 keypad

Baud Rates
300
1200
2400 (default)
4800
9600

Word Length
7 bits

Parity
Even Parity

Stop Bits
1 Stop Bit

Start Bits
1 Start Bit

Settings for baud rate, word length, parity, and start and stop bits must be the same for the LDE-740 and the computer, terminal or remote modem. XON / XOFF software handshaking is not supported.

In modem port mode, the LDE-740 can match its baud rate to the negotiated modem connection baud rate. This is known as adaptive baud rate equalization. When the modem is disconnected, the baud rate will return to its previously programmed speed. RS-232 Port setups that are printed or displayed will show the programmed baud rate, not the negotiated baud rate.

When automatic dialouts are enabled in modem port mode, the LDE-740 will attempt to call the stored phone number every 10 minutes for 1 hour until a connection is made. If a connection to the stored phone number cannot be completed in 1 hour, the dialout attempt will be aborted.

When a connection to the stored phone number is established, the LDE-740 will stay on-line so that further interrogation of the gauge may be performed. If no communication with the remote system is received for 2 minutes, the modem is disconnected, and the phone is hung up. The LDE-740 will then return to its previously programmed baud rate.

If a remote system calls the LDE-740, the gauge will stay on-line until no communication with the remote system is received for 5 minutes. The modem is then disconnected, and the phone is hung up. The LDE-740 will then return to its previously programmed baud rate.

Warranty

We warrant that our equipment, if installed according to instructions will be free from defects in material and workmanship for a period of one (1) year following the date of original shipment by Pneumercator.

Our liability under this warranty shall be limited to, at our option,

(i) repair of the defective equipment,

(ii) replacement of the original equipment with new equipment, or

(iii) refund of the original purchase price; and, we shall not be liable for any labor, other installation costs, indirect or consequential damages, or other damages in connection with such equipment.

This constitutes our obligation and none other stated for any purpose except the above shall apply.

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