

INSTRUCTION MANUAL



DRAWING NO. 20238 REV. N/C

LLP203

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1785 EXPRESSWAY DRIVE NORTH
HAUPPAUGE, NY 11788

TEL: (631) 293-8450
FAX: (631) 293-8533
Product Support: (800) 209-7858
www.pneumercator.com

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IMPORTANT SAFETY INFORMATION

This manual contains instructions for installing electrical hardware in explosion hazard areas. All warnings must be followed, to be in compliance with accepted codes. Any inquiries about this manual, or to return defective equipment should be directed to:

PNEUMERCATOR COMPANY
1785 EXPRESSWAY DRIVE NORTH HAUPPAUGE, NY 11788
Attention: Technical Services
TEL: (631) 293-8450
FAX: (631) 293-8533
TOLL FREE: (800) 209-7858

HAZARDOUS AREA WARNING

Installation must be in strict accordance with this manual as adopted from the following codes:

- UL - Underwriters Laboratories
- NFPA 70, "National Electric Code."
- NFPA 30A, "Automotive and Marine Service Station Code."

Alteration, modification, or replacement with non-factory components could impair the performance of this equipment, void the warranty, and void the UL Listing. Failure to comply with warnings could result in personal injury, property loss and equipment damage.

PREFACE

Read and follow the entire instructions in this manual before installing or working on this equipment.

Certified Installer/Service Person: Only a Pneumercator certified installer or service person may install and configure the TMS for use with the LLP203 Sensor.

Station Owner/Operator: The station owner or operator of the TMS console equipped with the LLP203 may only modify select TMS LLP203 settings. Performing the TMS AUTO CAPTURE procedure and servicing/removing the LLP203 is strictly prohibited.

Graphic Symbol Conventions

NOTE

Important information, tips, and hints are highlighted by the note graphic.

**CAUTION**

CAUTION messages are highlighted by the CAUTION graphic and contain instructions that should be followed to avoid faulty equipment operation, or environmental hazards, or personnel injury!

**WARNING**

WARNING messages are highlighted by the WARNING graphic and contain instructions that must be followed to avoid faulty equipment operation or explosion. If ignored, severe injury or death **may** result!

**DANGER**

DANGER messages are highlighted by the DANGER graphic and contain instructions that **must be followed** to avoid an explosion or fire hazard. If ignored, severe injury or death **will** result!

**ELECTRICAL
DANGER**

ELECTRICAL DANGER messages are highlighted by the ELECTRICAL DANGER graphic and contain instructions that **must be followed** to avoid an electrical shock. If ignored, severe injury or death **may** result and even severe damage to electronic equipment.

P.1 GENERAL OVERVIEW

Note: This section is provided strictly as an overview of the LLP203 and associated console. Please refer to the appropriate sections of this manual for detailed explanations, instructions and cautions.

The LLP203 is an EPA-compliant(40CFR280.44(a)) line leak detector intended for use with pressurized liquid piping systems, and is ideal for Critical Power applications where 3 GPH(11 LPH) catastrophic line leak detection with audible and visual alarms is required, but pump shutdown is not desired, but can be optionally programmed. The LLP203 is designed to be directly compatible with all TMS2000, TMS3000 and TMS4000 Tank Management Systems built after 2003 using Pneumercator's standard, universal leak sensor inputs. Note that some systems may require a simple firmware upgrade to support the LLP203.

The LLP203, in conjunction with a TMS console, operates on the principle of pressure decay over time to detect a 3 GPH leak. The parameters that govern the timing for leak detection are determined solely by the volume, charge pressure and bulk modulus(elasticity) of the piping system, and accordingly, are independent of piping descriptions such as "rigid", "semi-rigid", and "flex". Note that in all cases, leak detection applies only to the section of piping between the pump check valve and the outlet shutoff valve, which must hold pressure following supply pump shutdown. The system offers three methods of calibration, MANUAL, CALCULATED and AUTO CAPTURE, described as follows:

MANUAL: The discharge time from charge pressure down to 10 PSI is measured using a Pneumercator LG203 or similar 3 GPH leak generating device, and entered into the system, in seconds.

CALCULATED: The volume, charge pressure and bulk modulus are entered into the system. Note that if this method is used, a 3 GPH test must still be run to verify proper detection.

AUTO CAPTURE: A Pneumercator LG203 or similar 3 GPH leak generating device is installed, and the system automatically detects pump start, pump stop, and captures the decay time. This feature is only available on TMS4000/4000M series consoles.

The system offers two methods for triggering a line leak test. Following Pump Shutdown monitors pump activity and performs a line test when pump shutdown is detected. Following Pump Shutdown or Hourly monitors pump activity and performs a line test when pump shutdown is detected, or hourly if no pump activity. This second mode requires the programming of a system relay to control the pump.

Important Notes:

Each product line must be tested and verified free of leaks prior to installing LLP203 sensors, and all must be tested upon startup, and routinely thereafter (at least annually) under NFPA standards. These NFPA and other industry testing practices must be followed by the installer and the end user.

The LLP203 Sensors are Intrinsically Safe and are for use only with the TMS2000, TMS3000, and TMS4000. The Intrinsically Safe wiring requires separation from non-intrinsically safe circuit wiring as per Article 504 of the National Electric Code.

This Installation and Owner's Manual provides instructions for site assessment and preparations, installation, wiring, configuration, and operation. Each section gives step-by-step instructions to successfully complete the section. A troubleshooting guide is included if difficulties are encountered.

P.2 SITE SURVEY & ASSESSMENT

- ❑ A precision line test must be conducted before installing the LLP203 transducer for the first time and before replacing any line leak detector that indicates a leak to assure line integrity.
- ❑ USE A PRESSURE GAUGE TO VERIFY THAT EACH LINE IS STABLE. THE PRESSURE CHANGE WITHIN THE PIPELINE AFTER 5 MINUTES OF Pump-OFF MUST BE LESS THAN 5 PSI. The TMS cannot be accurately calibrated unless the product is stable in pipeline.
- ❑ A minimum static line pressure of 20 PSI is required for the LLP203 to perform a Gross (3 GPH) line leak test.
- ❑ Check that the pipeline volume, combined with the Piping Bulk Modulus and Charge Pressure, is less than or equal to the 3rd party approval (see table on Page 35). The TMS/LLP203 is Third party approved for use in pressurized pipelines up to 1179 gallons (4463 liters).
- ❑ Before installation of sensor, verify that the equipment is proper for the site.

P.3 MATERIALS & TOOLS REQUIRED

In addition to what is supplied with the LLP203 Sensor (the LLP203 Sensor, 6' Leader Cable with Splice Kit, Caution Labels, and this manual) the following materials and tools are required:

- ❑ Socket set, extension, and square socket for ¼" (6.5 mm) square head hole plugs (Non-sparking)
- ❑ Wrench, 2-3/8" open end hex wrench or adjustable 0-70 mm wrench (Non-sparking)
- ❑ Assorted non-sparking adjustable open-end wrenches, including pipe wrenches and slip-joint pliers (Non-sparking)
- ❑ Absorbent rags and petroleum absorbent, and approved waste containers
- ❑ Petroleum resistant, non-hardening, UL Classified, FEP Pipe Dope/Thread Sealant (Hercules Megaloc, Gasoila, etc.) to seal threads of the LLP203 transducer & LG203 Leak Generating Device with valve kit.
- ❑ Single scale, general purpose, Pressure Gauge (¼" NPT) capable of supporting the maximum line pressure for **temporary** installation during site assessment and during the LLP203 MANUAL calibration step
- ❑ Approved petroleum container (minimum 5-gallon capacity) to collect product from the LG203 Leak Generating Device during AUTO CAPTURE procedure
- ❑ LLP203 Transducer Cable: Belden 8442 cable, 22AWG, 2-conductor
- ❑ Electrician's tools: Safety Lockouts & Tags, assorted wire strippers, cutters, various size – flathead and Phillips-head screwdrivers, multimeter with leads & clips, strain relief fittings, wrenches, slip-joint pliers (Non-sparking) conductor markers, and indelible fine point marking pens

SECTION 1 – SAFETY**CAUTION**

This equipment is designed to be installed in association with volatile hydrocarbon liquids such as gasoline and diesel fuel. Installing or working on this equipment means working in an environment in which these highly flammable liquids or vapors are present. This represents a risk of severe injury or death if these instructions and standard industry practices are not followed.

- Prohibit access to the work area to certified and trained installers/service personnel
- Identify and mark the perimeter of the work area with signs, safety-cones and colored safety tape
- Prevent unauthorized vehicle access (block access) into the work areas by using barriers, barricades, and service trucks
- Use only non-sparking tools when working in these Hazardous Areas
- Occasionally check for presence of hydrocarbon vapors in containment sumps

⚠ CAUTION

You MUST check with local authorities for shut-down guidance when using any line leak detector on an emergency generator system. Life-Safety systems do not allow system shut-down, only audible and visual alarms.

**ELECTRICAL DANGER**

Before installing, servicing, or working on this equipment: turn off all pump power/pump controller power, TMS system power, and dispenser power at the electrical Service Panel(s). Lock out and tag these circuit breakers in the off position to prevent accidental/unauthorized circuit breaker closure. Failure to turn off and lock out power may result in severe injury or death.

**WARNING**

Highly flammable vapors may be present in the environment where this equipment is installed or serviced. DO NOT smoke while working on or near this equipment and only use non-sparking tools. Failure to follow these instructions could result in a serious fire or explosion.

**WARNING**

Follow all federal, state, and local laws governing the installation of this product and the entire system. When no other regulations apply, follow NFPA 30, 30A, and 70 from the National Fire Protection Association. Failure to do so could result in serious property damage, environmental contamination, and severe injury or death.

**ELECTRICAL DANGER**

The TMS may start pumps automatically to pressurize the line being tested. Automatic pump starts occur hourly after the pump stops. Before performing any installation or service (such as replacing fuel-filters) – tag and lock-out all electrical power sources to the pump(s), pump controllers, and dispensers and relieve fuel-line pressure. Failure to turn off power and relieve fuel-line pressure before work is started can result in: pressurized fuel spills (an environmental hazard associated with costly clean-ups), and fire or explosion hazard that may result in injury or death.



Verify that no Voltage exists before working on or wiring to circuits described in this manual, otherwise lethal electrical-shock-hazards could exist, which may cause injury or death. *Note: circuit breaker contact(s) can fail to open even when the circuit breaker lever indicates off.*

NOTE

Multiple PNEUMERCATOR Caution stickers are supplied with each LLP203. Apply these stickers on the pump relay box cover, in locations near dispenser fuel-line filters, plugs, emergency safety-shut-off valves, on or near the LLP203 (at the pump housing), and other serviceable components of a fuel line (where a spill would occur if the line became pressurized). The selected surfaces must be clean, dry, and in plain sight so that the label can be read and followed.



The fuel line from the pump to the output valve, may be under pressure. Turn off all pump power and relieve pipeline pressure (reference and follow the pump manufacturer's directions). If the LLP203/plug (or any other part of the pump and fuel line) is removed without first relieving pressure, then a product leak will occur. This could cause an environmental, fire, or explosion hazard, and may result in injury or death.



Avoid personnel injury or property damage: keep moving vehicles and unauthorized personnel out of the hazardous work area. Use Safety Cones, Barricades, Warning Signs, and Safety Tape, and block access with barricades/service trucks to the work area to avoid injury or property damage.



Be careful not to cause sparks when working on fuel dispensing equipment (volatile fuel may be within the pump's leak detector port). Allow no source of combustion near the work area. Failure to follow these directions may cause an explosion hazard, which could result in property damage and death.



During the AUTO CAPTURE process, ALWAYS secure the LG203 in the appropriate container. When the pump is turned on, a fine stream will be sprayed out the orifice of the LG203. This stream can cause movement of the LG203 and possibly come out of the container. This product stream can cause physical injury and environmental hazards.



Prevent static electric sparks and possible explosions — always have fuel container on the ground when filling with fuel. Use only containers approved for petroleum.



Refer to all applicable Federal, State, City and local codes, your National Electric Code (NEC), and the Automotive and Marine Service Station Code (NFPA 30A in the USA) before installation or maintenance. The TMS may provide a pilot relay to control the load relay for the Pump. Be sure to follow all applicable codes to ensure the safe operation of the Pump.



Although the LLP203 is water resistant, PNEUMERCATOR does not recommend operating the LLP203 for long periods while under water. Drain the sump and manhole immediately into a holding tank for disposal per Codes.



Before entering a containment sump, check for the presence of hydrocarbon vapors. If vapor levels are unsafe, ventilate the sump with fresh air. While working in the sump, periodically check the atmosphere in the sump. If vapors reach unsafe levels, exit the sump and ventilate it.



ALWAYS have a second person standing by for assistance when working in or around a containment sump. Electronic petroleum equipment is often housed in containment sumps designed to trap hazardous liquid spills and prevent contamination of the environment.



These containment sumps can trap dangerous amounts of hydrocarbon vapors. If these vapors are inhaled, they could cause dizziness or unconsciousness. If the vapors were ignited, they could explode causing serious injury or death.



ALWAYS lock out and tag electrical circuit breakers while installing or servicing this equipment, pumps and related equipment. A potentially lethal electrical shock hazard and the possibility of an explosion or fire from a spark can result if the electrical circuit breakers are accidentally turned-on during installation or servicing. During normal operation, the TMS may turn on the Pump as part of its leak testing process. A shock, fire or environmental contamination hazard could result from attempting to turn on the Pump while equipment is being serviced.



Petroleum is carcinogenic – use adequate protection to avoid health hazards. ALWAYS cleanup and dispose of used absorbent/rags and petroleum resistant gloves in approved waste containers. Cleanup refuse and dispose of these immediately to avoid personnel injury from vapors or direct skin contact to also avoid possible fire or environmental safety hazards.



The LLP203 is designed for use in specific applications and in compliance with industry standards and practices. Using it in applications for which it was not designed or failure to follow industry standards and practices may cause the product to malfunction or fail.



Contact Pneumercator for applications requiring over 5500 feet (1676 Meters) of cabling. Lengths exceeding 5500 feet may cause unreliable system operation, which may result in creation of environmental hazards in the event that a leak is undetected.

SECTION 2 – MECHANICAL INSTALLATION

2.1 LLP203 INSTALLATION

The LLP203 Line Leak Pressure Sensor is intended to be installed in the 2" Leak Detector Port of the Pump. Refer to Pump manufacturer's instructions for port location.

1. At the electrical Service Panel: lock-out & Tag POWER OFF for the Pump, Pump Controller, and Dispensers.



A TMS equipped with an LLP203 may start pumps automatically to run leak tests at full line pressure. Automatic pump starts occur hourly between periods of product dispensing when there is no product being dispensed. **BEFORE performing any installation or service (such as replacing fuel-filters) – tag and lockout all electrical power sources to the pump(s), pump controllers, and dispensers and relieve fuel-line pressure. Failure to turn off power and relieve fuel-line pressure before work is started can result in: pressurized fuel spills (an environmental hazard associated with costly cleanups), and fire or explosion hazard that may result in injury or death.**



Avoid personnel injury or property damage: ALWAYS secure the hazardous work area from moving vehicles. This equipment may be mounted underground, therefore, reduced visibility puts service personnel working on this equipment in danger from moving vehicles entering the work area. Use Safety Cones, Barricades, Warning Signs, and Safety Tape, and block access with barricades/service vehicles to the work area to avoid injury or property damage.

2. Relieve pipeline pressure to 0 PSI per pump manufacturer's recommendation and capture any product that escapes or use absorbent rags to clean up any product spills and dispose of properly.



The fuel line from the pump to the dispenser may be under pressure. Turn off all pump power and relieve pipeline pressure (reference and follow the pump manufacturer's directions). If the LLP203, plug (or any other part of the pump and fuel line) is removed without first relieving pressure, then a product leak will occur. This could cause an environmental, fire, or explosion hazard, and may result in injury or death.

3. Remove other in-line leak detection equipment before installing the LLP203.
4. Apply Petroleum resistant, non-hardening, UL Classified, FEP Pipe Dope/Thread Sealant (Hercules Megaloc, Gasoila, etc.) to the threads of the LLP203 Transducer and use a 2-3/8" open-end wrench to install it in the Leak Detector Port of the Pump housing (See Figure 2-1).
5. Install Couplings, threaded Rigid Metal Conduit (RMC), and Junction Boxes (J-Boxes) in the Pump sumps.
6. Install threaded RMC and Electrical Y Seal (EYS) fittings along with Sensor Field Cabling (Belden 8442) from TMS console to the J-Boxes.

7. After all LLP203 Line Leak Pressure Sensors have been installed, check that the system is ready to be pressurized to check for the absence of leaks.
8. After the installation is checked and all personnel are clear, have the electrician turn on power at the Service Panel for the Pump (Submerged Turbine Pumps and Output Devices).
9. Turn on the Pump at the output device (do not transfer product) and check for leaks at each Sump. If there are any leaks, immediately turn off power, lockout and tag at the Service Panel, use absorbent rags to clean up the product spills and dispose of properly, and repair the leak(s) and repeat step 8 and 9 until no leaks remain.
10. Clean areas where the Caution Labels will be placed so the adhesive backing will stick to a dry surface that is clean and free of petroleum.
11. Cleanup and dispose of installation materials, petroleum absorbent and waste material in appropriate containers.
12. Apply the supplied Caution Labels to clean dry areas near Dispenser Fuel Filters, Pump Controllers, and on the Cable of the LLP203 Transducer and on the Pump housing.



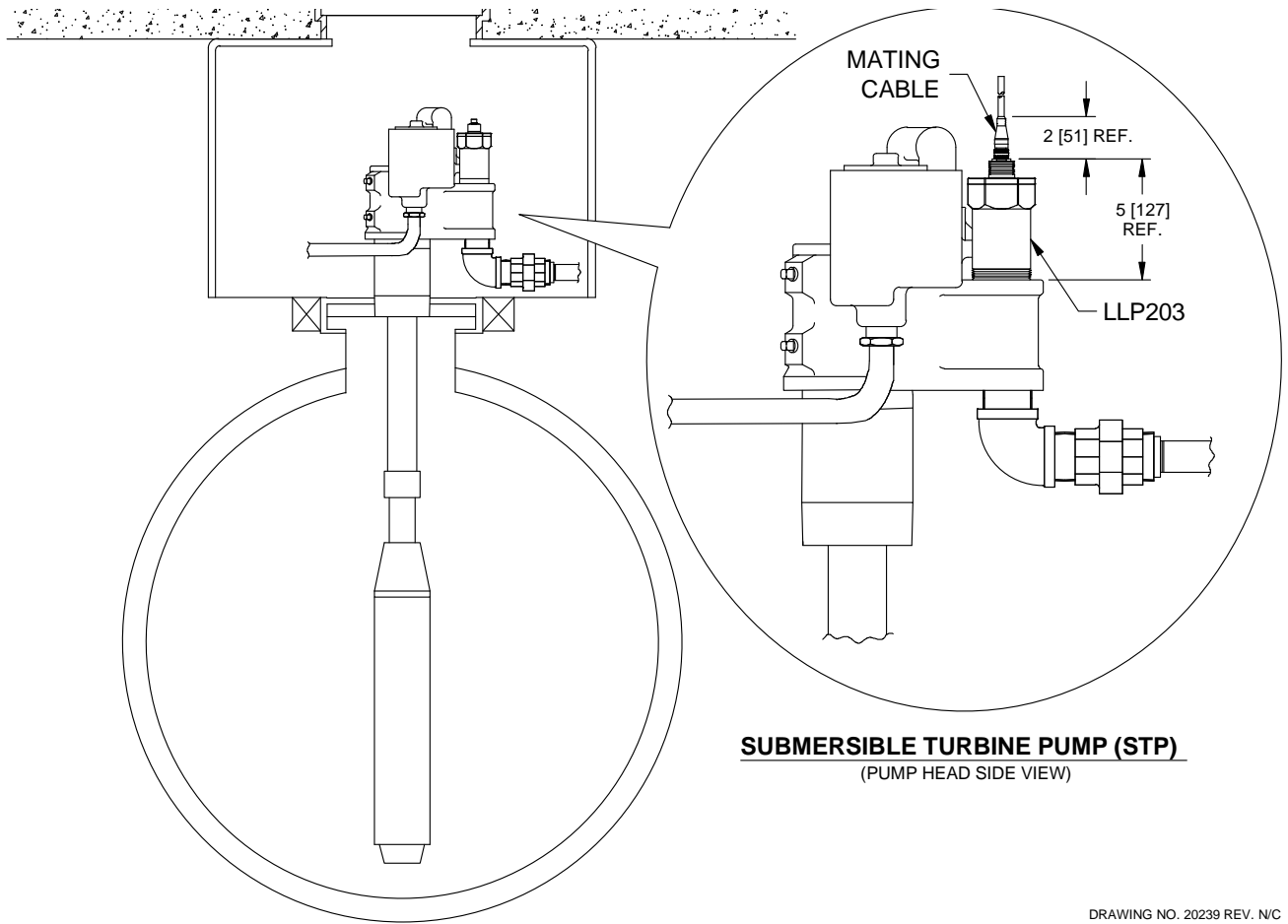


Figure 2-1: LLP203 Mounting in a Submersible Turbine Pump

SECTION 3 – ELECTRICAL INSTALLATION & WIRING

Complete the below Table to document the wiring and configuration requirements for each LLP203 Sensor.

Note: The TMS2000 and TMS3000 currently support a maximum of 8 LLP203 Sensors. The TMS4000 supports a maximum of 16 LLP203 Sensors.

LLP #	MANUAL	CALCULATED			Tank ID	Sensor Input #	CC Input #	Relay Output #	
	Discharge Time	Pipe Volume	Bulk Modulus	Charge Pressure				Pump Control	Pump Shut Off
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									

- Operating Modes:
 - MANUAL
 - Discharge Time: The amount of time, in seconds, it takes for a fully pressurized line to drop to 10 PSI/6.9 kPa.
Note: AUTO CAPTURE Mode (TMS4000 Only) automatically determines Discharge Time. See Section 5 for details.
 - CALCULATED
 - Pipe Volume: Total Pipe Volume in Gallons/Liters of the Pipe section being tested.
 - Bulk Modulus: Supplied by the Pipe manufacturer. Represents the elasticity of the pipe wall.
 - Charge Pressure: The maximum pressure in the piping in PSI/kPa when the pump is powered on.
- Tank ID: The configured Tank ID Number corresponding to the LLP203
- Sensor Input Number: The hardware position number in the TMS where the LLP203 is connected.
- CC Input Number: The Contact Closure (CC) Input Number where the signal representing pump activity is connected. This is typically provided by a CS-10 Current Sensor but may be any dry contact signal. This is required for all modes of operation.
- Pump Control Relay Output Number: The Relay Output position number in the TMS being used to control the pump. Required for the Hourly LLP203 Test Mode.
- Pump Shut Off Relay Output Number: The Relay Output position number in the TMS being used to disable the Pump when a Leak is detected in the piping. The pump will remain disabled until the alarm is acknowledged or the piping passes a test.

Follow the instructions below to wire the LLP203 Line Leak Sensor to the TMS. A licensed electrician is recommended and may be required to perform the electrical installation.

1. All cabling from the LLP203 transducer to the TMS console must be separated from non-intrinsically safe wiring as per Article 504 of the National Electric Code.



Avoid personnel injury or property damage: ALWAYS secure the hazardous work area from moving vehicles. This equipment may be mounted underground, therefore, reduced visibility puts service personnel working on this equipment in danger from moving vehicles entering the work area. Use Safety Cones, Barricades, Warning Signs, and Safety Tape, and block access with barricades/service vehicles to the work area to avoid injury or property damage.

2. At the electrical Service Panel: lock-out & tag POWER OFF for the Pump, Pump Controller, and Dispensers.



Hook inputs are 120/240 VAC. Disconnect all high Voltage sources before accessing internal electronics.

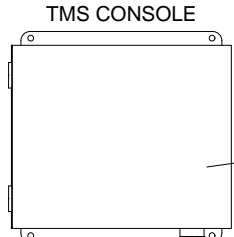


A TMS equipped with the LLP203 may start pump automatically to run a leak test at full line pressure. Automatic pump starts may occur between periods of product dispensing when no product is being dispensed. **BEFORE performing any installation or service (such as replacing fuel-filters) – tag and lock-out all electrical power sources to the pump(s), pump controllers, and dispensers and relieve fuel-line pressure. Failure to turn off power and relieve fuel-line pressure before work is started can result in: pressurized fuel spills (an environmental hazard associated with costly cleanups), and fire or explosion hazard that may result in injury or death.**

3. If not done during Mechanical Installation, Section 2, run 2-conductor cable (Belden 8442) from each Junction Box near the Pump where the LLP203 Transducer is installed, to the TMS console for Transducer wiring leaving about an 8" (203 mm) service loop. Label/Mark each cable jacket with the Tank #/LLP203 Transducer number.
4. Complete the electrical splices using the splice kits provided (P/N 10585-2LF) for each LLP203 as shown on the following page. Install J-Box cover after wire splicing is completed and checked.

INTRINSICALLY WIRING - LLP203 TO TMS

WARNING
 Refer to TMS installation manual for WARNINGS and CAUTIONS before proceeding. FAILURE TO COMPLY MAY RESULT IN PERSONAL INJURY, PROPERTY LOSS AND EQUIPMENT DAMAGE.



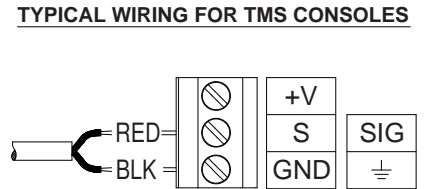
NON-INTRINSICALLY SAFE WIRING
 INTRINSICALLY SAFE WIRING

3/4" NPT (TMS2000)
 1" NPT (TMS3000/TMS4000)
 OR EQUIVALENT
 CONDUIT FITTING

CONDUIT AND VAPOR
 SEAL FITTING
 (SIZE AND LOCATION TO BE
 DETERMINED BY
 QUALIFIED INSTALLER)

NON-HAZARDOUS AREA
 HAZARDOUS AREA
 CLASS I, DIVISION 1, GROUP D
 CLASS I, ZONE 0, GROUP IIA

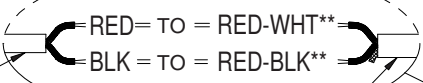
NOTE: TERMINAL BLOCK ORIENTATION AND WIRE CONNECTION NAMES MAY BE DIFFERENT ON CIRCUIT BOARD OR LABEL.



NOTE: "S" OR "SIG" = SIGNAL. THE "S" IS CONSECUTIVELY NUMBERED "S1" THROUGH "S8" ON TMS2000 CIRCUIT BOARDS.

WIRING MUST BE DONE IN WATERTIGHT RATED BOX/HOUSING

FIELD WIRING CABLE
 (BY CUSTOMER)
 Conductor colors may vary depending on cable manufacturer (Belden 8442 colors shown)



LLP203 CABLE (BY PCO*)
 Pin/Terminal no. 1 (GREEN**) has no connection. Wire should be cut back and left unterminated

TO CONSOLE

FROM LLP203

WIRE SPLICE SEAL CONNECTOR (BY PCO*)
 Follow supplied wire splice instructions BULLETIN 181 (Kit P/N 10585-2LF)

* "PCO" REFERS TO PNEUMERCATOR COMPANY.
 ** MATING CORDSET WIRE COLORS. SUPPLIED COLORS MAY VARY.

NOTE

Refer to the Table at the beginning of this Section to identify the relationship between the LLP203 Sensor Input, CC Input, and optional Relay Outputs. Both the wiring and TMS configuration must be consistent with this Table.

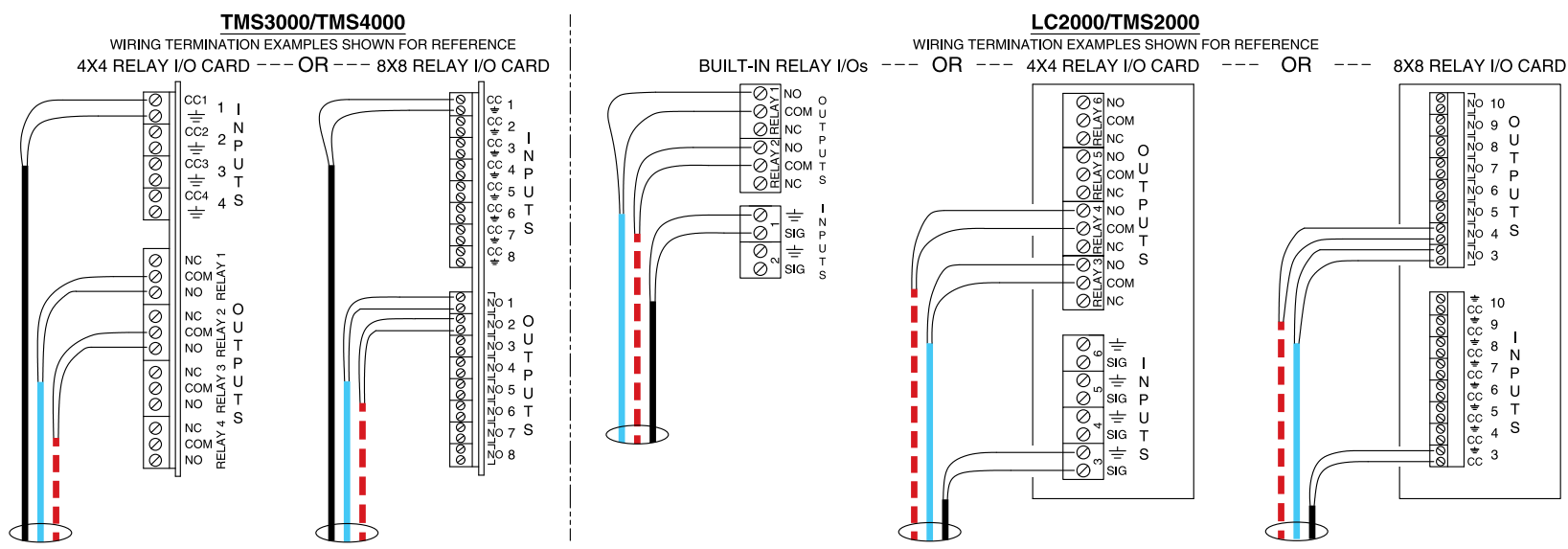
NOTE

Wire LLP203 transducers only to TMS consoles in accordance with applicable standards including Article 504 of the National Electric Code.

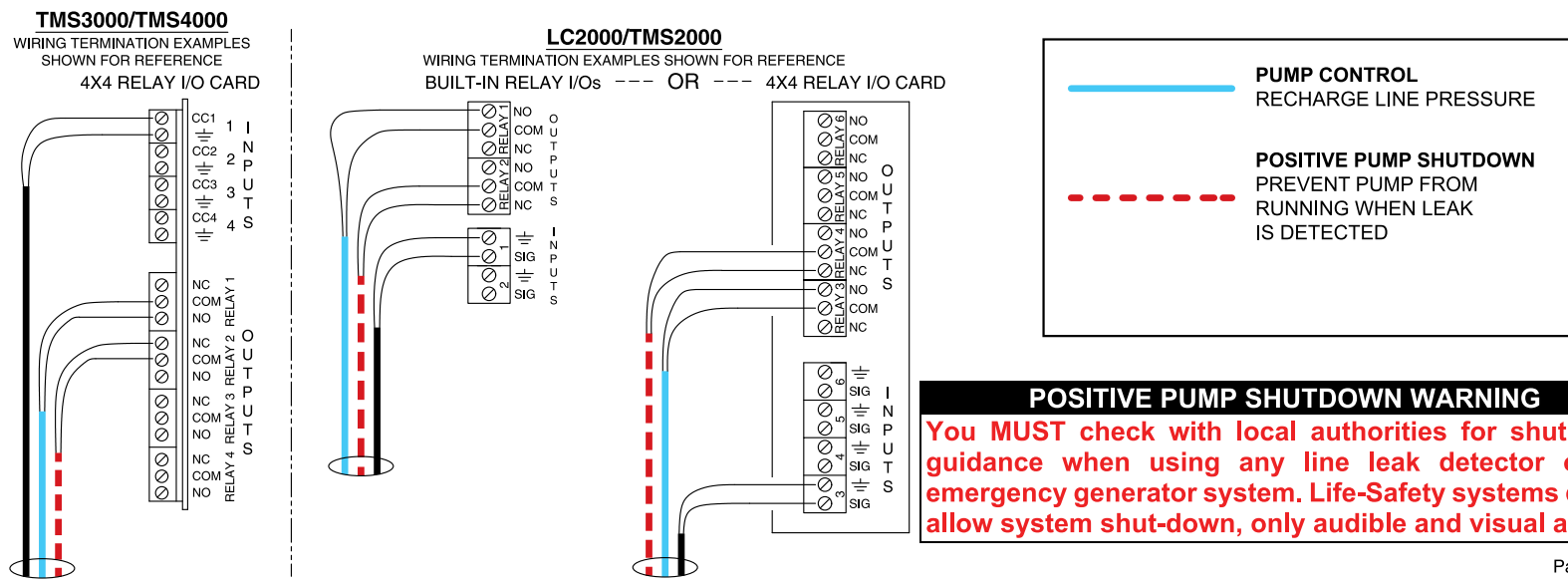
5. Wire LLP203 Transducers to the corresponding Sensor Input channels inside the TMS console.
 - a. Strip insulation from the ends of each conductor so that no insulation will enter the terminal block and minimal wire exposure exiting the terminal block.
 - b. Wire Transducers. Make sure all wires are fully inserted and clamped at the terminal block. Make sure no stray strands of wire are shorting to adjacent terminal block connections.
6. Connect Dry Contact Pump Running Signal for each LLP203, typically provided via CS-10 Current Sensor, to the corresponding Contact Closure (CC) Input. Refer to the following two pages for an illustrated example. Note that this connection is shown with a heavy black line.
7. Connect Pump Control Relay Output for each LLP203 configured to perform an Hourly Test. Refer to the following two pages for an illustrated example. Note that this connection is shown with a blue line.
8. As needed, connect Pump Shut Off Relay Output for each LLP203. Note that there are two methods available for support Pump Shut Off:
 - Pump Disabled with TMS powered off: Wiring connected to Normally Open Relay Terminals in TMS with Relay configured with a Normal Contact State of ON
 - Pump Enabled with TMS powered off: Wiring connected to Normally Closed Relay Terminals in TMS.

Refer to the following two pages for an illustrated example. Note that this connection is shown with a red dashed line.

I/O WIRING INCLUDES - NORMALLY ENERGIZED PUMP SHUTOFF RELAY - PUMP DISABLED WITH TMS OFF



I/O WIRING INCLUDES - NORMALLY DE-ENERGIZED PUMP SHUTOFF RELAY - PUMP FUNCTIONAL WITH TMS OFF



SECTION 4 – TMS CONFIGURATION

4.1 LINE LEAK MODE, 3 GPH

The TMS supports two modes of operation that affect the frequency of the line leak test. Each mode is described below, including all TMS connection requirements:

Note: The Line Leak Mode should be set prior to addressing any other LLP203 settings.

- **Follow Pump Off:** Performs line leak test every time the pump stops after running for at least 30 seconds. Failure is reported after a single test fails.

Connection Requirements:

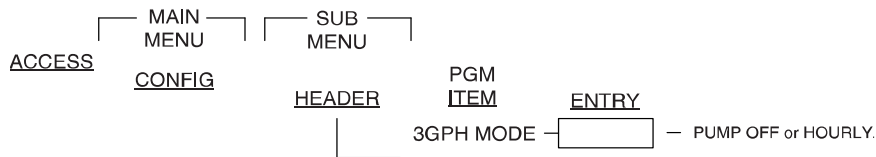
- 1 CC Input: Dry Contact Signal representing the pump running status.

- **Follow Pump Off and Hourly:** Performs line leak test every time the pump stops after running for at least 30 seconds and every hour thereafter. Failure is confirmed after three consecutive failed tests performed in rapid succession.

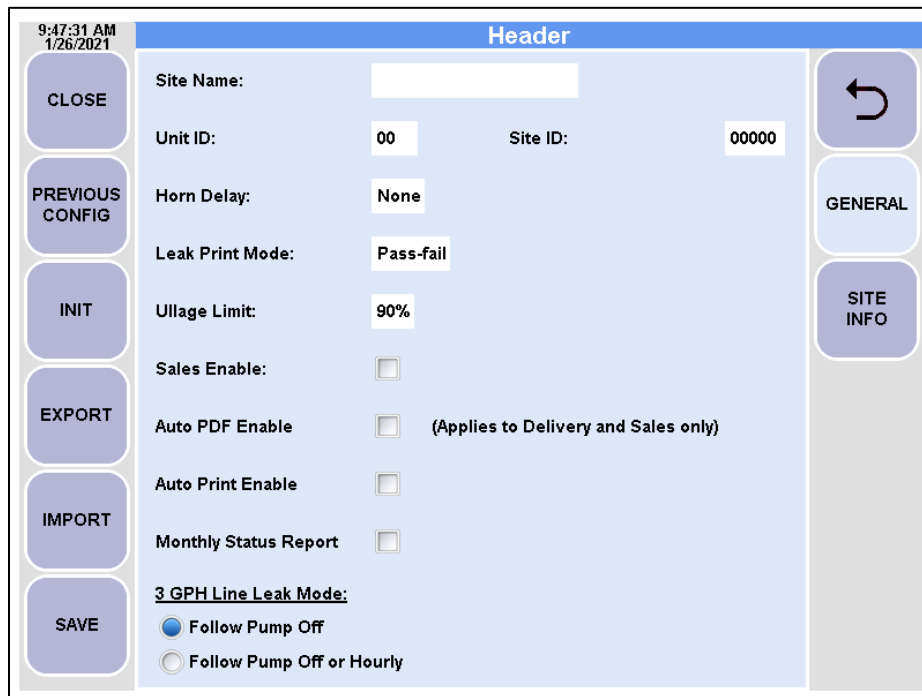
Connection Requirements:

- 1 CC Input: Dry Contact Signal representing the pump running status.
- 1 Relay Output: Activates pump for 30 seconds, as needed.

TMS2000/TMS3000 Setting Location



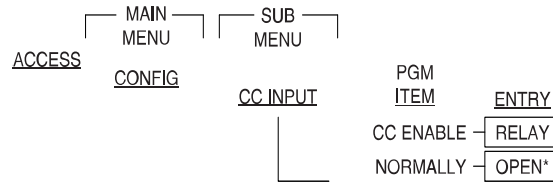
TMS4000 Setting Location



4.2 PUMP STATUS CONTACT CLOSURE INPUT

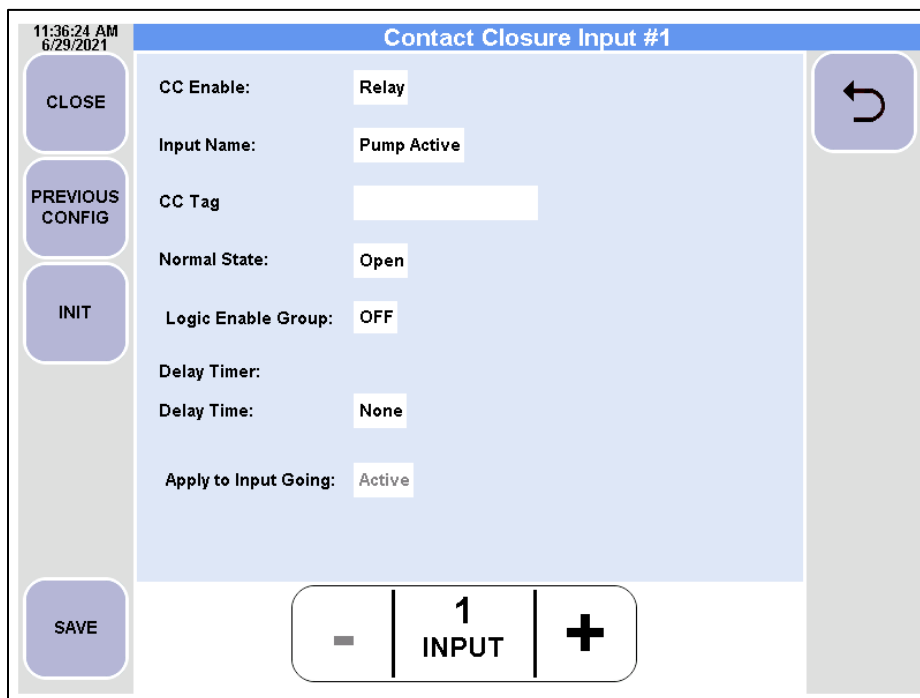
The TMS monitors the pump activity via a dry contact signal connected to a CC Input. The source of the signal may be a CS-10 current sensor or may be provided by the pump manufacturer. Note that the CS-10 is a Normally Open device.

TMS2000/TMS3000 Setting Location



* The CS-10 is Normally Open. Otherwise, contact Pump manufacturer for contact state of signal sent to the TMS CC Input.

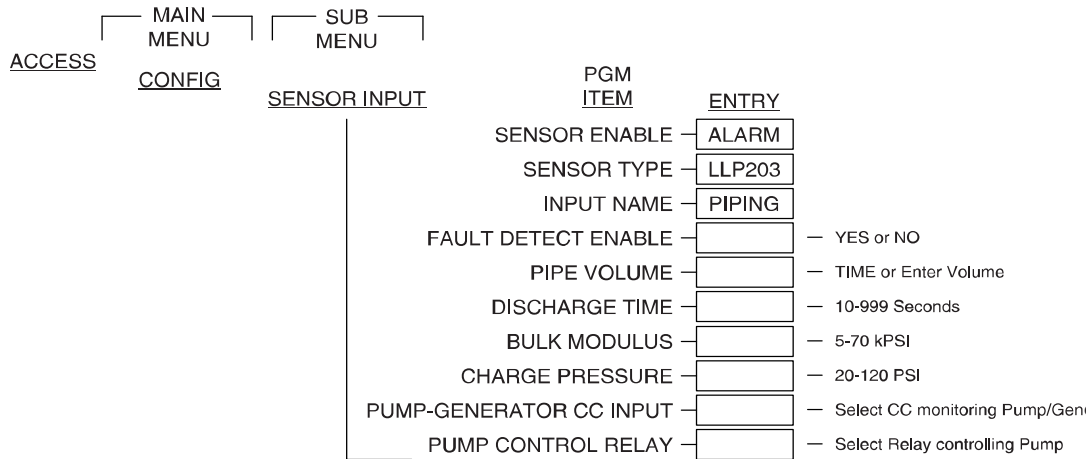
TMS4000 Setting Location



CC Enable: The CC Input supporting the Pump Status must be enabled as **Relay**.

Normal State: The normal contact state of the incoming wiring, representing the pump not running, must be specified. Note that the CS-10 is a Normally Open device. Otherwise, refer to the pump documentation regarding the dry contact signal.

4.3 TMS2000/TMS3000 LLP203 AND PIPING SETTINGS



The TMS2000 and TMS3000 support two different methods for determining the amount of time it takes a fully charged pipeline to drop to 10 PSI: CALCULATED or MANUAL. Refer to the below table for the settings required by each Discharge Time Capture Mode.

Setting Name	Discharge Time Capture Mode	
	MANUAL	CALCULATED
Pipe Volume	X	X
Discharge Time	X	
Bulk Modulus		X
Charge Pressure		X
Pump CC Input	X	X
Pump Control Relay		X

Pipe Volume: Indicates the Discharge Time Capture Mode and, for CALCULATED Mode, specifies the total volume of the piping being tested.

- **Time:** The Discharge Time for the Piping will be manually determined and entered.
- **Entered Volume:** By entering a volume, CALCULATED Mode is selected. Choose a volume that is greater than or equal to the actual volume.
 - Range
 - English: 50-1150 Gallons, selected in 50 Gallon increments.
 - Metric: 200-4600 Liters, selected in 200 Liter increments.



Failure to enter accurate information may result in creation of environmental hazards in the event that a leak is undetected.

Discharge Time: Represents the amount of time, in seconds, for the line pressure to decay to 10 PSI with a known 3 GPH Leak after the line is fully pressurized. See Section 5.1 for instructions.

- Range: 10-999 Seconds

Bulk Modulus: This value is provided by the piping manufacturer and represents the change in volume with a change in pressure. If the desired Bulk Modulus value does not appear in the table, select the next LOWER value.

- Range:
 - English: 5-70 kPSI, selected in 5 kPSI increments.
 - Metric: 34-482 mPa, selected in 32 mPa increments.

Note: If the Bulk Modulus is unknown, either set Pipe Volume to Time to select MANUAL Mode or contact Pneumercator for assistance.

Charge Pressure: The pressure in the piping with the pump running without any fluid being dispensed. If the desired Charge Pressure value does not appear in the table, select the next HIGHER value.

- Range:
 - English: 20-120 PSI, selected in 5 PSI increments.
 - Metric: 138-831 kPa, selected in 33 kPa increments.

Pump CC Input: This setting is **required** to allow the TMS to monitor the Pump activity. A 3 GPH line leak test is performed every time the Pump stops after at least 30 seconds of activity.

Pump Control Relay: The Relay specified will activate the Pump, as needed, to recharge the line pressure prior to starting a test. This setting is only required for the Hourly Line Leak Mode. See Section 4.1 for details.

4.4 TMS4000 LLP203 AND PIPING SETTINGS

Discharge Time Capture Mode: Selects the method used to determine the Discharge Time. The Discharge Time represents the amount of time, in seconds, that it will take for a fully pressurized line to drop to 10 PSI with a known 3 GPH leak after the pump powers off.

- **MANUAL:** Manually measured and entered. See Section 5 for procedure.
- **CALCULATED:** Calculated using entered Line Volume, Charge Pressure, and Bulk Modulus (provided by piping manufacturer).
- **AUTO CAPTURE:** Determined by the TMS. See Section 5 for procedure.

4.4.1 TMS4000 MANUAL DISCHARGE TIME CAPTURE MODE

3:07:49 PM
6/29/2021

Leak/Point Level Sensor #1

Enable: Alarm and Relay Type: LLP203

Name: Piping Tag:

Associate sensor with:

Tank: None Dispenser: None

Pump Status Contact Closure Input: #1

Pump Control: Relay #1

Discharge Time Capture Mode: Manual

Discharge Time (sec): 10

Fault Detect:

SAVE

- | 1 SENSOR | +

Pump Status Contact Closure Input: This setting is **required** to allow the TMS to monitor the Pump activity. A catastrophic line leak test is performed every time the Pump stops after running for at least 30 seconds.

Pump Control: The Relay specified will activate the Pump, as needed, to recharge the line pressure prior to starting a test. This setting is only required for the Hourly Line Leak Mode. See Section 4.1 for details.



CAUTION

Failure to enter accurate information may result in creation of environmental hazards in the event that a leak is undetected.

Discharge Time: Represents the amount of time, in seconds, for the line pressure to decay to 10 PSI with a known 3 GPH Leak after the line is fully pressurized. See Section 5 for instructions.

- Range: 10-999 Seconds

4.4.2 TMS4000 CALCULATED DISCHARGE TIME CAPTURE MODE

3:08:28 PM SA

Leak/Point Level Sensor #1

CLOSE

PREVIOUS CONFIG

INIT

SAVE

Enable: Alarm and Relay Type: LLP203

Name: Piping Tag: []

Associate sensor with:

Tank: None Dispenser: None

Pump Status Contact Closure Input: #1

Pump Control: Relay #1

Discharge Time Capture Mode: Calculated

Line Volume (Gal): 50

Charge Pressure (Psi): 135

Bulk Modulus (kPsi): 3

Fault Detect:

- | 1 SENSOR | +

Pump Status Contact Closure Input: This setting is **required** to allow the TMS to monitor the Pump activity. A catastrophic line leak test is performed every time the Pump stops after running for at least 30 seconds.

Pump Control: The Relay specified will activate the Pump, as needed, to recharge the line pressure prior to starting a test. This setting is only required for the Hourly Line Leak Mode. See Section 4.1 for details.



CAUTION

Failure to enter accurate information may result in creation of environmental hazards in the event that a leak is undetected.

Line Volume: Total volume of the piping being tested.

- Range:
 - English: 10-1180 Gallons
 - Metric: 50-4450 Liters

Bulk Modulus: This value is provided by the piping manufacturer and represents the change in volume with a change in pressure.

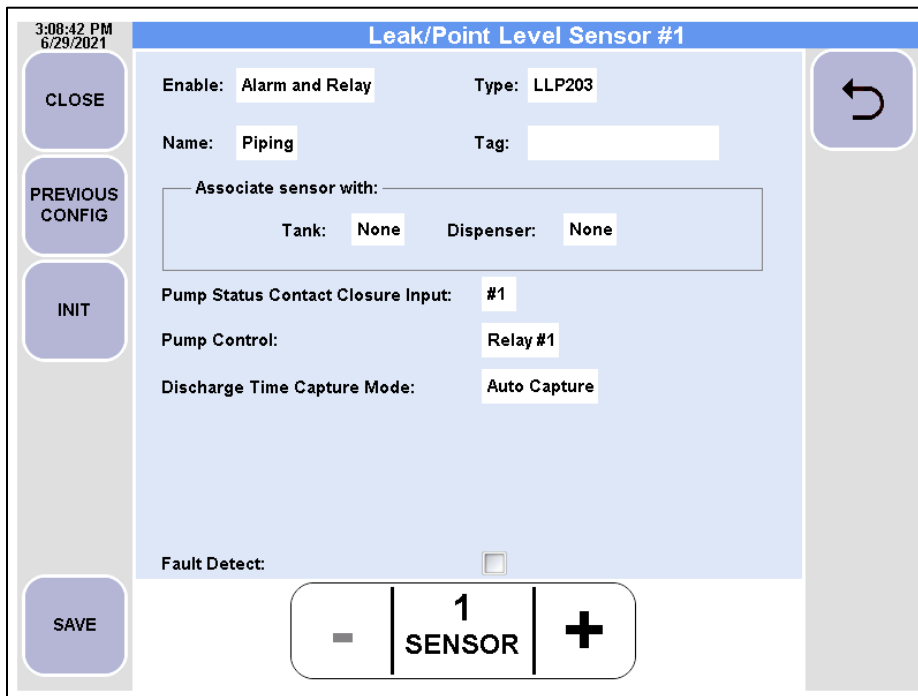
- Range:
 - English: 5-70 kPSI
 - Metric: 30-490 mPa

Note: If the Bulk Modulus is unknown, either select a different Discharge Time Capture Mode or contact Pneumercator for assistance.

Charge Pressure: The pressure in the piping with the pump running without any fluid being dispensed.

- Range:
 - English: 20-120 PSI
 - Metric: 135-830 kPa

4.4.3 TMS4000 AUTO CAPTURE DISCHARGE TIME CAPTURE MODE



NOTE TMS Security **must** be enabled to select AUTO CAPTURE. Security may be enabled in SETUP > SECURITY. Refer to TMS4000 Operations Manual for details.

Pump Status Contact Closure Input: This setting is **required** to allow the TMS to monitor the Pump activity. A catastrophic line leak test is performed every time the Pump stops after running for at least 30 seconds.

Pump Control: The Relay specified will activate the Pump, as needed, to recharge the line pressure prior to starting a test. This setting is only required for the Hourly Line Leak Mode. See Section 4.1 for details.

4.5 POSITIVE PUMP SHUTDOWN

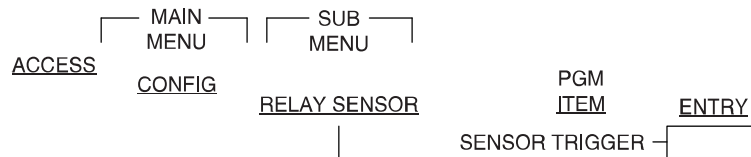
⚠ CAUTION

You **MUST** check with local authorities for shut-down guidance when using any line leak detector on an emergency generator system. Life-Safety systems do not allow system shut-down, only audible and visual alarms.

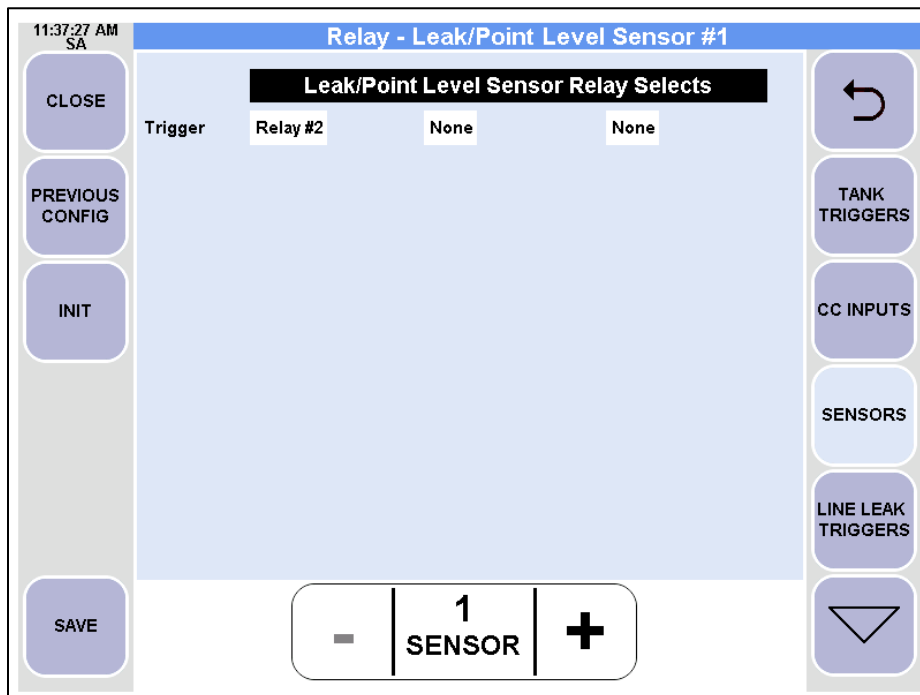
The TMS may prevent the pump from running if a catastrophic line leak is detected. This is accomplished by using an available Relay Output in the TMS to prevent the Hook signal from being received by the Pump Controller. The Relay Output may be returned to normal either by acknowledging the failure or by passing a subsequent line leak test.

Specify the Relay Output selected for Positive Pump Shutdown as wired in Section 3.

TMS2000/TMS3000 Setting Location



TMS4000 Setting Location



SECTION 5 – DISCHARGE TIME MEASUREMENT

The Discharge Time represents the amount of time, in seconds, that it takes a fully pressurized line to decay to 10 PSI with a known 3 GPH leak. The Discharge Time may either be Calculated by the TMS or measured. The measurement would be performed by a Pneumercator trained service technician either manually, using a pressure gauge and stopwatch, or using the TMS4000 set to AUTO CAPTURE. A calibrated 3 GPH Leak Generating Device is required for this measurement. Pneumercator offers the LG203, a calibrated Leak Generating Device, as a separately purchased item. See Section 5.1 below for installation instructions for the Pneumercator LG203 or refer to the documentation supplied with the third-party device.

5.1 LEAK GENERATING DEVICE (LG203) INSTALLATION

Note: After installing the Leak Generating Device, the timing procedure **must** be followed to complete the TMS configuration. See Section 5.2 to Manually time the pressure decay or see Section 5.3 to perform the AUTO CAPTURE procedure on a TMS4000.

NOTE

This Section details the installation for Pneumercator's LG203 Leak Generating Device. If a third-party Leak Generating Device is being used, refer to the Installation documentation provided.

NOTE

The LG203 Leak Generating Device is supplied with a valve assembly that will be installed during the Mechanical Installation of the Leak Generating Device. Contact Pneumercator if any items are missing.

NOTE

Identify the pump supporting the LLP203 to be calibrated. The procedure below must be followed, focusing on the correct pump to be effective.

1. At the electrical Service Panel: lock-out & Tag POWER OFF for the Pump, Pump Controller, and Dispensers.



ALWAYS lock out and tag electrical circuit breakers while installing or servicing this equipment, pumps and related equipment. A potentially lethal electrical shock hazard and the possibility of an explosion or fire from a spark can result if the electrical circuit breakers are accidentally turned on during installation or servicing.

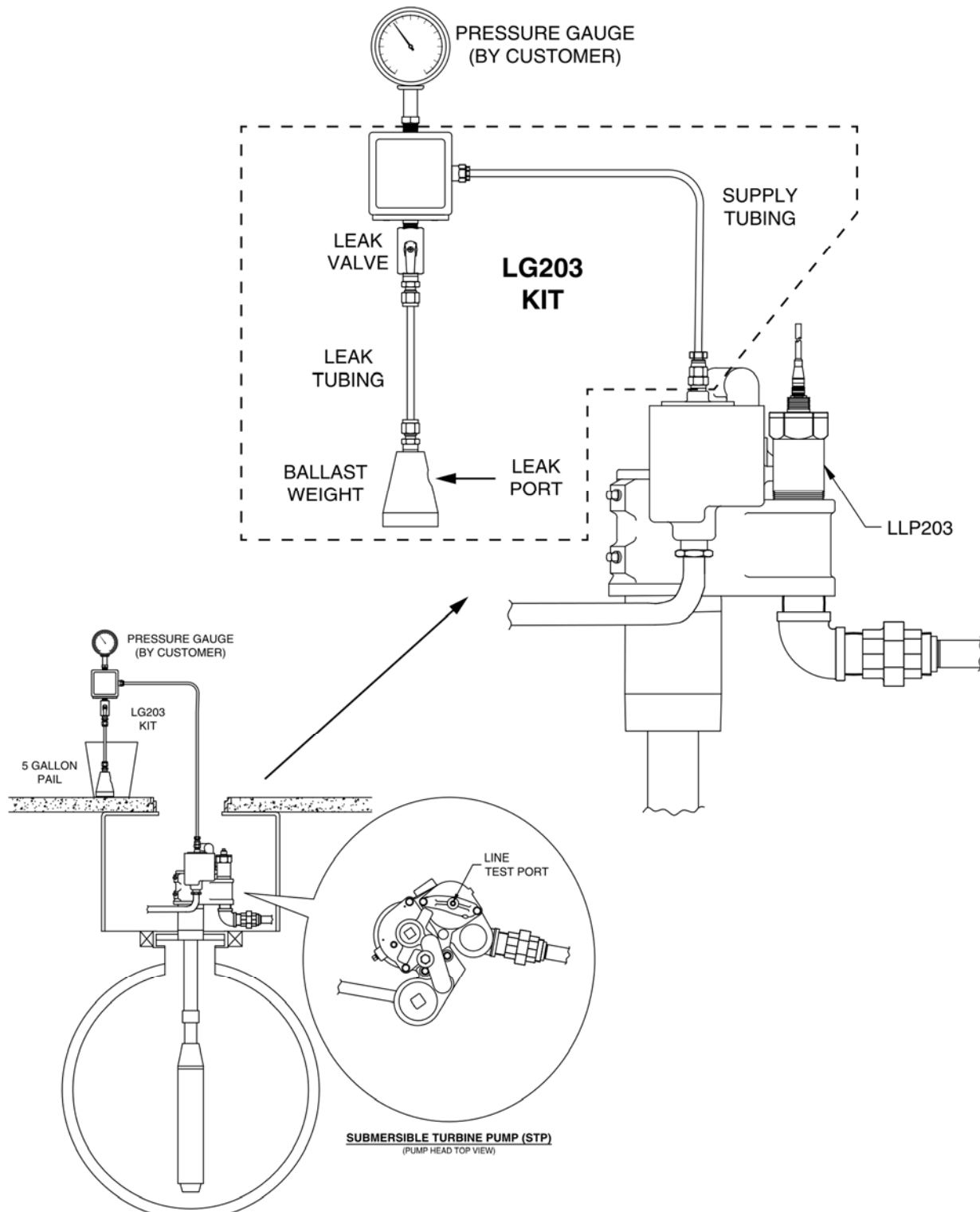


Before commencing with the installation of a LG203 Leak Generating Device, secure the work area by using safety cones, barricades, trucks, etc.

2. Relieve pipeline pressure to 0 PSI per pump manufacturer's recommendation and capture any product that escapes or use absorbent rags to clean up any product spills and dispose of properly.
3. Remove the ¼" plug from the Line Test Port on the pump for the line to have the Discharge Time measured.

NOTE

Save the ¼" plug removed from the Line Test Port so that it may be reinstalled after the LG203 is removed in Section 5.5.



4. Apply Petroleum resistant, non-hardening, UL Classified, FEP Pipe Dope/Thread Sealant (Hercules Megaloc, Gasoila, etc.) to the 1/4" threads of the LG203 Leak Generating Device, supplied valve and associated hardware, and pressure gauge (not supplied).
5. Install the LG203 Leak Generating Device with associated hardware in the 1/4" Line Test Port of the pump for the line being observed. This hardware will include a tee which will allow a pressure gauge to be connected when manually measuring the Discharge Time.

6. For MANUAL Discharge Time Measurements only: Install a pressure gauge (not supplied) into the valve tee that is rated to support the expected pressure range of the line.
7. Place and secure the orifice of the LG203 Leak Generating Device into a suitable container, minimum 5-gallon capacity.

CAUTION

Take steps to prevent foreign materials from getting into the orifice of the LG203 Leak Generating Device. Foreign matter may block flow through the orifice and prevent proper calibration or give inaccurate results during a test.

WARNING

ALWAYS secure the LG203 Leak Generating Device in the container. When the pump is turned on, a fine stream will be sprayed out the orifice of the LG203 Leak Generating Device. This stream can cause the orifice to move and possibly come out of the container. The stream can cause physical injury and environmental issues.

8. After the installation is checked and all personnel are clear, have the electrician turn on power at the Service Panel for the Pump (Submerged Turbine Pumps and Output Devices).
9. Turn on the Pump at the output device (do not transfer product) and check for leaks at each Sump. If there are any leaks, immediately turn off power, lockout and tag at the Service Panel, use absorbent rags to clean up the product spills and dispose of properly, and repair the leak(s) and repeat step 8 and 9 until no leaks remain.
10. Purge remaining air from the system as follows: Dispense enough fuel from the dispenser farthest from the pump to remove all the air from that line. Repeat this procedure with each dispenser, working your way back to the pump. Also open the Valve for the Leak Generating Device to remove air from this area. The measurement will not be accurate if all the air is not removed from the system. Once complete, close the Valve for the Leak Generating Device and turn off the submerged pump.

NOTE

During the measurement process, no other activity should take place on this product line. Product line stability is key to proper measurement of the Discharge Time. Measure the Discharge Time on only one channel at a time.

CAUTION

Confirm that all requirements outlined in Section P.2 Site Survey & Assessment have been met before proceeding with the measurement process. Failure to meet these requirements may result in an inaccurate measurement, which could result in not properly detecting leaks in a monitored line. Call Technical Support at (800) 209-7858 for assistance.

5.2 MANUAL DISCHARGE TIME MEASUREMENT

Note: For AUTO CAPTURE Discharge Time Measurement using the TMS4000, go to Section 5.3 for instructions.

 **WARNING**

Confirm the ballasted leak orifice of the LG203 Leak Generating Device has been placed in a suitable container, minimum 5-gallon capacity. Failure to do so could result in bodily injury, serious property damage and environmental contamination.

1. Open the Valve for the LG203 Leak Generating Device and completely bleed the line pressure to 0 PSI. Keep valve for the Leak Generating Device open during the calibration process, as this is necessary for proper calibration.

NOTE

After opening the valve for the Leak Generating Device to the LG203 Leak Generating Device, ensure that the fuel flow through the orifice is a steady stream from pump OFF pressure to 0 PSI. If there is not a steady stream, or line pressure does not drop completely to 0 PSI, replace the LG203 Leak Generating Device or call Technical Support at (800) 209-7858 for assistance. Never attempt to clean the orifice, as damage, or improper measurement, may result.

 **WARNING**

Prevent Static electric sparks and possible explosion by placing container on ground. Always have container on the ground when filling with fuel. Use only containers approved for petroleum storage.

 **CAUTION**

Before commencing with the Discharge Time Measurement procedure, confirm that the pump cannot be activated by site personnel or customers while retaining the ability of the service tech to manually activate the pump.

NOTE

A stopwatch or other comparable device will be needed to measure the number of seconds it takes for the fully pressurized line to decay to 10 PSI beginning the moment that the pump is powered off.

2. Manually activate the pump either at the dispenser or by following the instructions provided with the pump controller. The pump will need to be left running for at least 30 seconds to ensure that the line has been fully pressurized.
3. Power off the pump and start the stopwatch to begin timing the pressure decay. Continue monitoring the pressure gauge until the line pressure drops to 10 PSI. Make note of the total number of seconds to complete the pressure decay sequence. A Table is provided in Section 3 where the number of seconds can be recorded. This value will need to be entered in the TMS as the Discharge Time.
4. After configuring the TMS with the Discharge time, verify the newly configured channel detects a 3 GPH leak by manually starting the pump with the LG203 Leak Generating Device Kit still installed and in the approved container to catch all fuel and the Valve for the Leak Generating Device still open. If the leak is not detected, confirm the amount of time has been configured in the TMS or call Technical Support at (800) 209-7858 for assistance.
5. Advance to Section 5.5 to remove the LG203 for use when calibrating an additional line.

NOTE

Be sure to go to Section 5.5 for instructions on removing the LG203 Leak Generating Device. The procedures outlined in Section 5 will need to be repeated for each pipeline being monitored by the LLP203.

NOTE

See LLP203 Troubleshooting Guide at end of this manual for information on verifying the operation of the LLP203. Call Technical Support at (800) 209-7858 for any other concerns or questions regarding installation or service of the TMS system.

5.3 AUTO CAPTURE DISCHARGE TIME MEASUREMENT (TMS4000 ONLY)

Note: For MANUAL measurement of the Discharge Time, please refer to Section 5.2 for instructions.

**CAUTION**

A Pneumercator-trained service technician must perform the AUTO CAPTURE procedure. Failure to heed this Caution may result in an improperly calibrated system, resulting in an undetected environmental contamination release and/or serious property damage.

**WARNING**

Confirm the ballasted leak orifice of the LG203 Leak Generating Device has been placed in a suitable container, minimum 5-gallon capacity. Failure to do so could result in bodily injury, serious property damage and environmental contamination.

1. Open the Valve for the LG203 Leak Generating Device and completely bleed the line pressure to 0 PSI. Keep valve for the Leak Generating Device open during the calibration process, as this is necessary for proper calibration.

NOTE

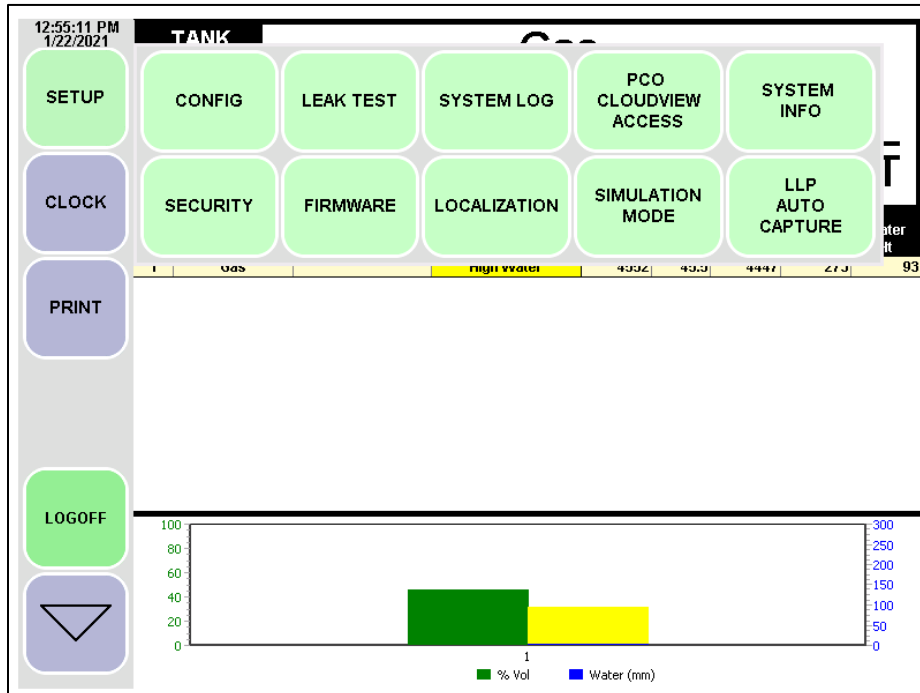
After opening the valve for the Leak Generating Device to the LG203 Leak Generating Device, ensure that the fuel flow through the orifice is a steady stream from pump OFF pressure to 0 PSI. If there is not a steady stream, or line pressure does not drop completely to 0 PSI, replace the LG203 Leak Generating Device or call Technical Support at (800) 209-7858 for assistance. Never attempt to clean the orifice, as damage, or improper measurement, may result.

**WARNING**

Prevent Static electric sparks and possible explosion by placing container on ground. Always have container on the ground when filling with fuel. Use only containers approved for petroleum storage.

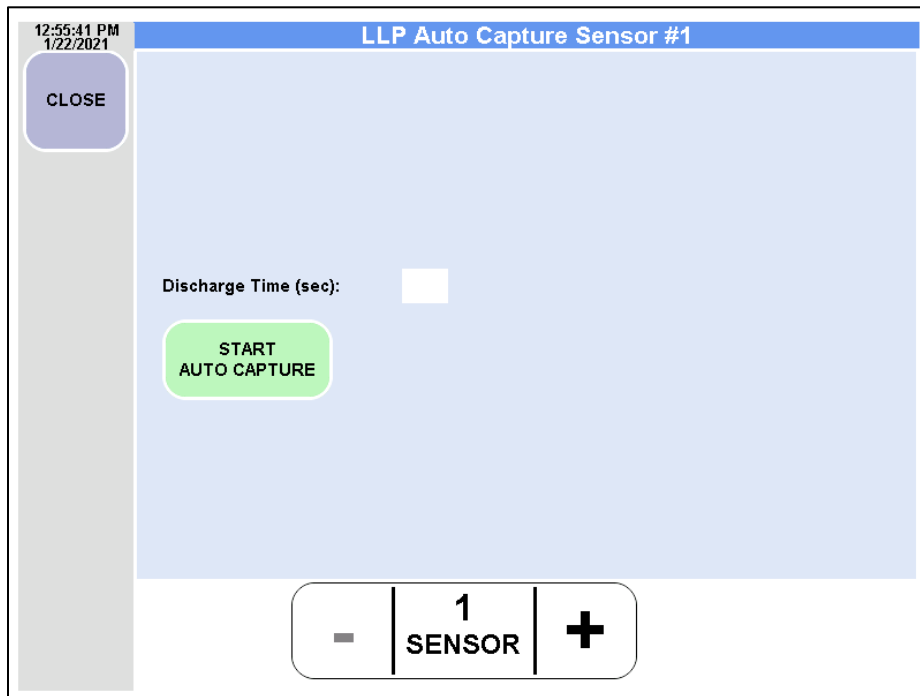
**CAUTION**

Before commencing with the Discharge Time Measurement procedure, confirm that the pump cannot be activated by site personnel or customers while retaining the ability of the service tech to activate the pump.

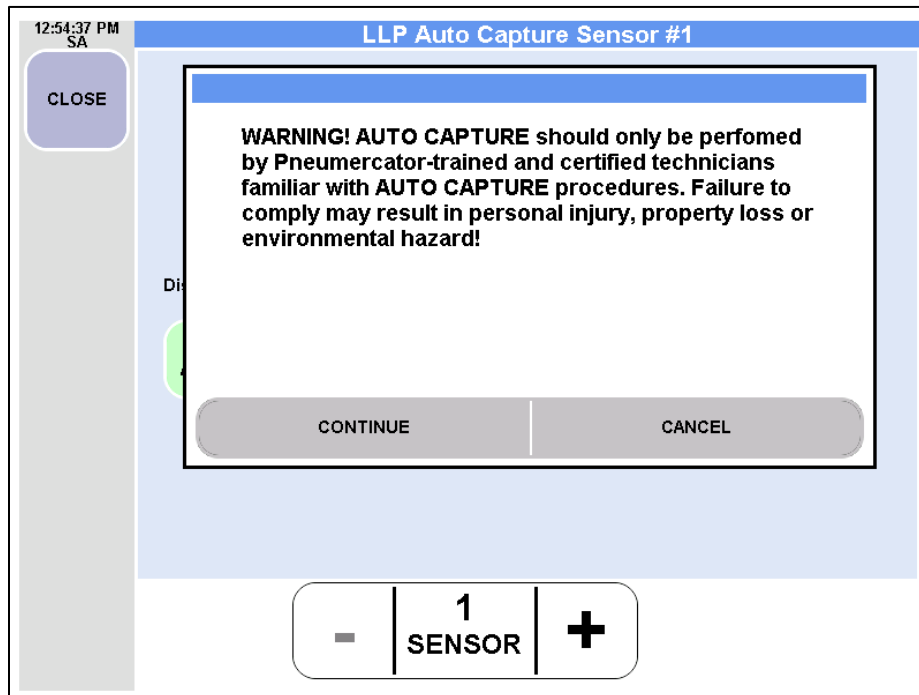


NOTE TMS Security **must** be enabled to perform LLP AUTO CAPTURE. Security may be enabled in SETUP > SECURITY. Refer to TMS4000 Operations Manual for details.

2. Tap SETUP, then LLP AUTO CAPTURE

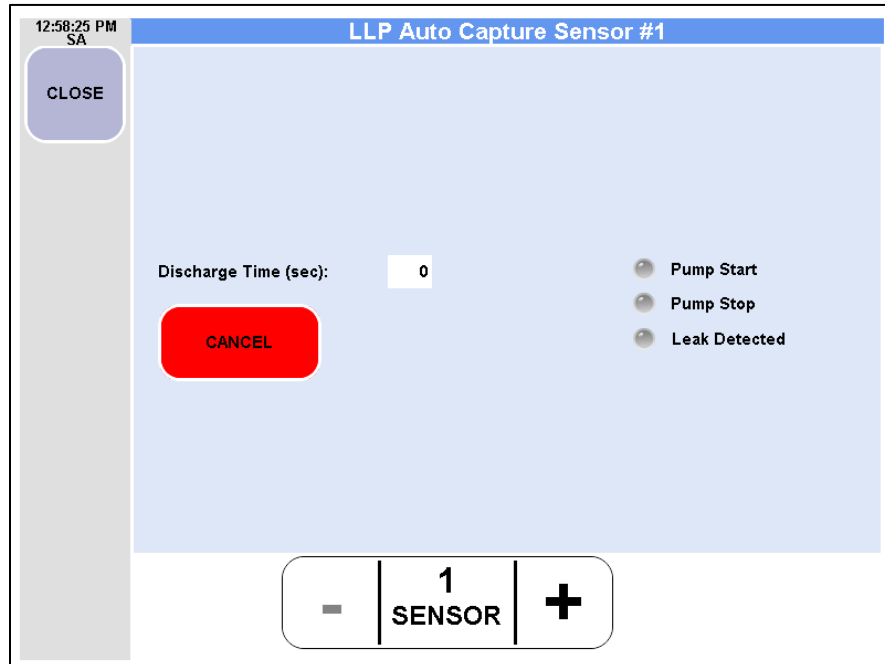


3. Select the Sensor Input number, using the plus or minus control, representing the LLP203 to be configured. Tap START AUTO CAPTURE to begin the process.

**⚠ CAUTION**

A Pneumercator trained service technician must perform the AUTO CAPTURE procedure. Failure to heed this Caution may result in an improperly configured TMS with its ability to detect a 3 GPH Leak impaired. Subsequently, this could result in serious property damage and/or environmental contamination.

4. Tap CONTINUE to acknowledge requirement for Factory-Trained Technician.

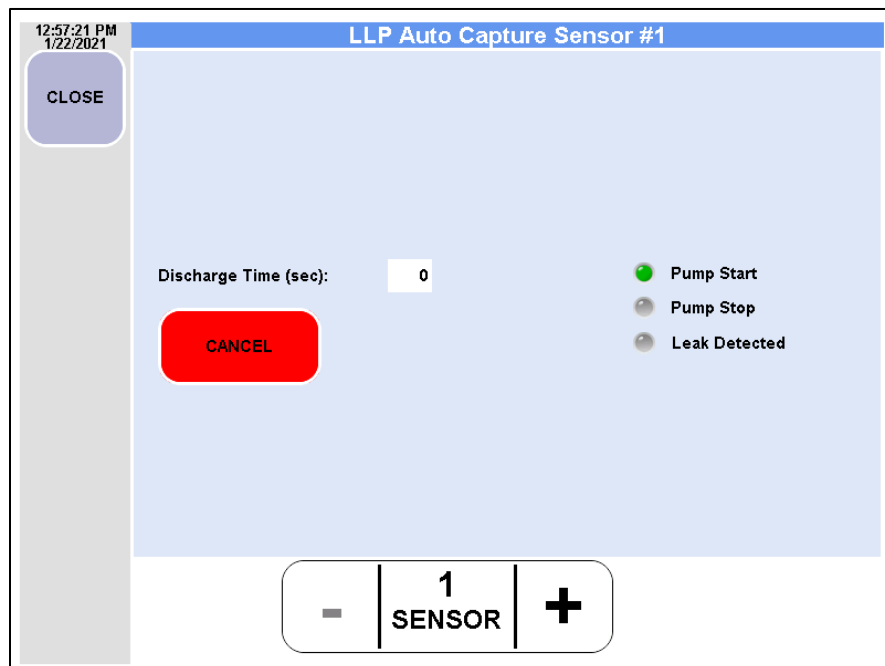


Pump Start LED will be blinking Green to indicate the TMS is waiting for the Pump to Start

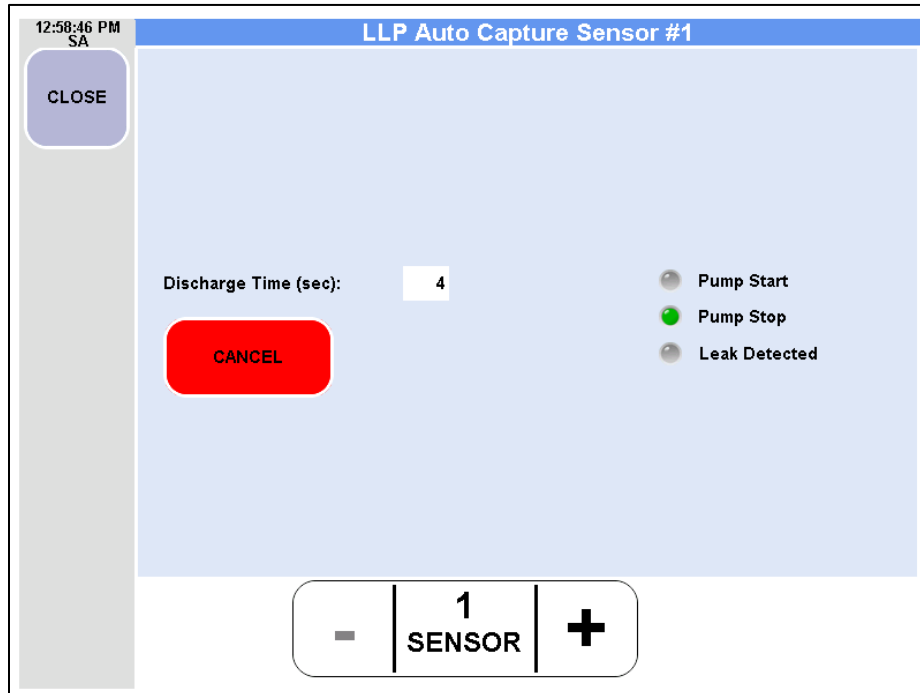
NOTE

If FOLLOW PUMP OFF OR HOURLY has been selected in the HEADER menu AND the TMS has been wired to control the pump via relay, as required by the TMS, the AUTO CAPTURE procedure will complete without any additional steps required by the technician. Skip to Step 7 and wait for Accept button to appear if this is the case.

- Manually activate the pump either at the dispenser or by following the instructions provided with the pump controller. The pump will need to be left running for at least 30 seconds to ensure that the line has been fully pressurized.

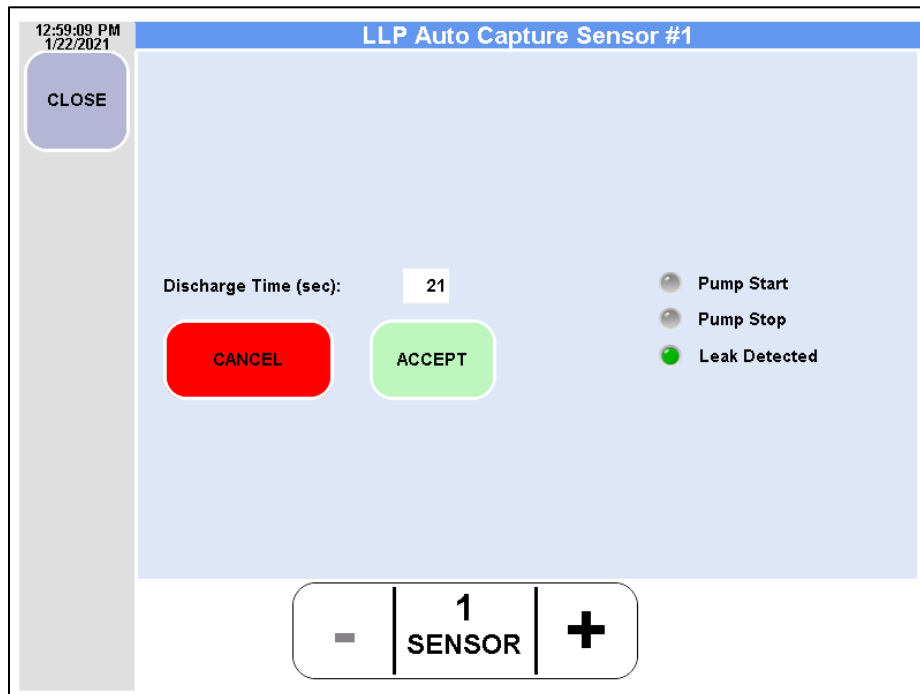


Pump Start LED stays active to indicate the Pump is running



**Pump Stop LED is active indicating the Pump has stopped.
The Discharge Time will increase until the line pressure drops to 10 PSI**

- 6. Power off the pump. Wait for the line pressure to drop to 10 PSI as indicated by the below screen.



Leak Detected LED is active indicating the Line Pressure has dropped to 10PSI.

- 7. Tap ACCEPT to save the Discharge Time.

8. After configuring the TMS with the Discharge time, verify the newly configured channel detects a 3 GPH leak by manually starting the pump with the LG203 Leak Generating Device Kit still installed and in the approved container to catch all fuel and the Valve for the Leak Generating Device still open. If the leak is not detected, confirm the amount of time has been configured in the TMS or call Technical Support at (800) 209-7858 for assistance.
9. Continue with Section 5.5 to remove the LG203 for use when calibrating an additional line.

NOTE

Be sure to go to Section 5.5 for instructions on removing the LG203 Leak Generating Device. The procedures outlined in Section 5 will need to be repeated for each pipeline being monitored by the LLP203.

NOTE

See LLP203 Troubleshooting Guide at end of this manual for information on verifying the operation of the LLP203. Call Technical Support at (800) 209-7858 for any other concerns or questions regarding installation or service of the TMS system.

5.4 VERIFICATION OF 3 GPH LEAK

 **WARNING**

Confirm the ballasted leak orifice of the LG203 Leak Generating Device has been placed in a suitable container, minimum 5-gallon capacity. Failure to do so could result in bodily injury, serious property damage and environmental contamination. Refer to Section 5.1 for LG203 installation details.

1. Confirm the Valve for the LG203 Leak Generating Device is open. Keep valve for the Leak Generating Device open during the calibration process, as this is necessary for proper calibration.

NOTE

After opening the valve for the Leak Generating Device to the LG203 Leak Generating Device, ensure that the fuel flow through the orifice is a steady stream. If there is not a steady stream, replace the LG203 Leak Generating Device or call Technical Support at (800) 209-7858 for assistance. Never attempt to clean the orifice, as damage, or improper measurement, may result.

 **WARNING**

Prevent Static electric sparks and possible explosion by placing container on ground. Always have container on the ground when filling with fuel. Use only containers approved for petroleum storage.

 **CAUTION**

Before commencing with the Leak Verification, confirm that the pump cannot be activated by site personnel or customers while retaining the ability of the service tech to manually activate the pump.

2. Manually activate the pump either at the dispenser or by following the instructions provided with the pump controller. The pump will need to be left running for at least 30 seconds to ensure that the line has been fully pressurized.
3. Monitor the TMS to confirm that the 3 GPH Leak is reported. This may take several minutes before the Line Pressure drops to 10 PSI, indicating a leak. The actual time can be identified in the TMS Configuration unless the Discharge Time is CALCULATED. Make note of the duration for use in Step 6.
4. Close the Valve for the LG203 Leak Generating Device.

5. Manually activate the pump either at the dispenser or by following the instructions provided with the pump controller. The pump will need to be left running for at least 30 seconds to ensure that the line has been fully pressurized.
6. Monitor the TMS to confirm that the 3 GPH Leak is NOT reported. Make sure to wait as long as it took in Step 3 to detect the leak. Once the specified time frame has passed without alarm, the TMS and LLP203 Sensor functionality have been confirmed.

5.5 LEAK GENERATING DEVICE (LG203) REMOVAL

NOTE

This Section details the removal of Pneumercator's LG203 Leak Generating Device. If a third-party Leak Generating Device is being used, refer to the documentation provided.

1. At the electrical Service Panel: lock-out & Tag POWER OFF for the Pump, Pump Controller, and Dispensers.



ALWAYS lock out and tag electrical circuit breakers while installing or servicing this equipment, pumps and related equipment. A potentially lethal electrical shock hazard and the possibility of an explosion or fire from a spark can result if the electrical circuit breakers are accidentally turned on during installation or servicing.



Before commencing with the removal of a LG203 Leak Generating Device, secure the work area by using safety cones, barricades, trucks, etc.

2. Relieve the line pressure to 0 PSI, then remove the LG203 and associated hardware, including optional pressure gauge, from the Line Test Port on the pump.
3. Apply Petroleum resistant, non-hardening, UL Classified, FEP Pipe Dope/Thread Sealant (Hercules Megaloc, Gasoila, etc.) to the threads of the ¼" plug originally removed from the Line Test Port.
4. Install the ¼" plug in the Line Test Port of the pump.
5. After the installation is checked and all personnel are clear, have the electrician turn on power at the Service Panel for the Pump (Submerged Turbine Pumps and Output Devices).
6. Turn on the Pump at the output device (do not transfer product) and check for leaks at each Sump. If there are any leaks, immediately turn off power, lockout and tag at the Service Panel, use absorbent rags to clean up the product spills and dispose of properly, and repair the leak(s) and repeat step 5 and 6 until no leaks remain.
7. Purge remaining air from the system as follows: Dispense enough fuel from the dispenser farthest from the pump to remove all the air from that line. Repeat this procedure with each dispenser, working your way back to the pump.

NOTE

Return to the beginning of Section 5 for each additional LLP203 configured for MANUAL or AUTO CAPTURE Discharge Time Measurement.

SECTION 6 - OPERATION

6.1 TMS2000/TMS3000

The diagram shows two states of the TMS2000/TMS3000 display. In the top state, the display shows 'Sensor 3' in red. Below it are buttons for LEAK (red LED), SP 1, SP 2, SP 3, and WATER. To the right are radio buttons for GAL, %GAL, ULL, IN, and °F. In the bottom state, the display shows 'Piping' in red. The same buttons are present. A double-headed arrow indicates the transition between the two states.

Sensor 3, named Piping, has detected a Leak in the Line. The Leak LED is active.

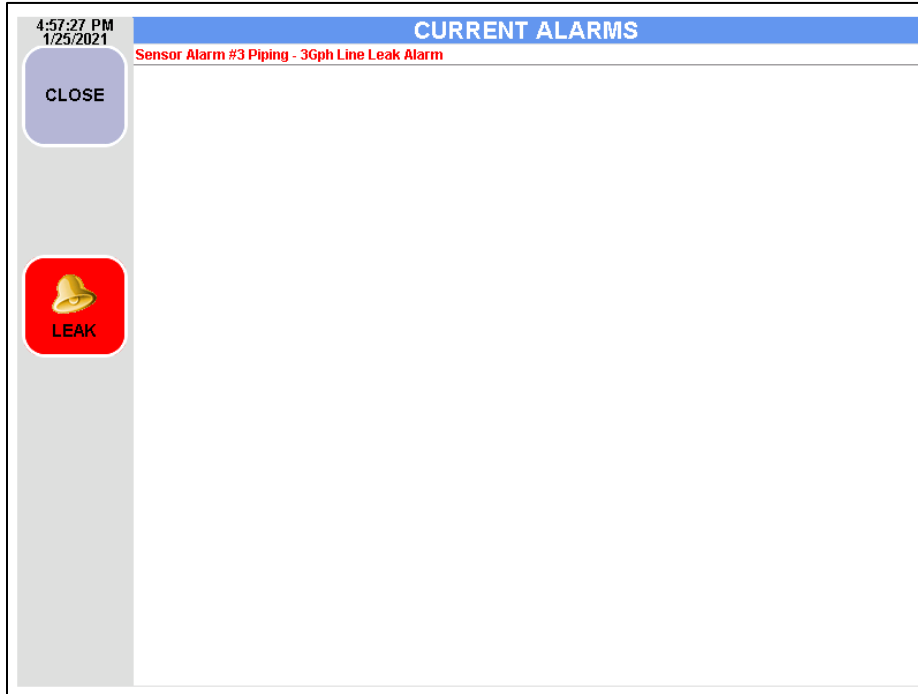
The TMS2000 and TMS3000 represents a Leak Alarm by activating the Leak LED, integrated horn, and displaying the Sensor Name and Number on the display. The alarm may be acknowledged by pressing the Edit Enable button on the back of the TMS door. Go to Section 6.3 to address the failed Line Leak Test.

6.2 TMS4000

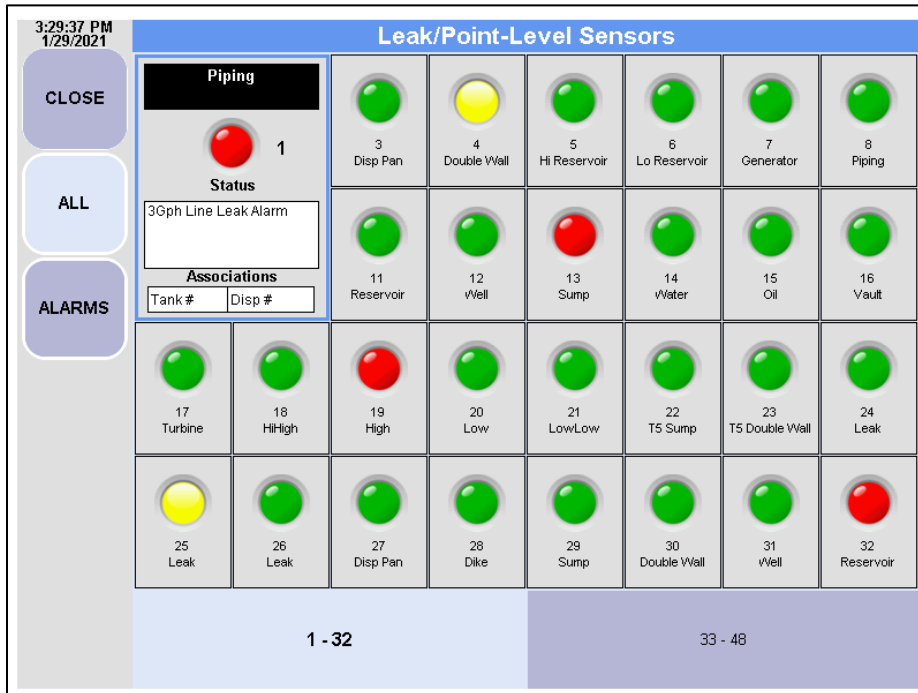
The screenshot shows the TMS4000 interface. At the top left, it displays the time '10:06:11 AM' and date '2/5/2021'. The main display area shows four tanks: Tank 4 (1-2-3) with 37600 GAL, Tank 22 (Motor Oil) with 36.1 % VOL, Tank 11 (Regular) with 3146 GAL, and Tank 12 (Super) with 14484 GAL and a red 'CH' indicator. Below this is a table with columns: Tank ID, Tank Name, Status, Alarms, % Vol, Ullage (gal), Prod. Ht (in), Water Ht (in), and Temp (°F). At the bottom, there is a bar chart showing % Vol (green) and Water (in) (blue) for tanks 1, 2, 3, 4, 11, 12, 21, 22, 31, and 32.

Tank ID	Tank Name	Status	Alarms	% Vol	Ullage (gal)	Prod. Ht (in)	Water Ht (in)	Temp (°F)
11	Regular	Leak Test IP		20.9	10353	16.15	0.6	66.5
12	Super		Crit High Prod	96.5	0	74.35	0.8	65.7
31	Waste	Probe Sync Error						
32	O/W Separator		High Prod	14.8		11.44	56.4	65.8
1	Diesel			70.9	3804	54.65	1.1	64.0
2	Diesel			69.1	4167	53.25	2.2	65.8
3	Diesel			47.8	8427	36.85	0.8	66.5
4	1-2-3			62.6	0	62.66		
21	Transmission Oil			47.0	1716	36.25	0.3	65.7
22	Motor Oil			36.1	2153	27.85	0.5	66.5

Tap BELL button to view current alarms or tap SENSORS button to view Sensor Status.



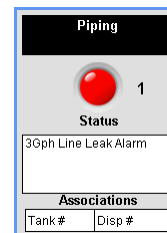
BELL Button: Sensor 3, named Piping, has detected a Leak in the Line.



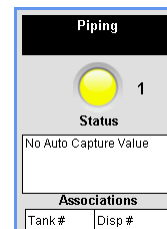
SENSORS Button: Sensor 1, named Piping, has detected a Leak in the Line.

The TMS4000 represents a Leak Alarm in both the Sensor Status and Alarm Acknowledgement screens. The Leak alarm is acknowledged from the Alarm Acknowledgement screen by tapping the Leak Bell button.

3 GPH Line Leak Alarm: Represents a Failed Line Leak Test. Go to Section 6.3 for Troubleshooting Instructions



No AUTO CAPTURE Value: Indicates the AUTO CAPTURE procedure has not yet been completed. Follow Sections 5.1, 5.3, and 5.4 to install the LG203, perform the AUTO CAPTURE procedure, and remove the LG203.



6.3 DETECTED LINE LEAK



Detected line leaks may be an actual or **false** line leak alarms. Treat all detected line leak alarms as actual line leaks until verified true or false.

False line leaks can occur because of the follow reasons:

Air trapped in a line or a loose fuel filter (this is likely to occur after a new installation, maintenance, or service), Pump/check-valve malfunction, or a vapor recovery system malfunction.

A Gross (3 GPH/11 LPH) leak is a large leak requiring immediate action to locate and repair the source of the leak to avoid environmental contamination, and to avoid fire or explosion hazards. A detected Gross leak may cause a positive pump shutdown, which will stop product dispensing.



DO NOT excavate / repair a fuel-line solely on the basis of a single line leak detected alarm – confirm the presence of a leak before attempting/scheduling any repairs.

When a line leak is detected, you the owner/authorized representative must follow the steps outlined below:

1. **Record (log) and identify:** the time and date it failed, the product line number, and the product name. Record this in a special station log at your site. The TMS will also document the failure in the Alarm Log/Report.
2. **Inspect the piping system, dispensers, fittings, and hoses for obvious leaks.** Open the dispenser enclosure and inspect the fittings and fuel filter for leaks (especially if maintenance or service was done recently).
3. **Stop/Prevent dispensing** from that product line (“bag” tape a polybag, over the appropriate dispenser nozzles and lever). If a leak was found in Step 2, skip Step 4, and perform Step 5.
4. **Initiate a Line Leak Test** by manually activating the pump for at least 30 seconds to verify the failure.

5. If a leak is discovered by visual inspection, or the second (verification) line leak test fails and detects a line leak on the same line:

- a. Immediately shut-off power to the affected pump, line, & dispenser, and call our Technical Service telephone number, (800) 209-7858.
- b. Take corrective action in accordance with local, State, and Federal rules and regulations
- c. Contact the local inspection agency about the leak, and follow all procedures and instructions as required by law

6. A line is considered verified tight and not leaking if a second (verification) line leak test passes.

REPORTING LINE LEAKS

When a line leak is detected, it is the site owner's obligation to contact the local inspection agency about line leaks, and to comply with the requirements concerning reporting and cleanup as determined by Local/State/Federal Laws and Regulations. These and other regulations as required, must be followed quickly and to the letter.

**WARNING**

Serious legal, health, and safety hazards could result from not taking the proper action within a specified time.

Where codes and regulations conflict with this manual, follow the regulations.

COMPLIANCE REPORTING

The line leak testing requirements often vary from area to area. It is the site owner's obligation to know the frequency of line leak testing, the compliance reporting requirements, and to comply with these requirements with appropriate documentation. Compliance is determined by local/State/Federal Laws and Regulations. Non-compliance may cause site shutdown, fines, or legal action.

SECTION 7 – MAINTENANCE AND TROUBLESHOOTING GUIDE

7.1 SYSTEM MAINTENANCE - ANNUAL OPERABILITY VERIFICATION

The system must be checked annually to verify compliance with leak detection requirements. This is accomplished by connecting a 3 GPH leak generating device to each line being monitored, and confirming detection of a 3 GPH leak. Please refer to Section 5.4, Verification of 3 GPH Leak.

7.2 LLP203 TROUBLESHOOTING

The LLP203 transducer is the main component of detecting line leaks with a TMS system. This section is to aid in the proper troubleshooting of the transducer and its wiring. A loose or broken wire connection, or damaged insulation on a wire, can cause the transducer to give erroneous readings. The LLP203 is a normally closed sensor that will open when the line pressure drops to 10PSI. The following procedure may be used to confirm that the LLP203 transducer is functioning properly:

1. At the electrical Service Panel: lock-out & Tag POWER OFF for the Pump, Pump Controller, and Dispensers.



ALWAYS lock out and tag electrical circuit breakers while installing or servicing this equipment, pumps and related equipment. A potentially lethal electrical shock hazard and the possibility of an explosion or fire from a spark can result if the electrical circuit breakers are accidentally turned on during installation or servicing.

NOTE

A Pressure Gauge, not supplied, is required, capable of supporting the maximum line pressure.



Before commencing with the installation of a Pressure Gauge, secure the work area by using safety cones, barricades, trucks, etc.

2. Relieve pipeline pressure to 0 PSI per pump manufacturer's recommendation and capture any product that escapes or use absorbent rags to clean up any product spills and dispose of properly.
3. Power off the TMS and disconnect the LLP203 transducer from the associated Sensor Input.
4. Using a continuity tester, confirm that there is an open circuit between the two wires, Red and Black. If there is a closed circuit, the fault is likely either in the cabling, including field cabling, leader cable, and associated splices and/or the LLP203 transducer. Contact Pneumercator Tech Support at (800) 209-7858 for assistance.

NOTE

DO NOT CONTINUE with the below steps unless no problems have been identified in Step 4.

5. Remove the ¼" plug from the Line Test Port on the pump for the line to have the LLP203 tested.

NOTE

Save the ¼" plug removed from the Line Test Port so that it may be reinstalled after the Pressure Gauge is removed later in this Section.

6. Apply Petroleum resistant, non-hardening, UL Classified, FEP Pipe Dope/Thread Sealant (Hercules Megaloc, Gasoila, etc.) to the ¼" threads of the Pressure Gauge.
7. Install the Pressure Gauge in the ¼" Line Test Port of the pump for the LLP203 transducer being tested.
8. After the installation is checked and all personnel are clear, have the electrician turn on power at the Service Panel for the Pump (Submerged Turbine Pumps and Output Devices).
9. Turn on the Pump at the output device (do not transfer product) and check for leaks at each Sump. If there are any leaks, immediately turn off power, lockout and tag at the Service Panel, use absorbent rags to clean up the product spills and dispose of properly, and repair the leak(s) and repeat step 8 and 9 until no leaks remain.
10. Confirm the Pressure Gauge is reading OVER 10 PSI. If so, use a continuity tester to confirm that there is a closed circuit between the two wires, Red and Black. If there is an open circuit, the fault is likely either in the cabling, including field cabling, leader cable, and associated splices and/or the LLP203 transducer. Contact Pneumercator Tech Support at (800) 209-7858 for assistance.
11. Relieve the line pressure to 0 PSI, then remove the pressure gauge, from the Line Test Port on the pump.
12. Apply Petroleum resistant, non-hardening, UL Classified, FEP Pipe Dope/Thread Sealant (Hercules Megaloc, Gasoila, etc.) to the threads of the ¼" plug originally removed from the Line Test Port.
13. Install the ¼" plug in the Line Test Port of the pump.
14. After the installation is checked and all personnel are clear, have the electrician turn on power at the Service Panel for the Pump (Submerged Turbine Pumps and Output Devices).
15. Turn on the Pump at the output device (do not transfer product) and check for leaks at each Sump. If there are any leaks, immediately turn off power, lockout and tag at the Service Panel, use absorbent rags to clean up the product spills and dispose of properly, and repair the leak(s) and repeat step 5 and 6 until no leaks remain.
16. Purge remaining air from the system as follows: Dispense enough fuel from the dispenser farthest from the pump to remove all the air from that line. Repeat this procedure with each dispenser, working your way back to the pump.

7.3 TMS TROUBLESHOOTING

Many problems with the TMS supporting the LLP203 can be caused by an improperly configured TMS and/or wiring problems. Refer to Section 3 for complete wiring instructions and Section 4 for TMS Configuration details. Below is a list of symptoms with the recommended troubleshooting actions.

SYMPTOM: The CC Input Status does not change when the Pump activates.

ACTION: Remove the wiring from the CC Input to simulate an Open Circuit. Confirm the Pump Status is properly represented. Subsequently, short out the CC Input using a jumper wire. The Pump Status should have changed.

Note: An Open Circuit may represent either the Pump Active OR Pump Inactive State. Review the TMS Configuration settings for the CC Input to identify the Normal Contact State representing the Pump Inactive Status.

TROUBLESHOOTING:

- Confirm the proper CC Input Number has been configured in the TMS and associated with the LLP203.
- Take a DC Voltage Reading on the CC Input. A working CC Input should have about 5VDC.

SYMPTOM: The TMS Relay Output is not activating the Pump.

ACTION: Power off the TMS. Take a Voltage reading across the two wires connected to the Relay. Voltage is expected since the circuit power originates outside of the TMS.

TROUBLESHOOTING:

- Confirm the Relay Output has been properly connected as per Section 3 AND per the Instructions provided with the Pump Controller.
- Confirm the wiring connecting the TMS to the Pump Controller is not damaged or exposed.
- Troubleshoot the Pump Controller as per the Manufacturer's Instructions.

ACTION: Power On the TMS. Temporarily reconfigure the TMS so that the Normal Contact State for the Relay is On. Confirm the state of the TMS Relay Output has changed by taking a Voltage reading across the two wires connected to the Relay. 0 Volts is expected.

TROUBLESHOOTING:

- If the Relay Output Fails to change:
 - Confirm the Relay Output Number configured matches wiring.
 - Replace Relay Card
- If Relay changes but fails to activate Pump:
 - Troubleshoot the Pump Controller as per the Manufacturer's Instructions.

APPENDIX A - LLP203 LINE LEAK DETECTOR

Technical Specifications

- Electrical Connection: 3-Conductor Cable(two wires used),
3-Pin Quick Disconnect,
3/4" NPT Male Conduit Connection
- Pressure Connection: 2" NPT Male
- Weight: Aluminum Housing,
316SS Sensor Body 2.25 lbs (1 kg),
All 316SS 3.75 lbs(1.7 kg)
- Dimensions (H x W): 6" x 2.6"(152 mm x 66 mm)
- Cable Type: Two-wire, 18-22 awg, shield not required, but good practice,
and recommended for cable lengths exceeding 500'.
- Maximum Cable Length: 4000'
- Operating Temp: -40 °F to 194 °F (-40 °C to 90 °C)
- Pressure Rating: 150 PSI (1033 kPa)
- Overpressure: 200 PSI (1379 kPa)
- Burst Pressure: 500 PSI (3447 kPa)
- Maximum Viscosity: 125 Centistokes @ 60°F(Kinematic)
- Applicable Liquids: All automotive and aviation gasolines, including ethanol blends
All diesel and biodiesel blends
All jet aviation kerosene-based fuels

Agency Approvals

- UL/cUL Approved, File #E139464
- Third-Party Approved
3.0 GPH (11 LPH): Pd = 100.0%, Pfa = 0%

LLP203 Piping Volume Limits Table									
Charge Pressure[PSI]	Bulk Modulus[PSI]								
	2000	5000	10000	20000	30000	40000	50000	60000	70000
30	117	292	584	1167	1179	1179	1179	1179	1179
35	93	233	467	934	1179	1179	1179	1179	1179
40	78	195	389	778	1167	1179	1179	1179	1179
45	67	167	333	667	1000	1179	1179	1179	1179
50	58	146	292	584	875	1167	1179	1179	1179
55	52	130	259	519	778	1037	1179	1179	1179
60	47	117	233	467	700	934	1167	1179	1179
65	42	106	212	424	637	849	1061	1179	1179
70	39	97	195	389	584	778	973	1167	1179
75	36	90	180	359	539	718	898	1077	1179
80	33	83	167	333	500	667	834	1000	1167
85	31	78	156	311	467	622	778	934	1089
90	29	73	146	292	438	584	729	875	1021
95	27	69	137	275	412	549	686	924	961
100	26	65	130	259	389	519	648	778	908
105	25	61	123	246	369	491	614	737	860
110	23	58	117	233	350	467	584	700	817
115	22	56	111	222	333	445	556	667	778
120	21	53	106	212	318	424	530	637	743

PNEUMERCATOR LLP203

LIMITED WARRANTY

TMS Series

Pneumercator, here and after referred to as **PCO**, warrants its **LLP203** to be free of defects in material and workmanship for a period of **Twelve (12) months** from date of installation or **Fifteen (15) months** from date of invoice, whichever comes first.

During the warranty period on the **LLP203**, **PCO**, or factory third party independent representatives will repair or replace the product at the location where it is installed at no additional cost to the customer.

Packages must be inspected upon receipt for damage, missing parts, and / or manuals. **PCO** must be contacted by telephone immediately with a description of damaged or missing parts so replacements can be sent. Written details must be sent within **thirty (30) days**.

Pneumercator will not be responsible for shipping charges incurred by the customer.

Warranty repair coverage invoices will be paid if **all** the following conditions are met:

- PCO has acknowledged and authorized warranty work to be done by issuing a *Warranty Repair Number*.
- Start-up Service technician has been trained by PCO
- Technician fills out and submits a PCO "Service Report"
- Parts (if any) used are returned to PCO with a proper WRGA (*Warranty Return Goods Authorization*)
- Returned parts are found to be defective.

Repair time will be paid according to PCO document "Standard Warranty Labor Charge Schedule"

If the product is installed in accordance with the specific PCO Installation Product Manual, PCO will activate and meet warranty criteria as described above. Warranty criteria shall be voided if any product has been subjected to misuse, negligence, damage from acts of nature (lightning, wind, rain, etc.) or is in violation of the products design intent, disregard to warnings, instructions, modified or repaired by unauthorized personnel or improperly installed. Given that the third party independent contractor has installed the equipment in accordance with the specific product instruction manual, and followed all precautions, PCO will fulfill the terms stated in our warranty obligation.

Under no circumstances does the warranty provide a remedy in excess of the equipment. No other expressed or implied warranty is given by PCO. PCO shall not be liable for consequential damages or any expenses incurred by the user.

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1785 Expressway Drive North, Hauppauge NY 11788
(631) 293-8450 Fax (631) 293-8533

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