



ATEX Zone 1 II B + T6

CSA/CUS Class 1 Div 1 Group C + D



Process Analyzer **User Manual**

P-800LT FREEZE POINT ANALYZER, LOW TEMP



FOREWORD

FOREWORD

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WARRANTY

POLICY

Orb Instruments warrants its products to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from date of shipment unless otherwise noted in the product manual.

In the event that a defect is discovered during the warranty period, Orb Instruments agrees that, at its option, it will repair or replace the defective product or refund the purchase price, excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents, or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact ORB Instruments or your distributor to initiate warranty support. Products may not be returned without authorization from ORB Instruments.

LIMITATIONS

This warranty does not cover:

- Damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction.
- Damage caused by misuse, neglect, accident or improper application or installation.
- Any product not used in accordance with the instructions furnished by ORB Instruments.
- Freight charges to return merchandise to ORB Instruments.
- Freight charges on expedited or express shipment of warranted parts or product.
- Travel fees associated with on-site warranty repair.

This warranty contains the sole express warranty made by ORB Instruments in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state, the above limitations may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty/terms and no person is authorized to make any other warranties or representations on behalf of ORB Instruments.

LIMITATION OF REMEDIES

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall ORB Instruments be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.

ANALYZER OVERVIEW

The ORB Instruments' Model P-800LT Freeze Point Analyzer is an on-line instrument designed for the continuous measurement of freeze point in hydrocarbon refining processes. Extremely rugged and simple to operate, the compact P-800LT Freeze Point Analyzer combines rapid analysis, exceptional measurement accuracy, and unmatched operational dependability to deliver highly reliable and repeatable freeze point determinations day in, day out, month after month.

- Rapid analysis — 10 minutes or less typical cycle time.
- Superior repeatability — $\pm 0.5^{\circ}\text{C}$ (1.0°F) or better.
- Exceptional uptime — 99% or better.
- High pressure sample detection cell eliminates the need for atmospheric recovery.

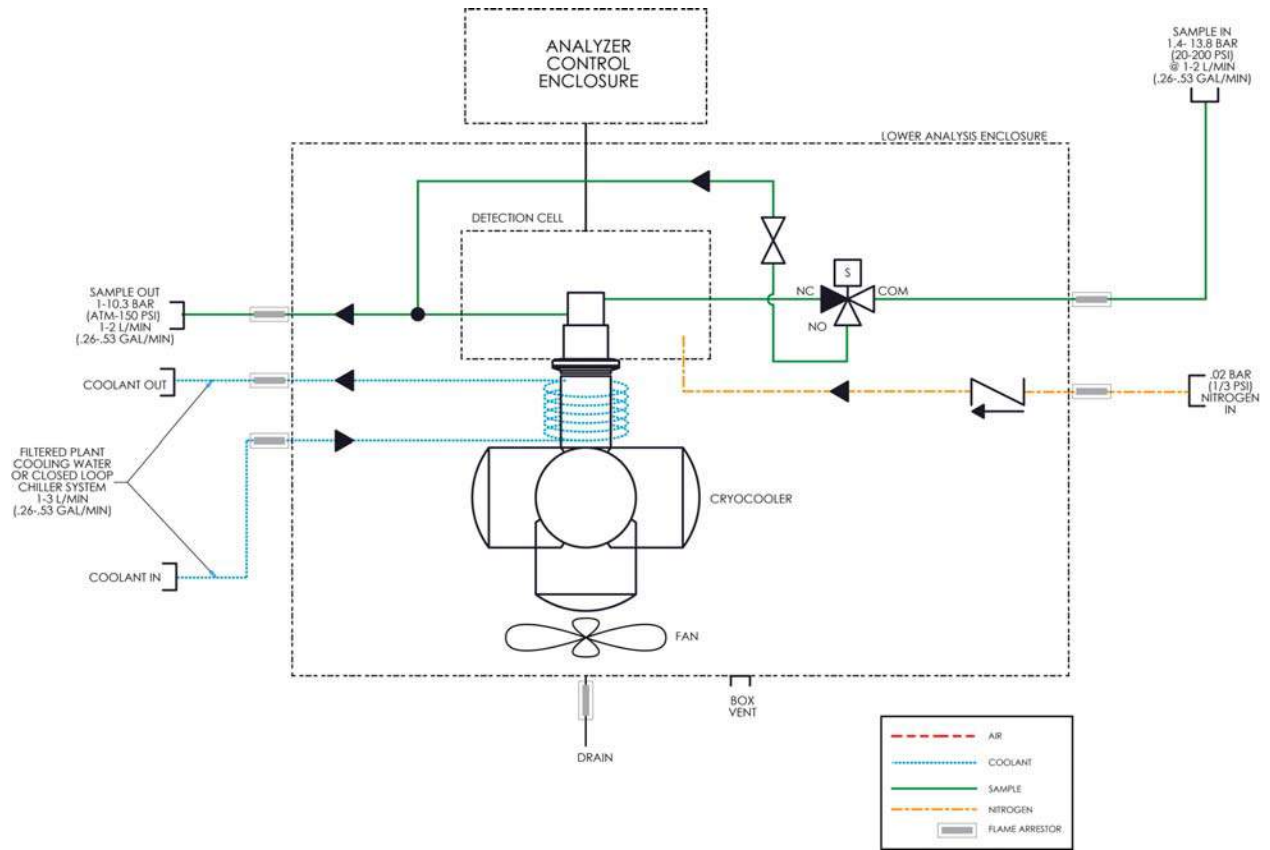
For optimum installation and applications versatility, the P-800LT Freeze Point Analyzer incorporates a wide variety of standard features, including:

- Isolated 4-20 mA analog output; optional second output available.
- Bidirectional serial output.
- Three SPDT dry contact alarm relays.
- Optional ModBus output.
- Separate electronics and measurement enclosures.
- NEC Class 1, Division 1, Group C, D or European ATEX Zone 1, Group II B and H2 T4 hazardous area classification.

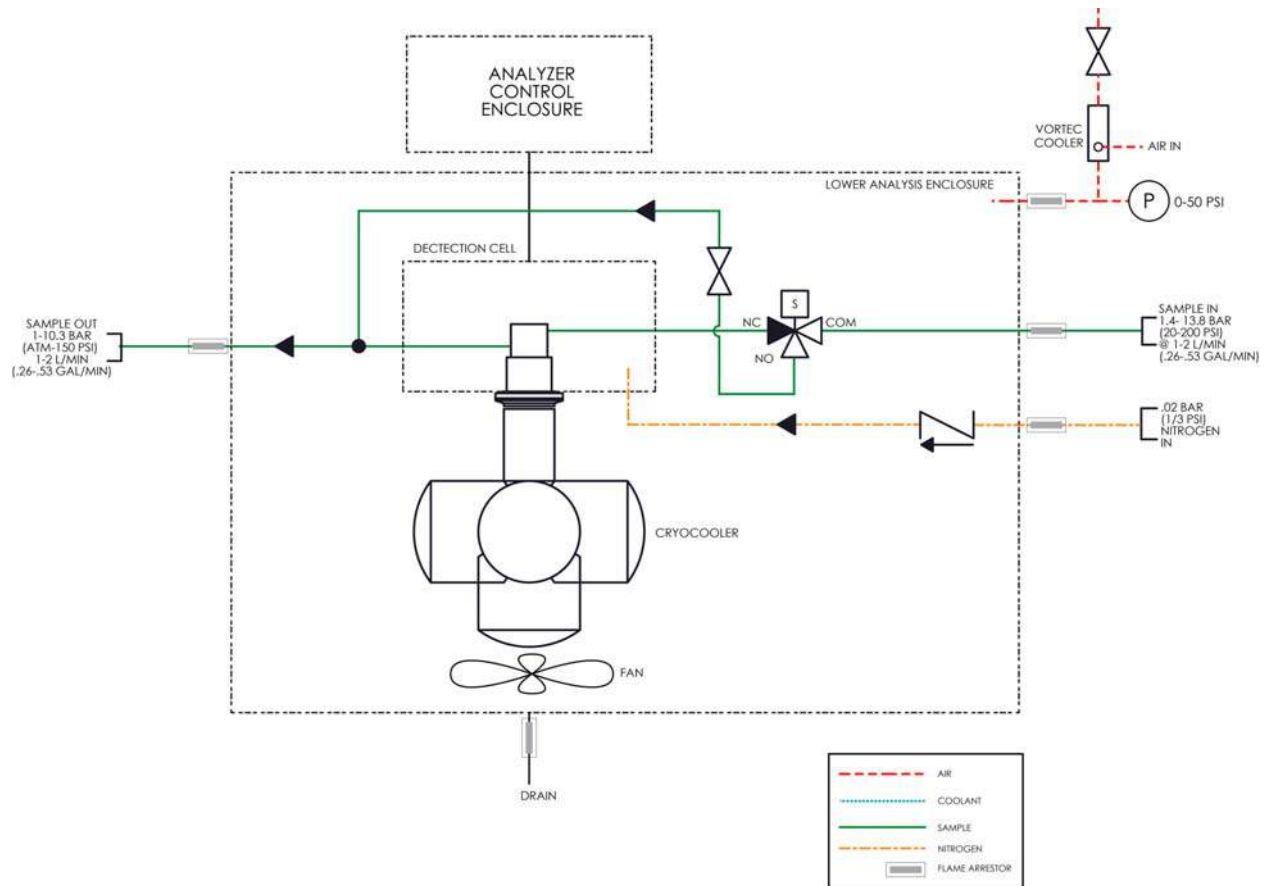
PRINCIPLE OF OPERATION

The P-800LT Freeze Point Analyzer is designed to provide freeze point determinations in correlation with ASTM Method D-2386 and IP-16. A near infrared sensing system has been employed to monitor the formation and removal of wax crystals through high-pressure optical windows that allow measurement cycles to occur at process pressures, eliminating the need for atmospheric sample recovery. A state-of-the-art air- or water-cooled cryocooler provides cooling power to the detection cell down to -125°C (-193°F). The use of the cryocooler eliminates the requirement of an external, explosion-proof recirculating chiller system.

See Figures 1-1a and 1-1b.



**Figure 1-1a: Flow Schematic
(Analyzers with a Water-Cooled Cryocooler)**



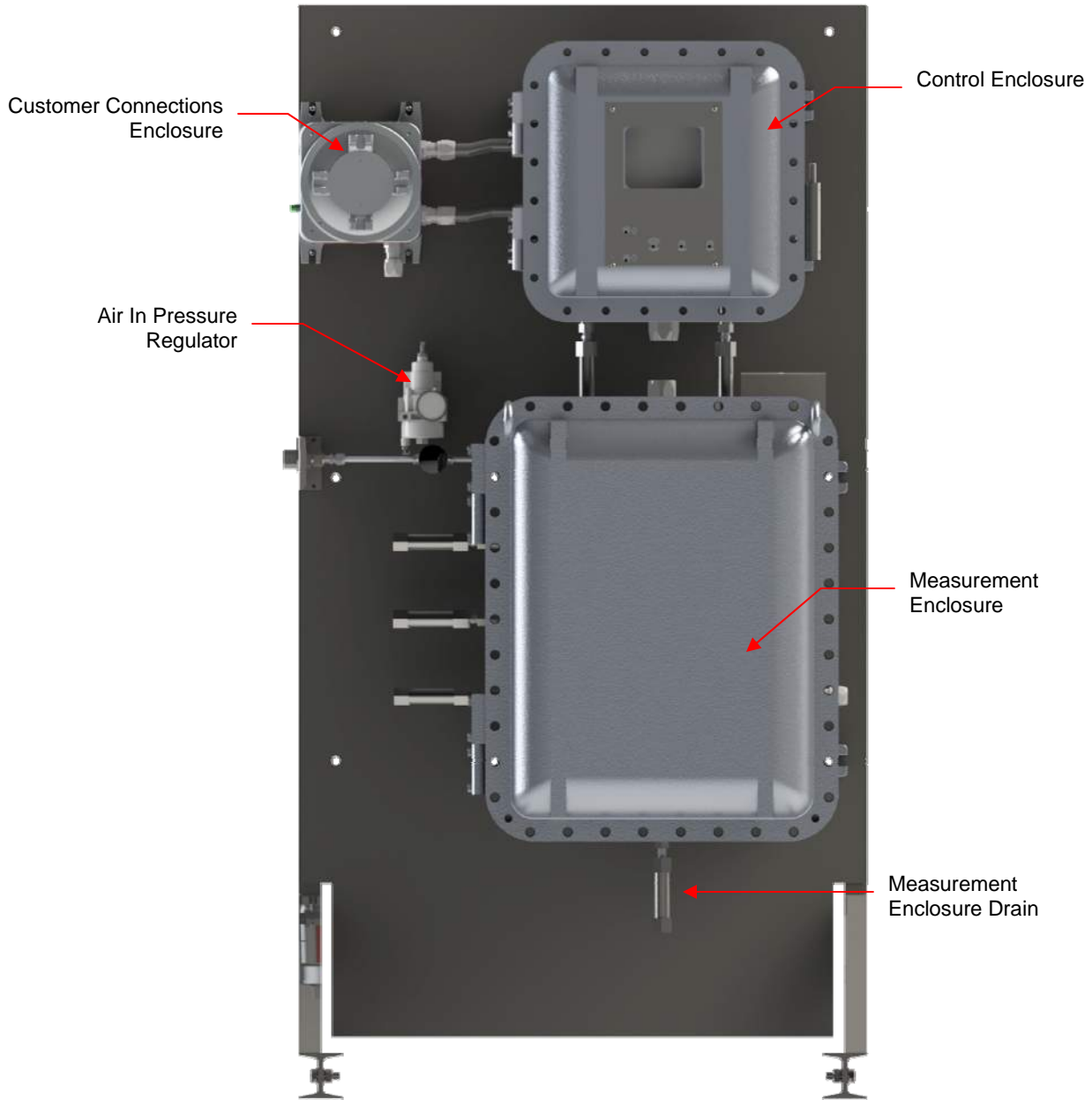
**Figure 1-1b: Flow Schematic
(Analyzers with an Air-Cooled Cryocooler)**

A typical measurement cycle takes less than ten minutes and is performed as follows:

1. The sample solenoid opens and fresh sample is flushed through the detection cell to warm and dislodge any wax crystals which may have remained on the detection cell windows from the previous measurement. The duration of the flush cycle is user-programmable.
2. The sample solenoid closes, locking fresh sample in the detection cell.
3. The cryocooler is activated. The power applied to the cryocooler is programmable and continuously monitored and automatically adjusted to maintain consistent cooling times to cloud point temperature.
4. Simultaneously, the optical system takes a baseline reading and then continuously monitors the sample as it cools for wax crystal formation. The temperature at which the crystals form is the cloud point.
5. When cloud point is detected, power to the cryocooler is turned off and low power heat applied to the detection cell. As this warming occurs, the wax crystals begin to disappear. The temperature at which the last of the wax crystals melt is the freeze point temperature. This value is displayed locally and output as an analog and/or serial signal.
6. The sample solenoid opens and a new measurement cycle is initiated.

COMPONENT IDENTIFICATION

FRONT VIEW



**Figure 1-2a: Front View
(Analyzers with a Water-Cooled Cryocooler)**

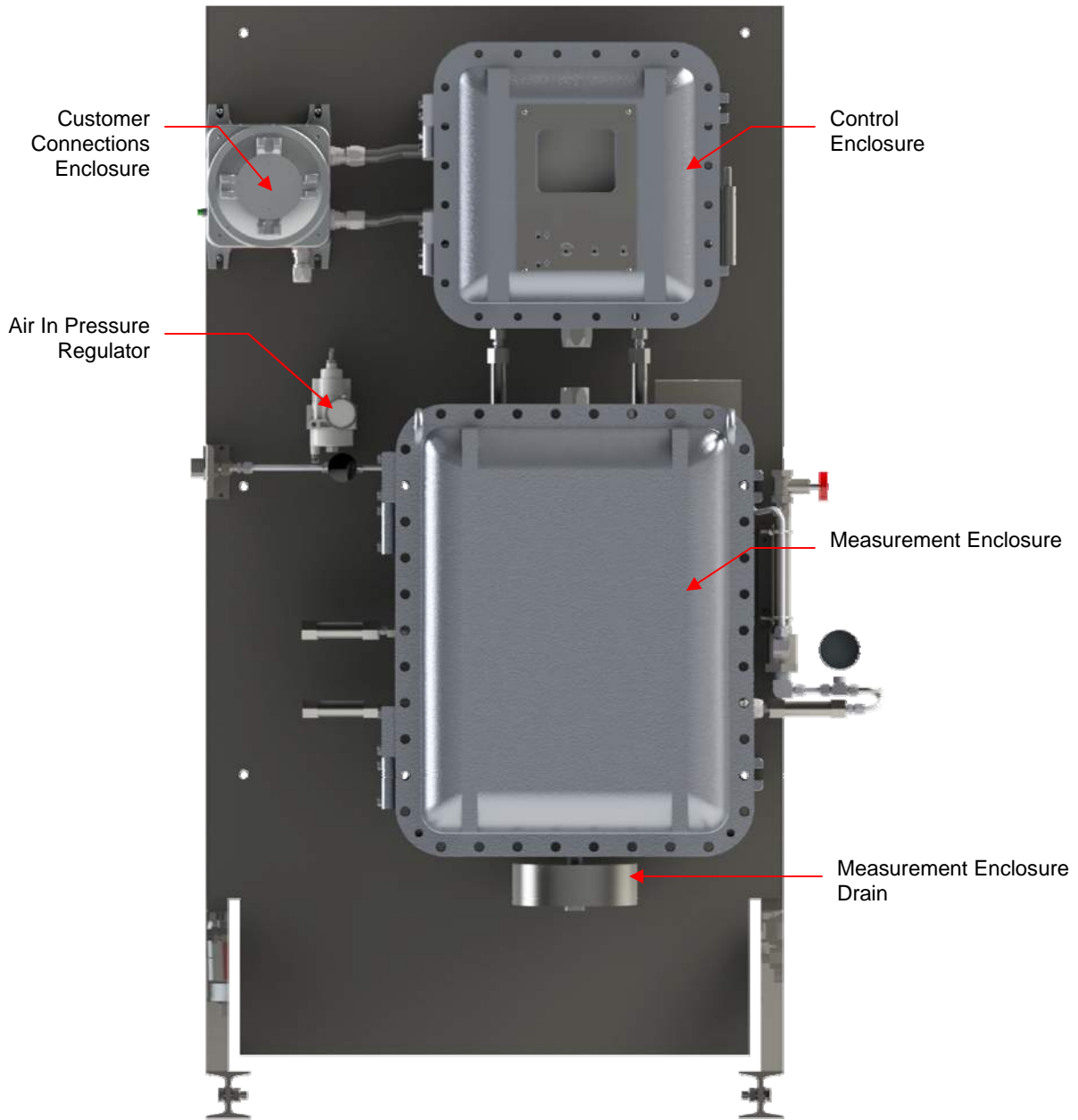


Figure 1-2b: Front View
(Analyzers with an Air-Cooled Cryocooler)

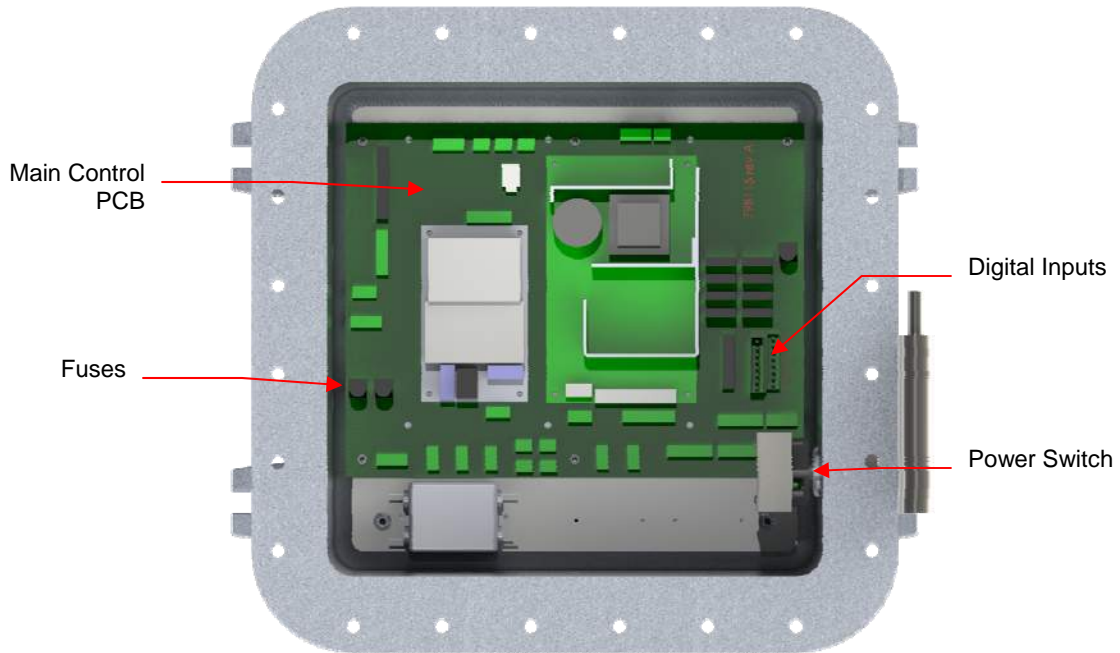


Figure 1-3: Control Enclosure

MEASUREMENT ENCLOSURE

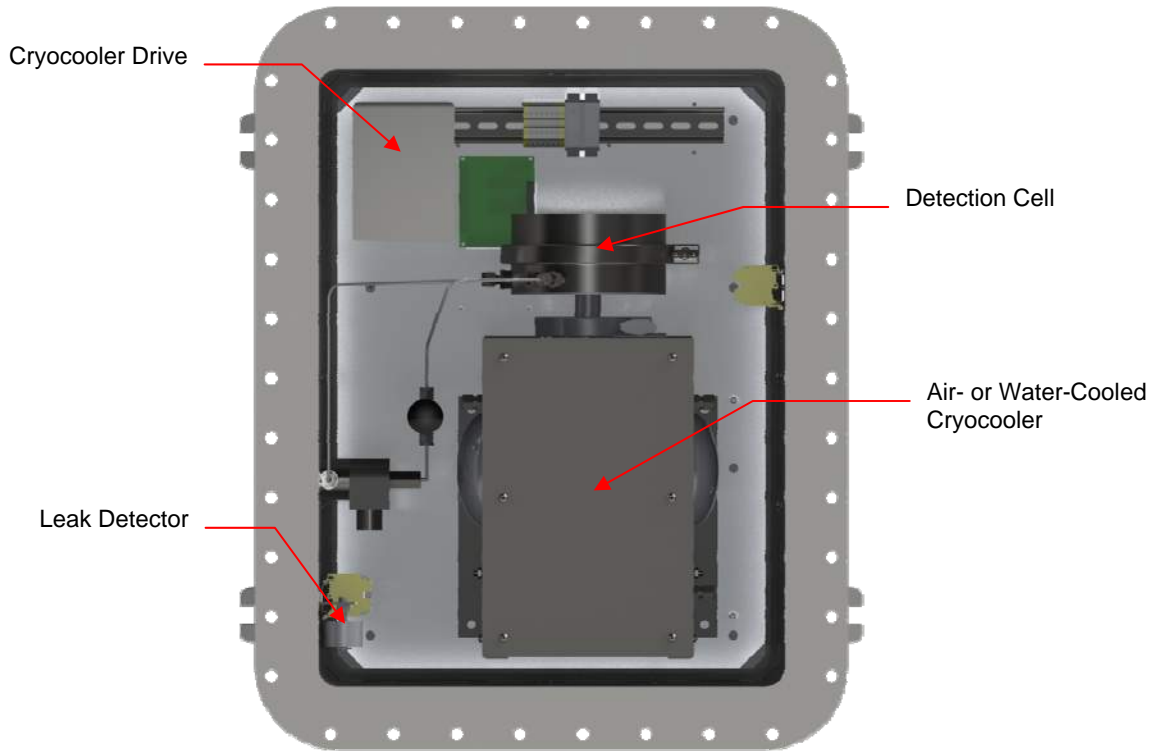


Figure 1-4: Measurement Enclosure



MENU STRUCTURE

Main Menu	Sub-Menu	Items	Choices / Settings / Comments
Analyzer Status	—	—	On Line / Off Line
Alarm History	—	—	Display only
Validation	—	Validation	Digital / Auto / Manual / Off
Service	—	Sys Temperatures T1 Sample Sensor Output Control Sample Solenoid Validation Solenoid Stream Solenoid 4-20 Control 4-20 1 4-20 2 Alarms R1 R2 R3 Cell Temp Control PWM Load Heater Cooler Optical System NIR Power NIR Source 0 Signal 90 Signal Run Autozero Az0 Volt Az90 Volt	For future use Display only – sample temperature For future use On / Off On / Off On / Off Outputs analog signal for device calibration Outputs analog signal for device calibration On / Off On / Off On / Off Display only On / Off On / Off Percent power On / Off Display only Display only Initiates Autozero Autozero volts for sig 0 Autozero volts for sig 90

Main Menu	Sub-Menu	Items	Choices / Settings / Comments
Setup	Output Settings	4-20 Out 1 Output 4 mA 20 mA Offset	CP1 / CP2 / Cell Temp / Sig 0 / Sig 90 / Validation Value = 4 mA signal Value = 20 mA signal Offset value
		4-20 Out 2 Output 4 mA 20 mA Offset	CP1 / CP2 / Cell Temp / Sig 0 / Sig 90 / Validation Value = 4 mA signal Value = 20 mA signal Offset value
	Digital Output Mode Trend Display Mode Rate Range Trend = CP History	RS232 / Modbus CP History / Cycle Full / Half (Cycle mode only) Horizontal range of trend graph (Cycle mode only)	
		Trend = Cycle	<u>CP 1</u> Enabled / Disabled Low = Bottom of graph scale High = Top of graph scale Clear graph = Clears graph <u>CP 2</u> Enabled / Disabled Low = Bottom of graph scale High = Top of graph scale Clear graph = Clears graph <u>Temp</u> Enabled / Disabled Low = Bottom of graph scale High = Tope of graph scale <u>Sig 0</u> Enabled / Disabled Low = Bottom of graph scale High = Tope of graph scale <u>Sig 90</u> Enabled / Disabled Low = Bottom of graph scale High = Tope of graph scale
	Alarm Settings	Alarm Ranges Low High No Detect Time No Detect Cycle	Lowest allowable Freeze Point Highest allowable Freeze Point Maximum allowable time to detect freeze point Maximum number of cycles to detect freeze point
	System Settings	Reload Defaults Stream Select Come Read Time Temperature Scale Valid EV Valid BW Digital Inputs Customer Alarm Remote Standby Stream Select Validation	Restores factory settings Stream 1 / Stream 2 / Alternate / Auto Select User selected in seconds °C / °F Expected Freeze Point Allowable deviation from expected freeze point Enable / Disable Enable / Disable Enable / Disable Enable / Disable

		Screen Settings Flush Heat Cell Heat CP Cool Sig 90 IR Mode Settings Standby Mode Mode CP Threshold Detect Relay Setup Relay Choice Conditions	Intensity / Screen Saver % power applied to heater during flush step % power applied to heater during cell heating % power applied to the cooling module Sensor sensitivity (Detect = Sig90 only) On / Off Baseline / First Derivative / Delayed T Cloud point sensitivity setting Sig0 / Sig90 R1 / R2 / R3 Off / Alarm Warning / Alarm Critical / Come Read / In Validation / Validation Normal / Failsafe
	State Table Setup	—	Steps in measurement cycle
	Time/Date Setup	Time Format Date Format Date Time	12 hour / 24 hour) US / EU MM/DD/YY or DD/MM/YR HH/MM/SS
	Factory Setup	—	For factory use only
Security	—	—	Enable / Disable

**SPECIFICATIONS****SECTION 2****MODELS**

P-800LT-1400	For NEC Class I, Division 1, Group C and D areas.
P-800LT-1500	For ATEX Zone I, II B + H2 T4 areas.

PERFORMANCE

Measurement Range	Minimum: -100°C (-148°F) Maximum: +25°C (+77°F)
Repeatability	±0.5°C (1.0°F)
Reproducibility	Meets or exceeds ASTM Method D-2386 or IP-16
Resolution	±0.25°C (0.5°F)
Measurement Accuracy	Meets or exceeds ASTM Methods D-2386 or IP-16
Temperature Accuracy	±0.5°C (±1.0°F)
Measurement Cycle Time	Less than 10 minutes
Operating Temperature Range	Minimum: 5°C (40°F) Maximum: 40°C (105°F)

SAMPLE REQUIREMENTS

Sample Bypass Flow Rate	Minimum: 1 liter/minute Maximum: 2 liters/minute
Sample Return Pressure	Atmospheric to 10 bar (150 psi) maximum
Sample Pressure	Minimum: 1.4 bar (20 psi) Maximum: 14 bar (200 psi)
Sample Temperature	Minimum: 2°C (35°F) Maximum: 65°C (150°F)
Sample Particulates	Less than 10 µm; optional sample conditioning system available
Sample Conditions	Homogeneous, single-phase sample. Must be free of water or water moisture

SIGNAL INPUTS/OUTPUTS

Analog Output	One isolated 4-20 mA output standard; Optional second isolated 4-20 mA output available. Signal output information is programmable.
Serial Communication	Bi-directional RS232 (RS485 optional)
Relay Output	Three SPDT failsafe relay contacts rated at 3A resistive load at 250 VAC. May be programmed for normal or failsafe operation. The conditions activating these relays are programmable.
ModBus	Optional; consult ORB Instruments


UTILITY REQUIREMENTS

Power	Auto-selecting 100 to 125 VAC ($\pm 10\%$) and 200 to 240 VAC ($\pm 10\%$), 50/60 Hz, single phase, 10A.
Optional Detection Cell Purge Gas Supply	Clean, dry nitrogen (better than 98% pure) or other inert gas at 0.07 bar (1.0 psi).
Instrument Air	<u>Analyzers with Water-Cooled Cryocooler</u> (for sample solenoid): Clean, dry instrument air at a minimum of 4 bar (58 psi). <u>Analyzers with Air-Cooled Cryocooler</u> (for sample solenoid and cryocooler): Clean, dry instrument air at 6-8 bar (87-116 psi); 50 cfm consumption.
Cryocooler Coolant	<u>Analyzers with Water-Cooled Cryocooler only:</u> Clean, filtered plant cooling water or closed-loop chiller system. Fluid Temperature: Up to 35°C (95°F); Flow rate: 2-4 liters/minute (0.5-1.0 gpm); Pressure: 2 bar (30 psi) minimum.

ANALYZER ENCLOSURE

Dimensions (W x H x D)	935 x 1803 x 762 mm (36.75 x 71.0 x 30 inches)
Weight	Approximately 318 kg (700 pounds)
Enclosure Rating	NEMA 4X / IP65 rated EExd enclosures
Certification	CE certified
Hazardous Classification	Model dependent; see above.

Due to ORB Instruments' commitment to continual product improvement, specifications subject to change without notice.

	<p>WARNING: Installation or operation of this Analyzer outside of the parameters indicated in the Specifications could result in personal injury or damage to the Analyzer. Installation, operation, and maintenance should be performed only by fully qualified personnel.</p>
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SITE REQUIREMENTS

Your particular site, application, and installed options will ultimately determine the need for any accessories or auxiliary equipment. This section defines the various parameters to be considered. Consult ORB Instruments for specific recommendations regarding your P-800LT Freeze Point Analyzer.

LOCATION

For ease of operation, your Analyzer should be installed as close as possible to the process stream to be monitored. To optimize performance, it should be housed in an appropriate shelter and protected against direct sunlight, moisture, and other adverse conditions. The shelter's ambient temperature should remain between 5° and 40°C (40° and 105°F) at all times.

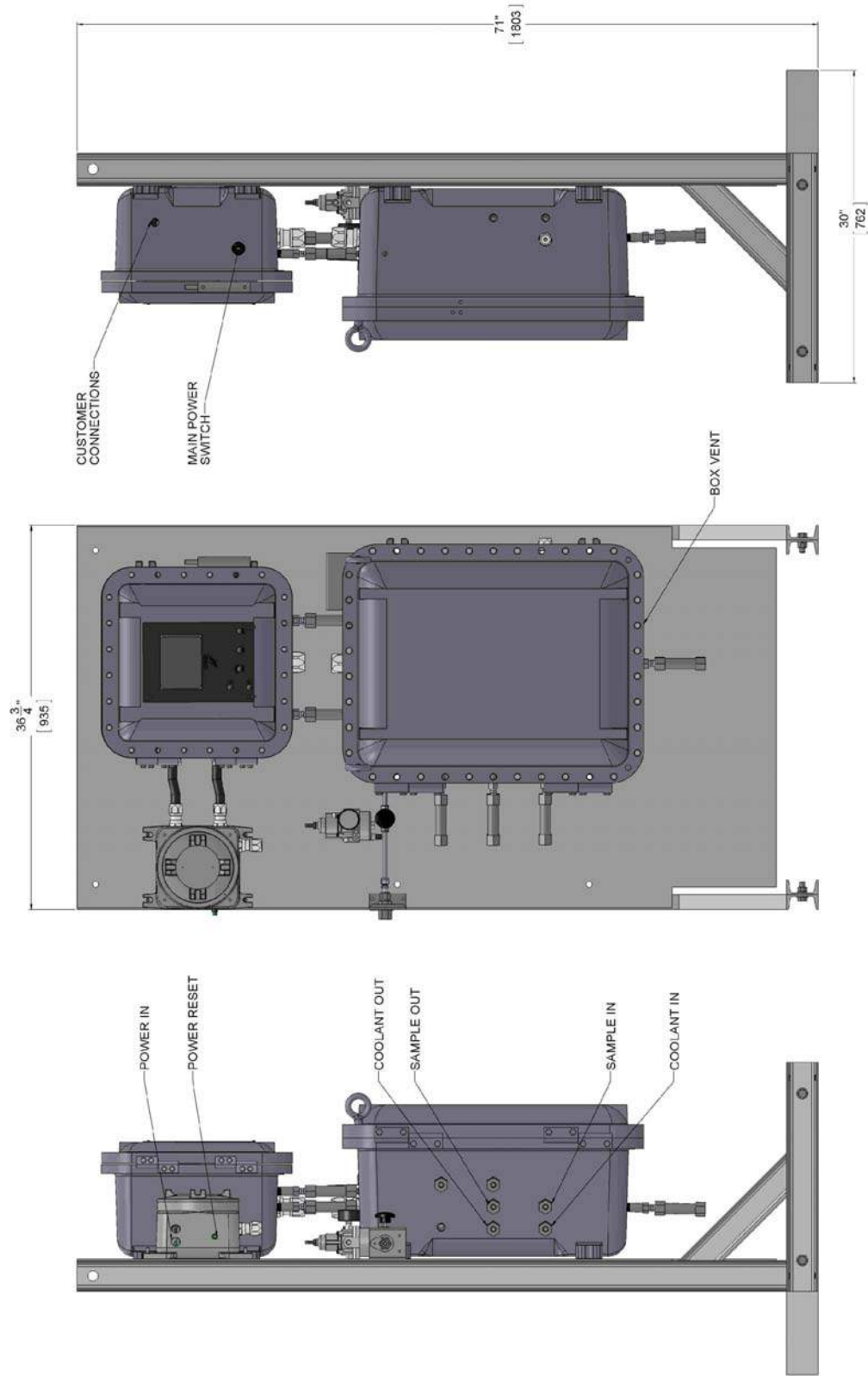
MOUNTING

	<p>NOTE: An optional free-standing mounting rack is available.</p>
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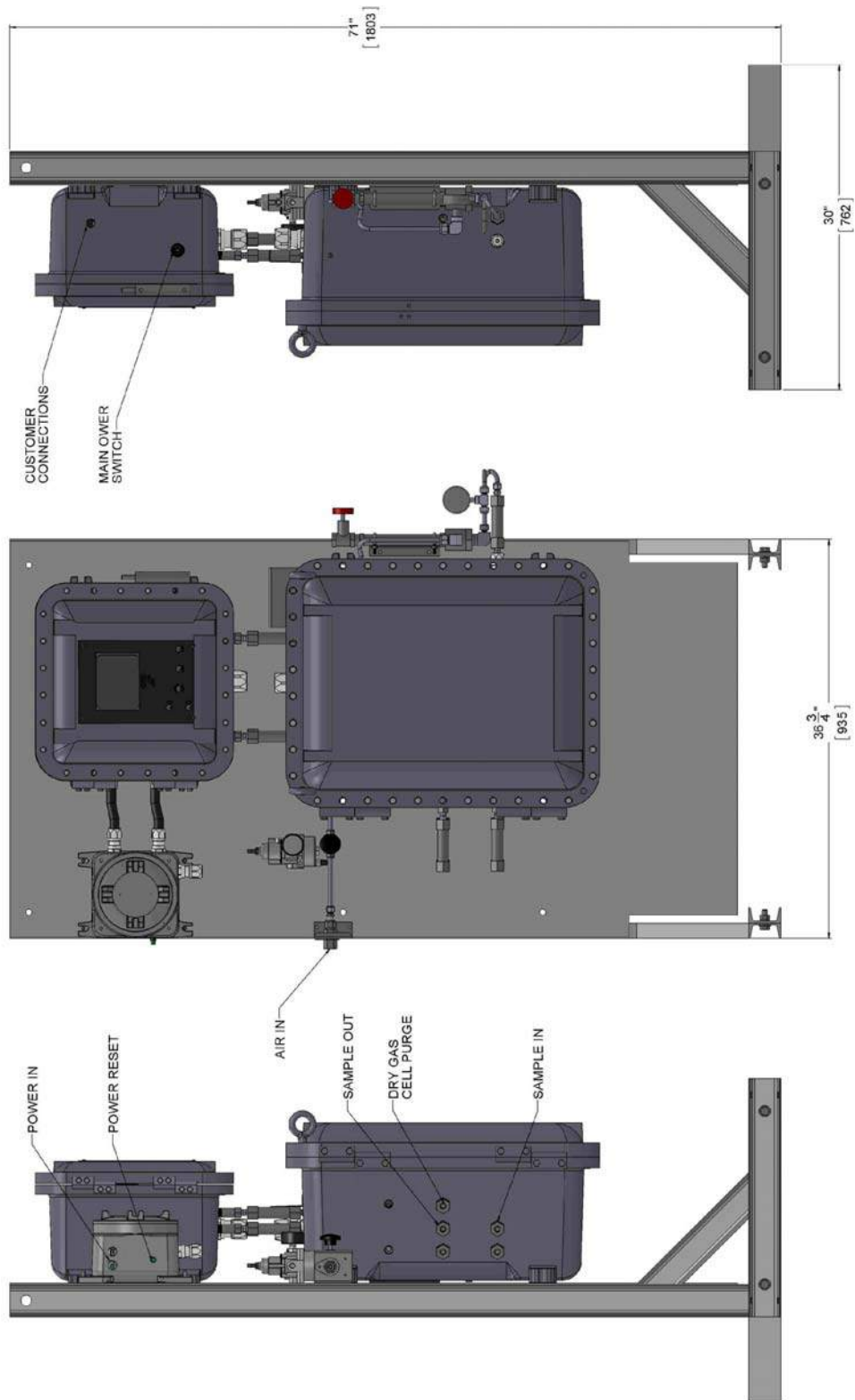
The P-800LT Freeze Point Analyzer is housed in a dual-chamber enclosure designed for wall mounting. It should be located on a flat, vertical surface and isolated from intense vibration. The cabinet incorporates mounting ears to facilitate installation.

The bottom of the enclosure should be located approximately 12 inches (30.5 cm) above the floor of the shelter. Adequate clearance (approximately 12 inches/30.5 cm) should also be allowed on either side of the unit for sample, utility, and control room connections.

See Figures 3-1a and 3-1b.



**Figure 3-1a: Dimensional Drawing
(Analyzers with a Water-Cooled Cryocooler)**

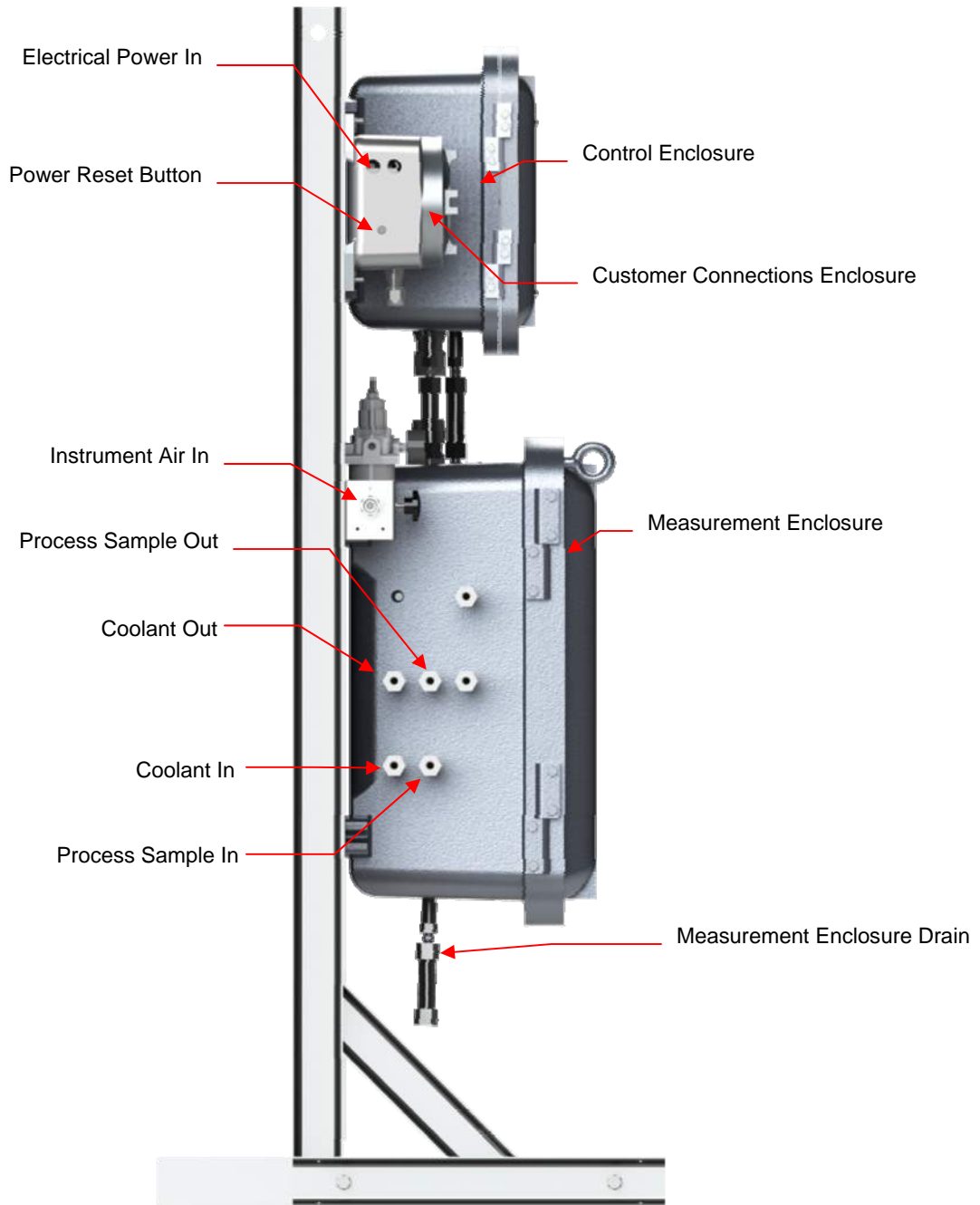


**Figure 3-1b: Dimensional Drawing
(Analyzers with an Air-Cooled Cryocooler)**

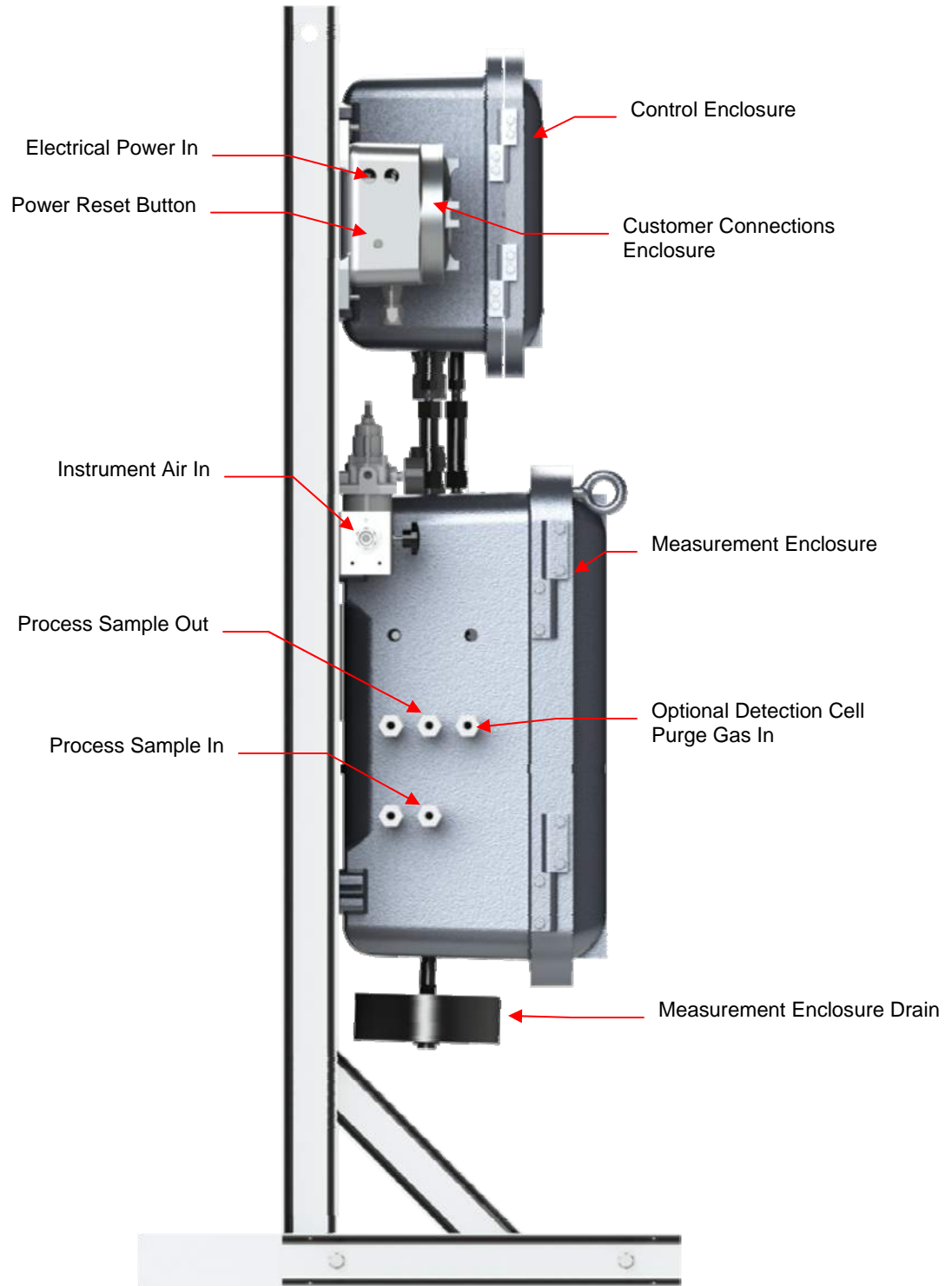
PIPING

The P-800LT Freeze Point Analyzer incorporates fittings for connecting process sample, purge gas lines, and plant cooling water. There is also a fitting for connecting a validation sample line if this option has been installed on the Analyzer. These fittings are located on the sides of the instrument.

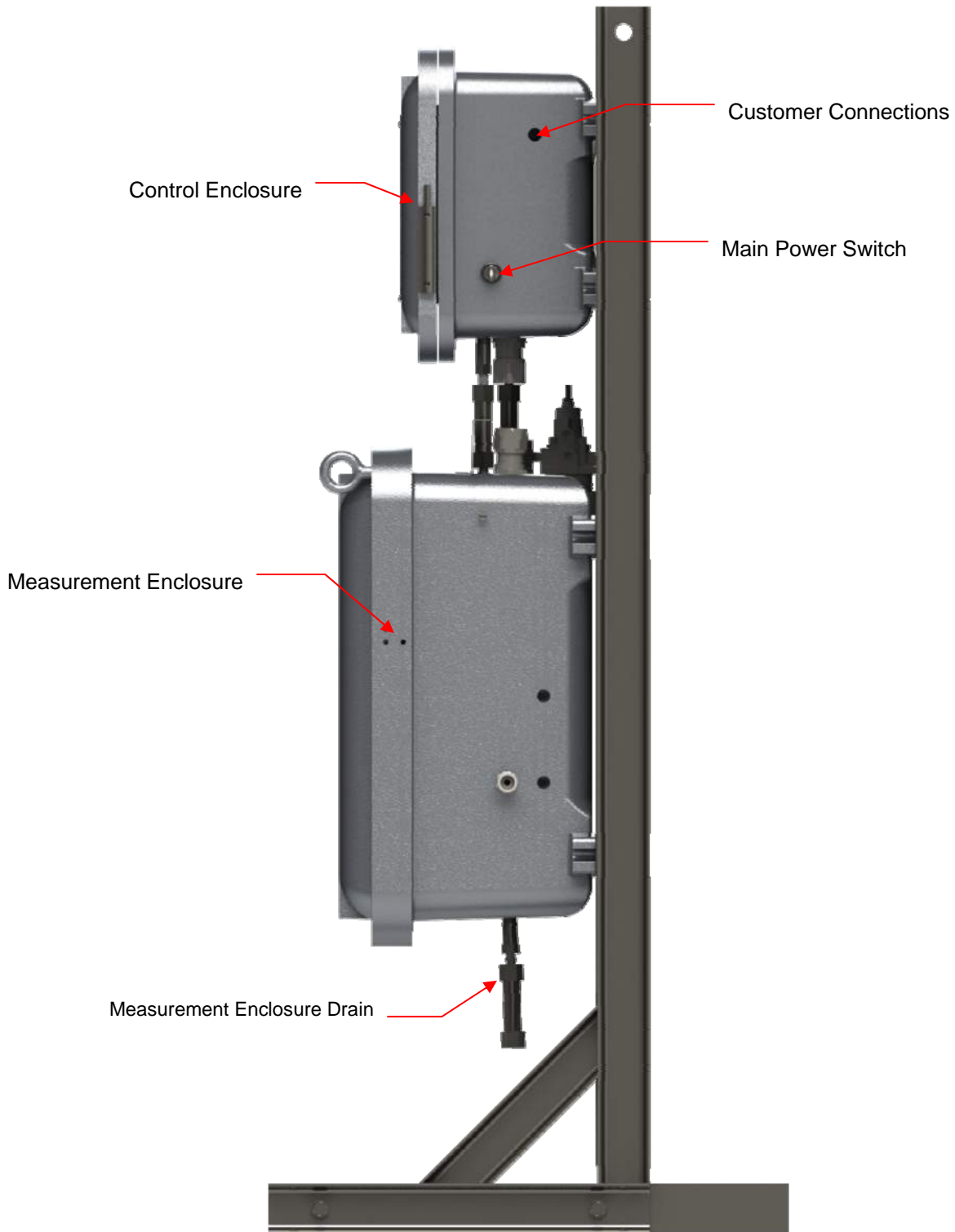
See Figures 3-2 and 3-3.



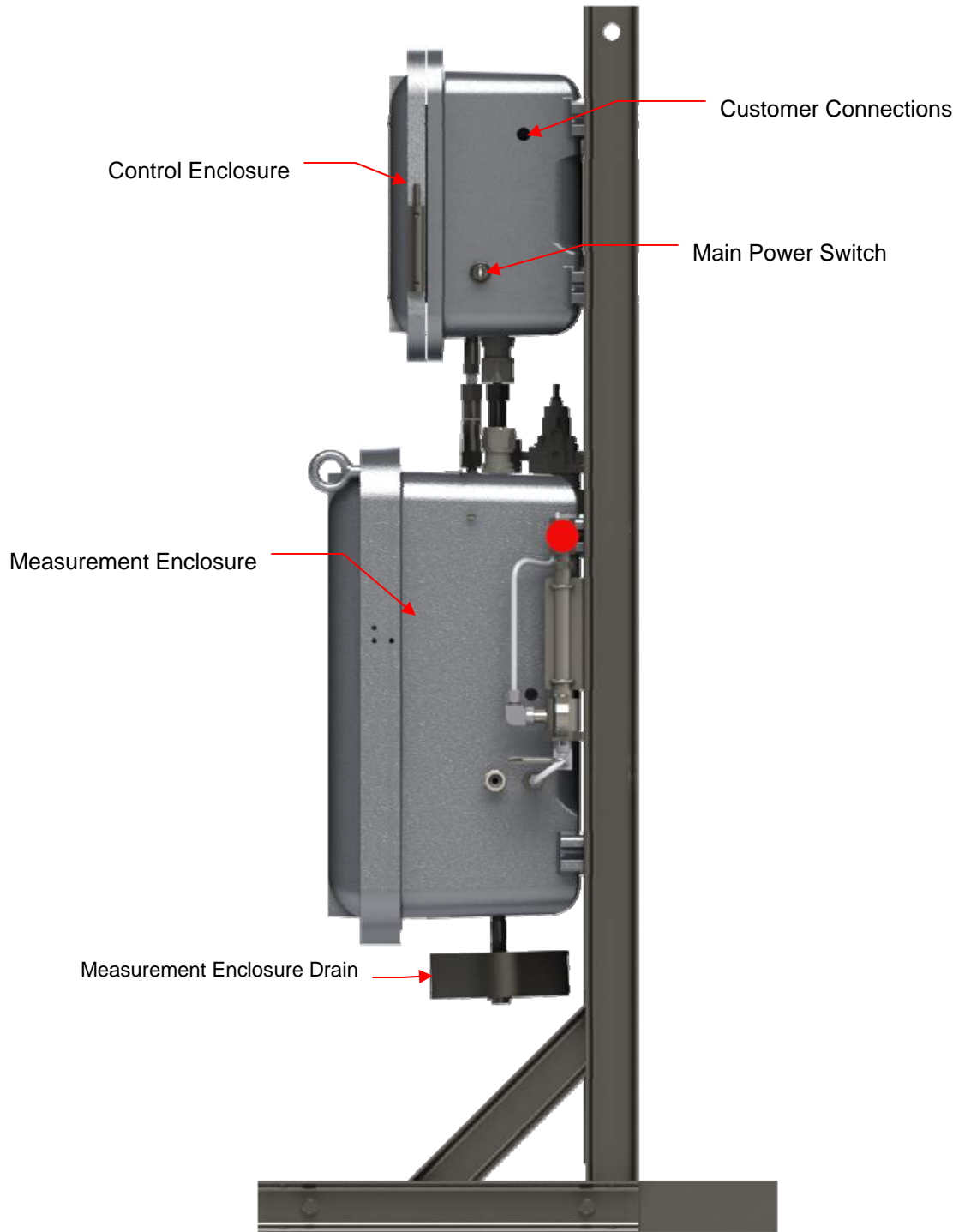
**Figure 3-2a: Left Side View
(Analyzers with a Water-Cooled Cryocooler)**



**Figure 3-2b: Left Side View
(Analyzers with an Air-Cooled Cryocooler)**




**Figure 3-3a: Right Side View
(Analyzers with a Water-Cooled Cryocooler)**




**Figure 3-3b: Right Side View
(Analyzers with an Air-Cooled Cryocooler)**

PROCESS SAMPLE LINES

	<p>NOTE: It is the user's responsibility to assure that a representative sample, free of moisture and particulate matter, is presented to the instrument for analysis. ORB Instruments can assist in specifying sample conditioning requirements and the selection/development of an appropriate sample conditioning system.</p>
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The P-800LT is designed to analyze samples from up to two different process streams. These lines are connected to the 1/8 inch NPT fittings labeled "Stream 1" and "Stream 2" located on the left side of the lower enclosure (Figure 3-2). Process samples should be provided at a pressure between 1.5 and 10 bar (20 and 150 psi) at a flow rate of 1 to 2 liters/minute. The temperature of the sample should be between 2° and 65°C (35° and 150°F).

	<p>NOTE: If the Analyzer is equipped with the optional Sample Conditioning Panel, the fittings for connecting Stream 1 and Stream 2 are located on this panel.</p>
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INSTRUMENT AIR

Analyzers with a water-cooled cryocooler: Clean, dry Instrument air at a minimum pressure of 4 bar (58 psi) is required to operate the sample solenoid. This connection is made on the right side of the Analyzer (Figure 3-2a).

Analyzers with an air-cooled cryocooler: Clean, dry Instrument air at a pressure of 6 to 8 bar (87 to 116 psi) is required to operate the sample solenoid and provide cooling air to the Vortex cooler. The instrument air supply should be capable of delivering at least 50 cfm. This connection is made on the right side of the Analyzer (Figure 3-2b).

CRYOCOOLER COOLANT SUPPLY

Analyzers with a water-cooled cryocooler only: Clean, filtered plant cooling water (or a closed loop chiller system) is required for cooling of the Analyzer's cryocooler. Cooling water should be supplied at a temperature below 35°C (95°F) at a flow rate of 2 to 4 liters/minute (0.5 to 1.0 gpm) and a pressure of at least 2 bar (30 psi). The detection cell cooling supply connection is made on the lower right side of the measurement enclosure (Figure 3-2a).

OPTIONAL DETECTION CELL PURGE GAS SUPPLY


Analyzers with an air-cooled cryocooler only: An optional inert gas purge is provided to prevent condensation from forming on the cryocooler. This optional purge, if supplied, requires clean, dry nitrogen (98% pure) or other inert gas at a pressure of 0.7 bar (1.0 psi); This insert gas connection is made on the left side of Measurement Enclosure (Figure 3-2b).


VALIDATION SAMPLE LINE

The connection for the optional validation sample line (if present) is located on the left side of the lower enclosure (Figure 3-2a and 3-2b). A 1/8 inch NPT fitting, labeled "Validation", is provided for this connection.


WIRING

ELECTRICAL POWER

	WARNING: This Analyzer is designed to meet the requirements of either the National Electrical Code (NEC) for installation in Class I, Division 1, Group C and D or European ATEX Zone 1, Group IIB hazardous areas. It is the user's responsibility to complete the electrical connections and comply with all pertinent codes.
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	WARNING: All electrical connections should be made by a licensed, qualified electrician. Proper building codes and safety regulations should be followed.
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The P-800LT Freeze Point Analyzer requires an independent 100 to 240 VAC ($\pm 10\%$), 50/60 Hz. power supply. AC power connections are made through the Customer Connections box attached to the upper left of the top enclosure (Figures 3-2a, 3-2b, 3-4a, and 3-4b).

	CAUTION: It is the installer's responsibility to verify that the jumpers on JP1 are configured properly for the supply voltage.
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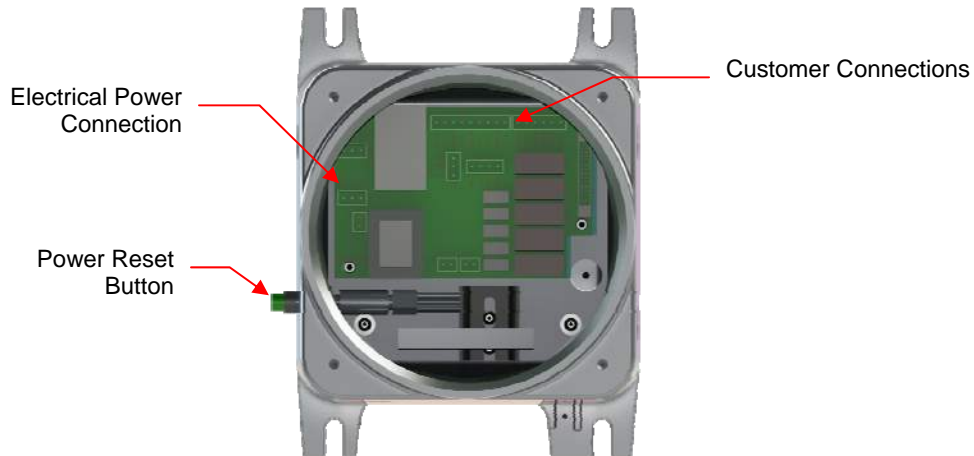


Figure 3-4a: Customer Connections Enclosure

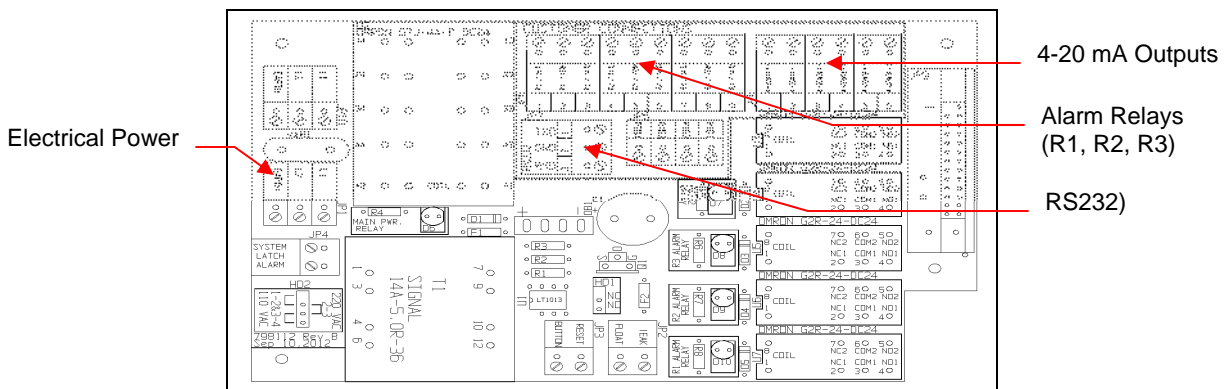


Figure 3-4b: Customer Connections PCB

The P-800LT-1500 Freeze Point Analyzer has internal and external grounding harnesses that tie all enclosures and power distribution together to a grounding lug mounted to the Analyzer frame leg. The grounding wire is 10 gauge with a green/yellow spiral Teflon[®] insulation and a 36 x 26 strand. Customer earth connection is made at this point (Figure 3-5).

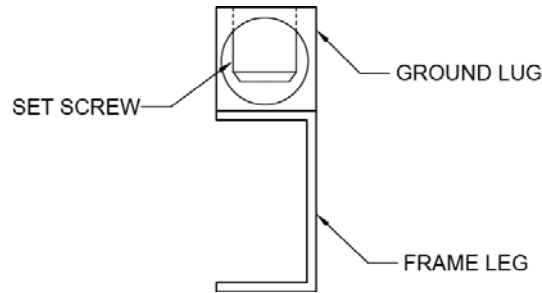


Figure 3-5: Customer Earth Connection

CONTROL ROOM SIGNALS

The Analyzer incorporates analog, serial, and relay output capability. ModBus output may be provided as a factory installed option.

The connections for control room signals are made in either the Customer Connections Enclosure (Figures 3-4a and 3-4b) or the Control Enclosure (Figure 3-6).

Analog Output

One isolated 4-20 mA output is standard on the P-800LT Freeze Point Analyzer. An optional two additional 4-20 mA outputs may be provided. These connections are made in the Customer Connections Enclosure (Figures 3-4a and 3-4b). See Section 4 for information on setting the 4-20mA parameters.

Relay Output

The Analyzer incorporates three SPDT relay contacts rated at 3A resistive load at 250 VAC. The relays may be programmed for either normal (non-energized) or failsafe (energized) operation and used to signal a variety of operational conditions. These connections are made in the Customer Connections Enclosure (Figures 3-4a and 3-4b). See Section 4 for information on alarm programming.

Serial Output

[The P-800LT Freeze Point Analyzer incorporates RS232 serial output. The maximum allowable external cable length on the RS232 output 98 feet is (30 meters). This connection is made in the Customer Connections Enclosure (Figures 3-4a and 3-4b). RS485 serial output (Figure 3-6) is available as an option and requires an auxiliary communications module (consult factory);.

Serial communication operates at 9600 baud, no parity, 8 start bits, 1 stop bit. Data is comma delimited and output in the following sequence:

Date (mm/dd/yy)
 Time (hr/min/sec)
 Freeze point value (XX.XX°)

A <CR> is used to designate the end of the data stream.

ModBus

ModBus is available as a factory-installed option which utilizes either the Analyzer's TCP/IP connection for ModBus or its serial ModBus connection. This connection is made in the Control Enclosure (Figure 3-6). Consult ORB Instruments for more information.

Digital Inputs

The Analyzer incorporates four sets of voltage dry contacts that allow the control room to remotely activate selected functions. The connections for these digital inputs are made inside the Control Enclosure (Figure 3-6).

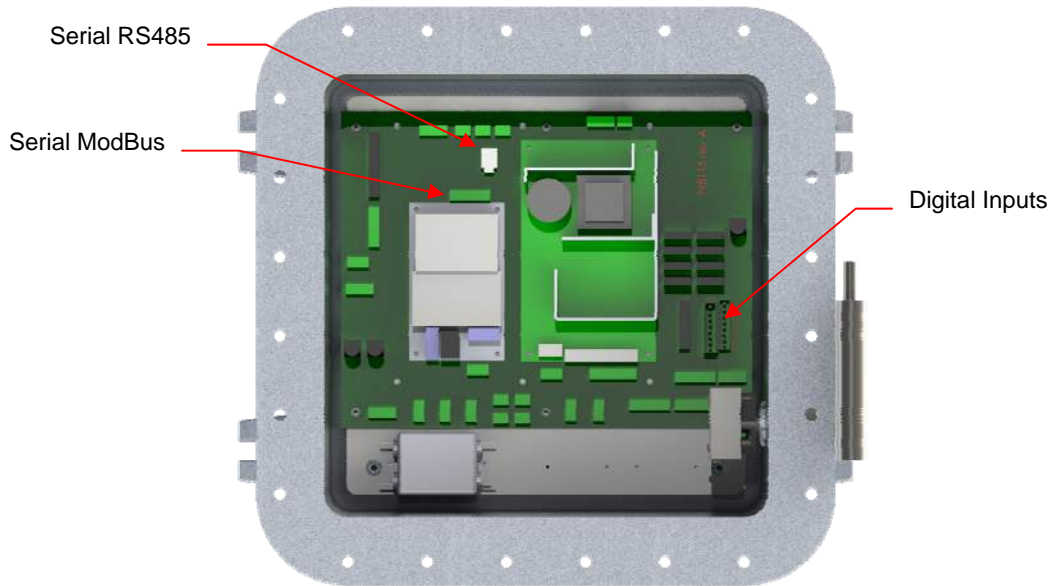


Figure 3-6: Control Enclosure

Customer Alarm — This connection is used to activate one or more of the Analyzer's alarm relays when an external dry contact alarm signal is received.

Remote Standby — This connection is used to place the Analyzer in a standby mode whenever an external dry contact signal is received. Analysis will stop until the signal is removed.

Validation Request — This connection is used to initiate a validation cycle whenever an external dry contact signal is received. The instrument will finish the current measurement cycle and then hold the resulting 4-20 mA output signals until the validation cycle has been completed.

Stream Select — This connection is used to switch to a different sample stream whenever an external dry contact signal is received. Sample stream selection is made by opening/closing this contact.

Digital Input	Terminals	Function
D0	1-2	Customer alarm
D1	3-4	Remote standby
D2	5-6	Validation
D3	7-8	Stream select
D4-7	9-16	Reserved for future use



NOTE: Although the Validation Request and Stream Select contacts may be present, these functions are only available on Analyzer's which incorporate these options.

STARTUP

1. Start flow of process sample to the Analyzer and verify that the flow rate is regulated at 1.4 to 10 bar (20 to 100 psi). A flow rate of 1 to 2 liters/minute is required. Check for sample line leaks.
2. Analyzers with an air-cooled cryocooler. Open the Vortext air valve and set the pressure to 2 bar (30 psi).
Analyzers with a water cooled cryocooler. Turn the coolant supply "ON" and check for leaks.
3. Start the flow of instrument air to the Analyzer and verify that the pressure is adequate. (Analyzers a water-cooled cryocooler require a minimum of 4 bar / 58 psi; Analyzers with an air-cooled cryocooler require 6-8 bar / 87-116 psi).
4. Apply electrical power to the Analyzer.
5. Open the Measurement Enclosure.
6. Access the Service menu and perform the following checks (see Section 6 for information on accessing this menu and performing these functions):

```

ORB Freeze Point Analyzer V3.0
-----
Submenu      Date: 10/10/13
Service      Time: 12:42:03 PM

Sys Temperatures      Cell Temp. Control
T1 : 0.00 C           PWM Load: 0%
Sample: 1.02 C        Heater: OFF
Sensor: CLOSE         Cooler: OFF

Output Control        Optical System
Sample Solen.: OFF   NIR Power : 0%
Validation : OFF     NIR Source: OFF
Stream Solen.: OFF   0 Signal : 375
                    90 Signal : 182

4-20 Control          Run Autozero
Stream 1: 12.0        AZ0 Volt: 2.5 VDC
Stream 2: 4.0         AZ90 Volt: 2.5 VDC

Alarms
R1 : OFF
R2 : OFF
R3 : OFF

ACTION REQUIRED:
ADVANCE to exit submenu / INDEX to scroll / UP-DOWN to change value
  
```

- A. Turn the sample solenoid (listed under Output Control) ON.
- B. Verify that sample is flowing to the detection cell and check for leaks in the Measurement Enclosure.
- C. Turn the sample solenoid OFF and note the sample temperature.
- D. Turn the cooler (Cell Temperature Control) ON for approximately 60 seconds. The sample temperature should decrease.
- E. Turn the cooler OFF.
- F. Increase NIR Power (Optical System) to 50%.
- G. Turn NIR Source (Optical System) ON. The 0 Signal should increase in value.

- H. Turn NIR Source OFF.
 - I. Adjust the value of the Stream 1 analog output signal (4-20 Control) to 4 mA and verify that the proper signal was received by the control room.
 - J. Repeat the loop check for Stream 1 at values of 12 mA and 20 mA.
 - K. Repeat the 4-20 loop check for Stream 2 (as required).
 - L. Turn R1 (Alarms) “on” and verify that the proper signal was received at the control room.
 - M. Repeat the alarm signal check for R2 and R3.
 - N. Return to the Main Menu.
- 7. Place the Analyzer On-line and observe while it runs 2-3 measurement cycles.
 - 8. Check for sample or coolant leaks and then close the Measurement Enclosure door.
 - 9. Program the Analyzer with the correct date and time (see Section 4, Programming, Main Menu, System Settings).
 - 10. You are now ready to run analyses using the factory default settings or program the instrument with your desired operational parameters (see Section 4, Programming, Main Menu).



NOTE: ORB recommends checking the Analyzer for leaks 24 hours and 1 week after startup to ensure there are no small leaks which go undetected.



11-07-2013

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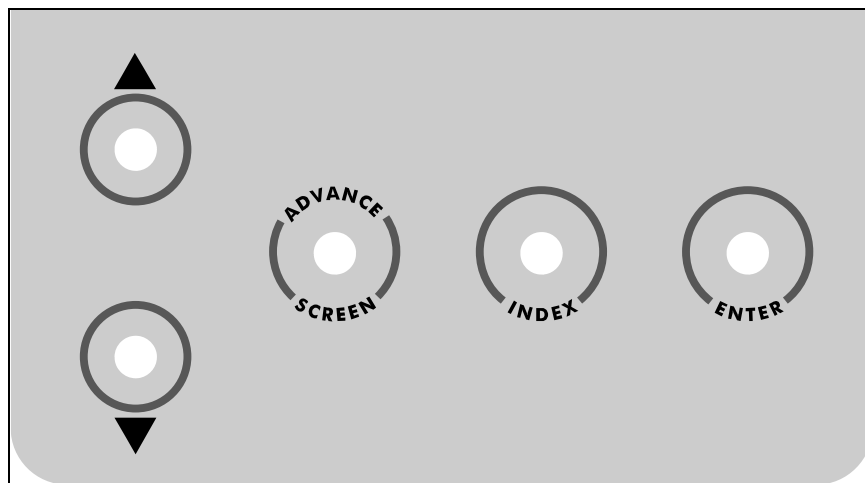
MAIN RUN SCREEN

When the P-800LT Freeze Point Analyzer is powered up, a short initialization program runs and either the Main Run Screen or Main Menu will appear. The Main Run Screen appears if the unit is programmed to power up in On-Line mode; the Main Menu appears if the unit is programmed to power up in the Off-Line mode. By default, the Analyzer is programmed to power up in the Off-Line mode, but it can be customer programmed to power up in the On-Line mode. See the Systems Setting section below for more information.



MENU NAVIGATION

The P-800LT Freeze Point Analyzer is programmed and controlled via a magnetic keypad on the front of the Electronics Enclosure. This eliminates the need for opening the enclosure to change operational settings, etc. A magnetic pencil is supplied with the instrument for this purpose.



To enter or exit the analysis mode, move to a new menu or within menu items, change a displayed value, the operator simply touches a magnet to the designated location on the keypad. These locations function as follows:

Advance Screen Key — When the Main Run screen displayed, touching this key brings up the Main Menu. When any other screen is displayed, touching this key returns the display to the previous screen.

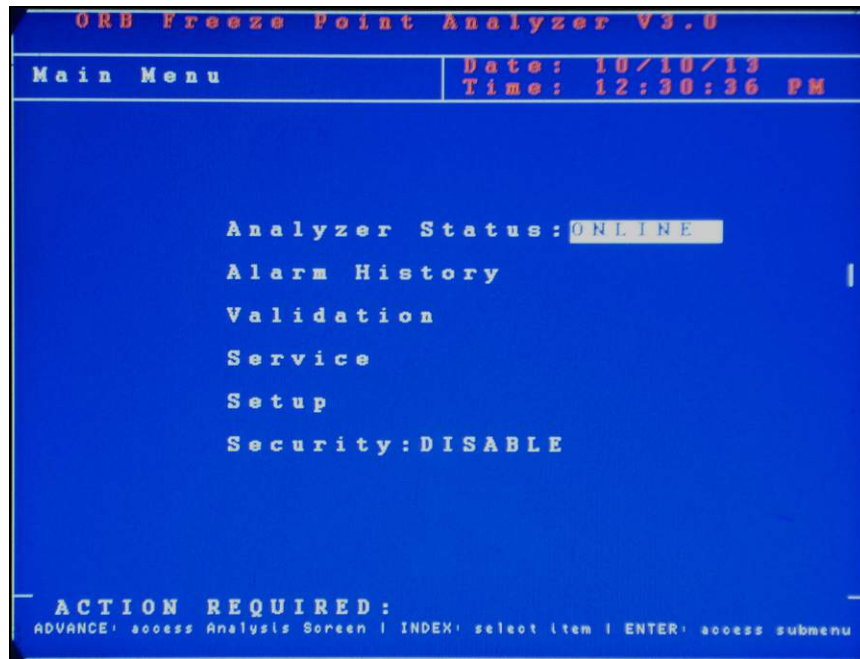
Index Key — Touching this key scrolls the Analyzer through the various items available within a specific menu. The “active” menu line is highlighted by reversing the background and foreground colors. Once you reach the last menu item, the indicator returns to the top of the menu.

Enter Key — Touching this key advances you to a sub-menu or runs a command associated with a selected menu item. It is also used to confirm some messages.

↑↓ **(Up/Down Arrow) Keys** — Touching these keys changes the displayed value for the indicated item. Depending on the specific item, it will either change the status of the selection, cycle through a list of available selections, or increase/decrease the value.

MAIN MENU

This menu is used to place the Analyzer On-Line and Off-Line. It also provides access to the all the various sub-menus. To access the Main Run screen, touch the Advance Screen key. From the Main Run screen, touch Advance Screen again to return to the Main Menu. Touch the Index key to advance to the next menu selection.



ANALYZER STATUS

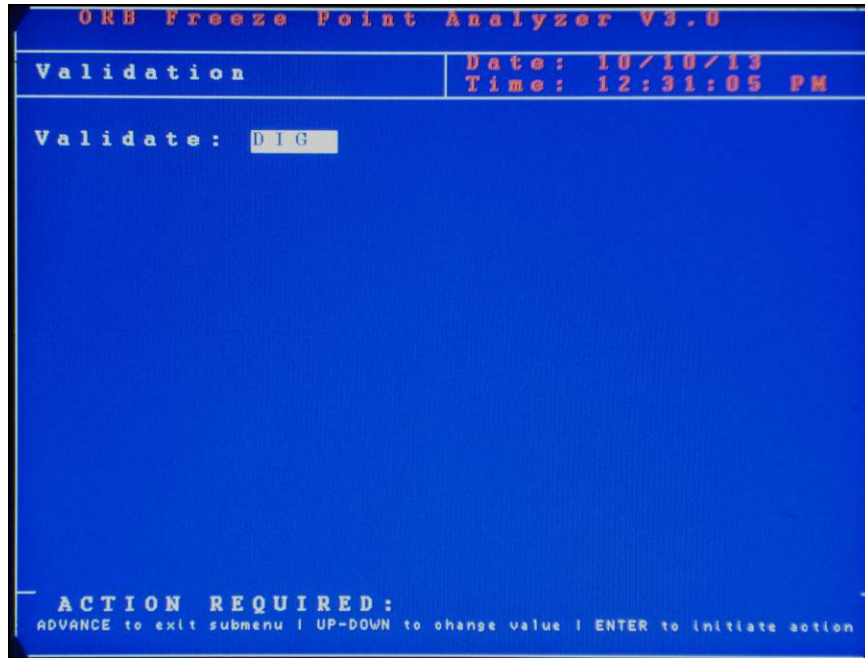
This indicates the current status of the Analyzer. Touch the up/down arrow keys to change the status.

ALARM HISTORY

This menu item provides access to the Alarms History sub-menu, which lists conditions which have activated one or more of the Analyzer’s alarm functions. It is described in further detail in Section 5 – Normal Operation. Touch the Enter key to access this sub-menu.

VALIDATION

This menu item provides access to the Validation sub-menu. It allows the operator to determine how validation measurements will be initiated. Touch the Enter key to access this sub-menu and then touch the Up/Down Arrow keys to toggle through the available choices.



Digital — When Digital is selected, validation measurements are initiated using a dry contact closure. See Section 3 for more information on the Analyzer's dry contacts.

Auto — When Auto is selected, validation measurements are initiated at a fixed time on a daily basis. For example, at 18:00 hours (4:00 PM). The validation start time (ST) is changed using by touching the Index key to advance to the Auto ST numerical field and then using the Up/Down Arrow keys to change the value.

Manual — When Manual is selected, validation measurements are initiated by touching the Enter key.

OFF — Disables validation.

SERVICE

This menu item provides access to the Service sub-menu; entering it automatically takes the Analyzer off-line. The Service menu allows you to activate various measurement system components, test the analog output, and view selected sensor readings. It is described in detail in Section 6 – Routine Maintenance & Service. Touch the Enter key to access this sub-menu.

SETUP

This menu provides access to the Analyzer's Setup sub-menu. This sub-menu is used to establish the instrument's output values and other operational settings. It is accessed from the Main Menu by touching the Enter key when this menu item is highlighted.

To return to the Main Run screen, touch the Advance Screen key.

SECURITY

This indicates the current status of the security setting. When Disabled, the operator has access to all Analyzer menus and submenus. When Enabled, a password must be entered to gain access to the various menus.



SETUP SUB-MENU

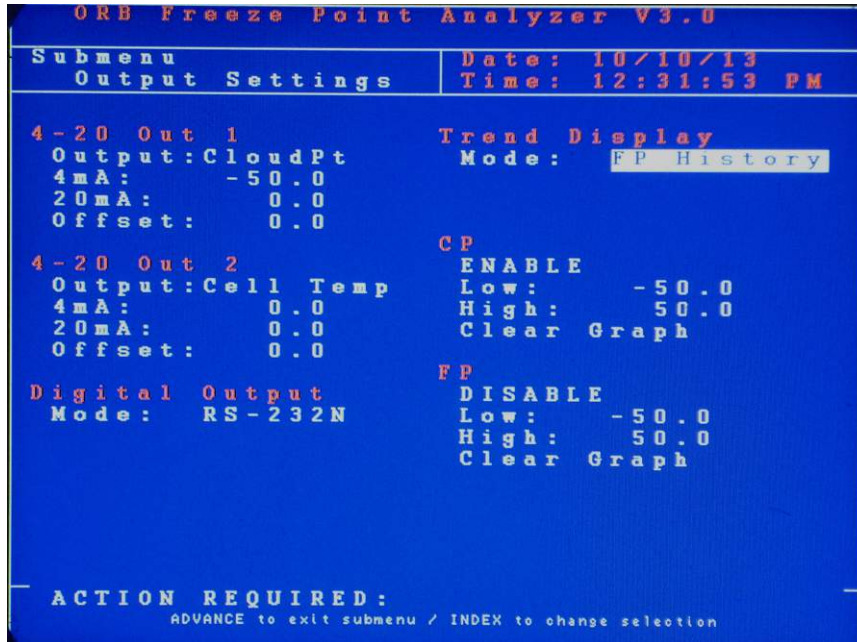
The Setup sub-menu is used to establish the Analyzer's various operating parameters.



Use the Index key to advance to the desired (highlighted) menu selection. Touch the Enter key to access the selected sub-menu.

OUTPUT SETTINGS

This menu item is used to program the Analyzer's analog output and digital output parameters. It is also used to establish how freeze point measurement information will be displayed on the Main Run screen.



4-20 Out 1 / 4-20 Out 2 — The P-800LT Freeze Point Analyzer’s analog outputs (one standard; second optional) can be programmed to output various types of information, as well as the range of the analog signal and an offset.

Output — This menu item allows you to select the type of information that will be output using the selected analog signal. The choices are cloud point temperature, freeze point temperature, cell temperature, signal 0, signal 90, or validation information.

4 mA — This menu item is used to set the value at which a 4 mA signal will be output.

20 mA — This menu item is used to set the value at which a 20 mA signal will be output.

Offset — This menu selection allows you to offset the analog output signal by the programmed value. For example, if the offset is set to +2.5, the Analyzer will generate an analog signal corresponding to 16.5° when the actual measured (and displayed) Freeze point value is 14.0°.

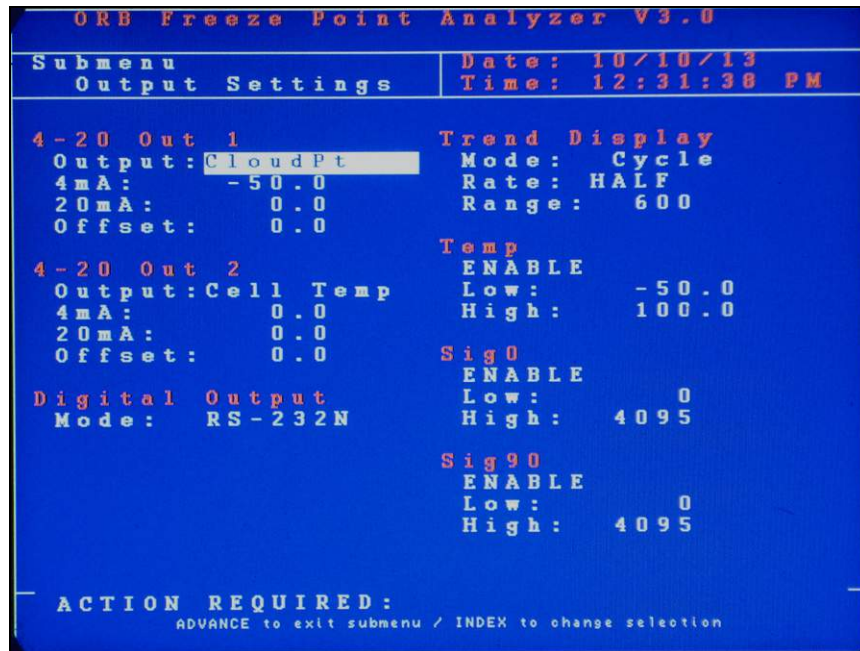
Digital Output — This menu item allows you to select the type of digital signal the Analyzer will output. The choices are RS232N (result), RS232D (data dump), or ModBus (If the Analyzer is equipped with the RS485 option, use the RS232 setting).

Trend Display — This menu item allows you to select the measurement information which will be displayed in the graphical data display section of the Main Run screen. The choices are:

Cycle — When cycle is selected, information regarding the current Freeze point measurement cycle is displayed. You can enable/disable any or all of the elements associated with the Freeze point measurement (temperature, signal 0, and/or signal 90).

Rate — This is the rate at which the display will refresh. It may be set to Half or Full.

Range — This establishes the horizontal range of the trend graph. As the graph progresses, the left and right boundaries will shift to show the latest data, but the range will always remain at this value.



Temperature — When enabled, the Analyzer will graph and display the temperature as the instrument makes a freeze point measurement. It also allows you to establish the display range for these measurements.

Enabled/Disabled — Turns this particular graphing function on/off.



Low — This establishes the bottom of the trend graph's temperature scale. This value should be set below the lowest expected Freeze point temperature.

High — This establishes the top of the trend graph's temperature scale. This value should be set above the highest expected Freeze point temperature.

Sig 0 — When this menu item is enabled, the Analyzer will graph and display the amount of light that passes directly through the sample and is detected by the instrument's primary 0° optical sensor.

Enabled/Disabled — Turns this particular graphing function on/off.

Low — This establishes the bottom of the trend graph's signal 0 scale. This value should be set below the lowest expected signal.

High — This establishes the top of the trend graph's signal 0 scale. This value should be set above the highest expected signal.

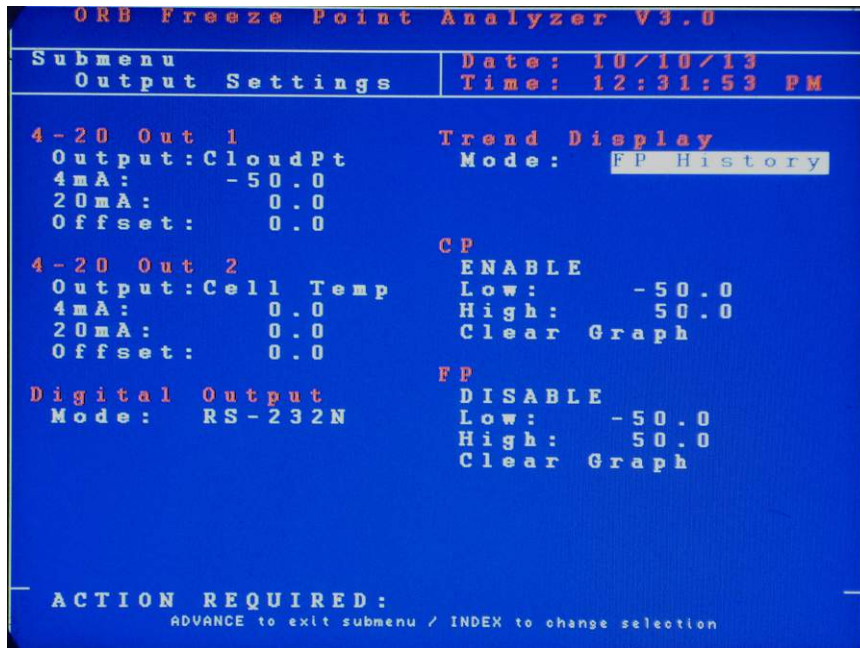
Sig 90 — When this menu item is enabled, the analyzer will graph and display the amount of light scattered by the sample and detected by the Analyzer's 90° optical sensor.

Enabled/Disabled — Turns this particular graphing function on/off.

Low — This establishes the bottom of the trend graph's signal 0 scale. This value should be set below the lowest expected signal.

High — This establishes the top of the trend graph's signal 0 scale. This value should be set above the highest expected signal.

FP History — When this is selected, measurement data for the most recent 1000 detection cycles are displayed. CP corresponds to cloud point; FP corresponds to freeze point.



Enabled/Disabled — Turns this the measurement history display ON and OFF.

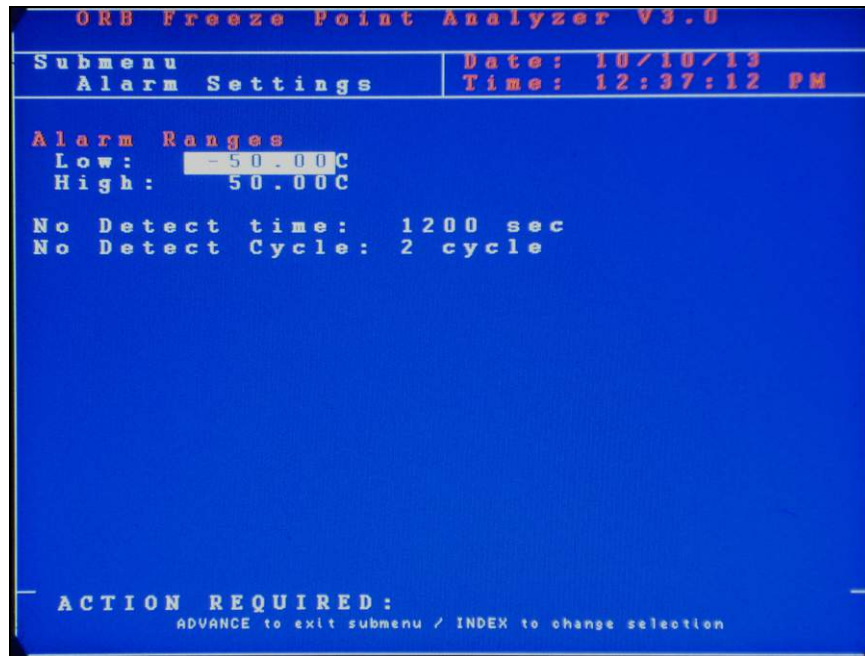
Low — This establishes the bottom of the trend graph’s temperature graph scale. This value should be set below the lowest expected temperature for the measured parameter.

High — This establishes the top of the trend graph’s temperature scale. This value should be set above the highest expected temperature for the measurement parameter.

Clear Graph — This menu item is used to clear the measurement data from the display.

ALARM SETTINGS

This menu item is used to program the Analyzer's alarm output.



Use the Index key to advance to the desired menu item. Use the Up/Down Arrow keys to change the displayed setting or value.

Alarm Range — These menu items are used to establish the temperature values at which the Analyzer's freeze point temperature alarm will be activated.

Low — This menu item allows you to establish the lowest allowable freeze point temperature value. Measurements below this value generate a freeze point alarm signal/message.

High — This menu item allows you to establish the highest allowable freeze point temperature value. Measurements above this value generate a freeze point alarm signal/message.

No Detect Time — This is the maximum allowable time, in seconds, permitted to detect freeze point. The appropriate alarm relay is activated if freeze point has not been detected within the programmed time period.

No Detect Cycle — This menu item allows you to establish the maximum number of consecutive measurement cycles that can occur without detecting freeze point before an alarm is activated.

OTHER SETTINGS

The Other Settings sub-menu allows you to establish global operating parameters for the Analyzer.


```

ORB Freeze Point Analyzer V3.0
-----
Submenu                               Date: 10/10/13
System Settings                        Time: 12:39:42 PM
-----
Reload Defaults                        FlushHeat: 25%
Strm Sel: STREAM 1                    CellHeat: 25%
Come Read Time: 10                    CP Cool: 50%
Temp Scale: C                          FP Cool: 25%
ValidEV: -40.00C                       FP Heat: 25%
ValidBW: 1.00C                          Sig90 IR: 50%
Digital Inputs                          Mode Settings
Cust Alarm: ENABLE                     Standby Mode: ON
Rem Stdby: ENABLE                       Mode: Baseline
Strm Sel: ENABLE                         CP Thresh: 150
Valid: ENABLE                            FP Thresh: 150
Screen Settings                         Detect: Sig90N
Intensity: 100%
ScreenSaver: 15 min

Relay Choice Condition
R1 Alarm Critical Fail Safe
R2 Alarm Warning Fail Safe
R3 Come Read Normal

ACTION REQUIRED:
ADVANCE to exit submenu / INDEX to change stream selection
  
```

Reload Defaults — This menu item is used to restore the Analyzer’s factory default settings. When accessed by touching the Enter key, the following message appears: “Are you sure? UP = Yes, DOWN = No” Touch the appropriate Arrow key to make your selection. After the process is complete, a message will appear. Press the Enter key to continue.

	<p>NOTE: When the Analyzer’s factory default settings are restored, all user programming is lost. All operational parameters will have to be re-entered.</p>
---	---

Stream Select — If your Analyzer is equipped with the Stream Switching option, this menu item allows you to select whether Freeze point measurements will be made on one or both streams.

Stream 1 / Stream 2 — The Analyzer only performs Freeze point measurements on the selected sample stream.

Alternate — The Analyzer alternates measurements between Streams 1 and 2.

Auto Select — Stream selection is made via a digital input signal from the control room.

Come Read Time — This menu item allows you to set the length of time the Analyzer’s “come read” relay will be activated upon the completion of a measurement cycle.

Temperature Scale — This menu item allows you to select the scale on which temperature will be displayed (°F or °C).

Valid EV — This is the expected Freeze point temperature.

Valid BW — This is the amount the Freeze point measurement can deviate (plus or minus) from the expected Freeze point temperature.


Digital Inputs — These menu items allow you to selectively enable/disable the Analyzer’s digital inputs. See Section 3 for information on wiring these inputs.

Customer Alarm — When enabled, the Analyzer’s system alarm relay will be activated whenever an external dry contact alarm signal is received. Analysis will stop and will have to be restarted from the front panel of the instrument.

Remote Standby — When enabled, the Analyzer can be placed on-line or off-line via a control room signal.

Stream Select — When enabled, a control room signal can be used to select Stream 1 or Stream 2 for analysis.

Validation — When enabled, a control room signal can be used to initiate a validation measurement.

	<p>NOTE: Although the Validation Request and Stream Select contacts may be present, these functions are only available on Analyzer’s which incorporate these options.</p>
---	--

Screen Settings — These menu items allow you to adjust Analyzer’s LCD.

Intensity — This is a brightness adjustment.

Screen Saver — This establishes how long the screen will remain lit without any keypad activity. Touching any of the magnetic keys re-activates the display. A value of zero disables the screen saver.

Flush Heat — This establishes how much power should be applied when heating the detection cell during a flush step. It should be set no higher than 50%.

Cell Heat — This establishes how much power will be applied to the heater when cell heating is required. It should be set no higher than 50%.

CP Cool — This establishes how much power will be applied to the heater to slow cell cooling.

FP Heat — This establishes how much power should be applied to the heater to melt wax crystals once freeze point has been detected.

Sig90 IR — This item is only active when Sig90 is selected as the sensor under Mode Settings – Detect. It establishes sensor sensitivity.

Mode Settings — These menu items are used to set other miscellaneous operating parameters.

Standby Mode — This menu item allows you to select how the Analyzer will operate upon application of power. When OFF is selected, the instrument will begin performing analyses automatically when power is applied and all purge requirement met. When ON is selected, the instrument will power up in the Off-Line mode and must be manually placed On-Line.

Mode — This setting determines the method the Analyzer will use to detect Freeze point.

Baseline — This is the recommended for use unless problems are encountered. It uses the delta change from the baseline average from the end of the flush cycle to the detection of freeze point.

First Derivative — This setting may be useful for samples with high moisture levels. This mode detects freeze point based on the first derivative rate of change of the luminance signal and uses the rate of change.

Delayed T — This method uses a baseline based on a moving average. The main advantage of this method is that it provides better measurement repeatability in some applications..

CP Threshold — This is a sensitivity setting for cloud point detection. The higher the value, the more the optical signal will have to change before cloud point is detected.



FP Threshold — This is a sensitivity setting for freeze point detection. The higher the value, the more the optical signal will have to change before freeze point is detected.

Detect — This setting determines which sensor is used to determine freeze point. It may be set for Sig0 or Sig90.

Relay Setup — These menu items allow you to enable/disable the alarm relays, indicate the type of alarm it will signal, and how the relay will operate.

Relay — This designates which alarm is being programmed. See Section 3 for alarm relay wiring information.

Choice — This designates the type of alarm.

Off — Alarm relay disabled.

Alarm Warning — Freeze point out of range. Warning alarms do not disrupt analysis.

Alarm Critical — This type of alarm indicates Analysis has stopped because one of the following conditions has been detected:

- Freeze point not detected
- Temperature sensor failure
- Temperature control failure
- Optic failure
- Customer alarm
- Remote standby enabled
- Machine not running

Come Read — Activated for a programmed period of time upon the completion of a measurement cycle.


In Validation — Activated when a validation measurement is in progress.

Validation — Activated when a validation measurement result is available.

Conditions — This designates whether the alarm relay will energize or de-energize when an alarm condition is detected. When Normal is selected, power will be applied to the relay when an alarm condition is detected; when Failsafe is selected, power will be removed from the relay when an alarm condition is detected.

STATE TABLE SETUP

This menu selection allows you to modify, add, or delete steps in the Freeze point measurement process.

	<p>NOTE: Any changes made will affect how the Analyzer performs a Freeze point measurement. You should have a complete and thorough understanding of how the instrument performs Freeze point measurements before making any changes to the State Table.</p>
---	---

```

ORB Freeze Point Analyzer V3.0
-----
Sub Menu      Date: 10/10/13
State Setup   Time: 12:34:47 PM

State      Type      Data
1          FLUSH     90
2          WAIT      5
3          AUTOZERO
4          COOL      200
5          FP-ANAL.  5
6          RETURN
7          RETURN
8          RETURN
9          RETURN
10         RETURN
11         RETURN
12         RETURN
12         RETURN

ACTION REQUIRED:
ADVANCE to exit submenu | INDEX to scroll | UP-DOWN to change value

```

Any of the following steps may be included in a Freeze point measurement cycle. Steps highlighted in **bold face** type are required. The last step in any Freeze point measurement cycle must be **Return**.

Flush XX — This is the detection cell flush time, in seconds. This step is used to clear the previous sample and any wax crystals from the detection cell. It is usually the first step in a measurement cycle.

Wait — This idles the Analyzer for a programmed period of time. It is generally used just before an autozero to allow the sample to settle.

Autozero — This is a baseline reading. It should be performed before cell cooling, and hence Freeze point detection, takes place.

Cool — When Cool is selected, the detection cell is cooled at the cryocooler’s maximum rate less the “drag” provided by the cell heat setting.

Cool F.R. XX — When Cool F.R. is selected, the detection cell is cooled at a fixed rate per minute (in °C).

FP – Analysis — This is the freeze point detection state; it is entered after cloud point has been detected. The number in the data column is the slope of the luminance curve and represents the point at which data logging ends.

Flush Heat XX — This allows you to apply heat during the Flush step. The setting is made as a percent of heater power.

Cell Heat XX — This allows you to preheat the sample to the designated temperature prior to cooling.

GoTo X — This allows you to loop back to a specific step in the detection cycle.



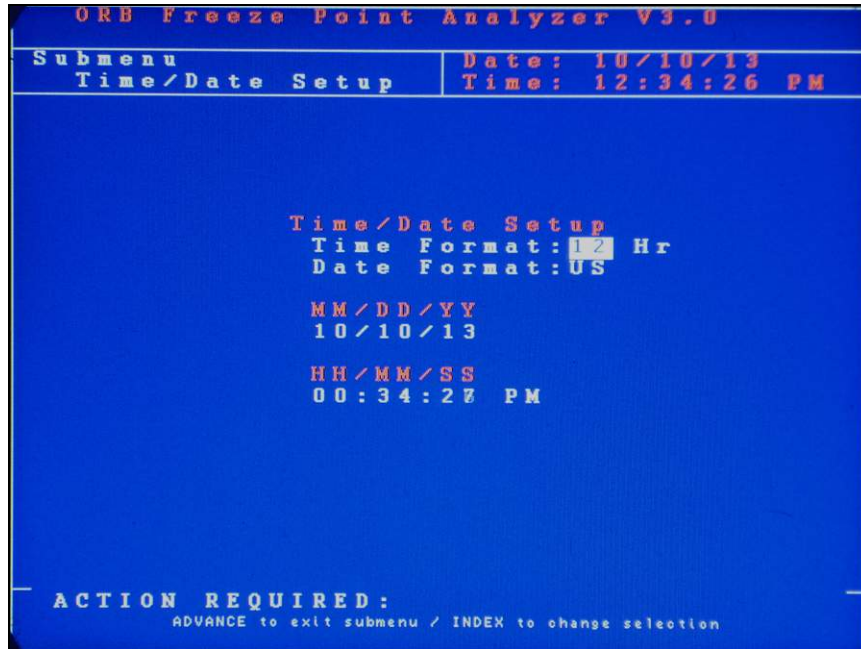
Abort — This selection immediately stops the analysis and prevents the Analyzer from proceeding. It is intended as a troubleshooting tool only and should never be included as part of a normal Freeze point measurement cycle.

Return — This should always be the last step in the State table. It tells the Analyzer to return to step 1.

<i>Step</i>	<i>Time</i>
Flush	90
Wait	5
Autozero	
Cool	200
FP-ANAL	5
Return	

TIME/DATE SETUP

The Date / Time Setting sub-menu is used to set the Analyzer's internal calendar and clock.



Time Format — This menu item allows you to select either a 12 or 24 hour time format. Touch the Up/Down Arrow keys to change the displayed value.

Date Format — This menu item allows you to select the format in which the date will be displayed. The selections are US (month/day/year) or EU (day/month/year). Touch the Up/Down Arrow keys to change the displayed value.

Date — This menu item allows you to program the Analyzer with the current date. To change the displayed date, touch the Enter key and then use the Index key to advance the cursor to the field which needs to change. Use the Up/Down Arrow Keys to change the value in the selected field. Touch the Enter key a second time to accept the new date entry.

Time — This menu item allows you to program the Analyzer with the current time. To change the displayed time, touch the Enter key and then use the Index key to advance the cursor to the field (Hour/Minute/Second) which needs to change. Use the Up/Down Arrow Keys to change the value in the selected field. Touch the Enter key a second time to accept the new date entry.

FACTORY SETUP

This is a password protected sub-menu intended for factory use only.

NORMAL OPERATION

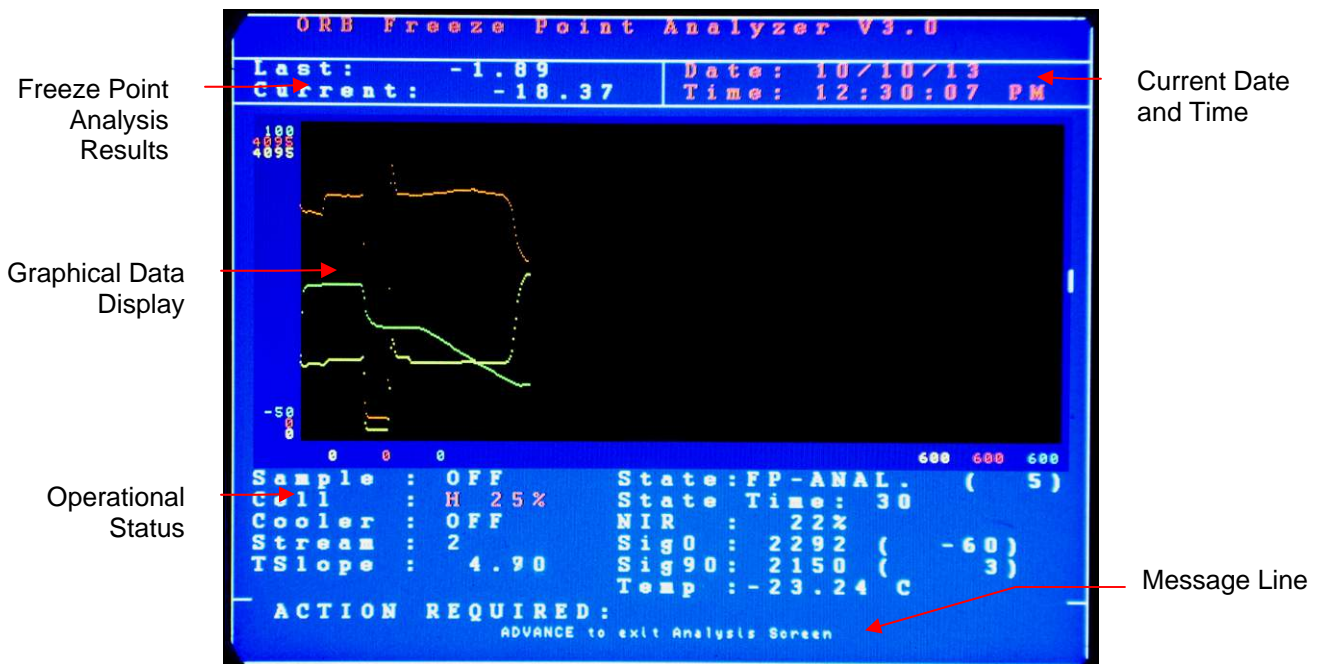
SECTION 5

The P-800LT Freeze Point Analyzer is an on-line process instrument designed for the continuous measurement of freeze point in hydrocarbon process streams.

In normal operation, these measurements and other pertinent monitoring information are displayed on the Analyzer's liquid crystal display. Measurement data are also output as analog and digital signals. Upon the application of power, the P-800LT runs a short initialization program and then displays either the Main Run screen or the Main Menu, depending on how the Standby mode has been set up (see Section 4 – Programming). If the Main Run screen is displayed upon power up, the instrument is in the on-line (analyzing) mode; if the Main Menu is displayed on power up, the instrument is in the off-line (idle) mode.

MAIN RUN SCREEN

The Analyzer's Main Run screen provides both measurement data and system operation information. A typical Main Run screen appears below:



Freeze Point Analysis Results — The two most recent freeze point measurements. Measurement data are displayed in a user-selected unit of measure and updated at the end of each measurement cycle.

Date & Time — The current date and time as tracked by the Analyzer's internal calendar and clock.

Graphical Data Display— Displays freeze point measurement data. If two sample streams are being analyzed, data appears in different colors. If power is lost or disrupted, the displayed graph is lost.

Cycle graph — If Cycle was selected as the Trend Display in the Output Settings menu (see Section 4), the graph displays temperature, signal 0, and/or signal 90 data for the current measurement cycle.

FP History graph — If FP History was selected as the Trend Display in the Output Settings menu (see Section 4), the graph displays as many as 1000 of the most recent cloud point and/or freeze point measurements.

Operational Status — Identifies the status and state of various Analyzer components and systems.

Sample — Status of the sample solenoid.

Cell — The percent power being applied to the heater.

Cooler — Status of the cryocooler.

Stream — Identifies stream currently being analyzed (on Analyzers with the stream switching option).

T Slope — The °/minute change in the temperature of the detection cell.

State — The current step in the measurement cycle.

State Time — The elapsed time or remaining time for the state, depending on the state.

NIR — The intensity of the light source, as a percent of full power.

Signal 0 — This is the strength of the optical signal as measured by an optical sensor located directly across from the light source. It is the amount of light passing directly through the sample and should decrease as wax crystals form.

Signal 90 — This is the strength of the optical signal as measured by an optical sensor located at approximately a 90° angle to the light source. It measures the amount of scattered light and should increase as wax crystals form.

Temperature — The temperature of the detection cell.

Message Line — Important operational messages, such as the detection of an alarm condition, initiation of a validation measurement, remote standby, etc. are displayed in this area.

SIGNAL OUTPUTS

4 – 20 MA ANALOG OUTPUT

The P-800LT Freeze Point Analyzer outputs an analog signal proportional to the last measured value. The range of the analog signal is user-programmable (see Section 4 – Programming). This signal is updated at the end of the measurement cycle.



NOTE: A second analog output is available as an option.



SERIAL OUTPUT

The Analyzer normally outputs an RS232 serial signal (RS485 output is available as a factory installed option). Data are output according to the following protocol:

Baud Rate	19200
Parity	No parity
Start Bits	8
Stop Bits	1
Field Delimiter	Comma
End of Data Indicator	<CR>

The information contained in the data stream is output in the following order:

Description	Format
Date	MM/DD/YY
Time	HR/MIN/SEC
Result	XX.XX° (C or F, depending on selected temperature scale.

MODBUS OUTPUT

ModBus output is available as a factory installed option and uses the Analyzer's serial interface. Consult ORB Instruments for additional information.

ALARMS

When an alarm condition is detected, a message will be displayed in the Message Line of the current screen. Depending on the type of alarm and the user-programming of the alarm relays, an alarm relay may also be activated.

TYPES OF ALARM CONDITIONS

Alarm Warning — This indicates that the measured Freeze point temperature is outside the acceptable programmed limits. Analysis continues.

Alarm Critical — An alarm of this type indicates that analysis has stopped.

Come Read — This signals that the Analyzer has completed a measurement cycle and that a new Freeze point value has been output. Analysis continues.

In Validation — This signals that the Analyzer is in the process of making a validation measurements.

Validation — This signals that the Analyzer has completed the validation measurement and a result is available.

When an alarm condition is detected, the appropriate alarm relay is activated (if enabled) and the alarm condition logged on the Alarms History sub-menu.

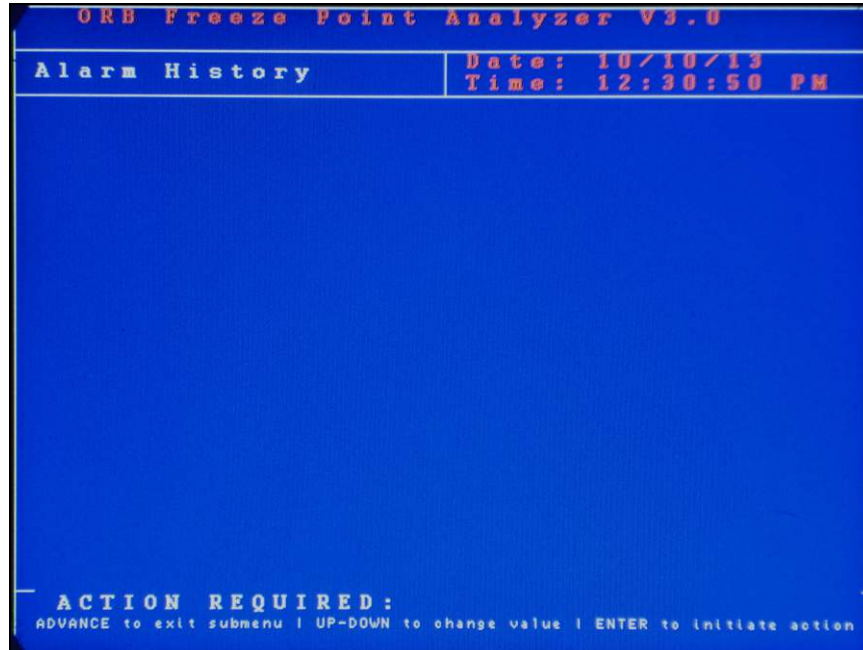
Type	Alarm Messages and Conditions	Analyzer State
Alarm Warning	Freeze point out of range	Analysis continues
Alarm Critical	Freeze not detected	Analysis stops
Alarm Critical	Temp. sensor failure	Analysis stops
Alarm Critical	Temp. control failure	Analysis stops
Alarm Critical	Optic failure	Analysis stops
Alarm Critical	Customer alarm	Analysis stops
Alarm Critical	Remote standby enable	Analysis stops
Alarm Critical	Machine not running	Analysis stops
Come Read	Measurement cycle complete	Analysis continues
In Validation	Validation measurement being performed	Analysis continues
Validation	Validation measurement complete	Analysis continues



NOTE: An alarm relay is activated only if one is programmed for that particular alarm type. See Section 4 – Programming.

ALARMS HISTORY

Operational alarms are logged and may be accessed via the Alarms History sub-menu. To access this sub-menu, go to the Main Menu, select Alarms History, and touch Enter. The Alarms History screen will appear.



To clear the alarm history, touch the Enter key when Reset is highlighted.

TAKING THE ANALYZER OFF-LINE

The P-800LT Freeze Point Analyzer may be taken off-line either locally from the front panel of the instrument or, if wired to do so, remotely via a contact closure from the control room.

LOCALLY

To exit analysis from the instrument's front panel, first access the Main Menu by touching the Advance Screen Key with the magnetic pencil and then select Status. Touch the Up/Down Arrow keys to toggle the status to OFF.


REMOTELY

The Analyzer may also be taken off-line via an optional remote dry contact relay closure (see Section 3). The instrument will remain idle until the signal is removed. A message indicating that the instrument has been remotely idled is displayed on the Main Run screen.

PERFORMING A VALIDATION MEASUREMENT

If the Analyzer is equipped with the Validation option, operating personnel can check measurement accuracy using a sample with a known freeze point value. This procedure is initiated via a control room contact closure (see Section 3).

When a validation check is initiated, the instrument analyzes the validation sample just as it would an actual hydrocarbon sample. At the end of the measurement cycle, the measurement results for the validation sample are displayed on the Main Run screen. A message indicating that a validation measurement is in progress is displayed on the Main Run screen.

	<p>NOTE: When a validation measurement is being performed, the 4-20 mA signal is held at the last measured Freeze point value. The signal is not updated until a new Freeze point measurement is performed.</p> <p>The measured Freeze point value of the validation sample is NOT output as an analog signal.</p>
---	--

SWITCHING SAMPLE STREAMS

On P-800LT Freeze Point Analyzers equipped with the stream switching option, the sample stream being analyzed can be changed from 1 to 2 via a control room contact closure (see Section 3). When the signal is removed, the instrument goes back to analyzing stream 1. The identity of the stream being analyzed is displayed on the Main Run screen.

LOSS OF POWER RESTART

In the event of a power loss, the P-800LT Freeze Point Analyzer will automatically begin monitoring when power is restored If the Standby mode (see Section 4) is set to OFF. If the Standby mode is set to ON, the Analyzer will have to be placed online manually by accessing the Main Menu and then setting Status to ON.


INTERNAL SAMPLE LEAK


The Analyzer incorporates a sample leak detector mounted on the bottom of the Measurement enclosure. Should an internal sample leak occur, accumulation of fluid in the bottom of the enclosure activates the leak detector and immediately removing power from the Measurement and Control enclosures.


To restore power once the leak has been corrected and fluid removed from the Measurement enclosure, press the Power Reset Button on the side of the Customer Connections enclosure. The Analyzer will restart.

ROUTINE MAINTENANCE & SERVICE

SECTION 6

	WARNING: Service should only be performed by qualified service personnel. Before performing any of the following procedures, disconnect unit from its electrical source. If electrical power is required, exercise extreme care as "LINE VOLTAGE" is present.
---	--

	CAUTION: Be sure to obtain all necessary permits and perform any required gas testing before opening the instrument's enclosures.
---	--

	WARNING: To prevent injury, the Analyzer must be shut off from the process. Personnel must avoid contact with hot equipment or sample.
---	---

RECOMMENDED ROUTINE MAINTENANCE SCHEDULE

Check sample pressure	Weekly
Check sample conditioning system & filter	Weekly
Inspect for internal sample leaks	One week after startup, 30 days after startup, and then every six months
Cryocooler cooling medium	Weekly

SERVICE AND OPERATIONAL CHECKS

The P-800LT Freeze Point Analyzer incorporates a special Service screen from which the operator can perform a variety of verification and diagnostic functions, including:

- Exercise the Analyzer's various components
- Output a fixed analog signal to check/calibrate external devices
- Check measurement cell temperature
- Check the optical system

Entering the Service Screen requires the Analyzer to be offline. If the Analyzer is online and the user tries to enter the Service mode, the Analyzer will automatically be taken offline before entering the Service mode.

```

ORB Freeze Point Analyzer V3.0
-----
Submenu      Date: 10/10/13
Service      Time: 12:42:03 PM

Sys Temperatures      Cell Temp. Control
T1 : 0.00 C           PWM Load: 0%
Sample: 1.02 C        Heater: OFF
Sensor: CLOSE         Cooler: OFF

Output Control        Optical System
Sample Solen.: OFF   NIR Power: 0%
Validation: OFF       NIR Source: OFF
Stream Solen.: OFF   0 Signal: 375
                     90 Signal: 182

4-20 Control          Run Autozero
Stream 1: 12.0        AZ0 Volt: 2.5 VDC
Stream 2: 4.0         AZ90 Volt: 2.5 VDC

Alarms
R1 : OFF
R2 : OFF
R3 : OFF

ACTION REQUIRED:
ADVANCE to exit submenu / INDEX to scroll / UP-DOWN to change value
  
```

System Temperatures — This is an informational display only.

T1 — For future use.

Sample — This is the temperature inside the sample cell.

Sensor — For future use.

Output Control — The operation of the Analyzer's various solenoids can be checked via these menu items. The Up/Down Arrow keys are used to change the status.

Sample Solenoid — The Analyzer's sample solenoid valve is opened when this menu item is switched from OFF to ON.

Validation Solenoid — The Analyzer's validation solenoid valve is opened when this menu item is switched from OFF to ON.

Stream Solenoid — The Analyzer's stream switching solenoid valve is opened when this menu item is switched from OFF to ON.



NOTE: The instrument must be equipped with the validation and stream switching options in order for the Validation and Stream Solenoid menu items to function properly.

4-20 Control — This menu item allows you to output an analog signal with which to calibrate external devices. The Up/Down Arrow keys are used to increase/decrease the analog signal value.

Alarms — The Analyzer's alarm relays will activate when these menu items are switched from OFF to ON.

Cell Temperature Control — These menu selections allow you to heat/cool the detection cell. When heat/cooling is applied, the system temperature information should change accordingly. The Up/Down Arrow keys are used to change the value or status of the highlighted selection.

PWM Load — This is the percent of maximum power applied to the heater.

Heater — The detection cell is heated when this menu item is switched from OFF to ON.

Cooler — The detection cell is cooled when this menu item is switched from OFF to ON.



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Optical System — The operation of the Analyzer's optical system can be checked via these menu items.

NIR Power — This controls the strength of the NIR light source and allows you to check the operation of the optical sensors. The signal 0 and signal 90 values should increase/decrease in conjunction with the changes in the NIR power.

NIR Source — This turns the optical signal ON and OFF. The signal 0 value should increase when the optical signal is turned on.

0 Signal — This is the signal level from the 0 sensor.

90 Signal — This is the signal level from the 90 sensor.

Run Autozero — Manually initiates an Autozero.

Az0 Volts — Sets the 0 voltage for an Autozero. The value may change once the Autozero is complete.

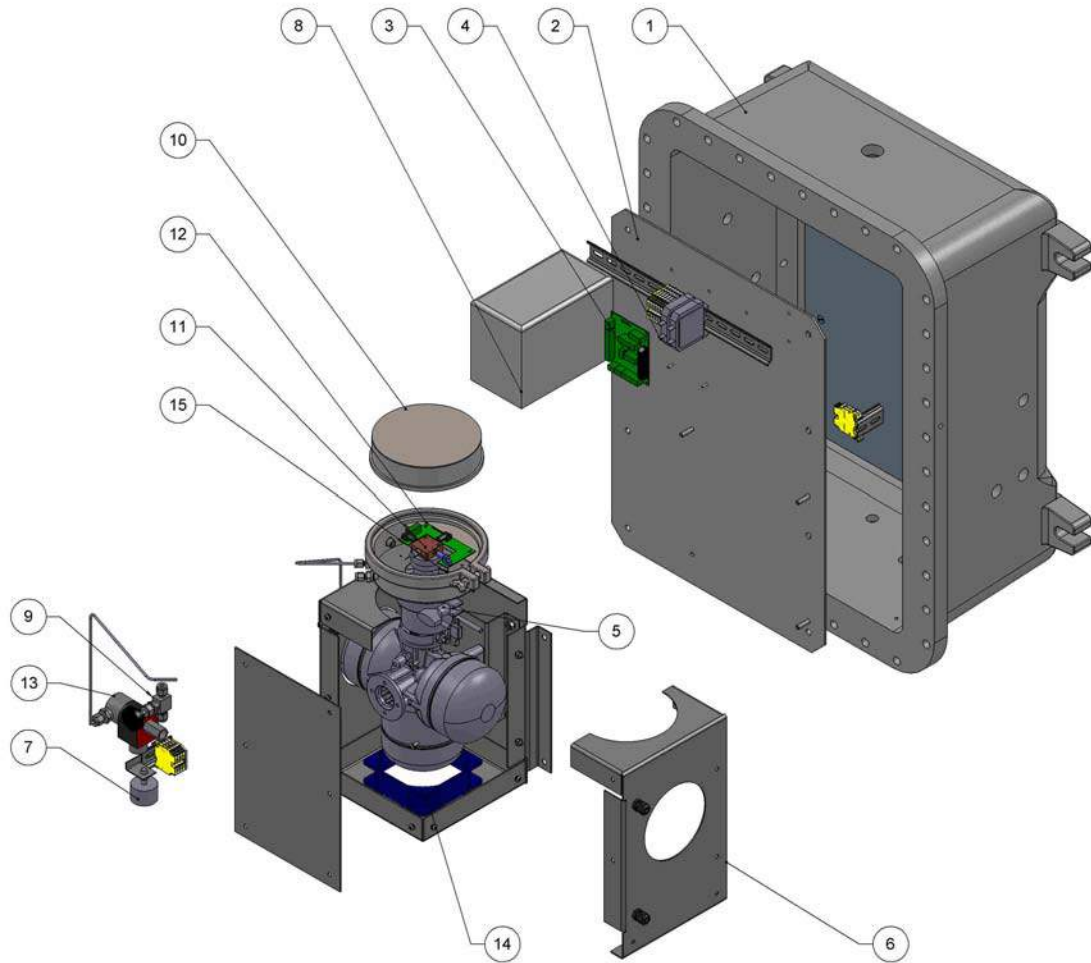
Az90 Volts — Sets the 90 voltage for an Autozero. The value may change once the Autozero is complete.

TROUBLESHOOTING

Problem / Symptom	Cause	Corrective Action
Freeze point out of range	<p>Detected freeze point value is outside the expected range of the Analyzer</p> <p>Faulty temperature sensor</p> <p>Incorrect 4-20 mA signal</p>	<p>Allow unit to run additional cycles. Process fluctuations or changeovers can cause out of range alarms due to different sample characteristics.</p> <p>Check and replace as required.</p> <p>Check 4-20 mA signal and range; correct as required (see Section 4).</p>
Freeze point not detected	<p>Time to detect value too short</p> <p>Faulty cryocooler</p>	<p>Increase time to detect interval (see Section 4).</p> <p>Check and replace as required.</p>
Erratic readings	<p>Faulty temperature sensor</p> <p>Faulty RTD PCB</p> <p>Electronics failure (main PCB)</p>	<p>Check and replace as required.</p> <p>Check and replace as required.</p> <p>Check and replace as required.</p>
Cell won't cool	<p>Low or no coolant supply to cryocooler</p> <p>Faulty cryocooler</p> <p>Sample solenoid leaking or faulty</p>	<p>Check and correct as required.</p> <p>Check and replace as required.</p> <p>Check for proper flow during analysis; replace as required.</p>
Low or no sample flow	<p>Damaged or plugged back pressure regulator</p> <p>Sample solenoid leaking or faulty</p> <p>Faulty air-actuated valve</p> <p>Blockage in cooling cell</p>	<p>Clean or replace as required.</p> <p>Check and replace as required.</p> <p>Check and replace as required.</p> <p>Check and clear blockage as required.</p>
4-20 mA failed or out of range	<p>Incorrect 4-20 mA values</p> <p>Faulty 4-20 module</p> <p>Faulty main PCB</p> <p>Faulty line to control room</p>	<p>Correct as required (see Section 4).</p> <p>Check and replace as required.</p> <p>Check and replace as required.</p> <p>Check line and repair as required.</p>

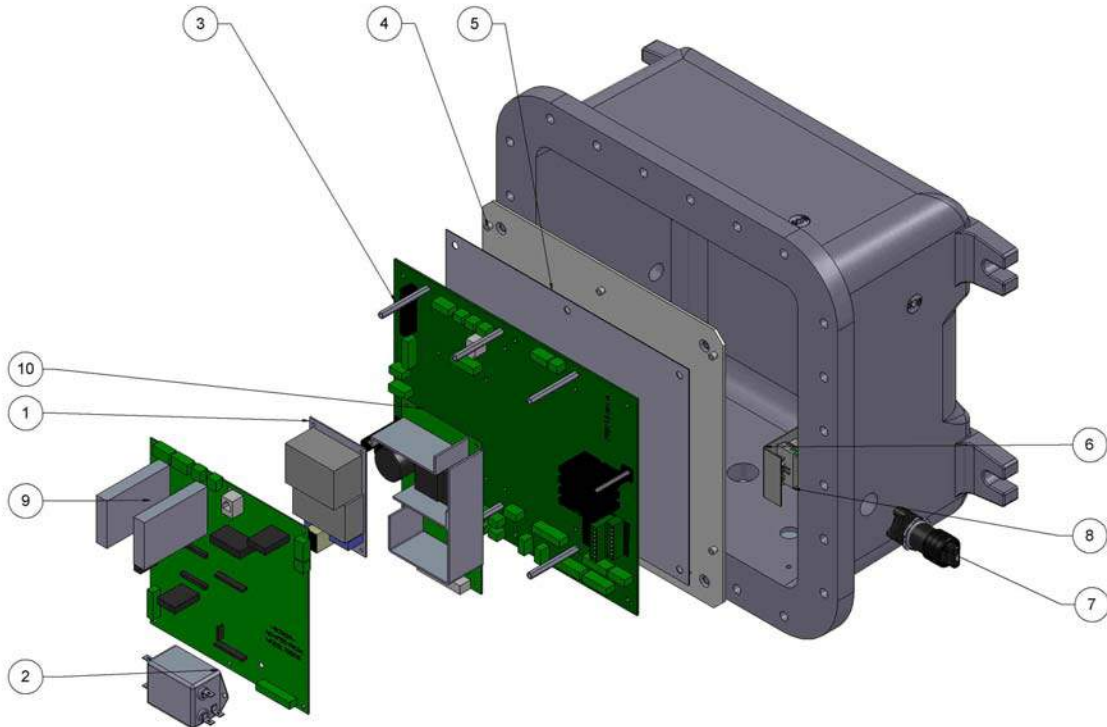
ASSEMBLY DRAWINGS

MEASUREMENT ENCLOSURE



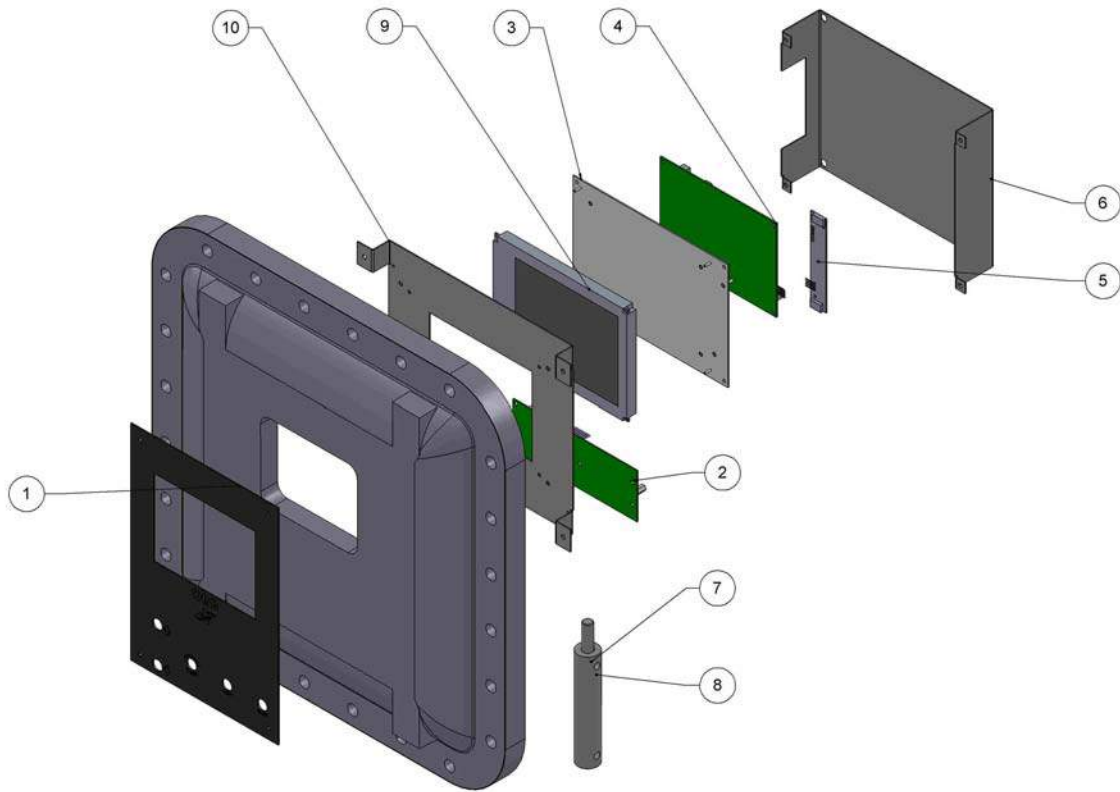
BOM Table(Restructured)			
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	680014	BOTTOM ENCLOSURE	1
2	701388	MAIN BACKPLATE	1
3	798021	CLOUD OPTICAL I/O PCB ASSY	1
4	620112	RELAY	2
5	700462	CRYOCOOLER	1
6	701085	CRYOCOOLER ENCLOSURE ASSY	1
7	660005	FLOAT SWITCH	1
8	620079	AC POWER CONVERSION MODULE 120VAC	1
9	650231	1/4" TUBE NEEDLE VALVE	1
10	FERRULE ASSY	DETECTION CELL ENCLOSURE	1
11	701771	COLD PROPERTY DETECTION CELL ASSY	1
12	798021R	CLOUD OPTICAL I/O PCB ASSY	1
13	650370	SOLENOID VALVE	1
14	640052	CRYOCOOLER FAN	1

CONTROL ENCLOSURE



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	620037	POWER SUPPLY (+5, +/- 12 VDC)	1
2	620076	LINE FILTER	1
3	798115RA	MAIN DISTRIBUTION PCB ASSY	1
4	701910	MTG PLATE FOR MOTHERBOARD 798115	1
5	701911	FISH PAPER FOR MOTHERBOARD 798115	1
6	700795	ADALET SWITCH COVER PLATE	1
7	620149	SPST SWITCH	1
8	620150	CONTACT BLOCK	1
9	700317	MAIN PCB	1
10	620038	POWER SUPPLY	1

CONTROL ENCLOSURE DOOR



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	701231	KEYPAD	1
2	798030	MAGNETIC KEYPAD PCB ASSY	1
3	700062	DISPLAY MOUNTING BRACKET	1
4	798063	DISPLAY DRIVER PCB ASSY	1
5	700288	BACKLIGHT DRIVER PCB	1
6	700793	Default	1
7	700701	MAGNETIC PENCIL ASSY	1
8	700348	EXP PROOF MAGNETIC PENCIL HOLDER	1
9	700286	GRAPHICS DISPLAY ASSY	1
10	700787	DISPLAY BRACKET EX PROOF UNITS	1



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SPARE AND REPLACEMENT PARTS

SECTION 7

SPARE PARTS KITS

Description Part Number

1-YEAR PARTS KIT..... 700506

- Cartridge heater, 2 each
- Optical window O-ring, 2 each
- Type J thermocouple, 1 each

2-YEAR PARTS KIT..... 700507

- 3-way solenoid, 1 each
- Cartridge heater, 4 each
- Optical window O-ring, 4 each
- Type J thermocouple, 1 each

**REPLACEMENT PARTS**

Description	Part Number
Cartridge Heater, 1 each	620078
Fuse (250 VAC, 2 A) / 230 VAC Systems, 1 each	620035
Fuse (250 VAC, 5 A) / 115 VAC Systems, 1 each	620036
Power Supply (+5, \pm 12 VDC), 1 each	620037
Power Supply (+24 VDC), 1 each	630038
3-way Solenoid, 1 each	650370
3-way Solenoid, 1 each	650011
Optical Window O-ring, 1 each.....	650029
Type J Thermocouple Sensor, 1 each	660017
Over-temp Bi-metallic Switch, 1 each	660009
Magnetic Keypad Assembly, 1 each	798030
Graphics Display Assembly, 1 each.....	700286
Display Controller PCB, 1 each.....	798063
Backlight Driver PCB, 1 each	700288
Cable Assembly, 1 each.....	700289
Cloud/Freeze Optical I/O PCB Assembly, 1 each.....	798021
IR Source Detection PCB Assembly, 1 each	798021A
Cloud/Freeze Optical Converter PCB Assembly, 1 each.....	798024
Main Control PCB, 1 each	700318
AC Power Conversion Module, 1 each	620079
Cryocooler Assembly, Water-Cooled, 1 each	700461
Cryocooler Assembly, Air-Cooled, 1 each.....	700462