BARTEC ORB

ATEX Zone 1 II B + H2 T6 CSA/CUS Class 1 Div 1 Group B, C + D

Process Analyzer

User Manual

P-600 SALT IN CRUDE ANALYZER

FOREWORD

SPARE & REPLACEMENT PARTS – SECTION 7

DRAWINGS & SCHEMATICS – SECTION 8

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WARRANTY

POLICY

BARTEC-ORB 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, BARTEC-ORB 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 BARTEC-ORB or your distributor to initiate warranty support. Products may not be returned without authorization from BARTEC-ORB.

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 BARTEC-ORB.
- Freight charges to return merchandise to BARTEC-ORB.
- 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 BARTEC-ORB 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 BARTEC-ORB.

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 BARTEC-ORB be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.

INTRODUCTION SECTION 1

ANALYZER OVERVIEW

The BARTEC-ORB Model P-600 Salt in Crude Analyzer is an on-line instrument designed for the continuous measurement of salt content in crude oil. Extremely rugged and simple to operate, the P-600 Salt in Crude Analyzer combines rapid analysis, exceptional measurement accuracy, and unmatched operational dependability to deliver highly reliable and repeatable salt content measurements.

- Rapid analysis — 6 minutes or less typical cycle time.
- Superior repeatability — ±2% of full scale or better.
- Sample conditioning included.
- Exceptional reliability — better than 99% uptime.

For optimum installation and applications versatility, the P-600 Salt in Crude Analyzer incorporates a wide variety of standard features, including:

- Isolated 4-20 mA analog output; optional second output available.
- 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-600 Salt in Crude Analyzer's measurement technique is based on the ASTM Method D 3230. This is accomplished by using a digitally controlled syringe injection system, micro-volume solenoid valves, and a measurement chamber equipped with a high-resolution conductivity probe, and temperature control. Measurement chamber temperature is monitored and held constant at a programmed level (typically 50°C).

A typical measurement is performed as follows:

1. The sample chamber is emptied by opening the sample drain and the measurement chamber pressure valve and applying purge gas to remove any remaining fluid and/or vapors.
2. The measurement cell is rinsed and cleaned with naphtha.

	**NOTE: Cell cleaning is not performed every measurement cycle. Cleaning frequency is adjustable. See State Table in Section 4.**

3. The crude sample solenoid is activated and a precisely measured volume of crude oil is drawn into the tubing path to the measurement cell.
4. The digitally controlled syringe draws a precise volume of Xylene from the solvent chamber and injects it into the tubing path, pushing the crude sample into the measurement cell.
5. The digitally controlled syringe draws a precise volume of alcohol from the solvent chamber and injects it into the tubing path, pushing the Xylene into the measurement cell.
6. Purge air is injected into the tubing path, pushing the alcohol into the measurement cell.
7. The air mixer is activated and the conductivity of the crude/xylene/alcohol mixture monitored after a programmed period of time.

8. When both the sample temperature and measured conductivity value have stabilized, the analysis is considered complete. The salt in crude level is then calculated and reported.

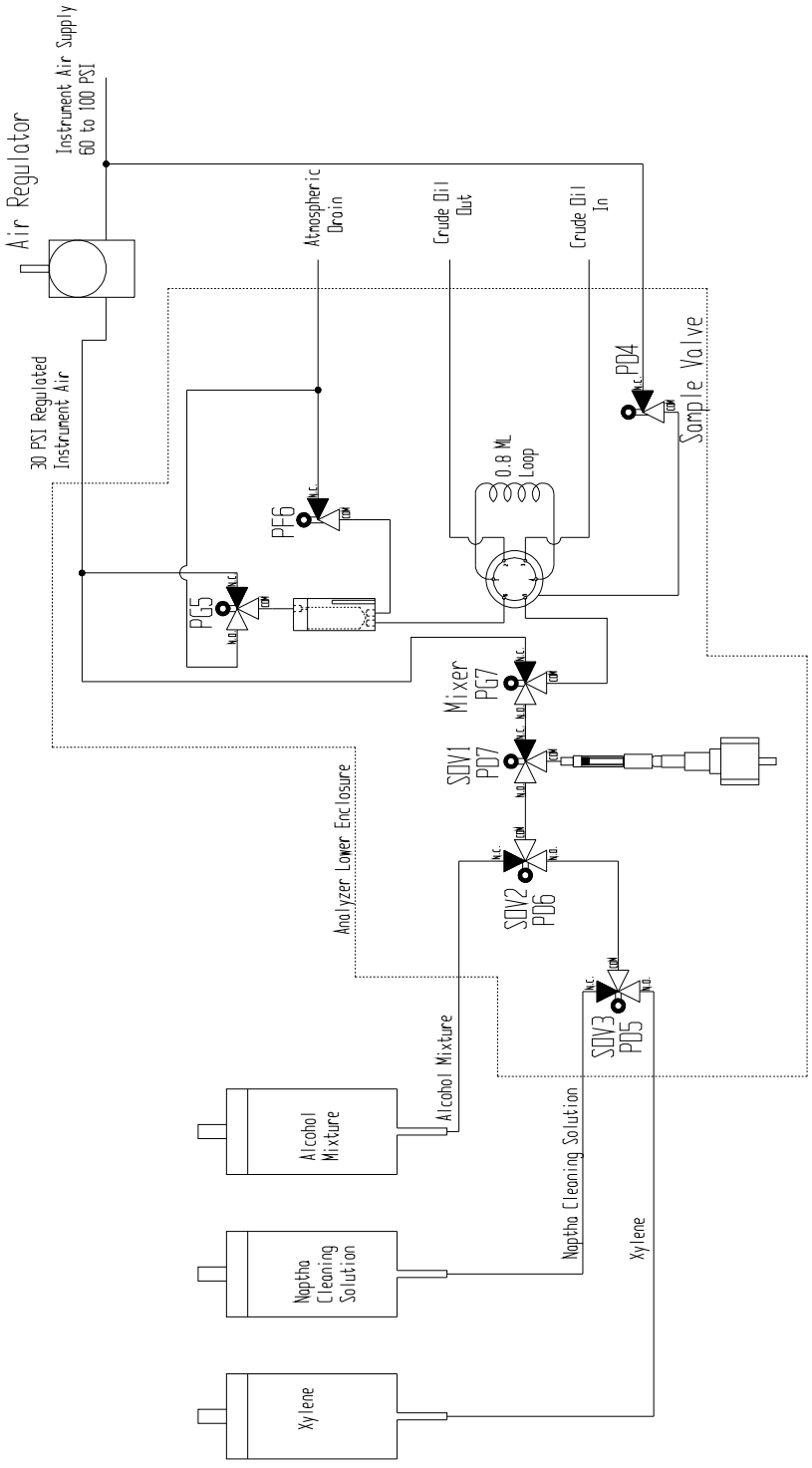


Figure 1-1: Flow Schematic

COMPONENT IDENTIFICATION

FRONT VIEW

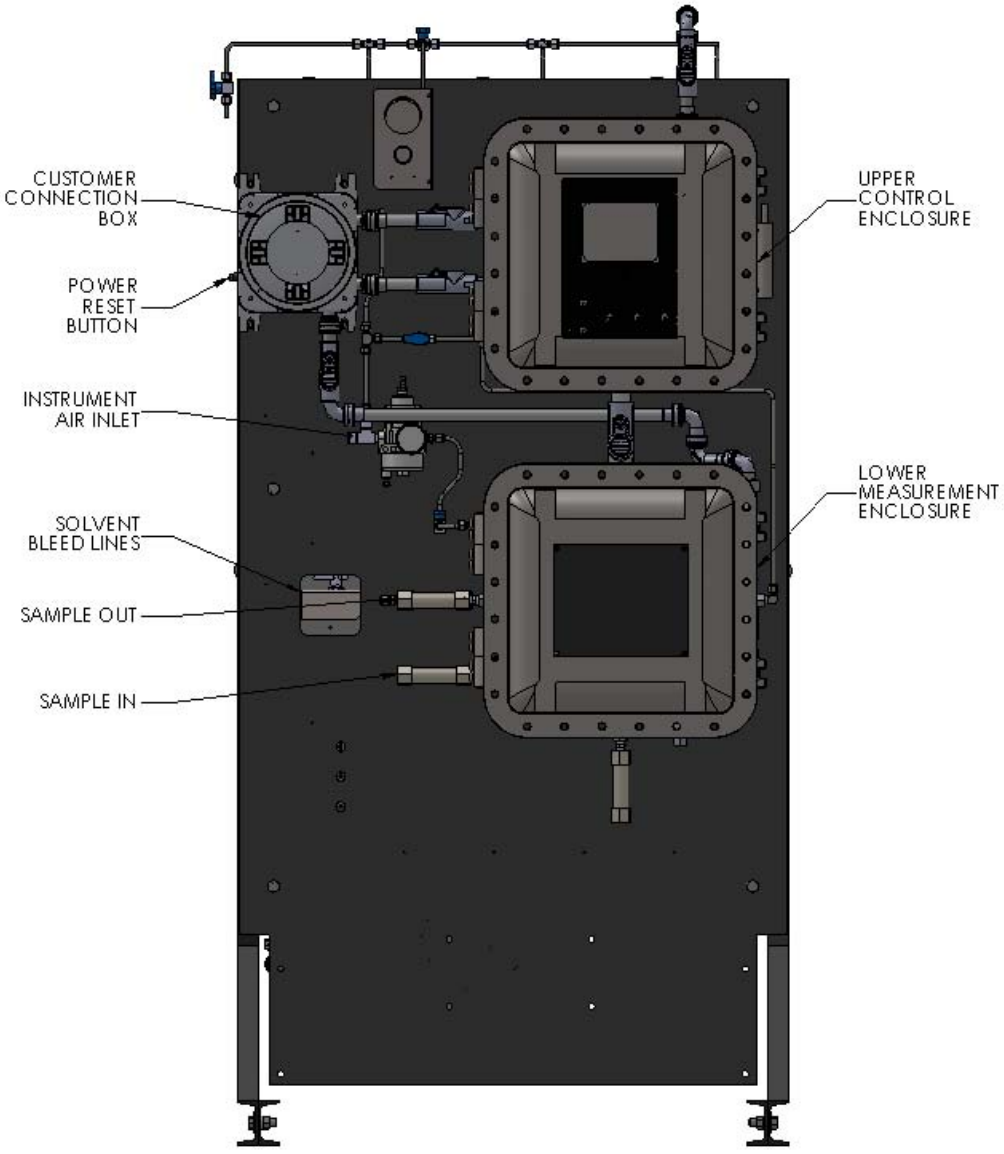


Figure 1-2: Front View

CONTROL ENCLOSURE

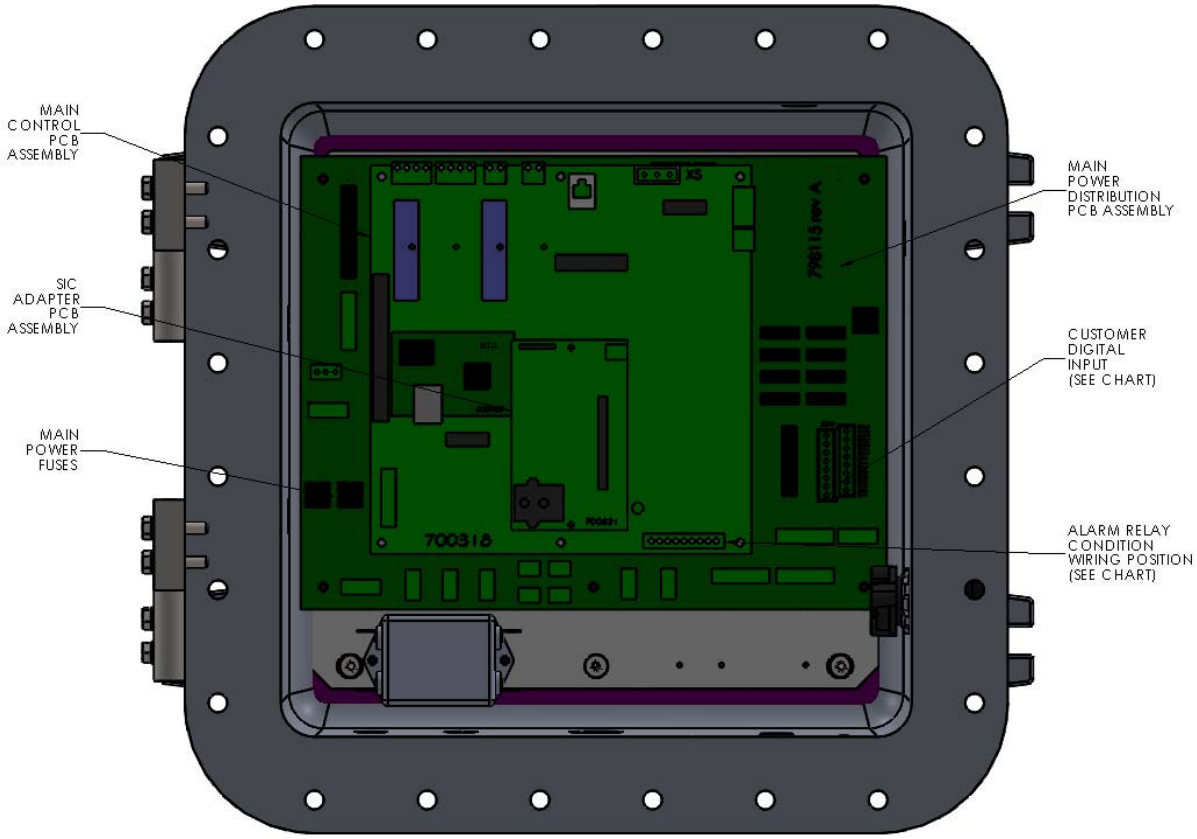


Figure 1-3: Control Enclosure

MEASUREMENT ENCLOSURE

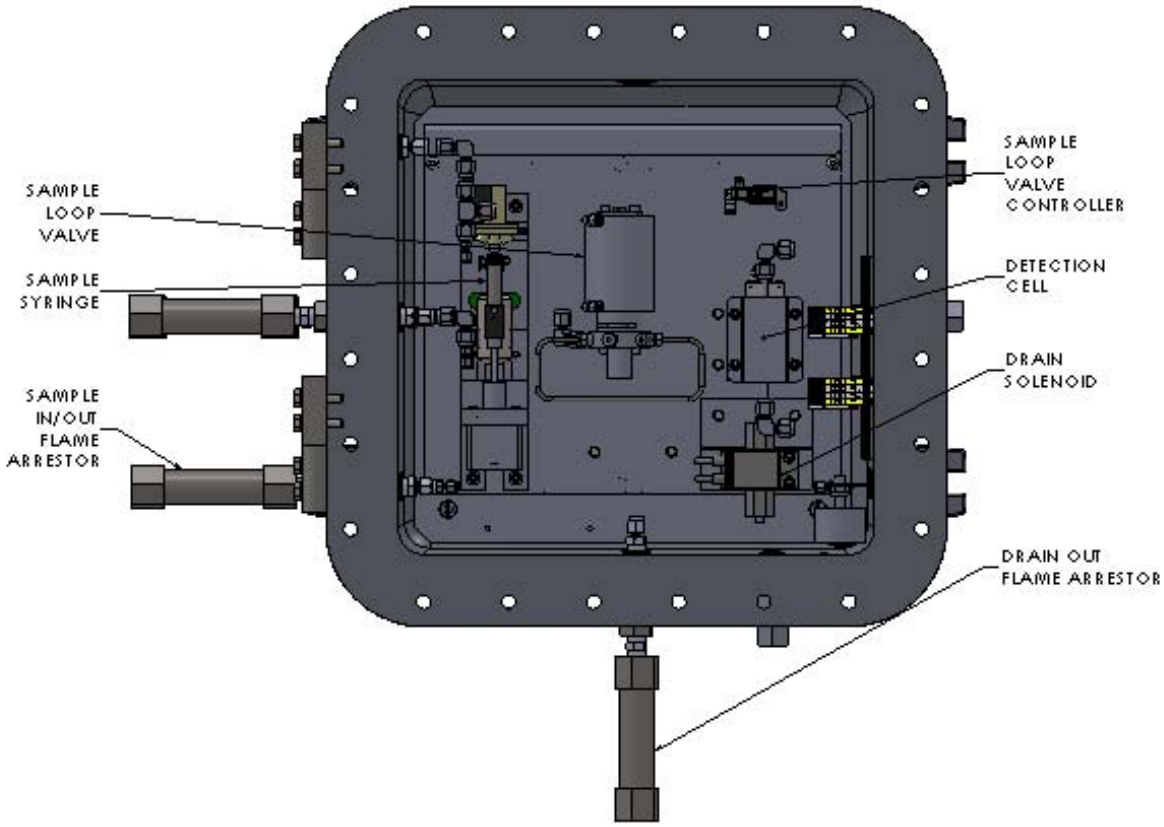


Figure 1-4: Measurement Enclosure

MENU STRUCTURE

Main Menu	Sub-Menu	Items	Choices / Settings / Comments
Analyzer Status	—	—	On Line / Off Line
Alarm History	—	—	Display only
Service	—	System Temperatures Output Control Injector Control 4-20 Control Conductivity System Digital Inputs Relays	Status displays, Peltier module operational check, target cell temperature Used to verity operation of various solenoids Used to check operation of injector Outputs external calibration signal Informational displays regarding the conductivity system Displays current status of various digital inputs Used to verity operation of various relays
Setup	Output Settings	4-20 Out 1 4-20 Out 2 Graphics	Output / 4 mA value / 20 mA value / offset Output / 4 mA value / 20 mA value / offset SIC / Cell Temp / Conductance /
	Alarm Settings	Warning Alarms Critical Alarms	Low SIC / High SIC Maximum Temperature
	System Settings	Unit Temperature Scale Come Read Time Digital Input Screen Settings Relay Setup PID Standby Mode Reload Defaults	PTB / mg per liter °C / °F User-selected in seconds Customer Alarm / Remote Standby Intensity / Screen Saver Relay / Choice / Conditions Cell temperature set point On / Off Restores Analyzer's default settings
	Comm. Setup	Serial Port C Mode: Rate: MODBUS ID: Mode: Serial Port B Rate: Ethernet Setup Our IP Address Router Address Network Mask	 Result / Data Dump Baud rate Modbus ID Ethernet / Serial Reserved for future use Analyzer IP address Router IP address Network mask address
	State Table Setup	—	Steps in measurement cycle
	Calibration Table Setup	—	Allow user to create a calibration table using samples with known salt content
	Time/Date Setup	—	Time Format (12 or 24 hour) / Date Format (US or EU) / Date / Time
	Factory Setup	—	For factory use only
Security	—	—	Enabled / Disabled

SPECIFICATIONS SECTION 2

MODELS

P-600-1400	EX area ready for NEC Class I, Division 1, Group C and D.
P-600-1500	ATEX Zone 1, Group IIB + H2 T4

PERFORMANCE

Measurement Range	0 to 400 PTB 0 to 1000 mg/liter
Repeatability	±2.0% of full scale or better
Reproducibility	±1.0% of scale
Measurement Accuracy	±5.0% of measurement; correlates to ASTM D 3230
Measurement Cycle Time	6 minutes or less
Conductivity Accuracy	±0.5% of full scale
Temperature Accuracy	±0.1°C (±0.2°F) of full scale
Operating Temperature Range	Minimum: 5°C (40°F) Maximum: 40°C (105°F)

SAMPLE REQUIREMENTS

Sample Conditions	Homogeneous, single-phase sample without water
Sample Bypass Flow Rate	2 liters per minute
Sample Pressure	4.0 bar minimum (60 PSI); 14.0 bar maximum (210 PSI)
Sample Return Pressure	Atmospheric; optional high pressure sample recovery system available
Sample Temperature	10° to 60°C (5° to 140°F)

SOLVENT REQUIREMENTS

Xylene	Per ASTM D 843
Alcohol Mixture	37/63 mix of absolute Methanol and n-Butanol (reagent grade)
Naphtha	For cell cleaning; must meet ASTM D91 specifications.

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	RS232/RS485
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	110-120 VAC (±10%), 50/60 Hz, 5 A or 230-240 VAC (±10%), 50/60 Hz, 2.5 A.
Purge Gas Supply	Clean, dry instrument grade air at 4.1 bar (60 PSI) minimum.
Vortex Gas Supply (optional)	Clean, dry instrument grade air at 5.5 to 8.2 bar (80 to 120 PSI)

ANALYZER ENCLOSURE

Dimensions (W x H x D)	955 x 1854x 762 mm (38.0 x 73.0 x 30.0 inches)
Weight	Approximately 205 kg (450 pounds)
Certification	CE certified
Hazardous Classification	X-proof housing: NEC Class I, Division 1, Group C, D; ATEX Zone 1, Group IIB + H2 T4

Due to BARTEC-ORB's commitment to continual product improvement, specifications subject to change without notice.

INSTALLATION AND STARTUP SECTION 3

	**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 performed only by fully qualified personnel.**

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 BARTEC-ORB for specific recommendations regarding your P-600 Salt in Crude 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

The P-600 Salt in Crude Analyzer is mounted on a free-standing rack housed. It should be located on a flat, vertical surface and isolated from intense vibration. Ample space should be provided on all sides of the analyzer for access to connections, solvent reservoirs, etc.

See Figure 3-1.

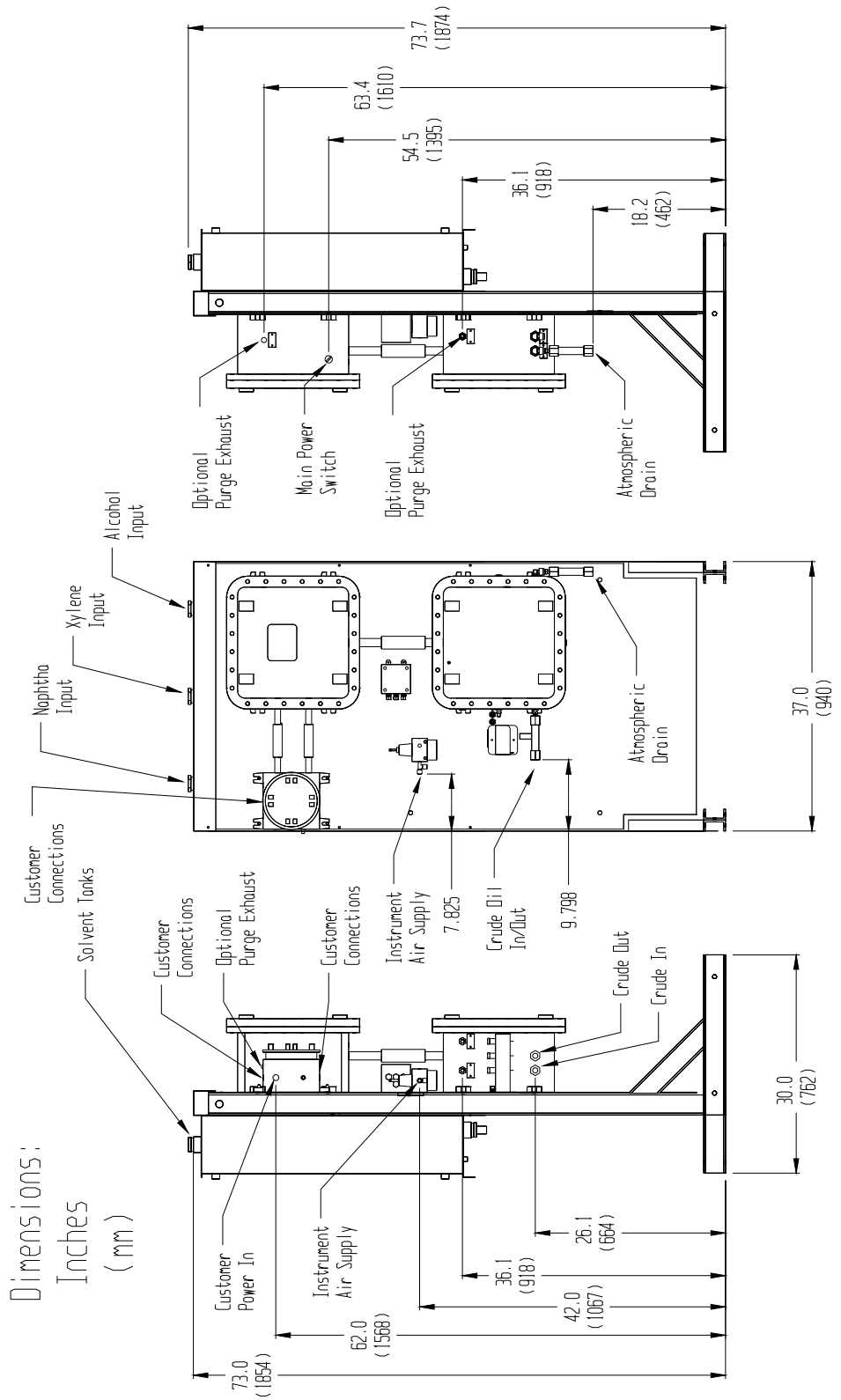


Figure 3-1: Dimensional Drawing

PIPING

The P-600 Salt in Crude Analyzer incorporates fittings for connecting the process sample inlet and outlet lines. These fittings are located on the sides of the instrument.

See Figures 3-2 and 3-3.

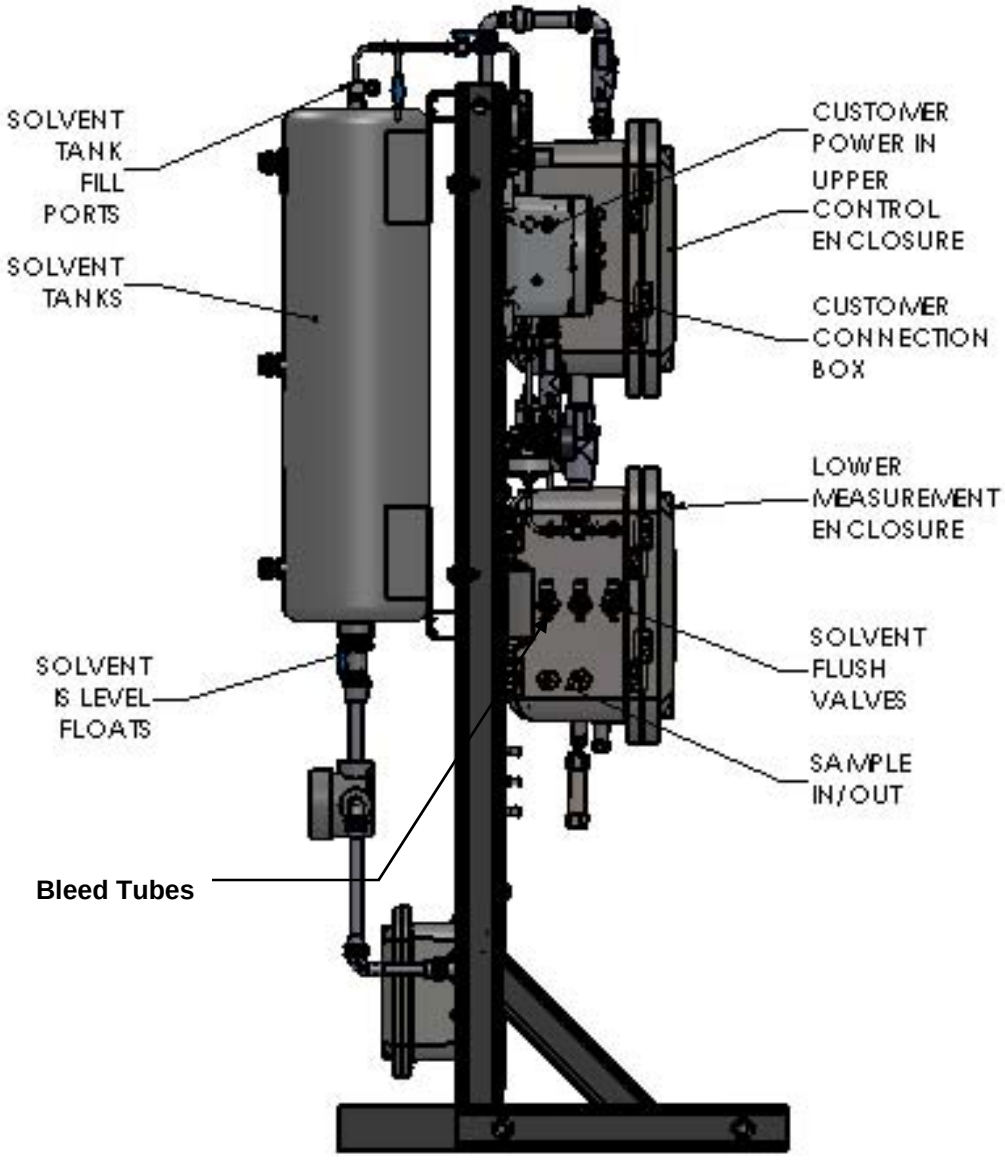


Figure 3-2: Left Side View

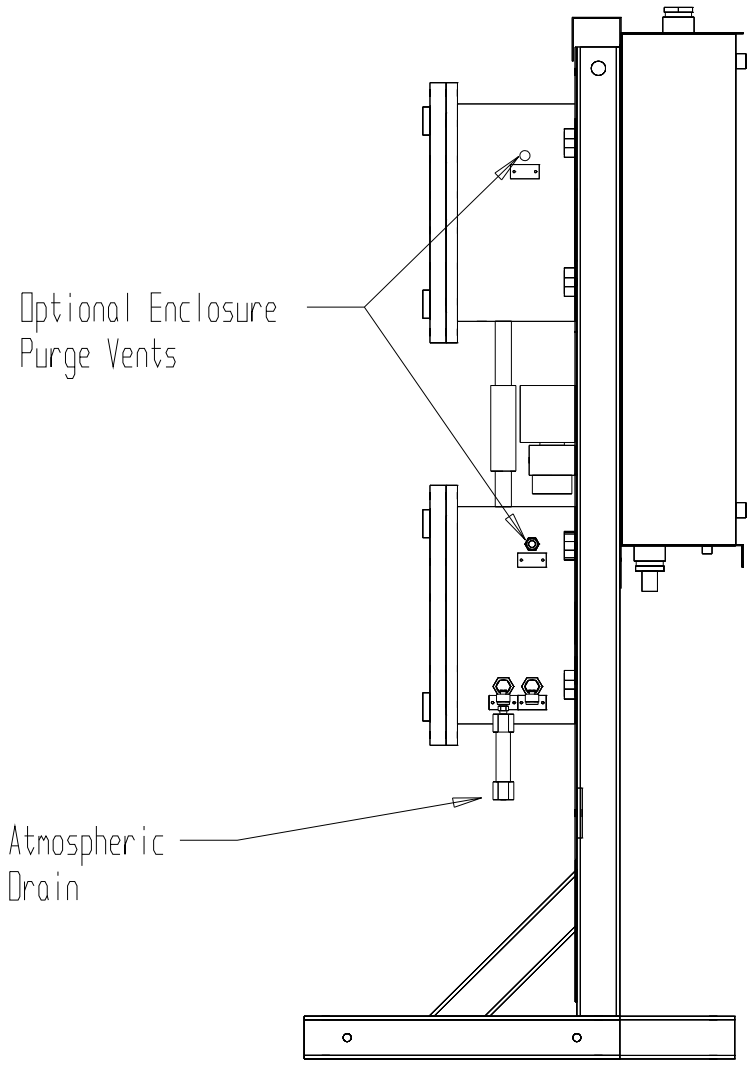


Figure 3-3: Right Side View

PROCESS SAMPLE LINES

The P-600 is designed to continuously analyze crude oil samples from a process stream. The fast loop supply and return connections are located on the left side of the analyzer. NPT fittings are provided for these connections.

Process samples should be provided at a pressure between 4.0 and 14.0 bar (60 and 210 PSI) at a flow rate of 2 liters/minute. The temperature of the sample should be between 10° and 60°C (50° and 140°F).

PURGE GAS SUPPLY LINE

The P-600 Salt in Crude Analyzer's purge system requires clean, dry instrument air for proper operation. This purge gas should be supplied to the instrument at a pressure of at least 4.1 bar (60 PSI); the supply must be capable of approximately 20 cc/minute The purge gas connection is made at the pressure regulator on the left size of the analyzer (Figure 3-2). A ½ inch NPT fitting is provided for this connection.

OPTIONAL VORTEX AIR SUPPLY

Instrument grade air will also be required if the analyzer is equipped with an optional Vortex cooler. It should be supplied at a pressure of 5.5 to 8.2 bar (80 to 120 PSI). A plugged port is available on the left size of the measurement enclosure for connecting this option.

SOLVENT SUPPLY

Three stainless steel reservoirs are provided on the rear of the free-standing rack for the measurement and cleaning solvents. These reservoirs will hold approximately 36 liters (9.5 gallons) each of liquid. The reservoir filling ports are located at the top front of each tank. The outlets are piped to a manifold on the front of the rack. All solvent connections are made at the factory; there are no field connections to make during installation.

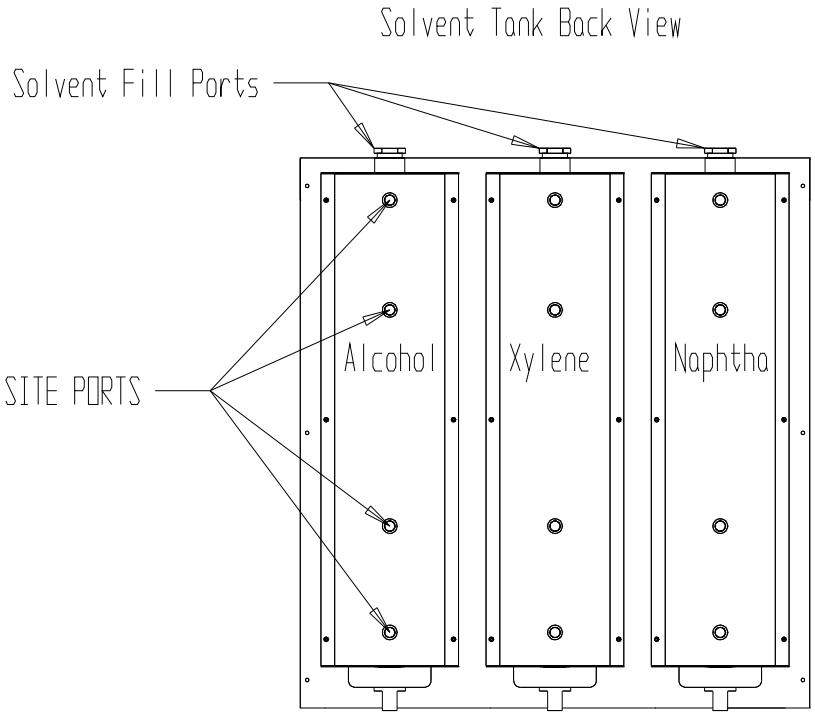


Figure 3-4 Rear View / Solvent Tanks

BLEEDING THE SOLVENT LINES

The lines connecting the solvent tanks to the manifold must be purged of air prior to Analyzer start up and when solvents are replaced or replenished. The manifold incorporates a 3-way valve with air purge tube for each line for this purpose. The solvent lines are bled as follows:

1. Place a suitable container under the bleed tube associated with the valve.
2. Rotate the 3-way valve 180° so that the handle points to the left (away from the Analyzer). A solvent air mixture should start to run out of the bleed tube. Allow the liquid to run until all air is out of the line.
3. Rotate the 3-way value 180° to that it points to the right (toward the Analyzer).
4. Repeat for remaining solvent lines.
5. Adjust the solvent tank pressure gauge until the tanks are pressurized to 5 PSI (Figure 3-5).

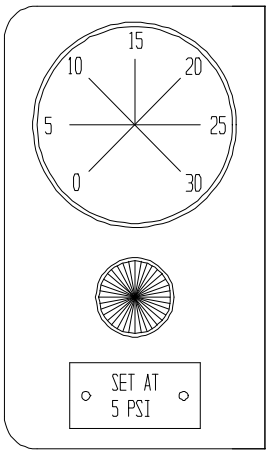


Figure 3-5 Solvent Tank Pressure Gauge / Adjustment

ATMOSPHERIC DRAIN

The Measurement enclosure incorporates an atmospheric drain that should be piped to collection vessel for the recovery of spent sample. This drain is located at the bottom of the enclosure.

	**WARNING: It is the user's responsibility to install an appropriate flame arrestor on the atmospheric drain outlet.**

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 ATEX Zone 1, Group IIB + H2 T4 hazardous areas. It is the user's responsibility to complete the electrical connections and comply with all pertinent codes.**

	**WARNING: All electrical connections should be made by a licensed, qualified electrician. Proper building codes and safety regulations should be followed.**

The P-600 Salt in Crude Analyzer requires an independent 110-120 or 230-240 VAC (±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 (Figure 3-2).

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

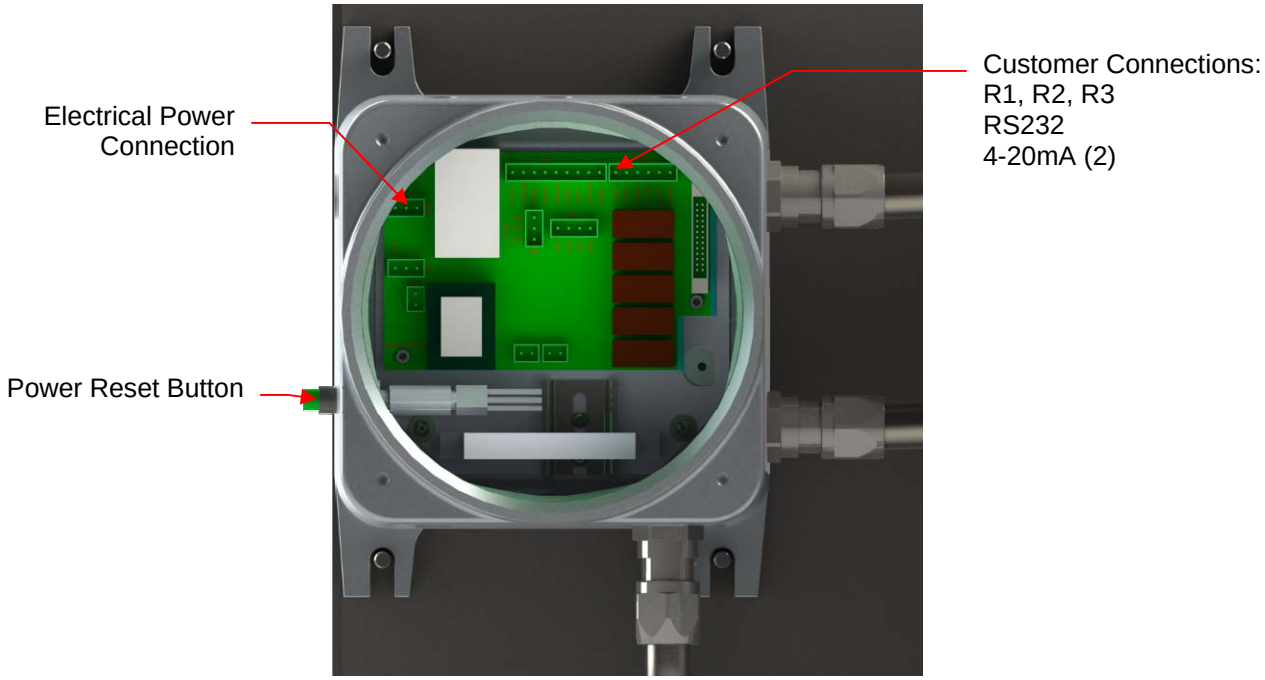


Figure 3-6: Customer Connections Enclosure

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 the either the Customer Connections Enclosure or the Control Enclosure (see Figures 3-6 and 3-7).

Analog Output

One isolated 4-20 mA output is standard on the P-800 Salt in Crude Analyzer. An optional second 4-20 mA output may be provided. See Figure 3-6.

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 (Figure 3-6). See Section 4 for information on alarm programming.

Serial Output

The P-600 Salt in Crude Analyzer incorporates RS232 and RS485 serial output. The connection is made in the Control Enclosure (Figure 3-6).

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)
Salt in crude concentration (XXX PTB)

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

ModBus

ModBus is available as a factory-installed option which utilizes the Analyzer's RS485 serial or TCP/IP output. This connection is made in the Control Enclosure (Figure 3-7). Consult BARTEC-ORB for more information.

Digital Inputs

The Analyzer incorporates three sets of 24 volt dry contacts that allow the control room to remotely activate selected functions. The connections for these digital inputs are made inside the Control Enclosure (see Figure 3-7). Wiring is brought into the enclosure through the Customer Connection #2 and #3 ports on the right hand side of the enclosure.

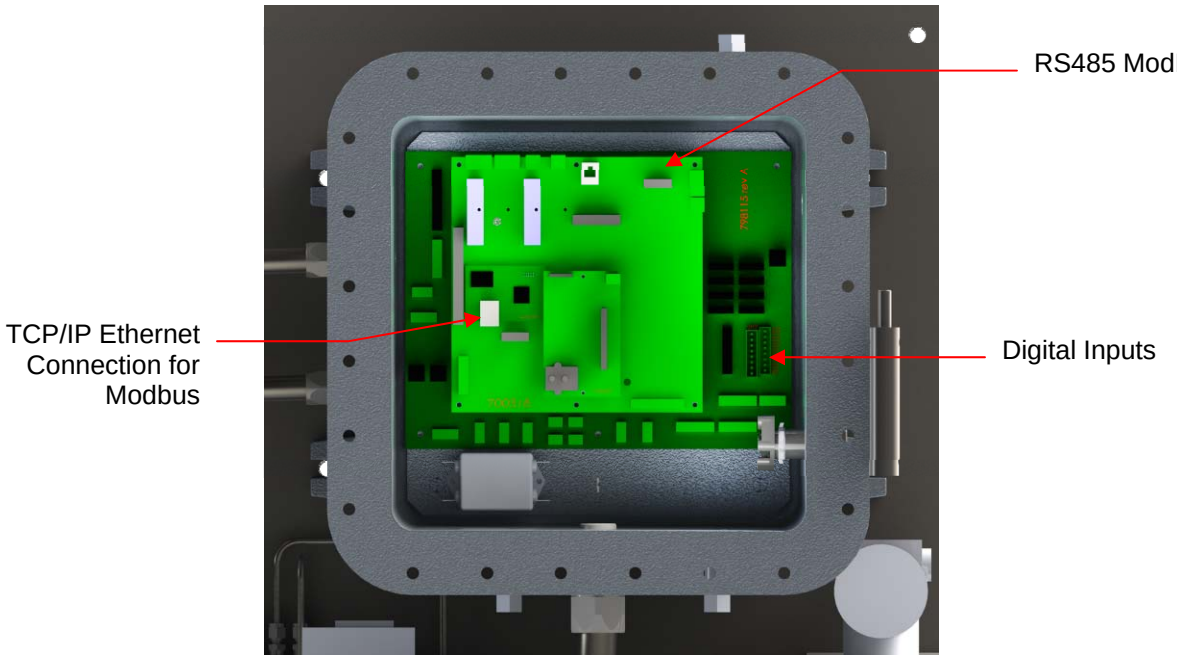


Figure 3-7: Control Enclosure - ModBus Connections and Digital Inputs

Digital Dry Contact Inputs

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.

Stream Select — Optional; consult factory.

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

NOTE: Although the Stream Select contact may be present, this function is only available on Analyzer's which incorporate this option.

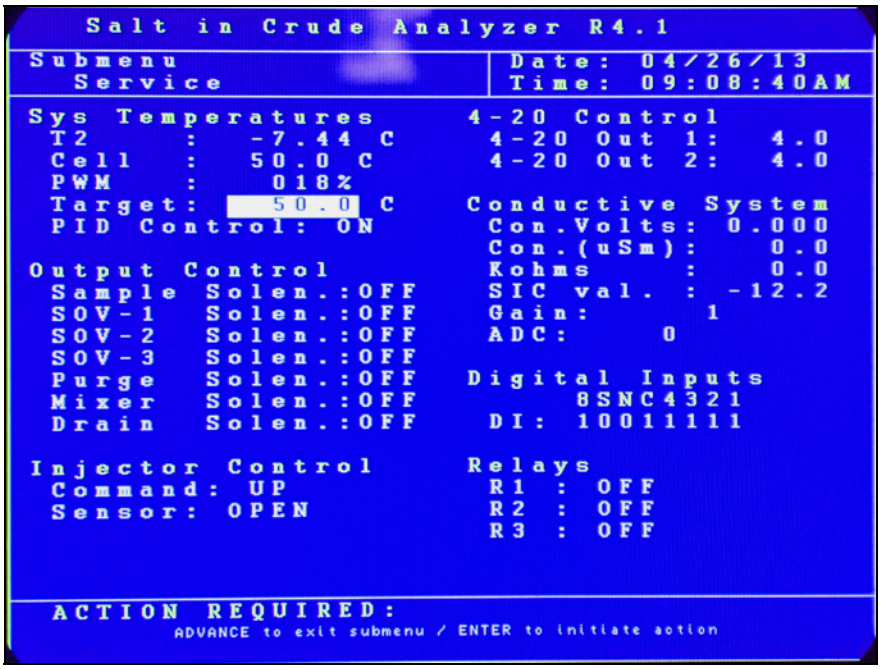
STARTUP

WARNING: All necessary safety permits should be obtained and the area checked for flammable vapors prior to opening the Analyzer's enclosure doors and applying power to the instrument.

1. Open the upper and lower enclosure doors.
2. Fill the solvent tanks with the appropriate fluids, bleed any entrained air out of the solvent lines, and check for leaks. Instructions for filling the solvent tanks and bleeding the lines are outlined under Solvent Supply (appears earlier in this section). Be sure to pressurize the tanks to 0.35 bar (5 PSI).
3. Start the flow of crude oil to the Analyzer. Verify that sample supply pressure is between 4 and 14 bar (60 and 210 PSI). Check for sample leaks at external connections and within the measurement enclosure itself.
4. Start the flow of instrument air to the Analyzer. Verify that it is regulated at 4.1 bar (60 PSI).
5. Apply power to the Analyzer.

NOTE: Upon initial application of external power to the Analyzer, only the Customer Connections enclosure is energized. Power will not be routed to other system components until the Power Reset button on the left side of the Customer Connections enclosure is pressed. The Power Reset button must be pressed to re-initialize the Analyzer whenever power is lost due to either an external event or internal power disruption (such as the detection of a leak within the measurement enclosure)

6. Press the press the Power Reset on the left side of the Customer Connections enclosure.
7. Place the Power Switch on the right side of the Control Enclosure in the On position.
8. The Analyzer's LCD should light. After a short initialization routine runs, the instrument's main "Run" screen will appear on the display. The unit should power up in the Off-Line mode.
9. Access the Service menu and perform the following checks (see Section 7 for information on accessing this menu and performing these functions):



A. Verify that the cell temperature (Sys Temperatures, Cell) is approaching 50°C.

B. Verify that the values shown for all digital inputs are as follows:

Digital Input	8	S	N	C	4	3	2	1
Value	1	0	0	0	1	1	1	1

9. Verify that the atmospheric drain is working.
10. Perform any required field calibration.
11. 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, System Settings).
12. Close and bolt the Control and Measurement Enclosure doors.

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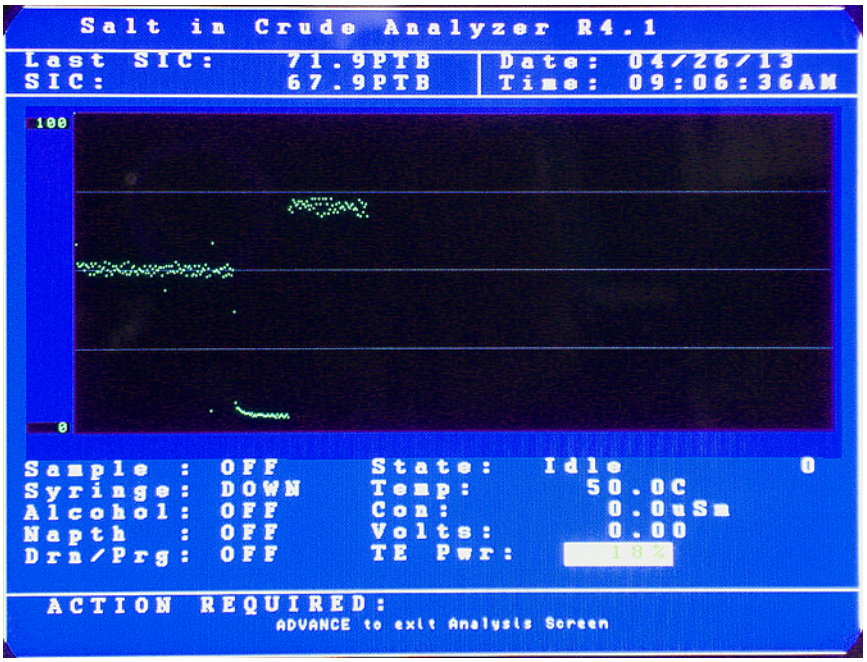
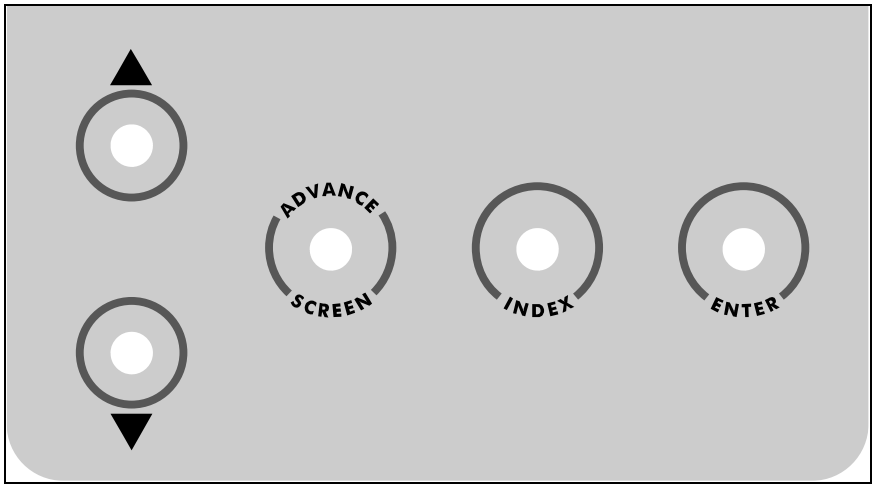
MAIN RUN SCREEN

When the P-600 Salt in Crude 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-600 Salt in Crude Analyzer is programmed and controlled via a magnetic keypad on the front of the Control 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.

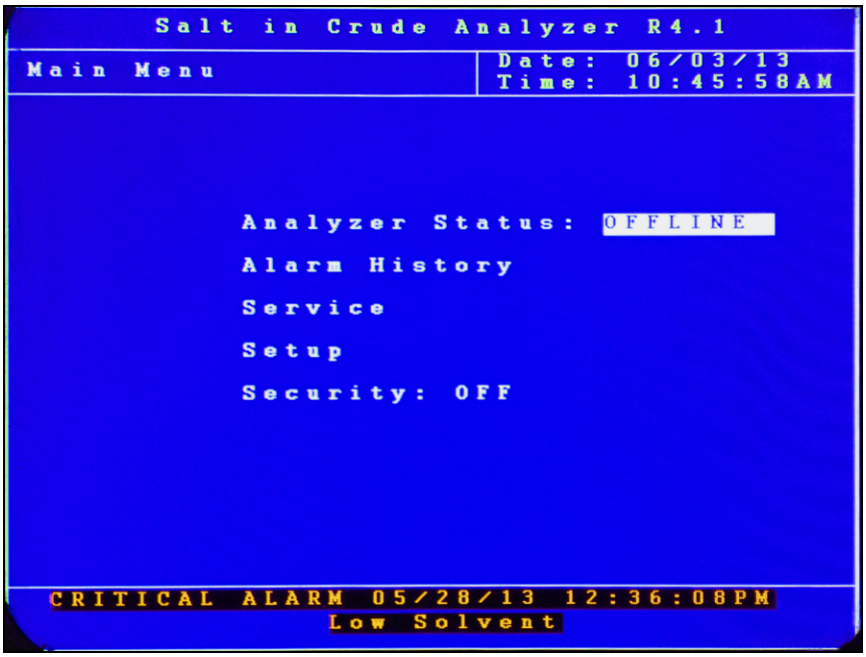
Index Key — Touching this key scrolls the Analyzer through the various items available within a specific menu. The "active" menu line is highlighted by reversing the background and foreground colors. Once you reach the last menu item, the indicator returns to the top of the menu.

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 Alarm 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.

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 7 – Routine Maintenance & Service. Touch the Enter key to access this sub-menu. A screen will appear asking if you are sure you wish to enter the Service menu; this is intended to prevent you from inadvertently taking the Analyzer off-line.

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.

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.

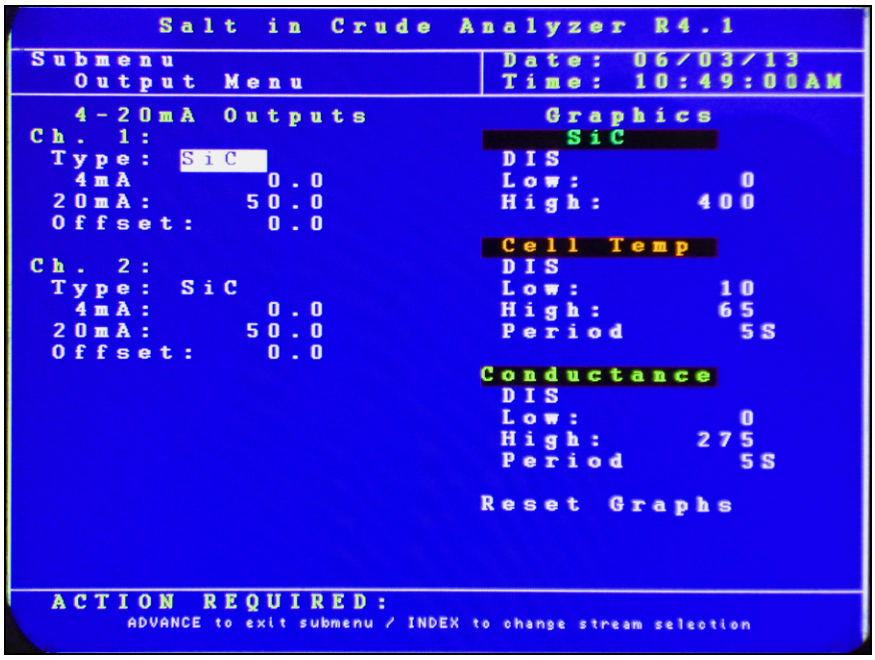
SETUP SUB-MENU

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, digital output, and alarm parameters. It is also used to establish how measurement information will be displayed on the Main Run screen.



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

4-20 mA Outputs — The P-600 Salt in Crude Analyzer's analog outputs (Channel 1 standard; Channel 2 optional) can be programmed to output various types of information, as well as the range of the analog signal and an offset.

Type — This menu item allows you to select the type of information that will be output using the selected analog signal. The choices are Salt in Crude, Conductivity, and Cell Temperature.

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 +1.5, the Analyzer will generate an analog signal corresponding to 10.5 when the actual measured (and displayed) concentration value is 9.0.

Graphics — These menu items allow you to select the measurement information which will be displayed in the graphical data display section of the Main Run screen. The choices are:

Salt in Crude — When this menu item is enabled, Salt in Crude measurement data are graphed.

Enable/Disable — Turns graphing for this item On and Off.

Low — This establishes the bottom of the trend graph's scale.

High — This establishes the top of the trend graph's scale.

Cell Temperature — When this menu item is enabled, the cell temperature is graphed.

Enable/Disable — Turns graphing for this item On and Off.

Low — This establishes the bottom of the trend graph's scale.

High — This establishes the top of the trend graph's scale.

Period — This establishes how often the graph will be refreshed.

Conductance — When this menu item is enabled, the measured conductance is graphed.

Enable/Disable — Turns graphing for this item On and Off.

Low — This establishes the bottom of the trend graph's scale.

High — This establishes the top of the trend graph's scale

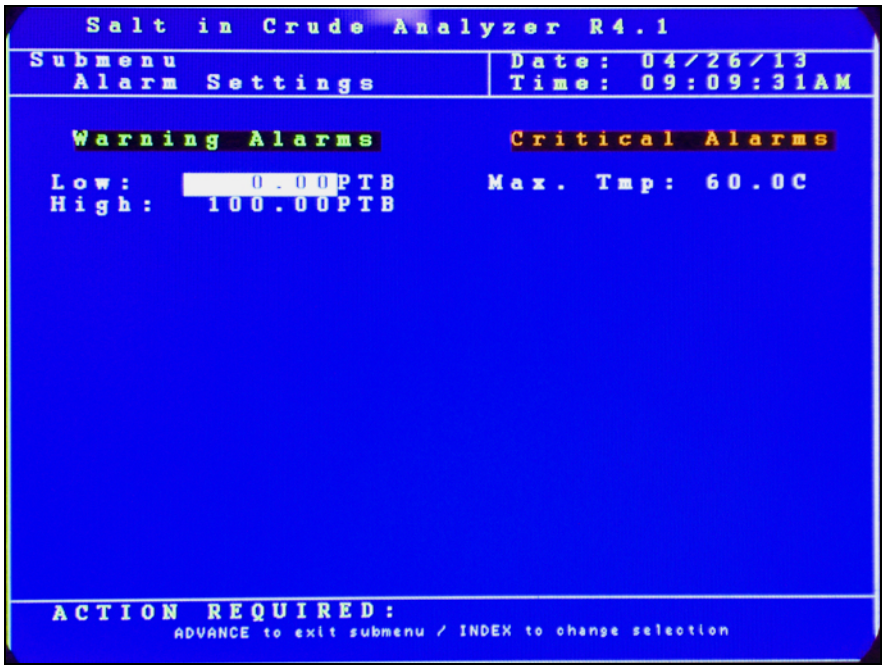
Period — This establishes how often the graph will be refreshed.

Reset Graphs — Clears graphed data.

	**NOTE: If Salt in Crude graphing is enabled, the graph is updated at the end of each measurement.**

ALARM SETTINGS

This menu item is used to program the Analyzer's alarm output. The instrument incorporates dual level alarms; these alarms are activated when the measured concentration exceeds the indicated alarm value.



Use the Index key to advance to the desired menu item. Use the Up/Down Arrow keys to change the displayed setting or value. The unit of measure used for these values is set in the Other Settings menu.

Low — This menu item allows you to establish a low alarm level. Salt concentration measurements below this value generate a warning alarm signal/message. Analysis will continue.

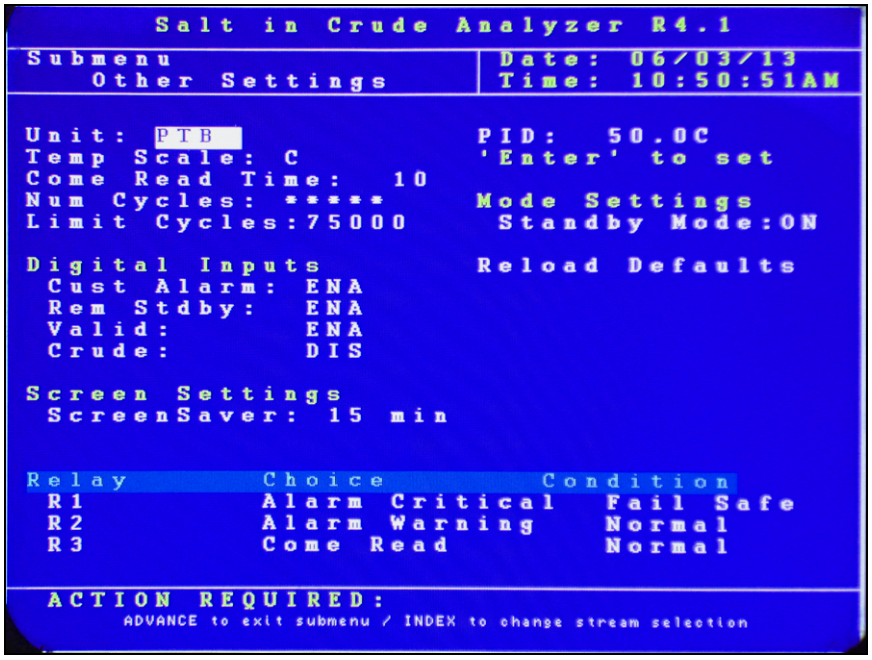
High —This menu item allows you to establish a high alarm level. Salt concentration measurements above this value generate a warning alarm signal/message. Analysis will continue.

Maximum Temperature —This menu item allows you to establish a maximum allowable cell temperature. Cell temperatures above this value generate a critical (fatal) alarm signal/message and stops analysis.

NOTE: The Analyzer DOES NOT automatically adjust alarm values when the units of measure are changed. It is the user's responsibility to make changes to these values.

System Settings

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



Use the Index key to advance to the desired menu item and then select it by touching the Enter key. Use the Up/Down Arrow keys to change the displayed setting or value. Touch Enter a second time to accept the displayed setting/value.

Unit — This menu selection allows you to select the unit of measure the Analyzer will use when displaying and outputting measurement data. The choices are PTB and mg/liter.

Temperature Scale — This menu selection allows you to select the temperature scale. The choices are °C or °F.

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.

Number of Cycles — This is the number of measurements which have been performed since the cycle counter was last reset. To reset the counter, touch the Enter key.

Limit Cycles — This menu item allows the operator to set the number measurements which can be performed before the Analyzer's Maintenance Alarm is activated.

Digital Inputs — These menu items allow you to enable and disable the Analyzer's customer-controlled digital 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

Validation — When enabled, a validation measurement can be initiated via a control room signal. The Analyzer must be equipped with the validation option for this to be functional.

Crude — This setting should remain disabled; it is intended for future use.

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

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.

PID — This is the cell temperature set point. The default value is 50°C. Under normal conditions, this value should not be changed; consult BARTEC-ORB before changing.

Mode Settings — 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. When ON is selected, the instrument will power up in the Off-Line mode and must be manually placed On-Line.

	**IMPORTANT: The Power Reset button on the side of the Customer Connections enclosure must be pressed to re-initialize the Analyzer whenever power is disrupted, even if Standby is set to Off.**

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.

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

Relay Setup — These menu items allow you to enable/disable the alarm relays, indicate the type of alarm the relay 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 — Measured concentration has exceeded either the low or high alarm setpoint. 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:

- Measurement system failure
- Customer alarm
- Remote standby enabled
- Machine not running

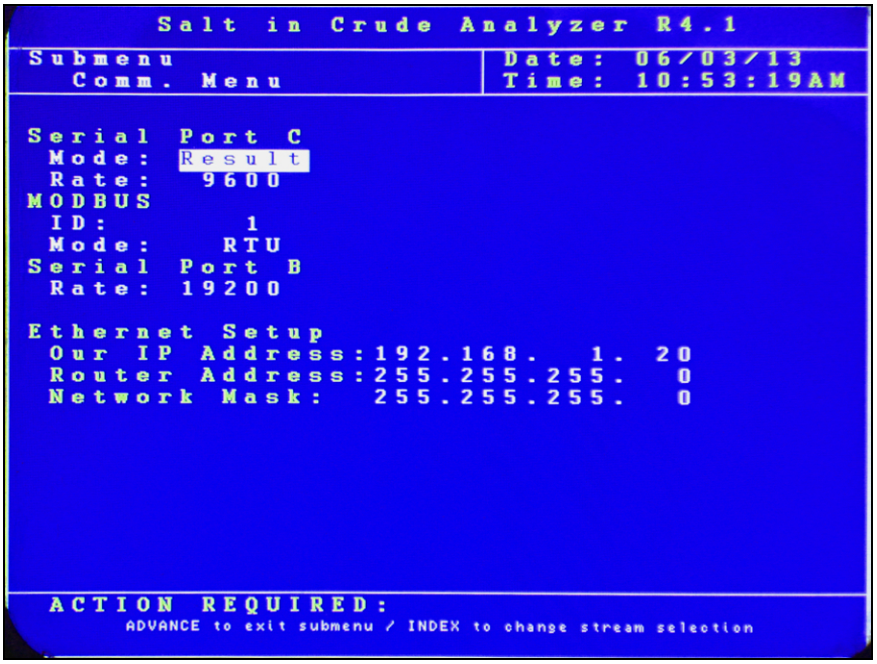
Come Read — Activated for a programmed period of time upon the completion of a measurement cycle.

Maintenance — Activated when the number of measurement cycles has exceeded the Limit Cycles setting.

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.

COMMUNICATIONS SETUP

The Communications sub-menu allows you to configure the Analyzer's serial and ModBus settings.



Serial Port C — This is the Analyzer's RS232 serial communication port.

Mode — This menu item determines what data will be output through the RS232 port. The choices are Result, Data, and None.

Rate — This is the baud rate used for serial communications through this port.

Modbus — This configures the Analyzer's ModBus output.

ID — This is the ID assigned to the Analyzer.

Mode — This allows you to select either Ethernet or serial ModBus communication. When Ethernet is selected, the appropriate IP, router, and network mask addresses must be assigned.

Serial Port B — Reserved for future use.

Ethernet Setup — This allows you to configure the Analyzer's IP, router, and network mask addresses when Ethernet ModBus communications is selected.

Our IP Address — This is the IP address assigned to the Analyzer.

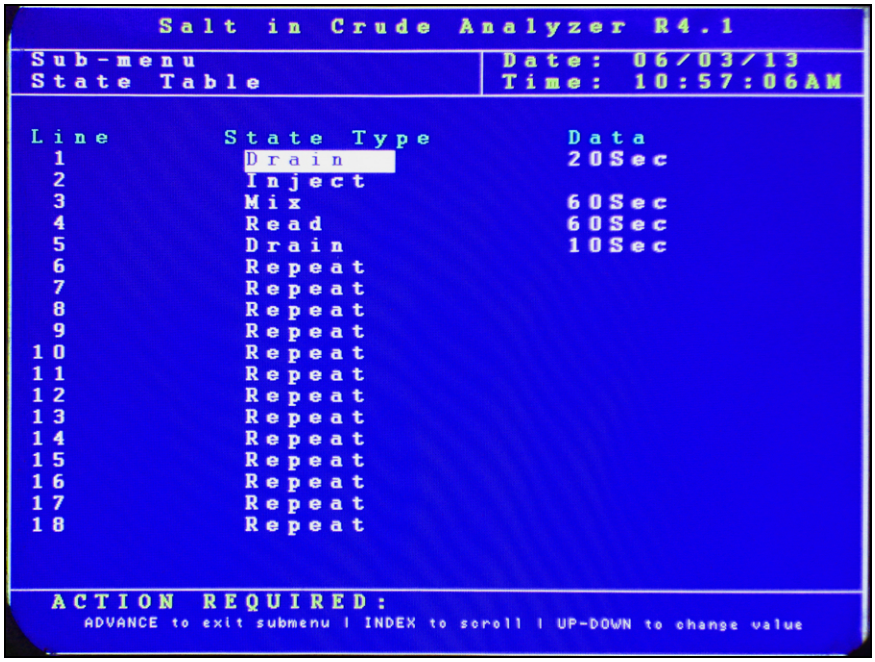
Router Address — This is the address of the router the Analyzer is connected to.

Network Mask — This is the network mask address.

STATE TABLE

The State Table setup selection allows you to modify, add, or delete steps in the measurement process.

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



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

Wait — This idles the Analyzer for a programmed period of time. It is generally used to allow a component or function to stabilize before proceeding to the next step. It is set in seconds.

Inject — This injects crude sample and solvent into the measurement cell.

Mix — This injects instrument air through the sample/solvent line to (1) ensure all contents have been injected into measurement cell and (2) thoroughly mix the crude/solvent mixture. It is set in seconds.

Read — This step is used to read and calculate the SIC value. The programmed time period associated with this step allows the reading to stabilize. It is set in seconds.

Drain — This opens the valve to the atmospheric drain to ensure that spent sample and vapors are removed from the measurement cell.

Clean — This step allows for the injection of cleaning solvent (naphtha) into the measurement cell. If a cleaning step is used, it should occur after Drain and before Return. The duration is the number of measurements that should be performed between cleaning steps.

Delay — This step is used to delay the start of the next salt in crude measurement. It is set in seconds.

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

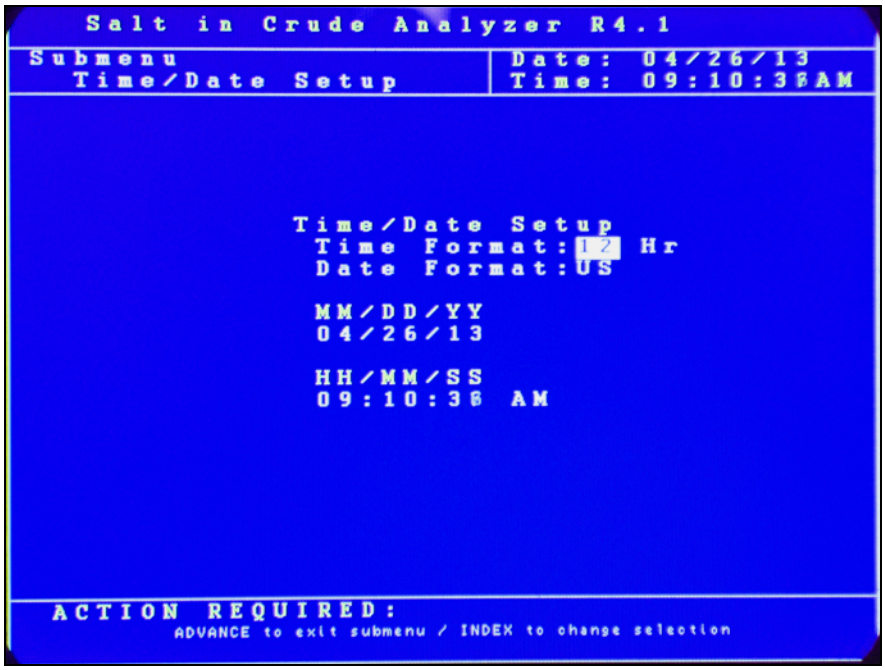
State Type	Data
Drain	10
Inject	
Mix	60
Read	60
Drain	15
Repeat	

CALIBRATION

This menu selection is used for calibrating the Analyzer. See Section 6 for more information.

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.

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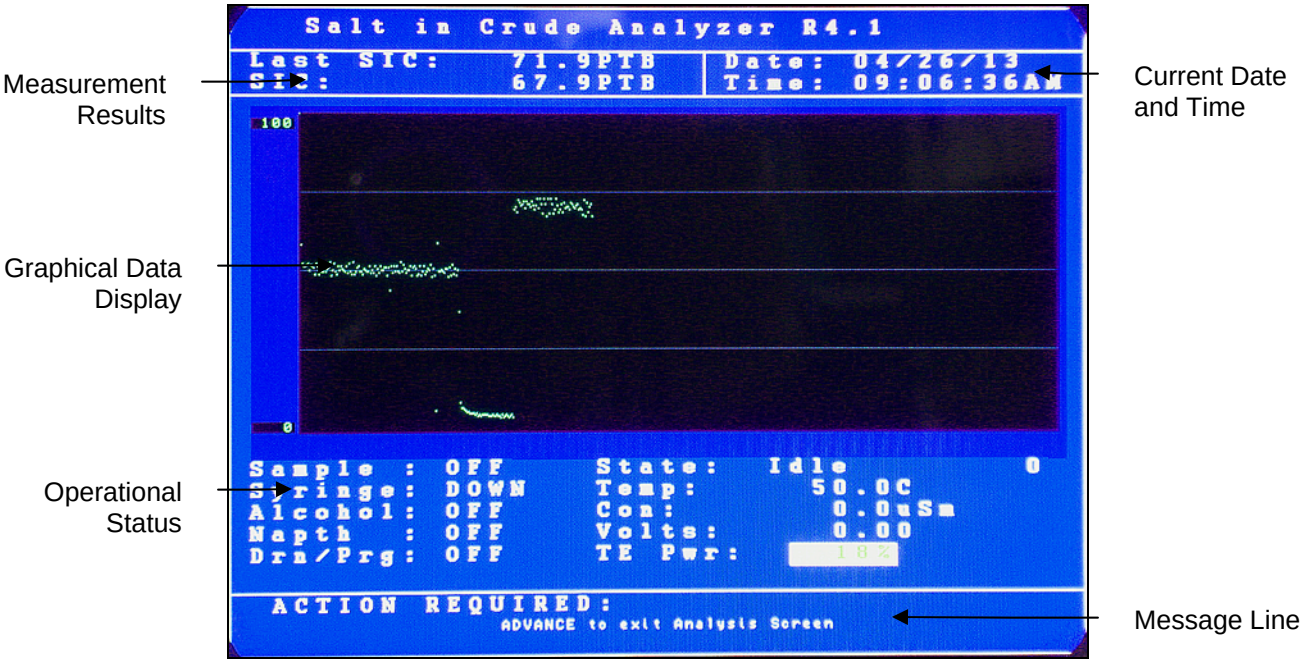
NORMAL OPERATION SECTION 5

The P-600 Salt in Crude Analyzer is an on-line process instrument designed for the continuous measurement of salt content in crude oil.

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 Analyzer 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:



Measurement Results — The two most recent measurements. Measurement data are displayed in either PTB or mg/liter and are 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 measurement, cell temperature, and/or conductance data. If power is lost or disrupted, the displayed graph is lost.

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

Sample — Indicates the status of the sample solenoid.

Syringe — Indicates the current position of the injection syringe.

Alcohol — Indicates the status of the solvent solenoid.

Naphtha — Indicates the status of the cleaning solvent solenoid.

Drain / Purge — Indicates the status of the drain / purge solenoid.

State — Indicates the Analyzer's current activity.

Temperature — Indicates the temperature of the measurement cell

Conductivity — Displays measured conductivity (in micro siemens).

Volts — This is the voltage being applied to the electrode.

TE Power — Indicates the percentage power being applied to the Analyzer's TE module. When the value displayed is in red, the cell is being heated; when the value displayed is in green, the cell is being cooled.

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

SIGNAL OUTPUTS

4 – 20 MA ANALOG OUTPUT

The P-600 Salt in Crude 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	9600
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	XXXXX

MODBUS OUTPUT

ModBus output is available as a factory installed option and uses the Analyzer's serial or Ethernet/IP interface. Consult BARTEC-ORB 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 concentration has exceed either the low or high alarm limit. 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 concentration value has been output. Analysis continues.

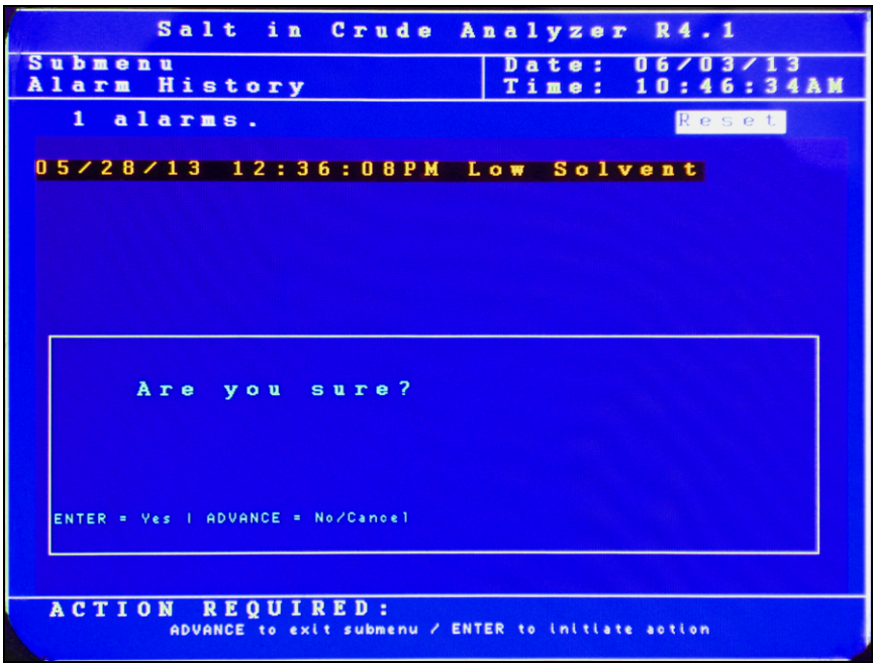
When an alarm condition is detected, the appropriate alarm relay is activated (if enabled) and the alarm condition logged on the Alarms History sub-menu.

Type	Alarm Messages and Conditions	Analyzer State
Warning	*Alarm 1 Out of Range* — Measured concentration value is greater than low concentration alarm setpoint.	Analysis continues
Warning	*Alarm 2 Out of Range* — Measured concentration value is greater than high concentration alarm setpoint.	Analysis continues
Warning	Naphtha supply depleted	Analysis continues
Critical	Alcohol and/or Xylene supply depleted	Analysis stops
Critical	No crude flow	Analysis stops
Come Read	Measurement cycle complete	Analysis continues
Maintenance	The number of measurement cycles has exceeded the Limit Cycles setting	Analysis continues

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

ALARM HISTORY

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



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

SOLVENT SUPPLY

Based on an average of 240 analyses per day, the Analyzer's solvent tanks are capable of holding a 30 day supply of Xylene, alcohol, and naphtha. Floats in the respective tanks will signal the Analyzer when the supply of a particular solvent has been depleted. In the event that either the flow of Xylene or alcohol is disrupted, salt in crude analysis will stop and a critical alarm issued. In the event that the flow of naphtha is disrupted, a warning alarm will be issued; analysis will continue.

NOTE: The P-600 Salt in Crude Analyzer is capable of performing salt content measurements approximately every 6-8 minutes. However, it can be programmed to perform measures less frequently and thus conserve the solvent supply. This is done by including a delay step in the measurement process. See State Table in Section 4.

TAKING THE ANALYZER OFF-LINE

The P-600 Salt in Crude 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 Analyzer Status. Touch the Up/Down Arrow keys to toggle the status to OFFLINE.

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.

LOSS OF POWER RESTART

In the event of a power loss, the P-600 Salt in Crude 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.

IMPORTANT: In order to restart the Analyzer after external power has been lost, the Power Reset button on the side of the Customer Connections enclosure must be pressed — regardless of the Standby setting.

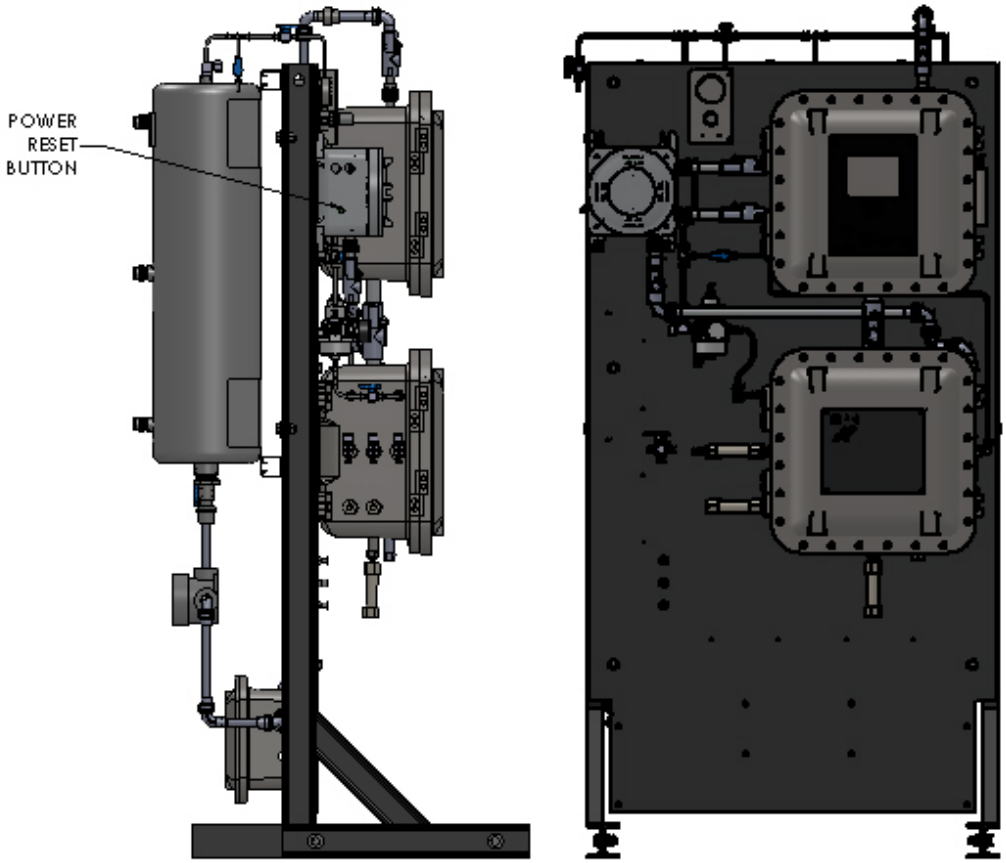


Figure 5-1: Power Reset Button

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 removes 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.

	**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.**

	**WARNING: 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

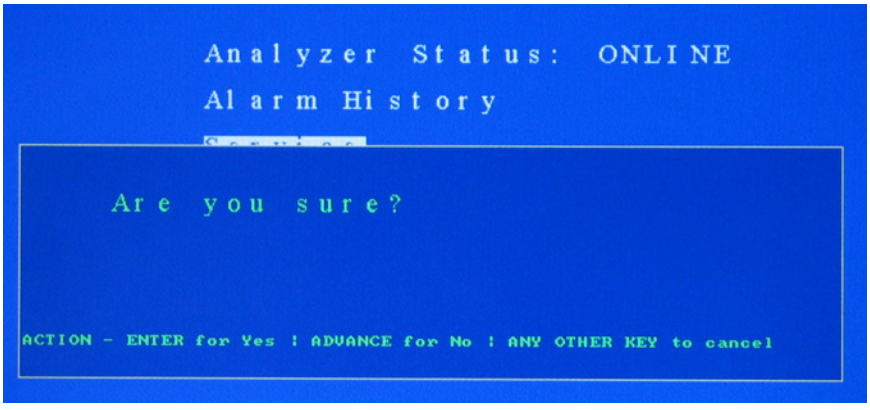
Check instrument air pressure	Weekly
Check sample pressure	Weekly
Check solvent levels	Weekly
Inspect for internal sample leaks	Monthly

SERVICE AND OPERATIONAL CHECKS

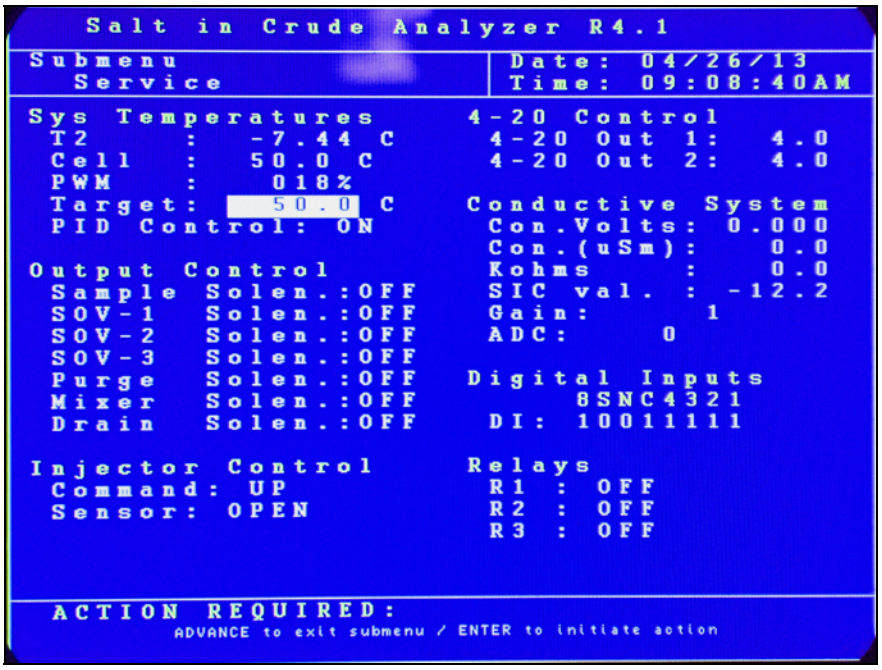
The P-600 Salt in Crude Analyzer incorporates a special Service screen from which the operator can perform a variety of verification and diagnostic functions, including:

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

Entering the Service Screen requires the Analyzer to be off-line; if it is on-line, it will automatically be taken off-line when the Service menu is accessed. To prevent you from inadvertently taking the Analyzer off-line, the following screen appears whenever the Service menu is selected:



Upon confirmation that access to the Service menu is desired, the Service screen appears.



System Temperatures

T2 — This is an optional information display.

Cell — This displays the current cell temperature.

PWM — This allows you to check the operation of the Peltier modules. Increasing or decreasing the percent value will raise or lower the cell temperature accordingly.

Target — This is the set point temperature for the measurement cell. The factory default is 50°C.

PID Control — This turns the cell heater ON and OFF. When OFF, the cell temperature should begin to drop.

Output Control

Sample Solenoid — This allows you to open (ON) and close (OFF) the sample solenoid.

Solvent 1 Solenoid — This solenoid (SOV-1) controls the flow of sample and solvent to the syringe. Off = From solvent lines; On = To detection cell. See Figure 6-1.

Solvent 2 Solenoid — This solenoid (SOV-2) controls the flow of alcohol and/or xylene and naphtha to the Solvent 1 solenoid. See Figure 6-1.

Solvent 3 Solenoid — This solenoid (SOV-3) controls the flow of xylene or naphtha to the Solvent 2 solenoid. See Figure 6-1.

Purge Solenoid — This allows you to open and close the solenoid that pressurizes the detection cell during the draining process (the drain solenoid must also be open). See Figure 6-1.

Mixer Solenoid — This allows you to open and close the solenoid that controls the flow of instrument air to the measurement cell.

Drain Solenoid — This allows you to open and close the drain solenoid.

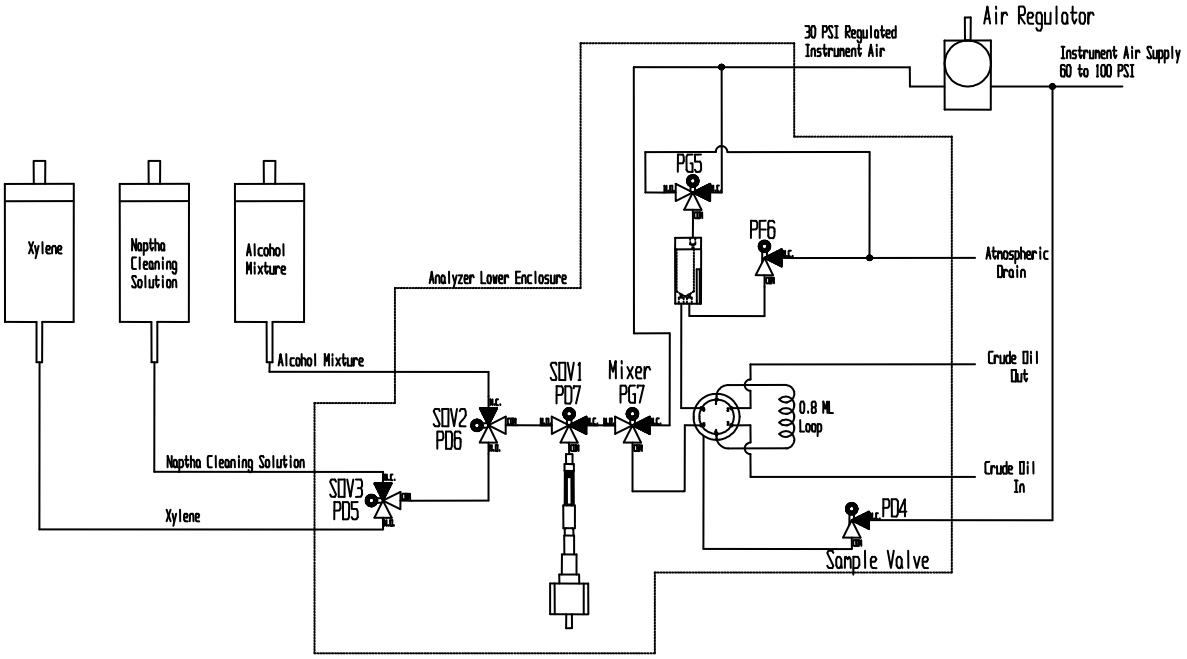


Figure 6-1: Solvent Solenoid Valves

Injector Control

Command — This allows you to move the injector up and down.

Sensor — This displays the status of the syringe sensor. It should read "Open" when the injector is up and "Closed" when the injector is down.

4-20 Control

4-20 Out 1 **—** This menu item allows you to output an analog signal via the Analyzer's first 4-20 mA output connection. It is used to calibrate external devices. Use the up/down arrow keys to increase/decrease the output value.

4-20 Out 2 **—** This menu item allows you to output an analog signal via the Analyzer's second 4-20 mA output connection. It is used to calibrate external devices. Use the up/down arrow keys to increase/decrease the output value.

	NOTE: The instrument must be equipped with the optional second 4-20 mA output in order for the 4-20 Out 2 menu item to function properly.

Conductivity System

Conductivity Volts **—** This is an informational display that shows conductivity in volts.

Conductivity (micro siemens) — This is an information display that shows the conductivity in crude concentration in micro siemens.

Kohms — For Factory use only.

SIC Value — This is an information display that shows the calculated salt in crude value in the selected unit of measure.

Gain — For Factory use only.

ADC — For Factory use only.

Digital Inputs

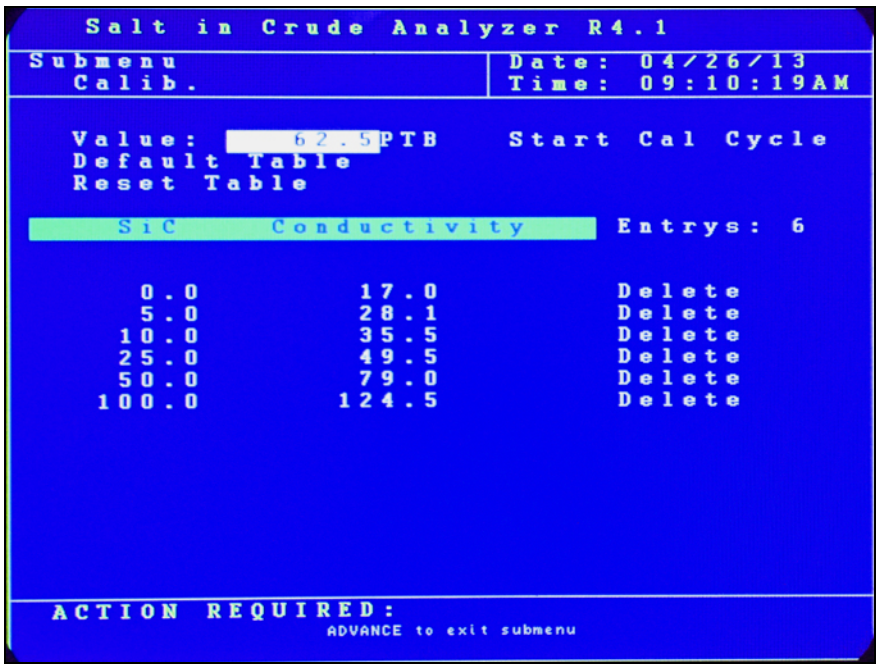
This shows the current status of the Analyzer's digital inputs.

Input	Description	Status = 1	Status = 0
8	Syringe	Fully closed	Not closed
S	Solvent Tank	Empty / low	OK
N	Naphtha Tank	Empty / low	OK
C	Crude Flow Switch	No Flow	Flow
4	Future Use		
3	Stream Select	Inactive	Active
2	Remote Standby	Inactive	Active
1	Customer Alarm	Inactive	Active

Relays — These menu items allow you to check the operation of the Analyzer's alarm relays.

CALIBRATION

The Analyzer allows you to create and load a custom calibration table. The calibration function is accessed by selection Calibration from the Main Menu.



	NOTE: Calibration must be performed in PTB. BARTEC-ORB recommends starting with the calibration sample that has the lowest salt content and then moving to samples with increasingly higher salt concentrations. A minimum of four calibration samples should be used for calibration.

Calibration is performed as follows:

1. Reset the table so that all values read 0.0.
2. Introduce a blank (0 concentration) sample into the Analyzer.
3. Enter the concentration value of the blank sample in the Value field and touch the Enter key with the magnetic pencil. The Analyzer will initiate a measurement cycle and display the measured value in the table when the measurement is complete. This will take 5-10 minutes.
4. Introduce the calibration sample with the lowest salt content into the Analyzer and repeat Step 3..
5. Repeat the above for all remaining calibration samples.

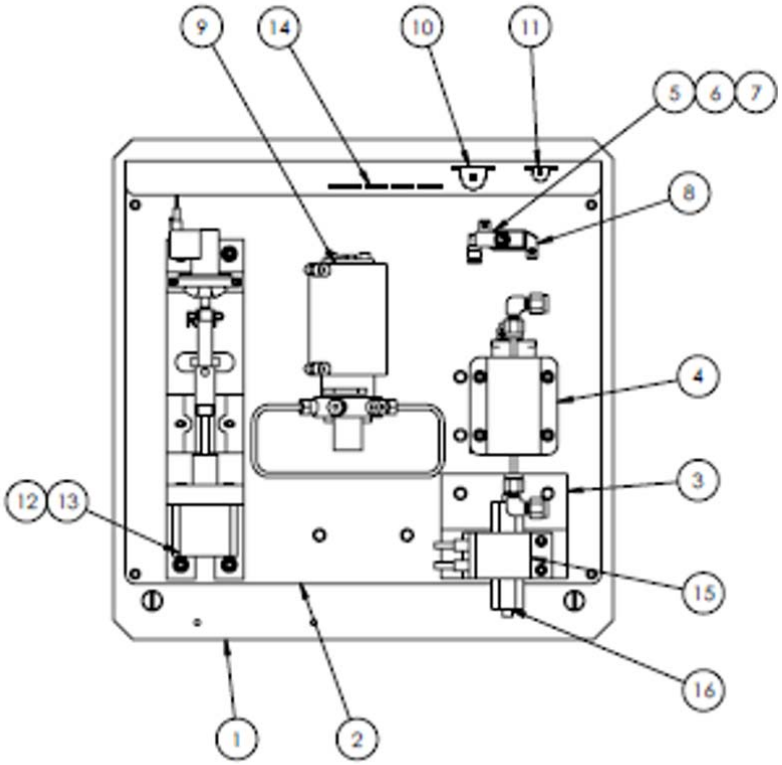
	IMPORTANT: Restoring the Analyzer's default settings restores the factory default calibration table.

TROUBLESHOOTING CHART

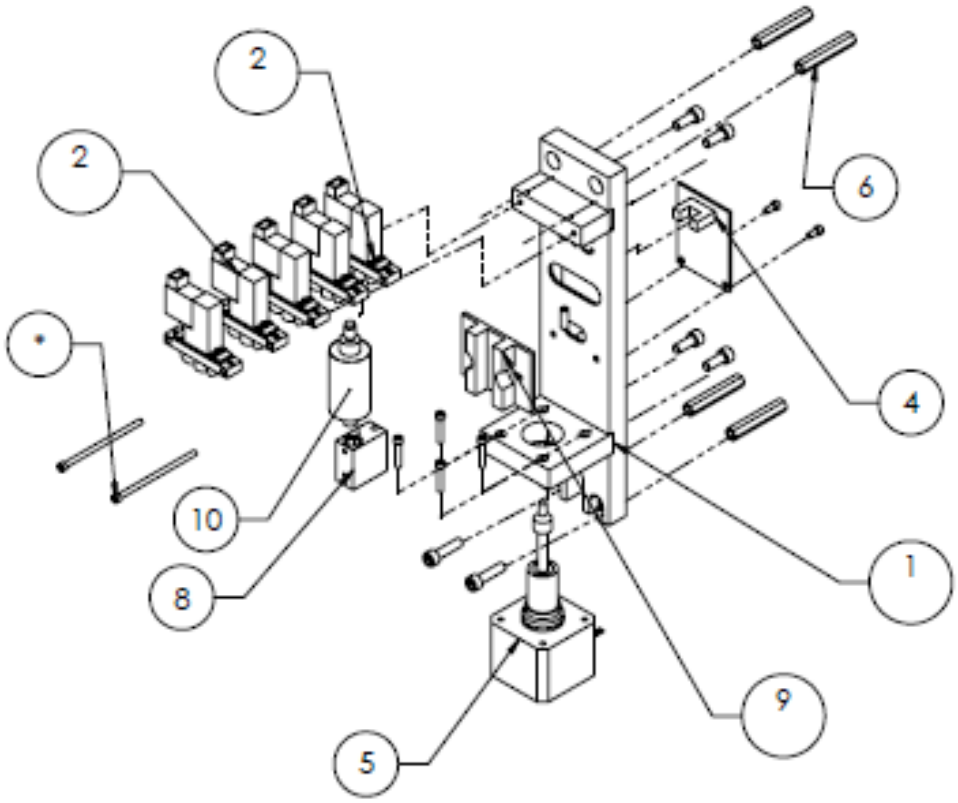
Problem / Symptom	Cause	Corrective Action
Display blank	No electrical power to Analyzer	Apply electrical power.
	Screen saver activated	Touch keypad with magnetic pencil.
	Faulty display or display PCB	Replace as required.
SIC out of range (warning alarm activated)	Detected SIC value is outside the expected range of the Analyzer	Allow unit to run additional cycles. Process fluctuations or changeovers can cause SIC warning alarms due to different sample characteristics.
Cell temperature alarm	Ambient temperature too high	Provide proper ambient conditions or increase cell temperature set point.
	Cell temperature outside of acceptable range (±5°C)	Adjust cell temperature as required.
	Faulty RTD	Replace as required.
	Faulty TE module	Replace as required.
Salt concentration result too low	No sample	Check sample line for blockage and clear as required. Check sample valve for proper operation and replace as required.
	Faulty electrode	Check and replace as required.
Salt concentration result too high	Insufficient solvent	Check syringe for proper operation and replace as required. Check solvent valve for proper operation and replace as required. Check drain for blockage and clear as required.
Erratic salt concentration result	Incorrect methanol/butanol ratio	Drain solvent tank and replace with correct solvent mix.
	Faulty syringe	Check and replace as required.
	Faulty solvent valve	Check and replace as required.
	Faulty mixer valve	Check and replace as required.
	No or insufficient air supply	Check and correct as required.
	Incorrect valve wiring	Consult BARTEC-ORB.

ASSEMBLY DRAWINGS

MEASUREMENT ENCLOSURE

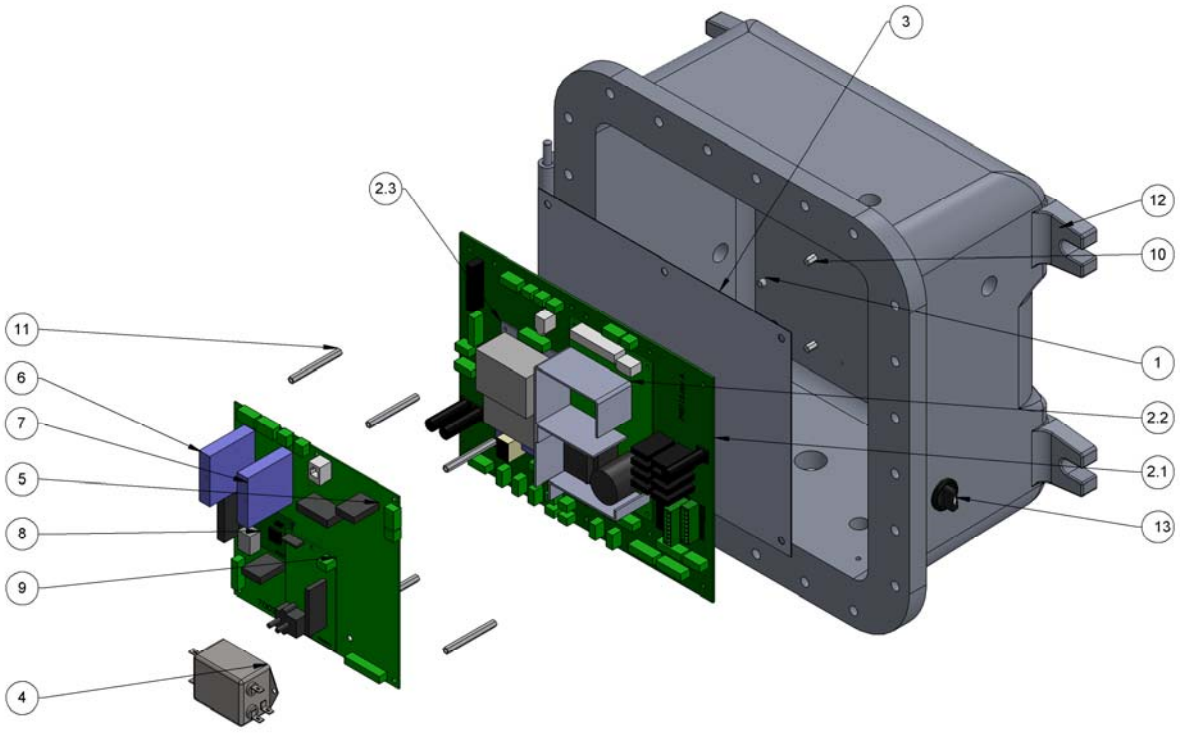


Item No.	Quantity	Part Number	Description
1	1	700524	Exp Proof Analyzer Enclosure Back Plate
2	1	700792	Detection Cell Back Plate
3	1	700796	Drain Solenoid Bracket
4	1	701389	Measurement Assembly
5	1	650019	4-way Valve
6	1	650218	1/8” Quik-Connect Elbow
7	1	650218	1/8” Quik-Connect
8	1	650199	4-way Air Solenoid Bracket
9	1	650184	6-port Spider Valve
10	1	600001	5 Ohm / 50 Watt Resistor
11	1	600002	33 Ohm / 10 Watt Resistor
12	4	650407	Standoff, 5/16 Hex x 1-1/2” L 10-32 Female Thread Both Ends
13	1	702653	Syringe & Valve Assembly
14	1	798078	SIC / Interconnection PCB Assembly
15	1	650049	Drain Solenoid
16	2	650142	1/8” Adapter Bushing / Cover
17	1	650001	1/8” T Union Elbow
18	6	630088	Internal Nut 1/8”

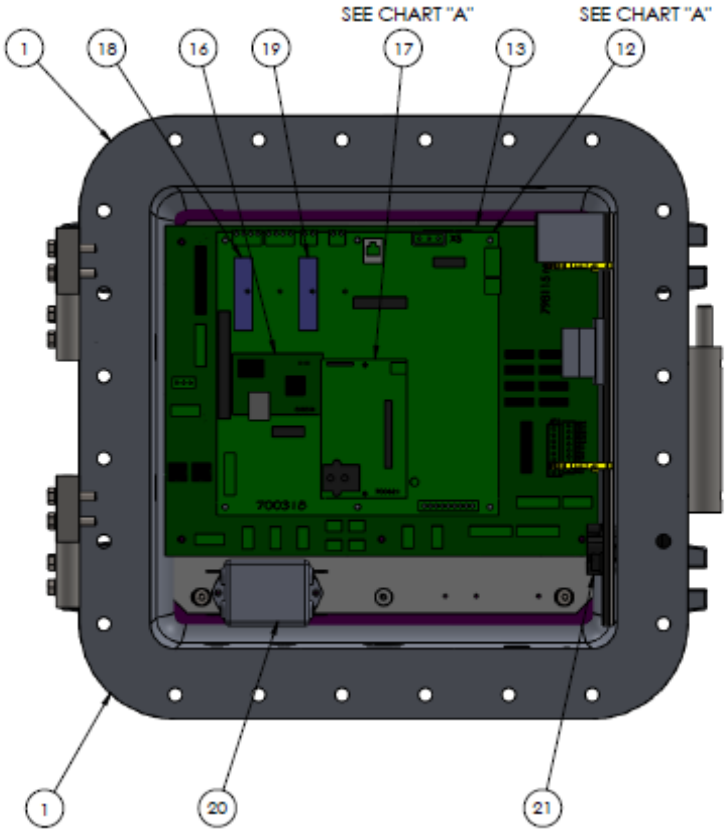


Item No.	Quantity	Part Number	Description
1	1	702654	SIC Stepper Motor Assembly
2	2	650005	3-way Solenoid
3	2	650004	2-way Solenoid
4	1	700100	Optical Sensor PCB Assembly
5	1	640001	Syringe Stepper Motot
6	4	650407	Standoff, ¼ Hex x 1-1/2” L 10-32 Female Thread Both Ends
7	2	N/A	6-32 x 1-1/2” Socket Head Screw
8	1	702213	Syringe Adapter
9	1	702202	Syringe Guide, Teflon Support
10	1	690024	5 mL Syringe

CONTROL ENCLOSURE



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	701910	MTG PLATE FOR MOTHERBOARD 798115	1
2	701937	LOWER ELECTRONICS PLATE	1
2.1	798115RA	MAIN DISTRIBUTION PCB ASSY	1
2.2	620038	POWER SUPPLY (+24 VDC)	1
2.3	620037	POWER SUPPLY (+5, +/- 12 VDC)	1
3	701911	FISH PAPER FOR MOTHERBOARD 798115	1
4	620076	LINE FILTER	1
5	700318	MAIN PCB ASSY	1
6	620081	RTD INPUT MODUKE	1
7	620080	4-20 mA OUTPUT MODULE	1
8	600025	MICROPROCESSOR CORE MODULE	1
9	700321	RVP ADAPTER PCB ASSY	1
10	4-40 x 0.4375 F-F Nylon Standoff		2
11	10-32 x 2.500 F-F Aluminum Standoff		6
12	701510	UPPER ENCLOSURE	1
13	620149	SELECTOR SWITCH	1

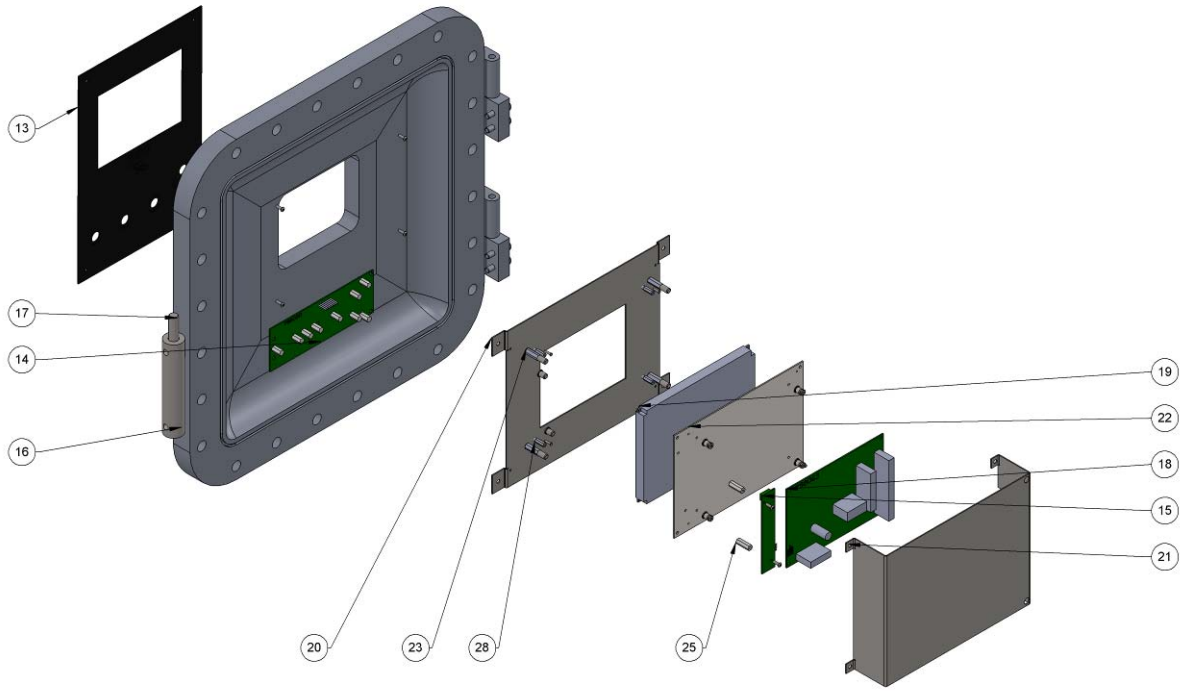


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	701510	EX-PROOF UPPER ENCLOSURE	1
12	700318	MAIN PCB ASSY	1
13	798114	Main Distribution PCB Alt Assy	1
14	620038	POWER SUPPLY (+24 VDC)	1
15	620037	Power Supply (+5, +/- 12 VDC)	1
16	600025	MICROPROCESSOR CORE MODULE	1
17	798114	ADAPTER PCB ASSY	1
18	620081	RTD Input Module	1
19	620080	4-20 mA Output Module	1
20	620076	LINE FILTER	1
21	620149	SELECTOR SWITCH	1

ITEMS 11 & 16 NOT SHOWN. BOTH ARE MOUNTED TO ITEM 5 AND HIDDEN BY ITEM 4.

CHART A		
ANALYZER TYPE	ITEM #12 ⚠	ITEM #17 ⚠
RVP	700318	700321
FLASH POINT	700318	798090
CLOUD POINT	700318	798024
FREEZE POINT	700318	798024
SALT IN CRUDE	700318	798045
POUR POINT	700318	798024
VI / VISC	700318	798114

CONTROL ENCLOSURE DOOR



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
14	798030	MAGNETIC KEYPAD PCB ASSY	1
15	700288	BACKLIGHT DRIVER PCB	1
16	700348	EXP PROOF MAGNETIC PENCIL HOLDER	1
17	700701	MAGNETIC PENCIL ASSY	1
18	798063	DISPLAY DRIVER PCB ASSY	1
19	700286	GRAPHICS DISPLAY ASSY	1
20	700787	DISPLAY BRACKET	1
21	700793	COVER PLATE	1
22	700062	DISPLAY MOUNTING BRACKET	1
23	4-40 x 0.750 F-F Aluminum Standoff		4
25	4-40 x 0.750 F-F Nylon Standoff		2
28	2-56 x 0.500 F-F Aluminum Standoff		4

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SPARE & REPLACEMENT PARTS — SECTION 7

SPARE PARTS KITS

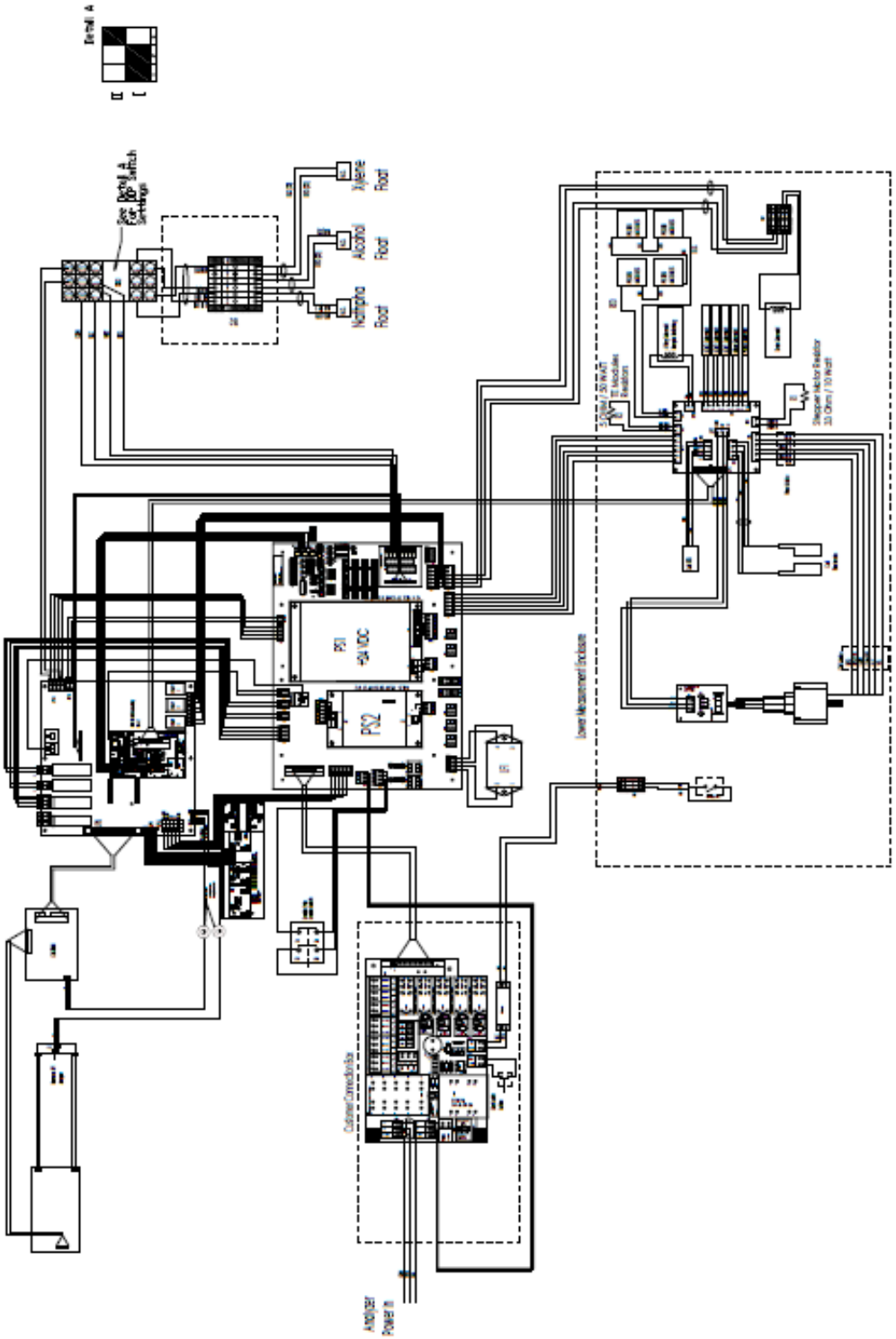
Description	Part Number
1-YEAR PARTS KIT	***700641***
3-way Solenoid (5 each)	650005
4-way Solenoid (1 each)	650019
Drain Solenoid (1 each)	650049
5 mL Syringe (2 each)	690024
Salt-in-Crude Tubing Kit (1 each)	700633
2-YEAR PARTS KIT	***700642***
3-way Solenoid (5 each)	650005
4-way Solenoid (1 each)	650019
Drain Solenoid (1 each)	650049
5 mL Syringe (4 each)	690024
Salt-in-Crude Tubing Kit (2 each)	700633
Spider Valve (1 each)	650184
TE Module Replacement (1 each)	620074

REPLACEMENT PARTS

Description	Recommended Quantity	Part Number
Fuse (250 VAC, 15 amps)	1	600051
Fuse (250 VAC, 10 amps)	2	600052
Power Supply, +5, +/- 12 VDC.	1	620037
Syringe Stepper Motor	1	640001
3-way Solenoid	1	650005
RTD Sensor	1	660001
Optical PCB	1	700100
Graphics Display Assembly	1	700286
Backlight Driver PCB	1	700288
Cable Assembly	1	700289
Main Control PCB	1	798072
Power Supply, +24 VDC.	1	620038
4-way Solenoid	1	650019
Drain Solenoid	1	650049
Spider Valve	1	650184
5 mL Syringe	1	690024
Salt-in-Crude Electrode, High Range	1	701393-1
Salt-in-Crude Electrode, Low Range	1	701393
Salt-in-Crude Tubing Kit	1	700633
TE Module Replacement Kit	1	700659
Magnetic Keypad Assembly	1	798030
Salt-in-Crude Conductivity Adapter PCB Assembly	1	798047
Display Controller PCB	1	798063
Salt-in-Crude Interconnect PCB	1	798078
Main Distribution PCB	1	798115

DRAWINGS & SCHEMATICS SECTION 8

Overall Wiring Diagram



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APPENDIX SECTION 9

MODBUS MAP

The following tables provide an overview of the function codes and registers associated with operation.

Function Code 1 — Read Coils (output bits)	
1	Sample valve
2	Solvent 3 valve
3	Solvent 2 valve
4	Solvent 1 valve
5	Purge valve
6	Mixer
7 - 13	Not used
14	Alarm relay 1
15	Alarm relay 2
16	Alarm relay 3

Function Code 2 — Read Digital Inputs (Logic is inverted)	
0	Customer alarm
1	Remote standby
2 - 3	Not used
4	No crude flow
5	Low naphtha
6	Low solvent
7	Not used

Function Code 3 — Read Holding Registers Registers 1 through 99 are big endian 16 bit signed integers. Fractional values are coded as a multiple of that value. For example, if a variable's value is 12.76, it would read as 1276 or 12.76 times 100.	
1	Main board ADC channel 1 (0-4095 = 0-5V)
2	Main board ADC channel 2 (0-4095 = 0-5V)
3	Main board DAC channel 1 (0-1023 = 0-5V)
4	Main board DAC channel 2 (0-1023 = 0-5V)
5	Main board PWM channel 1 (0-1023) Heater
6	Main board PWM channel 2 (0-1023) Cooler
7	Main board PWM channel 3 (0-1023) Not used
8	Main board PWM channel 4 (0-1023) Display backlight
9	External inputs 8 bits
10	External outputs 8 bits
11-15	Not used
16	Heating power (0-100%)
17	Cooling power (0-100%)
32	Analysis status: 0 = Idle 1 = Running
33	Temperature control set point, degrees C or F times 10.0
34	Heating power (0-100%)
35	Cooling power (0-100%)
36	Cell temperature in degrees C or F times 10.0
37	Conductivity in uSm times 10.0
38	Salt in crude in PTB or mg/L times 10.0
39	Temperature Control status: 0 = Off 1 = Heating 2 = Cooling
40	Current analytical state: 0 = Idle 1 = Initializing 2 = Wait 3 = Clean 4 = Mix 5 = Drain 6 = Injecting 7 = Repeat 13 = Abort
41	State timer in seconds
42	Temperature scale (0 = F; 1 = C)
43	Concentration scale (0 = PTB; 1 = mg/L; 2 = gm/cubic liter)

44	Alarm word Bit Weight — Alarm Warnings: 0001H — Result alarm 0002H — Low naphtha 0004H — Remote standby Informative: 0010H — Cleaning cycle 0020H — Maintenance Fatal: 0100H — No crude flow 0200H — Low solvent 0300H — RTD failure 0400H — Heater failure 0500H — Motor failure 0600H — External user alarm
48	SIC high or low
49	Low naphtha
50	Remote standby active
51	Cleaning
52	Maintenance required
53	No crude flow
54	Low solvents
55	RTD failure
56	Heater failure
57	Motor failure
58	External user alarm

Floating Point Holding Registers	
100	Sample temperature in degrees C or F
102	Conductivity in uSm
104	Salt in crude in PTB or mg/L

Function Code 6, Write Holding Registers	
32	Start/Stop Analysis If the analyzer is running, writing a value of 0 to this register turns the analyzer off. If the analyzer is off line, writing a value greater than 0 starts the analysis.

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