BARTEC

Process Analyzer

User Manual

P-600 SALT IN CRUDE ANALYZER

September 21st, 2021
Version 1.1

Table of Contents

BARTEC ORB
4724 South Christiana Avenue
Chicago, IL 60632
USA

Foreword

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.

Revision History

Rev.	Description / Changes	Date
1.0	First version of the new Manual	May 22nd, 2020
1.1	Revised Spare Parts Numbers, Added Solvent Fill	September 21st, 2021

Chapter I: Introduction

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 — 5 minutes or less typical cycle time;
- Superior repeatability — ±2% of full scale or better;
- 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, self-powered 4-20 mA analog output (optional second output available);
- Three SPDT dry contact alarm relays;
- Optional Modbus output (Ethernet TCP/IP or RS-485 RTU);
- RS-232 serial output;
- Separate electronics and measurement enclosures;
- CSA/CUS Class I, Division1, Group B, C and D or ATEX II 2G Ex db IIB+H2 T6 Gb or IECEx II 2G Ex db IIB+H2 T6 Gb

Principle of Operation

The P-600 Salt in Crude Analyzer's measurement technique is based on the ASTM Method D3230. 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 cycle takes about five minutes and is performed as follows:

1. The sample cell is emptied by opening the cell's drain solenoid valve and purge valve. The purge air (at ~ 30 psi) removes any remaining fluid and/or vapors from the cell.
2. The sample valve is activated, and a precisely measured volume of crude oil (0.8mL sample loop) is introduced into the tubing path to the measurement cell.
3. The digitally controlled syringe draws a precise volume of xylene (3.2mL) from the solvent tank and injects it into the tubing path, pushing the crude sample into the measurement cell.
4. Next, the digitally controlled syringe draws a precise volume of alcohol (4mL) from the solvent tank and injects it into the tubing path, pushing the remaining xylene into the measurement cell.
5. The mixer is activated to inject air into the tubing path, pushing the remaining alcohol into the measurement cell.
6. During the mix state, the air "stirs" the solution inside the cell.
7. The programmable counter for the read state allows the mixture to settle.
8. At the end, the conductance reading is taken, and Salt in Crude concentration is calculated and reported.
9. The sample cell is emptied in the same way as in point #1.
10. The measurement cell and tubing are rinsed and cleaned with naphtha.

	NOTE: Cell cleaning is not performed every measurement cycle. Cleaning frequency is adjustable. See State Table in Chapter IV.

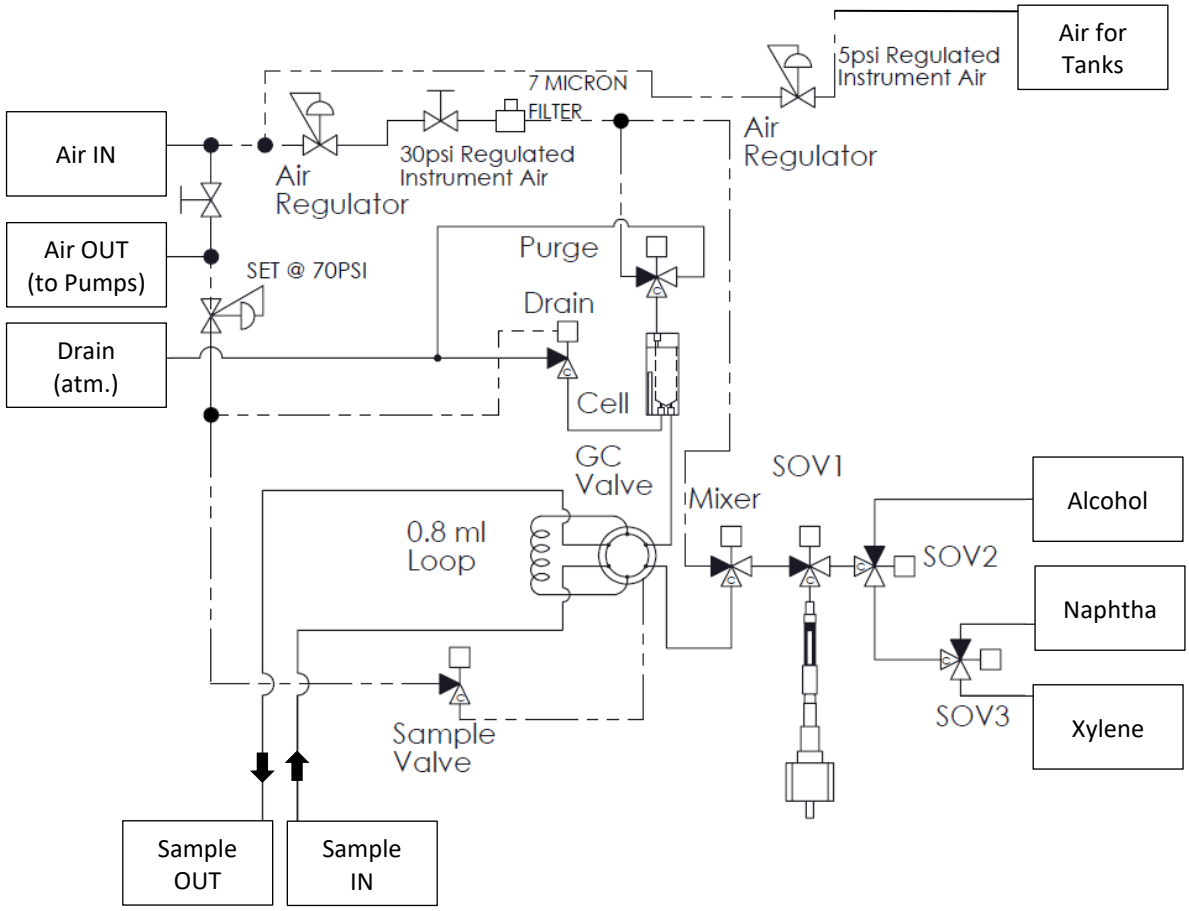


Figure 1-1: Analyzer Flow Schematic

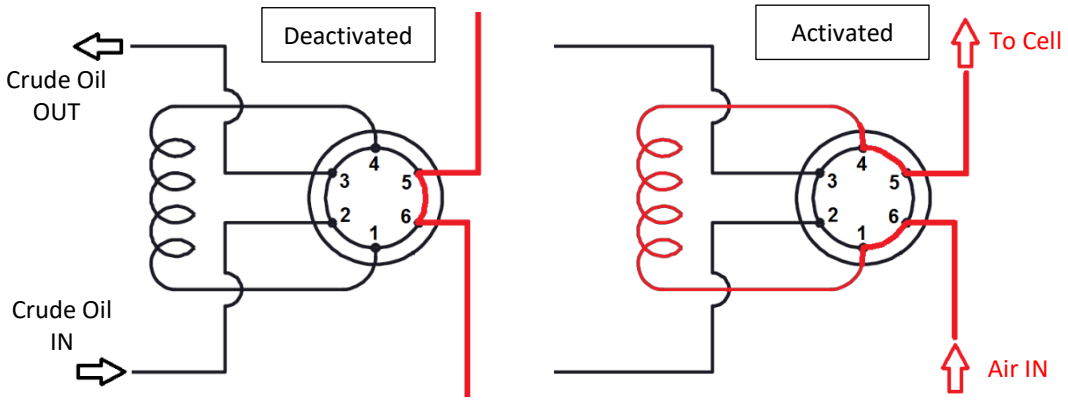


Figure 1-2: Sample Spider Valve Flow

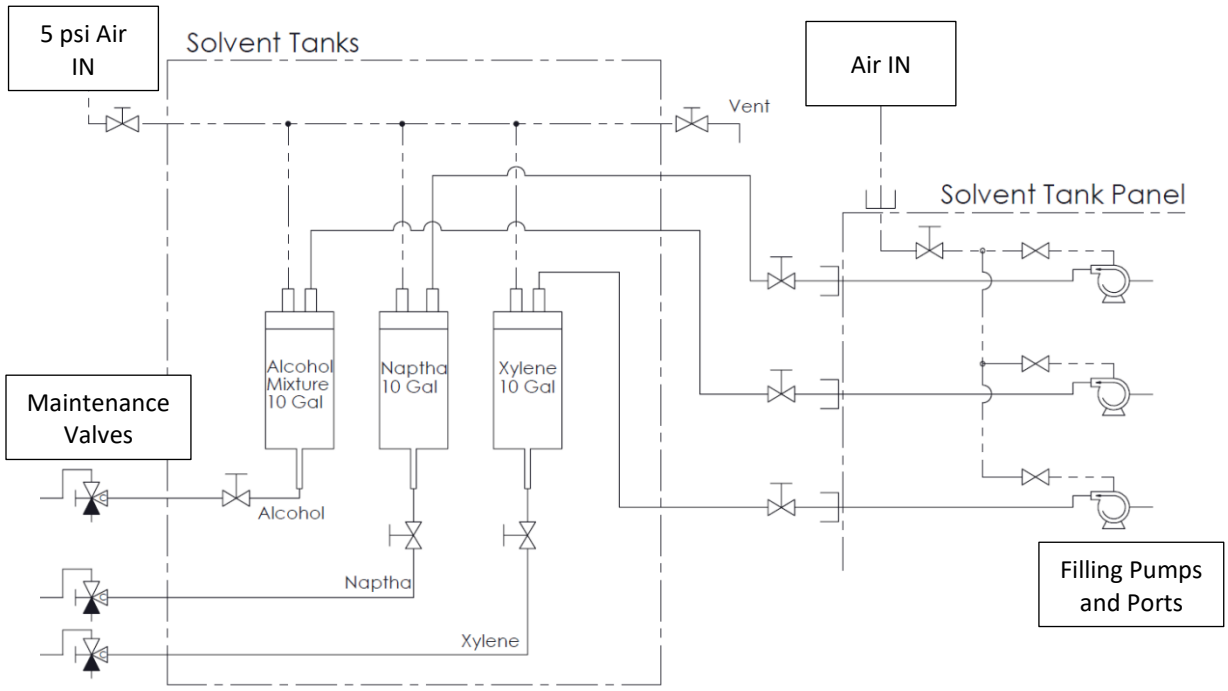


Figure 1-3: Solvent Flow Schematic

Component Identification

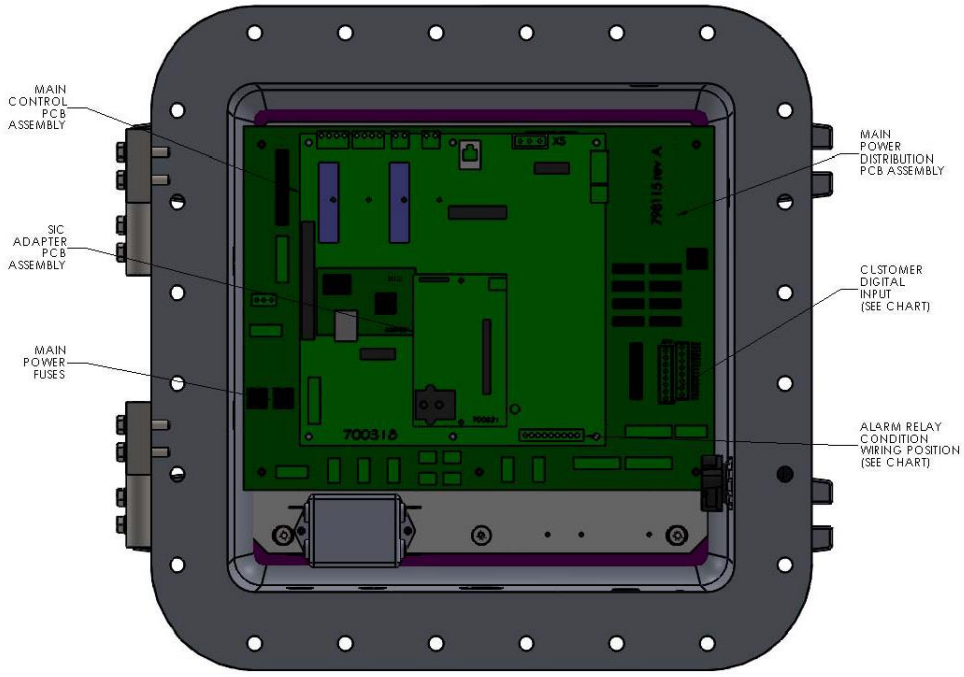


Figure 1-4: Upper Control Enclosure

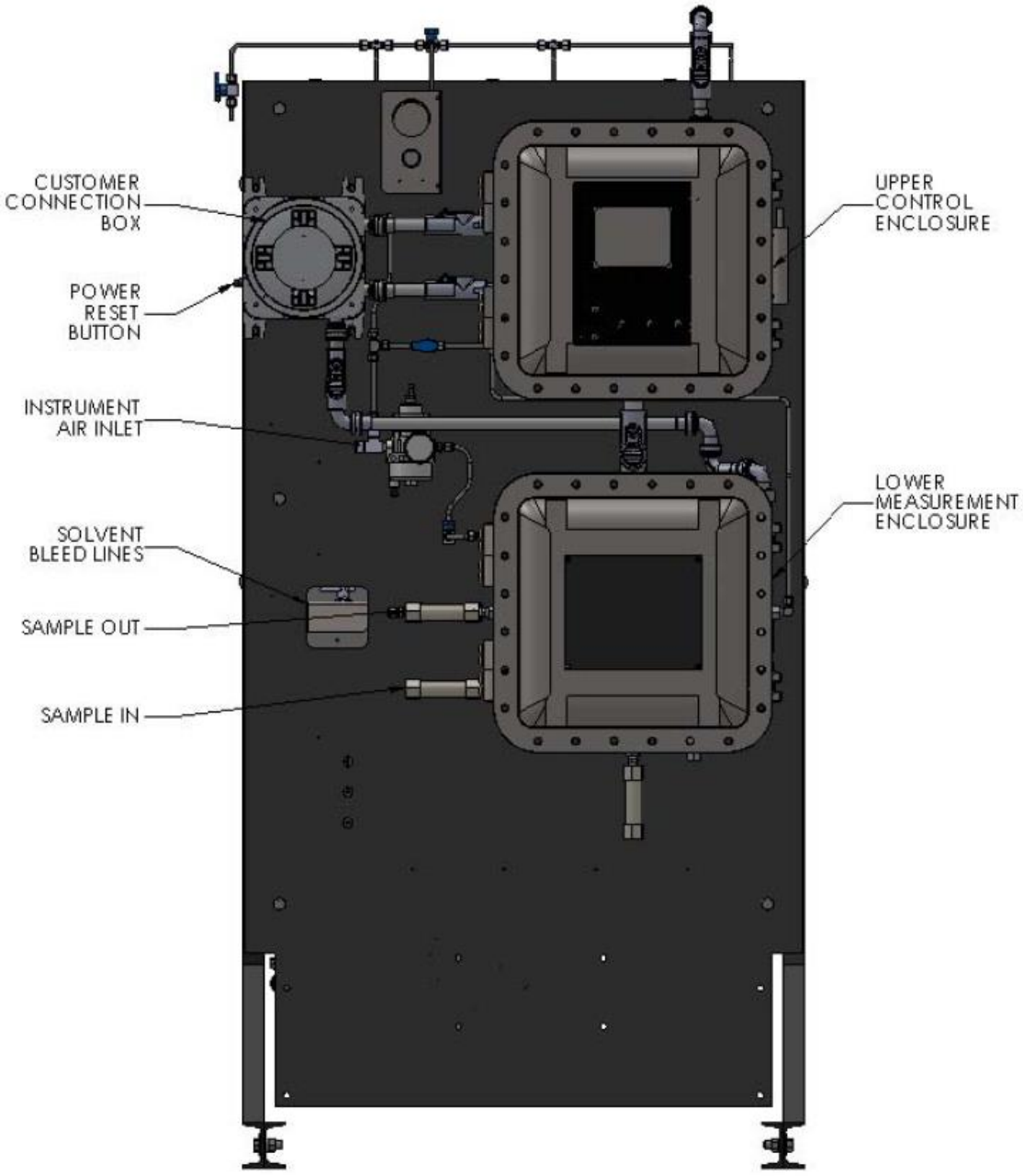


Figure 1-5: Front View

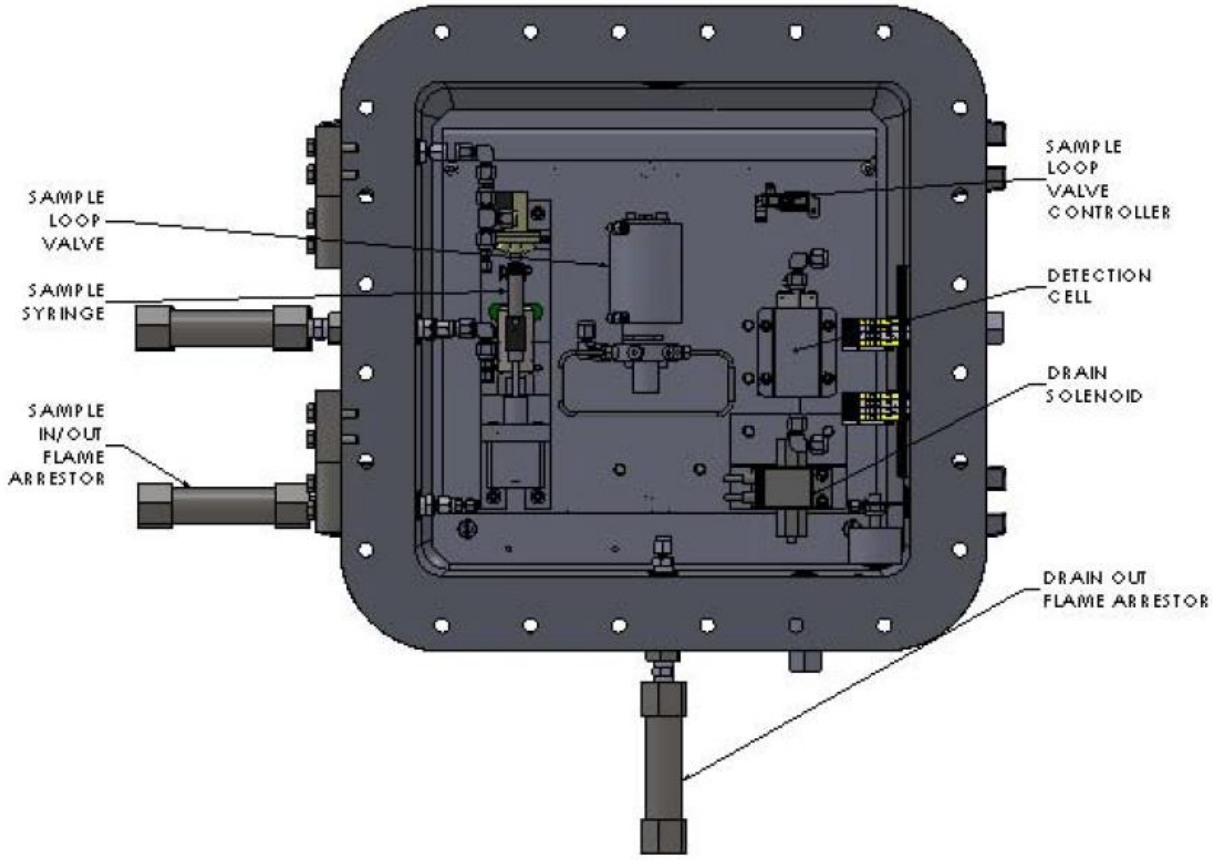


Figure 1-6: Lower Measurement Enclosure

Menu Structure

Main Menu	Submenu	Items	Choices / Settings / Comments
Analyzer Status	–	–	Online / Offline
Alarm History	–	Reset	Reset Alarms log
Validation History	–	Reset Req. Valid.	Reset Validation log Request Validation
Service	–	Sys Temperatures Output Control	Cell Temperature PWM Target set PID Control Used to verity operation of various solenoids

Main Menu	Submenu	Items	Choices / Settings / Comments
Service	–	Injector Control	Used to check operation of stepper motor
		4-20 Control	Used to set Analog Output signals
		Conductive System	Information about measurement circuit Read, Cell Clean and Validation run commands
		Digital Inputs	Displays current status of various digital inputs
		Relays	Used to verify the operation of relays
Setup	Output Settings	4-20mA Outputs	Program 4-20mA settings
		4-20 Out 1	Channel 1
		Type	Off / SiC 1 / SiC 2 / Cell Temp / Cell Cond / Validation
		4mA	4mA value
		20mA	20mA value
		Offset	Offset value
		4-20 Out 2	Channel 2
		Type	Off / SiC 1 / SiC 2 / Cell Temp / Cell Cond / Validation
		4mA	4mA value
		20mA	20mA value
		Offset	Offset value
		Graphics	Program graphs settings
		Clear All	Clear All graphs history
		Period	Set graphs draw rate
		Salt in Crude	Disable / Enable Low and High range
		Cell Temp.	Disable / Enable Low and High range
		Conductance	Disable / Enable Low and High range
		Validation	Disable / Enable Low and High range

Main Menu	Submenu	Items	Choices / Settings / Comments
Setup	Alarm Settings	Warning Alarms	Warning alarms settings
		Stream 1	Low and High values for stream 1
		Stream 2	Low and High values for stream 1
		Critical Alarms	Critical alarms settings
		Max. Temp	Max. cell temperature
		Rem Stdby	Disable / Enable Alarm Critical when in rem. standby
	System Settings	General	
		Conc. Units	PTB / mg/L / g/m3
		Temp. Units	°F / °C
		Stdby Mode	On / Off
		Come Read	0 – 90 seconds
		Num Cycles	Cycles counter
		Max Cycles	10000 – 75000 limit for maintenance alarm
		Validation	
		Value	Validation target
		Margin	Validation range (+/-)
		Offset	Validation offset
		Stream Select	
		Type	Stream 1 / Stream 2 / Alternate / Auto
		Rinse Time	0 – 200 seconds
		Str. 1 Reps	1 – 100 cycles (only for alt.)
		Str. 2 Reps	1 – 100 cycles (only for alt.)
		Digital Inputs	
		Cust. Al.	Disable / Enable
		Rem Stdby	Disable / Enable
		Valid	Disable / Enable
		Strm Sel	Disable / Enable
		Screen Settings	
		ScrSaver	0 – 60 seconds
		Reload Defaults	Loads default customer settings
		Relay	R1 / R2 / R3

Main Menu	Submenu	Items	Choices / Settings / Comments
Setup	System Settings	Choice	OFF / Alarm Warning / Alarm Critical / Maintenance / Stream 1 / Stream 2 / Come Read / In Validation / Valid. Pass
		Condition	Normal / Fail Safe
	Comm. Setup	Serial Port C	Comm. settings for RS-232
		Mode	None / Data / Result
		Rate	9600 / 19200 / 38400
		MODBUS	Modbus comm. settings
		ID	1 – 250
		Mode	Ethernet / RTU
		Serial Port B	RS-485 RTU settings
		Rate	9600 / 19200 / 38400
		Ethernet Setup	Modbus TCP/IP settings
		Our IP Address	Analyzer's IP address
		Router Address	Router Address
		Network Mask	Network Mask
	State Table Setup	Reset Defaults	Loads default state table
		Line	1 – 16 states
		State Type	Wait / Clean / Mix / Read / Drain / Inject / Repeat
		Data	None / seconds or counter (depends on state)
	Calib. Table Setup	Value	Sample concentration value for calibration
		Start Cal Cycle	Run calibration sequence
		Default Table	Loads default table
		Reset Table	Clears whole table
		SiC Offset	Offset for the final reading
		SiC	Table points
		Conductance	Concentration result
		Entries	Number of entries 1 – 10
		Delete	Deletes entry in that row
	Time/Date Setup	Time Format	12 / 24 Hr
		Date Format	US / EU
		Date	Set current date
		Time	Set current time

Main Menu	Submenu	Items	Choices / Settings / Comments
Setup	Factory Setup	–	For factory use only
Security	–	–	Disable / Enable

Chapter II: Specifications

Models

P-600-1400	CSA/CUS Class I, Division1, Group B, C and D
P-600-1500	ATEX II 2G Ex db IIB+H2 T6 Gb
P-600-1600	IECEx II 2G Ex db IIB+H2 T6 Gb

Performance

Measurement Range	0 to 400 PTB 0 to 1140 mg/Liter (g/m^3)
Repeatability	±2.0% of full scale or better
Reproducibility	±1.0% of scale
Measurement Accuracy	±5.0% of measurement; correlates to ASTM D3230
Measurement Cycle Time	5 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: -20°C (-4°F) Maximum: 40°C (104°F)

Sample Requirements

Sample Conditions	Homogeneous, single-phase sample without water
Sample Bypass Flow Rate	3.0 to 6.0 L/h
Sample Pressure	2.0 bar minimum (29 psi) 10.0 bar maximum (145 psi)
Sample Return Pressure	Atmospheric (optional high-pressure sample recovery system available)
Sample Temperature	10 to 60°C (50 to 140°F)

Solvent Requirements

Xylene	Per ASTM D843
Alcohol Mixture	50/50 mix of 1-Butanol and Absolute Methyl Alcohols (Reagent Grade) used for Calibration and Operation
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	RS-232 (output only) / RS-485 (Modbus)
Relay Output	Three SPDT relay contacts rated at 3A resistive load at 250VAC. May be programmed for normal or failsafe operation. The conditions activating these relays are programmable.
Modbus	Optional (Ethernet TCP/IP or RS-485 RTU) Consult Bartec Orb for details

Utility Requirements

Power	110-120VAC (±10%), 50/60 Hz, 5A 230-240VAC (±10%), 50/60 Hz, 2.5A
Purge Gas Supply	Clean, dry instrument grade air at 5.5 bar (80 psi) minimum

Analyzer Enclosure

Dimensions (W x H x D)	955 x 1854 x 762 mm (38 x 73 x 30 inches)
Weight	Approximately 205 kg (450 lbs)
Certification	CE certified
Hazardous Classification	P-600-1400: CSA/CUS Class I, Division1, Group B, C and D P-600-1500: ATEX II 2G Ex db IIB+H2 T6 Gb P-600-1600: IECEx II 2G Ex db IIB+H2 T6 Gb

Due to Bartec Orb commitment to continual product improvement, specifications subject to change without notice.

Chapter III: Installation and Startup

	**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.**

Site Requirements

Your particular site, application, and installed options will ultimately determine the need for any accessories or auxiliary equipment. This chapter 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 always remain between -20°C and 40°C (-4°F and 104°F).

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).

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).

PROCESS SAMPLE LINES

The P-600 is designed to continuously analyze crude oil samples from a process stream. The micro 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 2.0 and 10.0 bar (29 and 145 psi) at a flow rate of 3.0 – 6.0 L/h. The temperature of the sample should be between 10°C 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 5.5 bar (80 psi); the supply must be capable of approximately 500 cc/minute. The purge gas connection is made at the pressure regulator on the left size of the analyzer (see Figure 3-2). A ¼" FNPT fitting is provided for this connection.

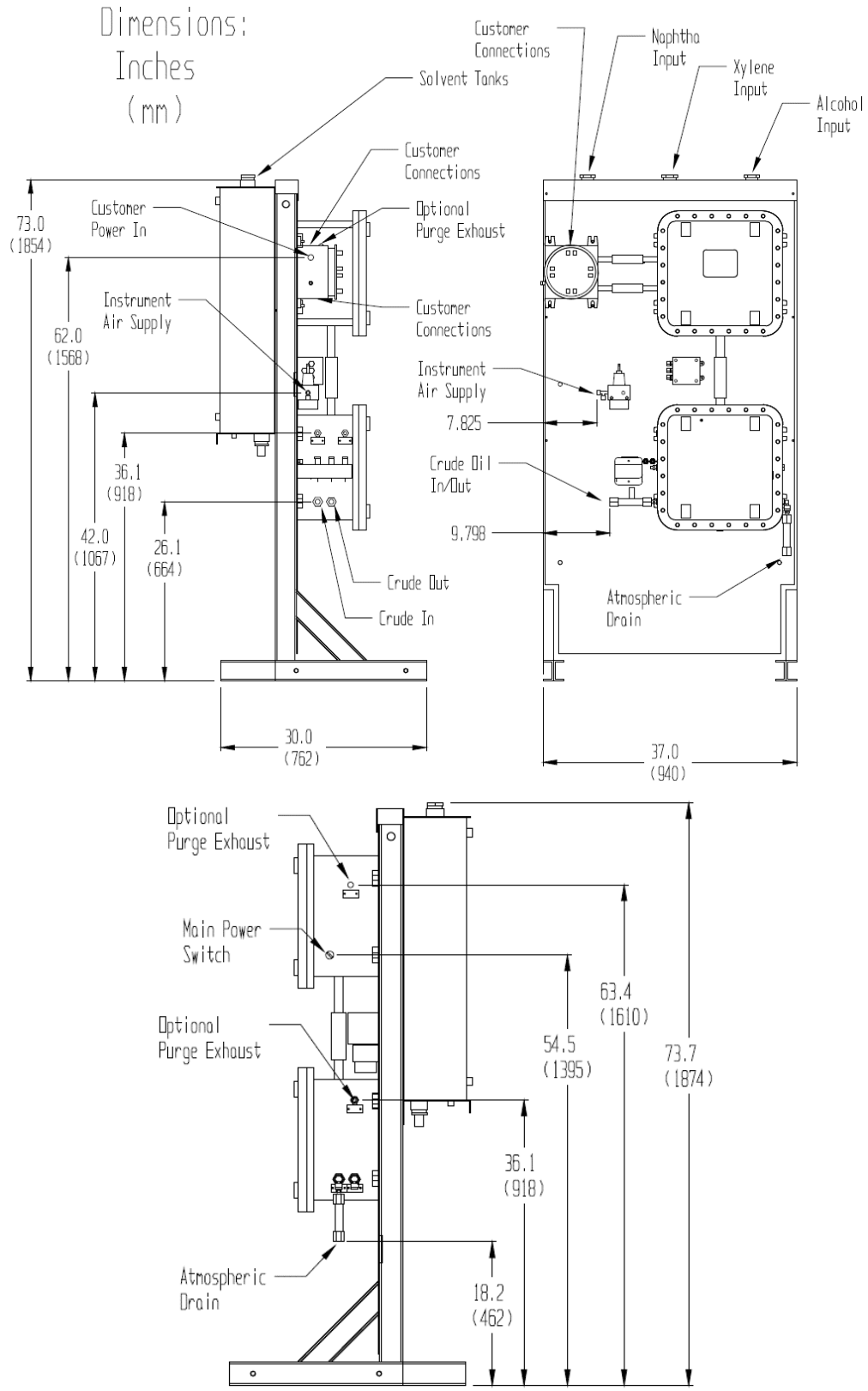


Figure 3-1: Dimensional Drawing

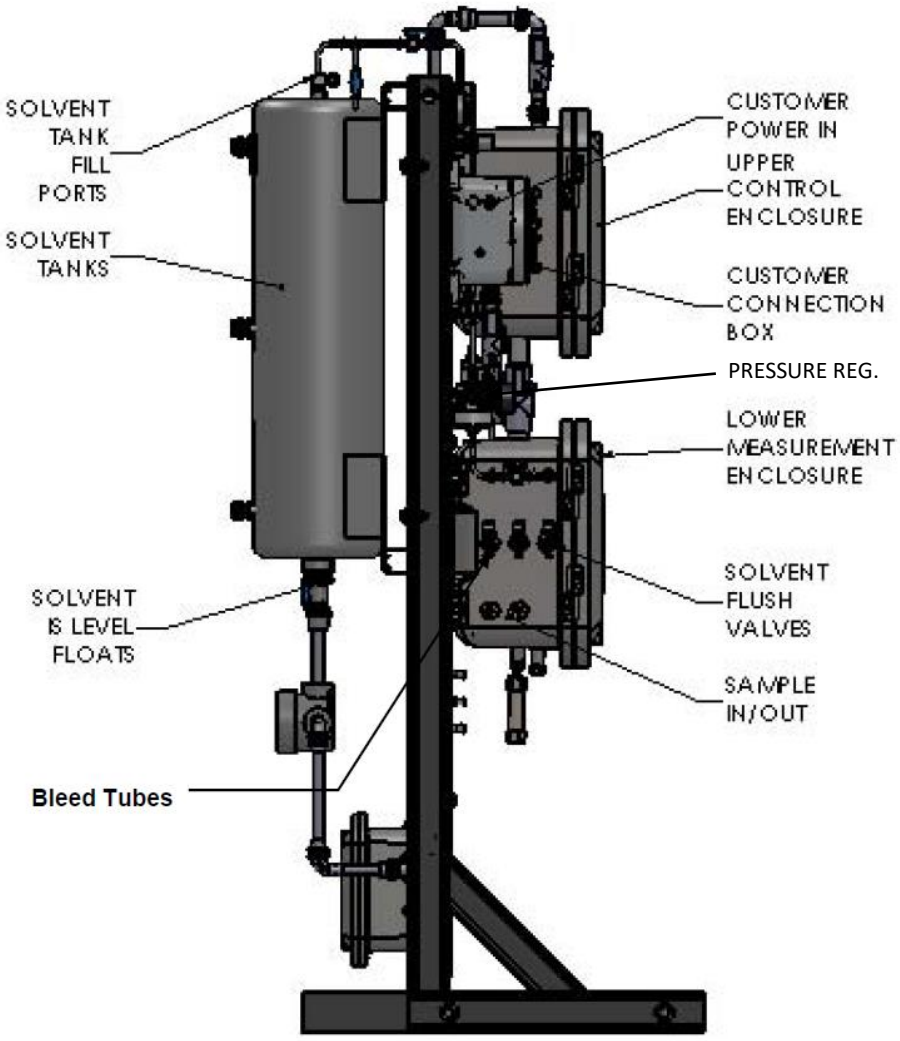


Figure 3-2: Left Side View

Solvent Supply

Three stainless steel reservoirs are provided on the rear of the free-standing rack for the measurement and cleaning solvents (see Figure 3-4). 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.

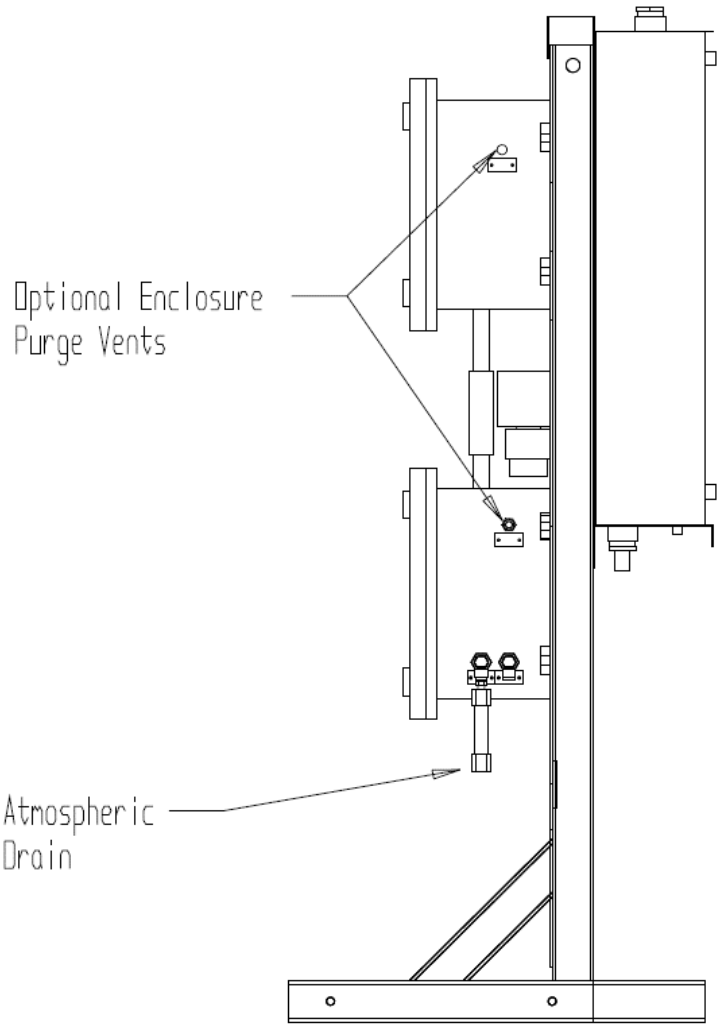


Figure 3-3: Right Side View

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 or regulator until the tanks are pressurized to 5 psi.

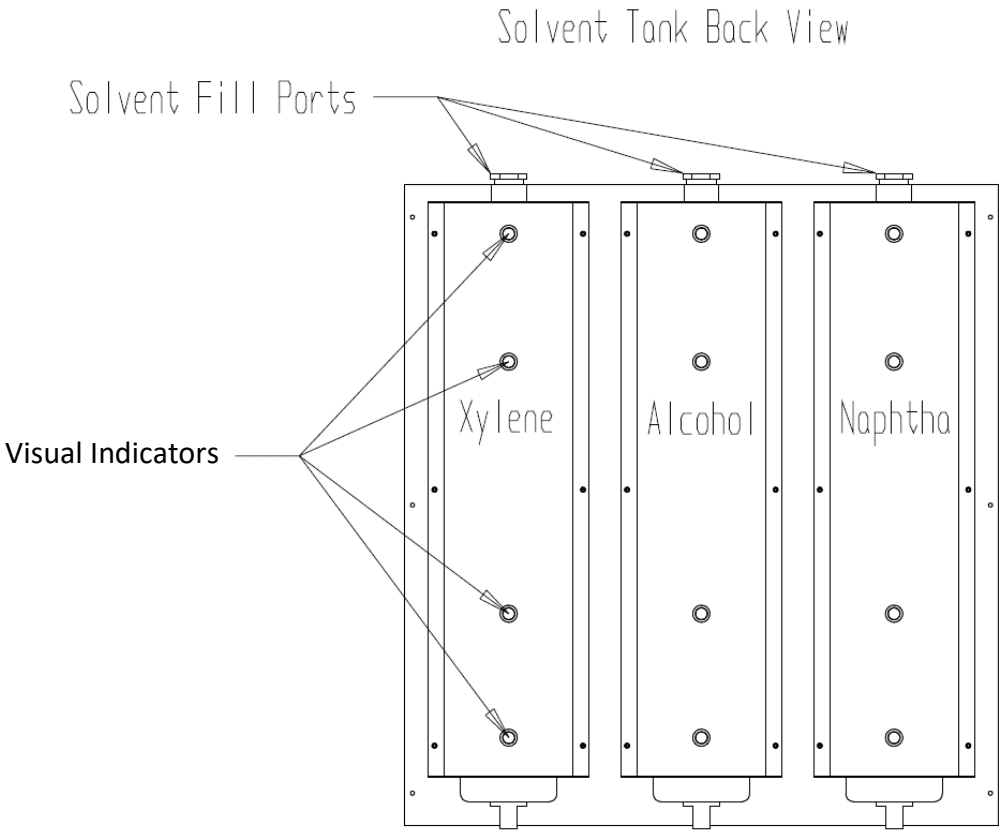


Figure 3-4: Rear View / Solvent Tanks

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.

Wiring

ELECTRICAL POWER

	**WARNING: This Analyzer is designed to meet the requirements of either the National Electrical Code (NEC) for installation in CSA/CUS Class I, Division1, Group B, C and D or ATEX II 2G Ex db IIB+H2 T6 Gb or IECEx II 2G Ex db IIB+H2 T6 Gb 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 230-240VAC (±10%), 50/60Hz power supply. The system is jumper selectable 110-120/220-240VAC (±10%) 50/60 Hz, single phase, 5A. AC power connections are made through the Customer Connections box attached to the upper left of the top enclosure (see Figure 3-2).

	**CAUTION: It is the installer's responsibility to verify that the jumpers on HD2 (798112 Rev. B) in Customer Connection Box are configured properly for the supply voltage (see Figure 3-6).**

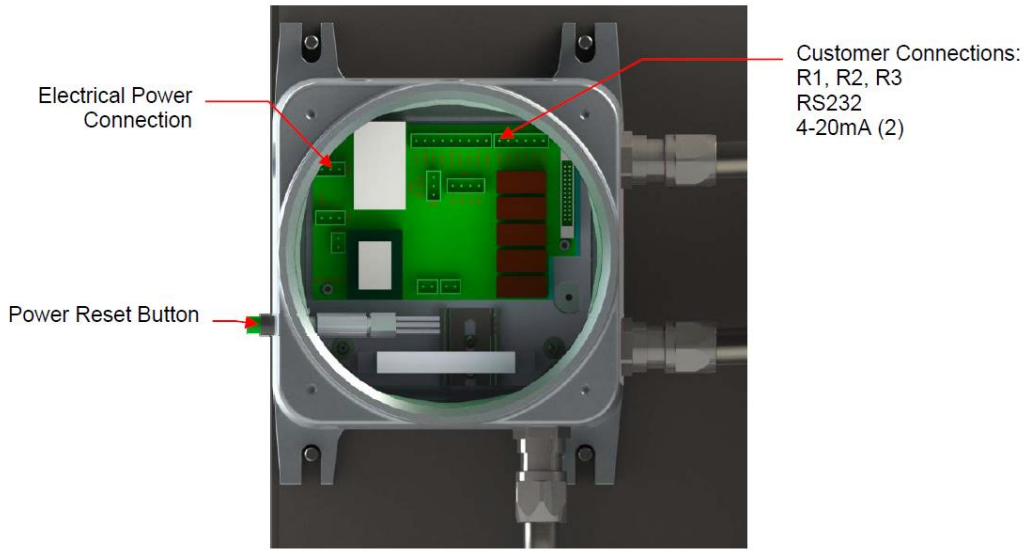


Figure 3-5: Customer Connections Enclosure

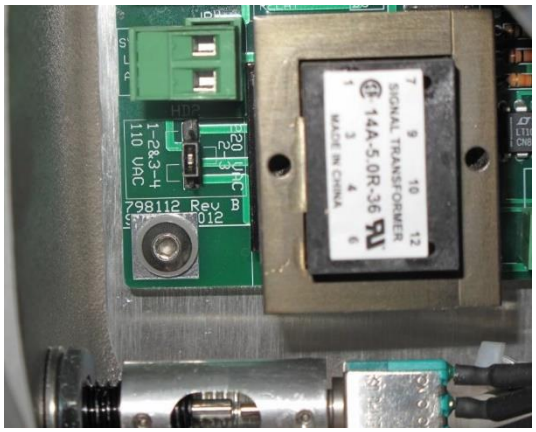


Figure 3-6: Voltage selection header (shown 220VAC, pin2-3)

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 Upper Control Enclosure (see Figures 3-5 and 3-7).

Analog Output

One isolated 4-20mA output is standard on the P-600 Salt in Crude Analyzer. An optional second 4-20mA output may be provided (see Figure 3-5).

Relay Output

The Analyzer incorporates three SPDT relay contacts rated at 3A resistive load at 250VAC. 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 (see Figure 3-5). See Chapter IV for information on alarm programming.

Serial Output

The P-600 Salt in Crude Analyzer incorporates RS-232 serial output. The connection is made in the Customer Connections Enclosure (Figure 3-5).
Serial communication operates at a selectable baud, no parity, 8 start bits, 1 stop bit. Data is comma delimited and output in the following sequence: Date, Time, Salt in crude concentration, conductance, cell temperature. Output is user selectable as a result or data dump. A <CR> is used to designate the end of the data stream.
The maximum allowable external cable length on the RS-232 output is 30 meters (98 feet).

Modbus

Modbus is available as a factory-installed option which utilizes the Analyzer's Ethernet TCP/IP or RS-485 RTU serial output. This connection is made in the Upper Control Enclosure (Figure 3-7). Consult Bartec Orb for more information.

Digital Inputs

The Analyzer incorporates four sets of dry contacts that allow the control room to remotely activate selected functions. The connections for these digital inputs are made inside the Upper Control Enclosure at JP2 terminal (see Figure 3-7). Wiring is brought into the enclosure through ports on the right-hand side of the enclosure.

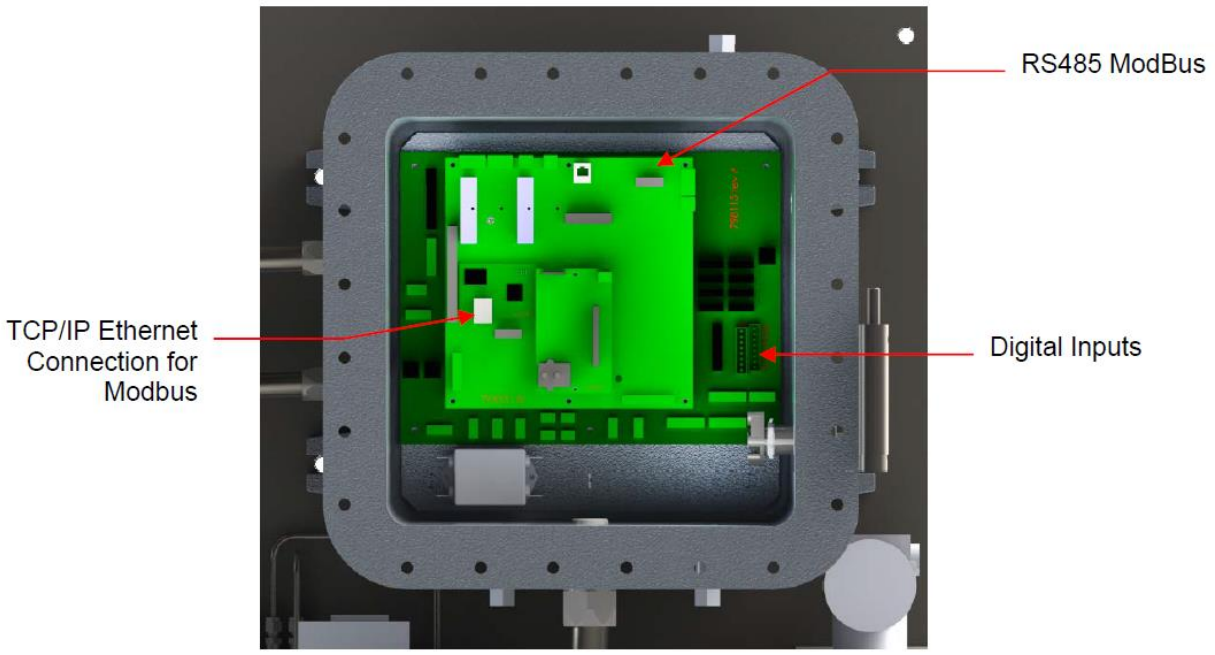


Figure 3-7: Upper Control Enclosure

Digital dry contacts inputs are as follows:

- **Customer Alarm** — This connection is used to stop the analysis, put the Analyzer Offline and activate Alarm Critical and Alarm Warning relays;
- **Remote Standby** — This connection is used to place the Analyzer in a Remote Standby Mode. Analysis will stop until the signal is removed;
- **Validation Request** — This connection is used to initiate a validation cycle;
- **Stream Select** — This connection is used to switch to Stream 2 sample;
- **Low Naphtha** — This connection is used for Analyzer's operation;
- **Low Solvent** — This connection is used for Analyzer's operation.

The minimum external dry contact alarm signal pulse width should be 100ms.

Digital Input	Terminals (JP2)	Function
DI0	RCC1 – RCC2	Customer Alarm
DI1	RCC3 – RCC4	Remote Standby
DI2	RCC5 – RCC6	Validation Request
DI3	RCC7 – RCC8	Stream Select
DI4	RCC9 – RCC10	Reserved for future use
DI5	RCC11 – RCC12	Low Naphtha
DI6	RCC13 – RCC14	Low Solvent
DI7	RCC15 – RCC16	Reserved for future use

	**NOTE: Although the Validation Request and Stream Select contacts may be present, these functions are only available on Analyzers which incorporate these options. Contact Bartec Orb for more details.**

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.**

The following points describe the default procedure to check the main components of the Analyzer and perform startup sequence:

1. Open the Upper Control and Lower Measurement Enclosure doors.
2. Start the flow of instrument air to the Analyzer. Verify that it is regulated at 5.5 bar (80 psi).
3. 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 chapter). Be sure to pressurize the tanks to 0.35 bar (5 psi).
4. Start the flow of crude oil to the Analyzer. Verify that sample supply pressure is between 2 and 10 bar (29 and 145 psi). Check for sample leaks at external connections and within the measurement enclosure itself.
5. Apply power to the Analyzer.

	**NOTE: Upon initial application of external power to the Analyzer, only the Customer Conn. 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.**

6. Press the green 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.

	**NOTE: 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).**

8. The Analyzer's LCD should light-up. After a short initialization routine runs, the instrument's Main Menu screen will appear on the display. The unit should power up in the Offline mode (default).
9. Access the Service menu and perform the following checks (see Chapter VI for information on accessing this menu and performing these functions):
    - Verify that the cell temperature is approaching 50°C;
    - Verify that digital inputs;
    - Verify solenoid valves operation.

10. Verify that the atmospheric drain is working.
11. You are now ready to run analysis using the factory default settings or program the instrument with your desired operational parameters (see Chapter IV: Programming).
12. Close and bolt the Upper Control Enclosure and Lower Measurement Enclosure doors.

Chapter IV: Programming

Menu Navigation

The P-600 Salt in Crude Analyzer is programmed and controlled via a magnetic keypad on the front of the Upper Control Enclosure (see Figure 4-1). This eliminates the need for opening the enclosure to change operational settings. A magnetic pencil is supplied with the instrument for this purpose.

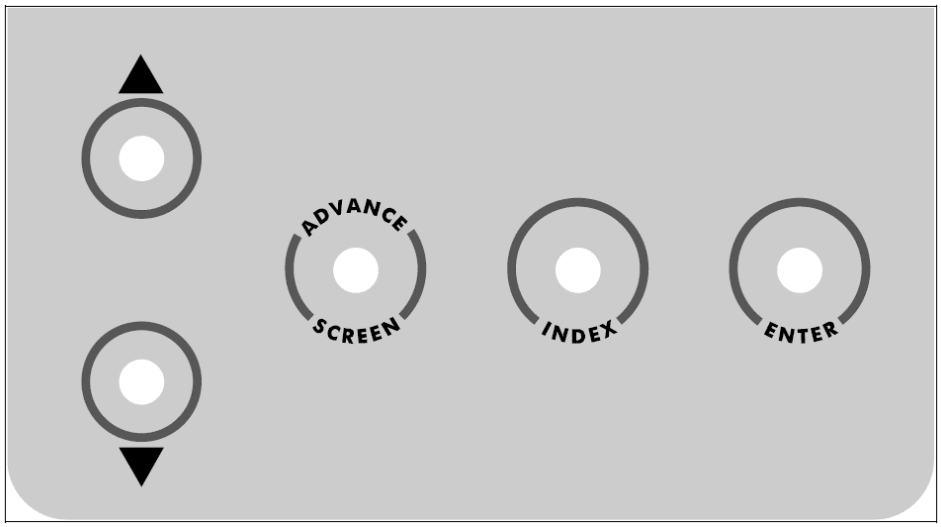


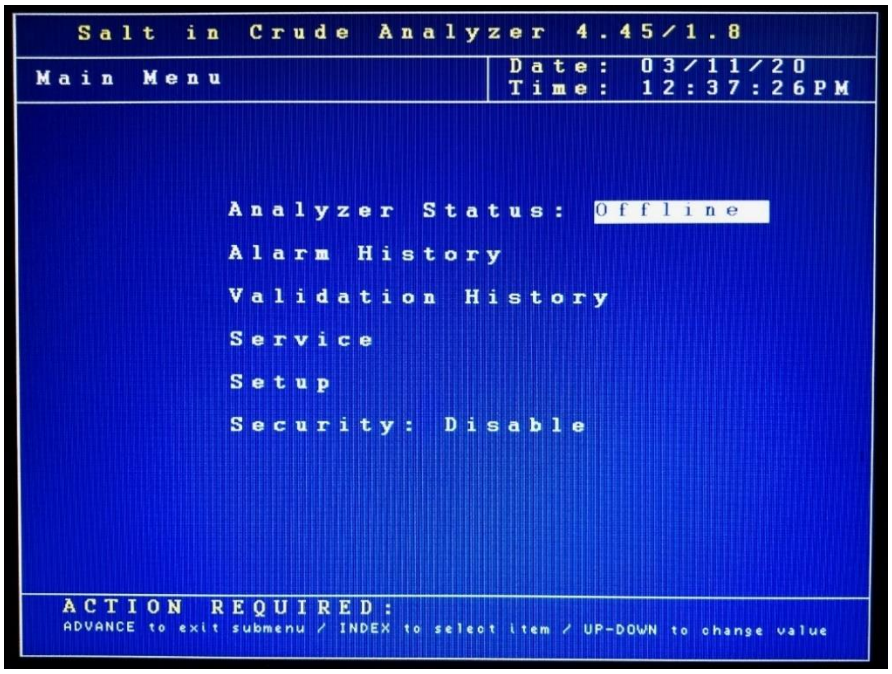
Figure 4-1: Magnetic Keypad

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 —** controls displayed screen. It moves out of the submenus (screen by screen) to the highest hierarchy screen, which is Main Run screen. From there, tapping Advance Screen Key will cycle between Main Menu and Main Run screen. It is also used to decline window messages.
- **Index Key —** scrolls through the various items available within a specific screen. The “active” menu line is highlighted (white bar) 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 —** accesses submenu or runs a command associated with a selected menu item. It is also used to confirm window messages.
- **▲▼ (Up/Down Arrow) Keys —** change 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 ONLINE and OFFLINE. It also provides access to the all the various submenus. To access the Main Run screen (see page 33), 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 field indicates the current status of the Analyzer. Touch the up/down arrow keys to change the status. Window message will appear to confirm or decline your choice.

ALARM HISTORY

This menu item provides access to the Alarm History submenu, which lists conditions which have activated one or more of the Analyzer's alarm functions. It is described in further detail in Chapter V: Normal Operation. Touch the Enter key to access this submenu.

VALIDATION HISTORY

This menu item provides access to the Validation History, which lists validation measurements that have been performed. Validation is described in further detail in Chapter V: Normal Operation. Touch the Enter key to access this submenu.

SERVICE

This menu item provides access to the Service submenu; entering it automatically takes the Analyzer offline, if it was running. 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 Chapter VI: Maintenance & Service. Touch the Enter key to access this submenu. A screen will appear asking if you are sure to enter the Service menu; this is intended to prevent you from inadvertently taking the Analyzer offline.

SETUP

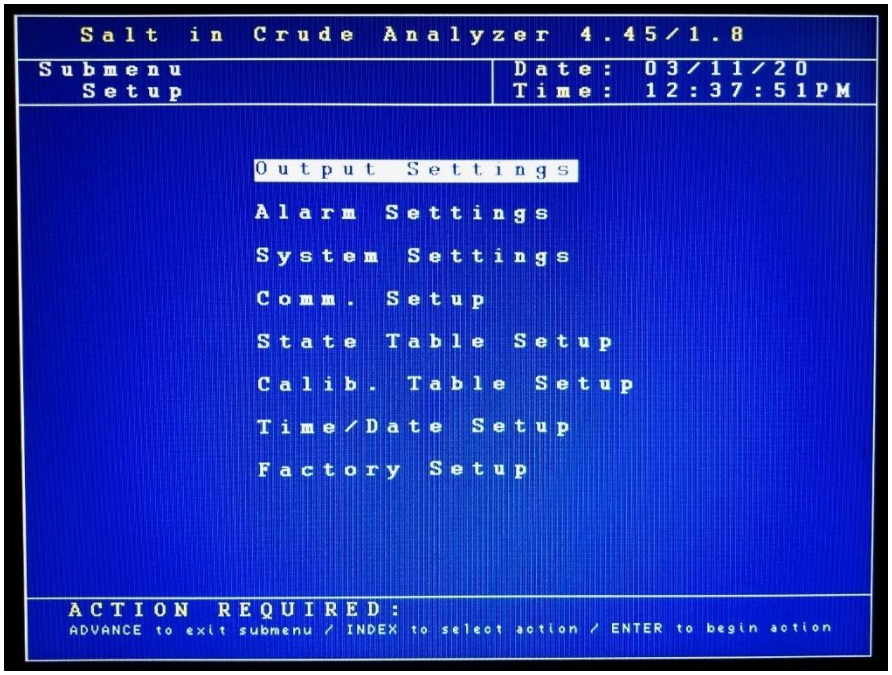
This menu provides access to the Analyzer's Setup submenus. It is accessed by touching the Enter key when this menu item is highlighted.

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 Submenu

The Setup submenu is used to enter the Analyzer's various settings screens.

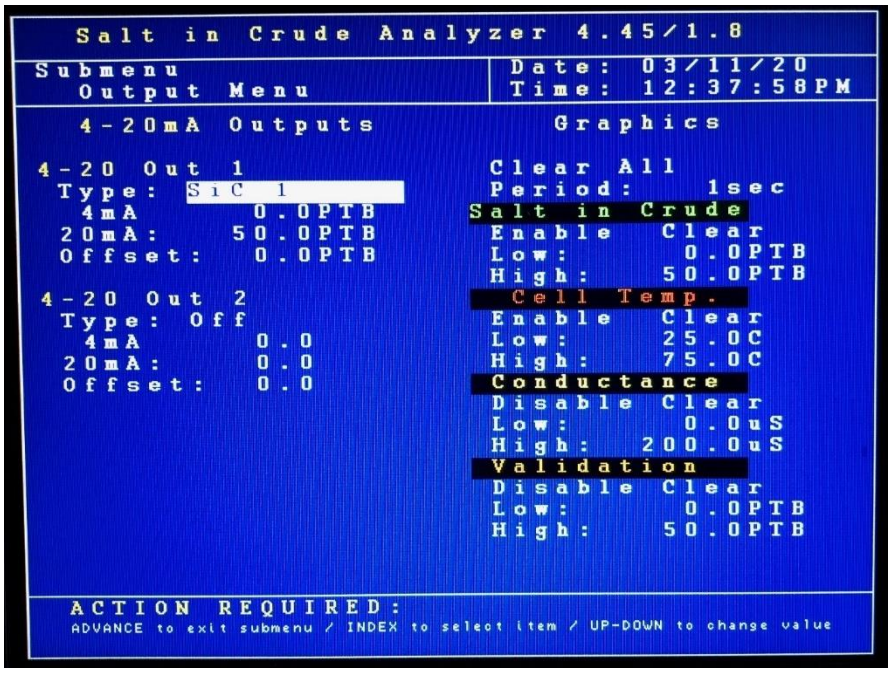


Use the Index key to move to the desired (highlighted) menu selection. Touch the Enter key to access the selected submenu.

Output Settings

This submenu screen is used to program the Analyzer's 4-20mA Analog Outputs and Graphics settings.

Use the Index key to move to the desired menu item. Use the Up/Down Arrow keys to change the displayed setting/value or use the Enter key to Clear the Graphs.



4-20mA 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 Off, SiC 1, SiC 2, Cell Temperature, Conductance, and Validation.
- **4 mA —** This menu item is used to set the value at which a 4mA signal will be output.
- **20 mA —** This menu item is used to set the value at which a 20mA 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:

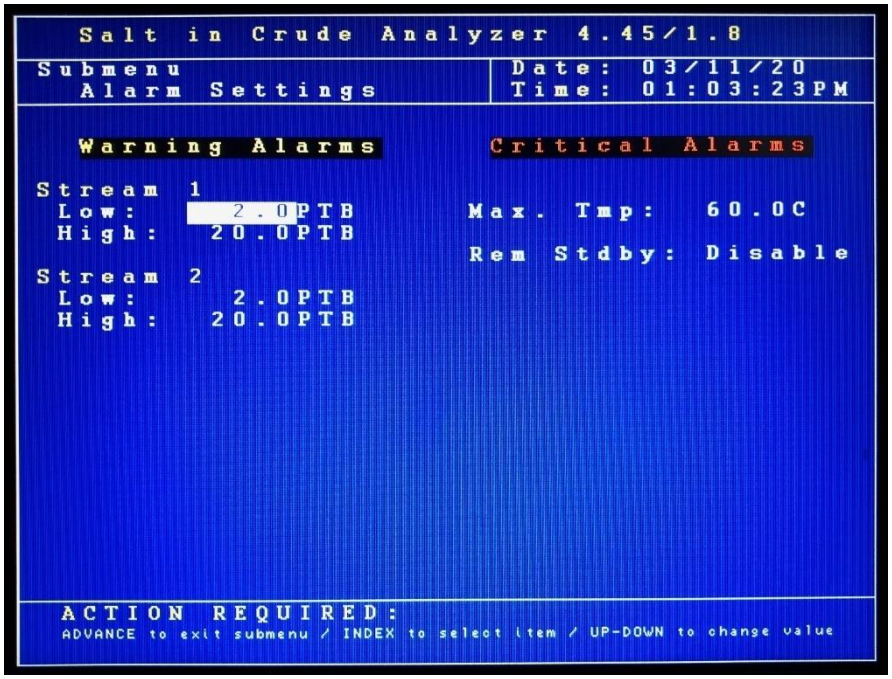
- **Salt in Crude —** When this menu item is enabled, Salt in Crude measurement data are graphed.
- **Cell Temp. –** Cell Temperature reading.
- **Conductance –** Conductance measurement result.
- **Validation –** Validation measurement results.

  Enable/Disable — Turns graphing for this item on and off.
  Clear — clears current graph.
  Low — This establishes the bottom of the trend graph's scale.
  High — This establishes the top of the trend graph's scale.

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

Alarm Settings

This submenu screen is used to program the Analyzer's alarms.



Use the Index key to move 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 submenu.

Warning Alarms

Those types of alarms do not stop the analysis. "Result out of range" warning alarm is activated when the measured concentration exceeds the indicated value.

- **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.

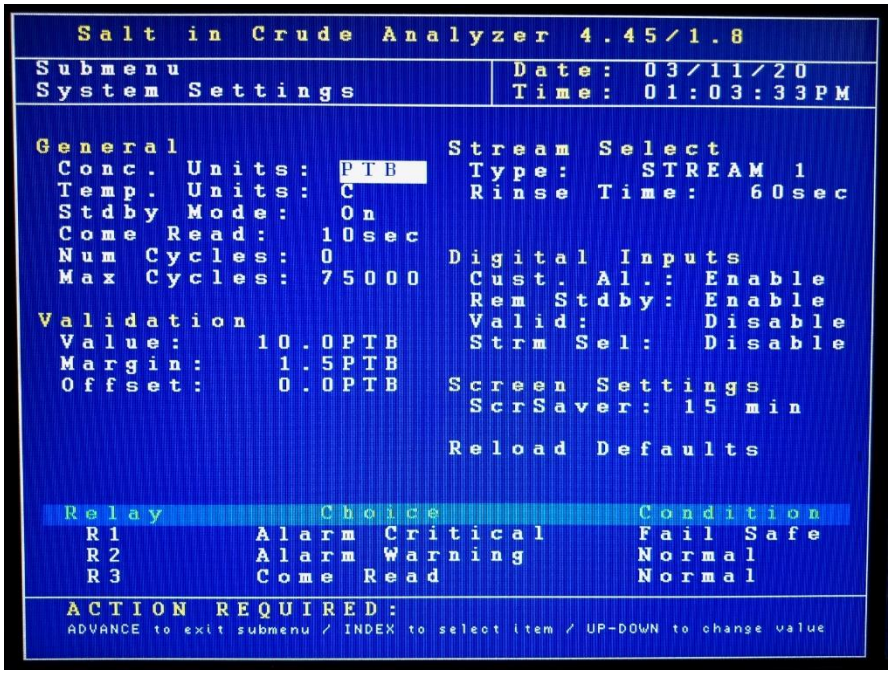
Critical Alarms

Those types of alarms stop the analysis. Programmable critical alarm is a maximum cell temperature.

- **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.
- **Rem Stdby —**Enables or Disables Alarm Critical when in Remote Standby mode.

System Settings

The System Settings submenu allows you to establish global operating parameters for the Analyzer.



Use the Index key to move to the desired menu item. Use the Up/Down Arrow keys to change the displayed setting or value. Tap Enter key to reset cycle counter or reload defaults.

General

Those are general setting for Analyzer's operation.

- **Conc. 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, mg/L and g/m^3.
- **Temp. Unit —** This menu selection allows you to select the temperature scale. The choices are °C or °F.
- **Stdby Mode —** this controls how the Analyzer will operate upon application of power. When OFF is selected, the instrument will begin performing analysis automatically when power is applied. When ON is selected, the instrument will power up in the Offline mode and must be manually placed Online.
- **Come Read —** 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.
- **Num 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.
- **Max Cycles —** This menu item allows the operator to set the number measurements which can be performed before the Analyzer's Maintenance Alarm is activated.

	**NOTE: 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.**

Validation

- **Validation Expected Value —** This is the expected value of the validation sample.
- **Validation Bandwidth —** This is the acceptable range of the validation sample. It is entered as a plus/minus value of the Validation Expected Value entered in the previous field.

Stream Select

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

- **Type –** The Analyzer performs measurements only on the selected sample stream (Stream 1 or Stream 2), alternates between streams (Alternate) or Auto (Stream selection is made via a digital input signal from the control room).
- **Rinse Time –** it's a delay before performing analysis to make sure the new stream sample reached the Analyzer.

Digital Inputs

These menu items allow you to enable and disable the Analyzer's customer-controlled digital inputs.

	**NOTE: Although the Validation and Stream Select contacts may be present, these functions are only available on Analyzers which incorporate these options.**

Reload Defaults

This menu item is used to restore the Analyzer's factory default settings.

	**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.

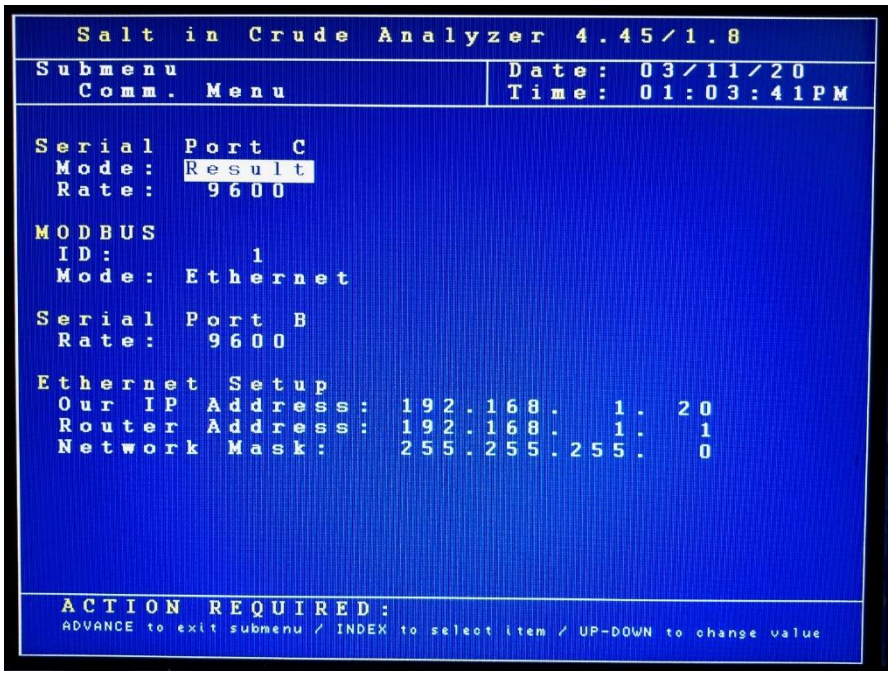
- **Relay —** This designates which alarm is being programmed. See Chapter III for alarm relay wiring information.
- **Choice —** This designates the type of alarm (see page 35 for detailed description).
  - *Off* – Alarm relay disabled.
  - *Alarm Warning* – *Analyzer is Offline; m*easured concentration has exceeded either the low or high alarm setpoint; Low Naphtha tank. Warning alarms do not disrupt analysis.

Alarm Critical –	This type of alarm indicates Analysis has stopped because one of the critical conditions has been detected.
Maintenance –	Activated when the number of measurement cycles has exceeded the Max Cycles setting.
Stream 1 –	stream 1 is being measured.
Stream 2 –	stream 2 is being measured.
Come Read –	Activated for a programmed period of time upon the completion of a measurement cycle.
In Validation –	validation cycle is being performed.
Valid. Pass –	validation cycle passed.

- **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 submenu allows you to configure the Analyzer's Serial and Modbus settings.



Serial Port C

This is the Analyzer's RS-232 serial communication port.

- **Mode —** This menu item determines what data will be output through the RS-232 port. The choices are Result, Data, and None.
- **Rate —** This is the baud rate used for serial communications through this port (9600 / 19200 / 38400).

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

- **Rate —** This is the baud rate used for serial communications through this port (9600 / 19200 / 38400).

Ethernet Setup

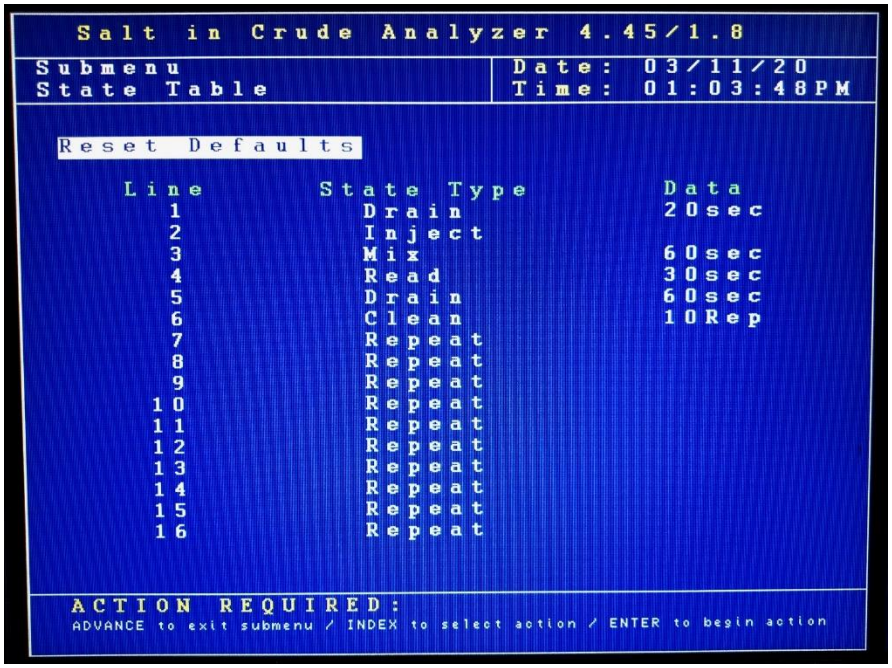
This allows you to configure the Analyzer's IP, router, and network mask addresses when Ethernet Modbus communications is selected.

- **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.

	**NOTE: When changing Ethernet address, the Analyzer has to be reset in order to save the new settings to the microcontroller.**

State Table

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



	**CAUTION: 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 can be included in a salt in crude measurement cycle. Steps that are underlined are required. The last step in any measurement cycle must be Repeat.

- **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 solvents 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 Repeat. The duration is the number of measurements that should be performed between cleaning steps.
- **Repeat —** This should always be the last step in the State table. It tells the Analyzer to return to state #1.

The default states are as follows:

Line	State Type	Data
1	Drain	20
2	Inject	-
3	Mix	60
4	Read	30
5	Drain	60
6	Clean	10
7	Repeat	-

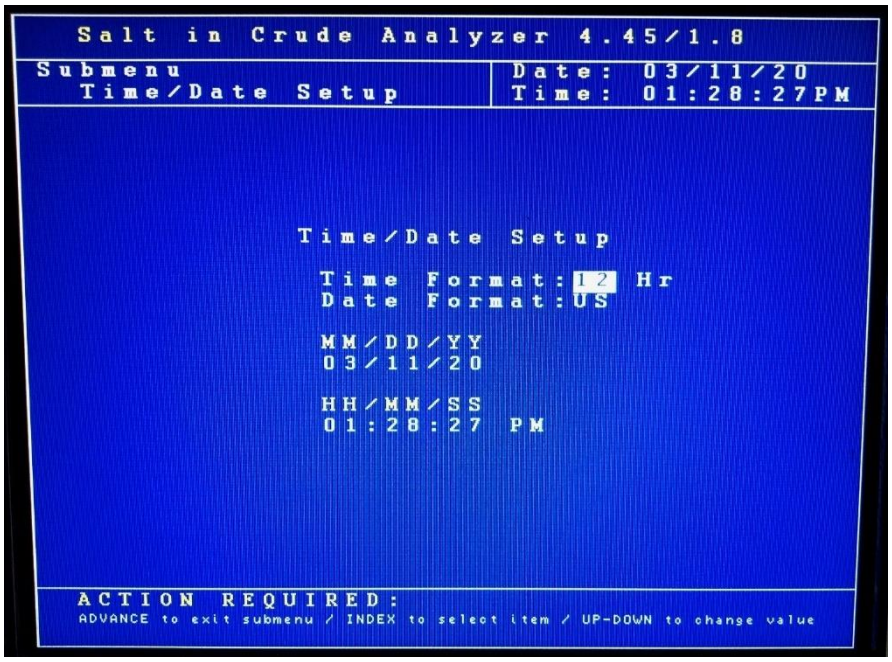
* Read state has additional hardcoded 40 seconds for measurement circuit.

Calibration

This menu selection is used for calibrating the Analyzer. See Chapter VI: Maintenance & Service for more information (see page 44).

Time/Date Setup

The Time/Date Setup submenu 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, use the Up/Down Arrow keys.
- **Time —** This menu item allows you to program the Analyzer with the current time. To change the displayed time, use the Up/Down Arrow keys.

	**NOTE: In order to keep current time and date when the unit is Off, the charged battery (CR1220) must be installed on the Main PCB.**

Factory Setup

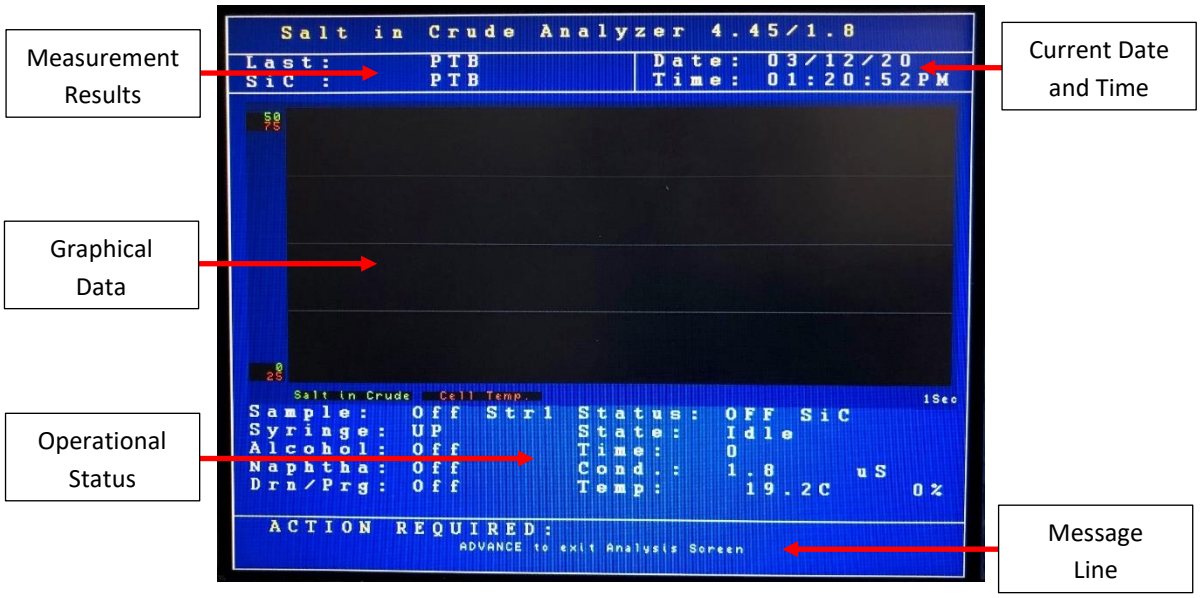
This is a password protected submenu intended for factory use only.

Chapter V: Normal Operation

In normal operation, the P-600 Salt in Crude Analyzer continuously measures salt content in crude oil. These measurements and other pertinent monitoring information are displayed on the Analyzer's display in the Main Run screen. Measurement data are also output as analog and/or 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 Chapter IV).

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.
  - *Conductance* — Displays measured conductivity (in micro siemens).

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

4-20mA 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 Chapter IV: Programming). This signal is updated at the end of the measurement cycle.

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

RS-232 Serial Output

The Analyzer can output an RS-232 serial signal to capture and log measuring information. Data are output according to the following protocol settings:

Baud rate	9600 / 19200 / 38400
Data bits	8
Parity	None
Stop bits	1
Flow control	None

Depending on how communications were programmed (see Chapter IV), the information contained in the data stream is output as follows:

Description	**Format**
Date	Current date (US or EU format)
Time	Current time (US or EU format)
Result	Concentration result (in current unit settings)
Conductance	Conductance results (in µS)
Temperature	Cell temperature (in current unit settings)
Stream	Current stream

Modbus Output

Modbus output is available as a factory installed option and uses the Analyzer's Ethernet TCP/IP or RS-485 RTU Serial interface. Consult Bartec Orb for additional information.

Alarms

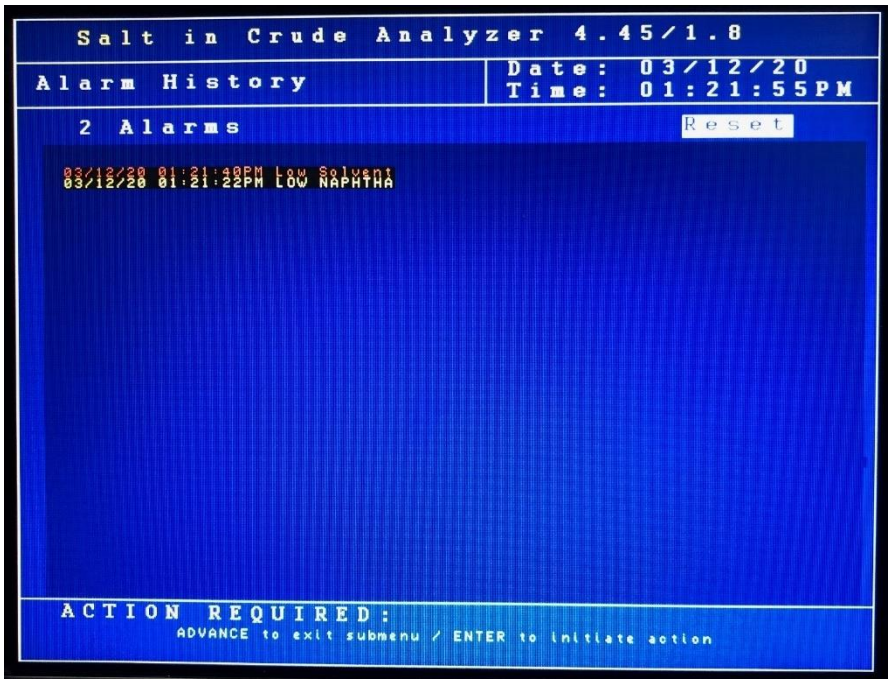
When an alarm condition is detected, a message might be displayed in the Message Line of the current screen and/or relay will be activated (depending on the type of alarm and the user-programming of the alarm relays).
There are 3 types of alarms:

- **Informative –** doesn't stop the analysis. Informs about change or occurred event. Doesn't get recorder in Alarm History log.
- **Warning —** indicates less severe event. Analysis continues.
- **Critical —** indicates fatal/severe error. Analysis stops.

Alarm Type	Alarm Message	Description	Alarm Relay Choice
Informative	"Maintenance Required"	Num Cycles counter in System Settings reached Max Cycles settings.	Maintenance
Informative	"Validation Requested"	Validation cycle has been requested.	-
Informative	"Validation in progress"	Analyzer is in validation cycle.	In Validation
Informative	"Remote Standby Active"	Analyzer is in remote standby mode	Alarm Warning Critical (optional)
Informative	-	Current stream in operation	Stream 1 Stream 2
Informative	-	New result	Come Read
Warning	"SiC Out of Range"	Result is out of set range (low or high)	Alarm Warning
Warning	"LOW NAPHTHA"	Naphtha tank is empty	Alarm Warning
Critical	"Low Solvent"	Xylene or Alcohol tank is empty	Alarm Critical
Critical	"Bad Sample RTD"	Defective/open RTD	Alarm Critical
Critical	"Cell Over Temp"	Cell temperature over max. temp or PID failure	Alarm Critical
Critical	"Motor Failure"	Stepper motor or home position sensor failure	Alarm Critical
Critical	"Ext. Custom Alarm"	Digital Input signal for external alarm	Alarm Critical

Alarm History

Operational (Alarm Warning and Alarm Critical) alarms are logged and may be viewed via the Alarm History sub-menu. To access this sub-menu, go to the Main Menu, index to Alarm History, and tap Enter key. The Alarm History screen will appear.



To clear the alarm history, tap the Enter key when Reset is highlighted and confirm.

Solvent Supply

Based on an average of 250 analysis per day, the Analyzer's solvent tanks can hold 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 will be issued. If the flow of naphtha is disrupted, a warning alarm will be issued; analysis will continue.

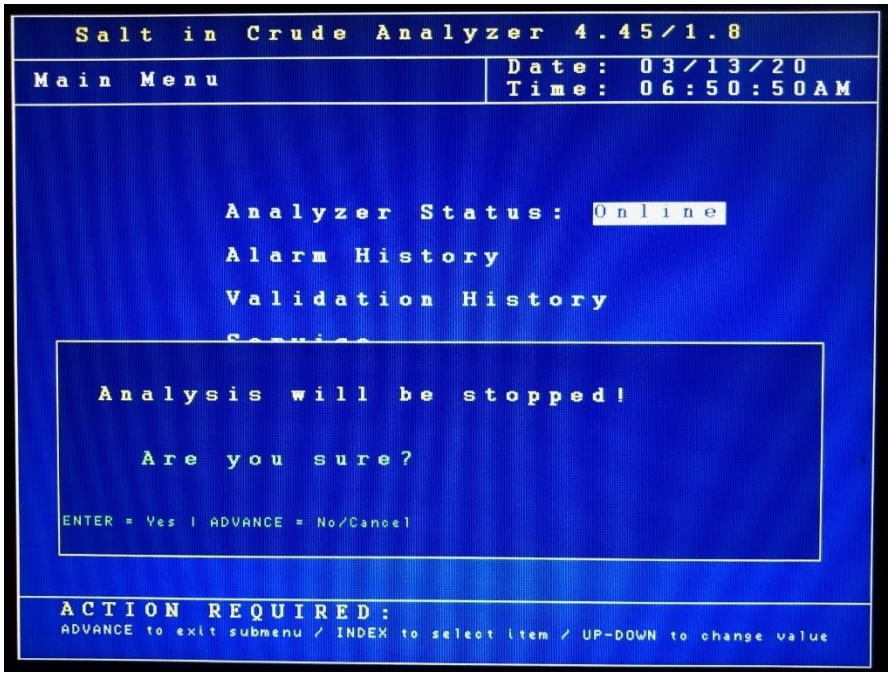
	NOTE: The P-600 Salt in Crude Analyzer can perform salt content measurements approximately every 5 minutes. However, it can be programmed to perform measurements less frequently and thus conserve the solvent supply. This is done by including additional wait state in the measurement process. See Chapter IV: Programming.

Taking the Analyzer Offline

The P-600 Salt in Crude Analyzer may be taken offline either locally or remotely.

Locally

From the Main Menu, under Analysis Status, tap the Up or Down Arrow key with the magnetic pencil. When the message box appears, confirm your choice with Enter key to toggle the status to offline mode.



Remotely

The Analyzer may also be taken offline via an optional remote dry contact digital input closure (see Chapter III). 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.
Modbus communication can also be used to control analyzer status.

Validation

If the Analyzer is equipped with the Validation option, it will run a series of standard test cycles on a known product when validation is requested. A passed validation is considered if the test results of two consecutive readings, within maximum numbers of five attempts, are within a programmable bandwidth of a programmable expected value.

Example:

Programmed Expected Value (In System Settings Screen): 8 PTB
Programmed Margin (In System Settings Screen): 1 PTB
Results from Validation Test #1: 6.9, 7.6, 6.8, 8.4, 9.1 = FAIL
Results from Validation Test #2: 6.9, 7.6, 7.9 = PASS

Request of Validation

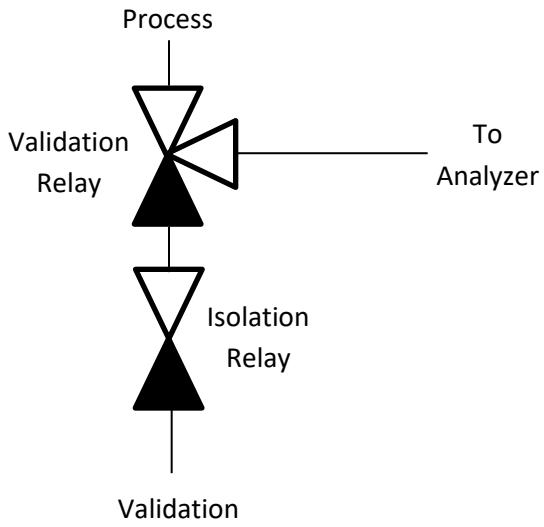
The validation protocol is a requested procedure which does not take precedence in the operational hierarchy. Therefore, the current cycle will always complete before moving to the validation protocol. Validation is requested by writing a command (value = 1) to the associated MODBUS address (see current MODBUS map for exact address). Alternatively, a local validation can be requested from the Validation History menu at the local analyzer display. If done locally, the analyzer will ask the user to confirm if they want to do this (ENTER = Yes, ADVANCE = No/Cancel).

Validation Supplied Hardware & Its Function

Two relays (SPDT, 250VAC, 6A rating) can be used for validation logic. They have been designated as “Validation” and “Isolation”. The inputs (coils) of these relays will be activated automatically by the analyzer

software. It is assumed that the output terminals will be connected to energize externally located solenoid valves. Their function is as follows:

- Following the validation request and completion of the current cycle, the “Validation” Relay will be activated during the entire validation protocol. Its purpose is to choose between the process sample and the validation sample.
- During the validation protocol, the “Isolation” Relay will be activated only at times necessary to place fresh sample into the crude loop. Its purpose is to limit the amount of validation fluid being consumed by the test.
- Pictorially, it would be as shown below:



Pre-Rinse State

The analyzer allows the user to program in a time period for a pre-rinse command. This variable is located in the Factory Setup menu. This will allow the sample loop to initially fill with validation product prior to measurement and the time variable is dependent on the distance of the validation container to the analyzer inlet as well as the supplied volumetric flowrate.

Post Clean

After completion of the validation protocol, the analyzer will run a cell clean before returning to process fluid measurements.

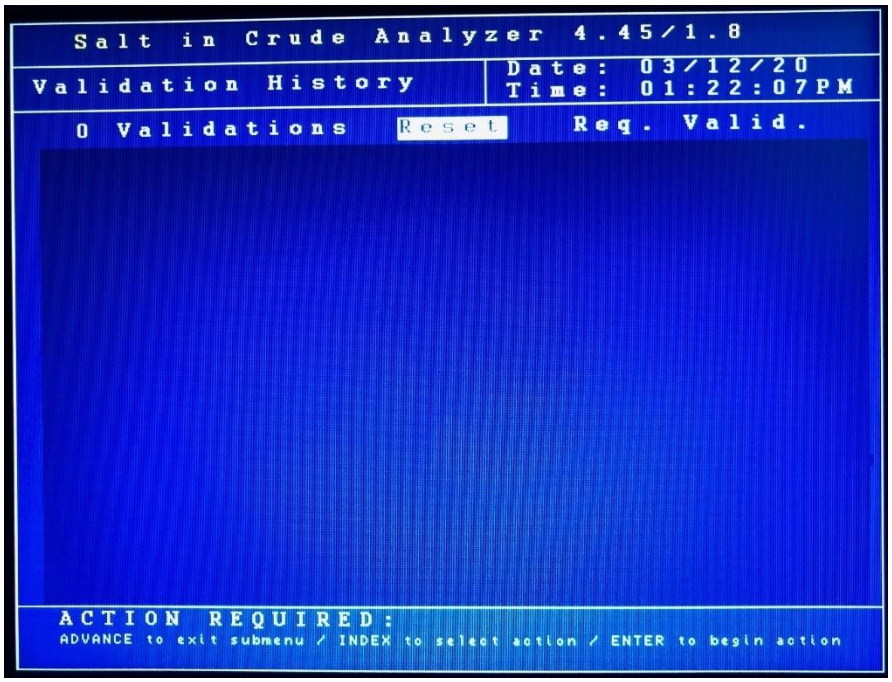
Validation Results

In the Validation History Menu, the results of the validation are listed and color coded.
RED = FAIL,
GREEN = PASS.

If the analog output channel is programmed as such, the last measured value will be transferred.

If one of the three programmable relays are programmed to “Validation”, the relay will energize upon the first successful validation protocol and will remain on until the system power is cycled or there is a failed validation protocol.

There is also a MODBUS register which will communicate a “PASS” or “FAIL” status (see current MODBUS map for exact address).



Sample Streams

On Analyzers equipped with the stream switching option, the sample stream being analyzed can be changed from 1 to 2 via a control room digital input contact closure (see Chapter III). When the signal is removed, the instrument goes back to analyzing stream 1.
The Analyzer can also be programmed to alternate between two streams (see Chapter IV).

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 Chapter IV) 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.

	**NOTE: 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.**

Internal Sample Leak

The Analyzer incorporates a sample leak detector (Figure 5-1) 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.

Figure 5-1: Leak Detector

Chapter VI: Maintenance & Service

	**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.**

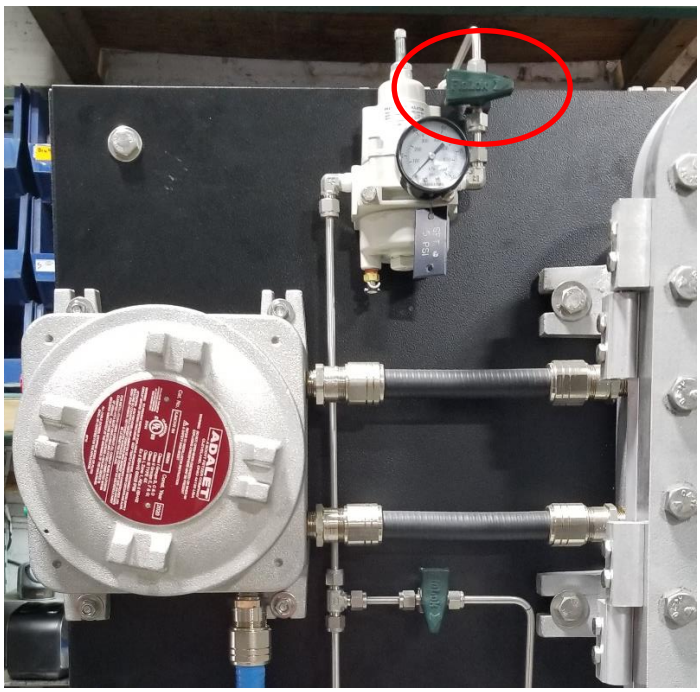
Recommended Routine Maintenance Schedule

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

Filling Solvent Tank Assemblies

In order to fill the solvent tank assemblies:

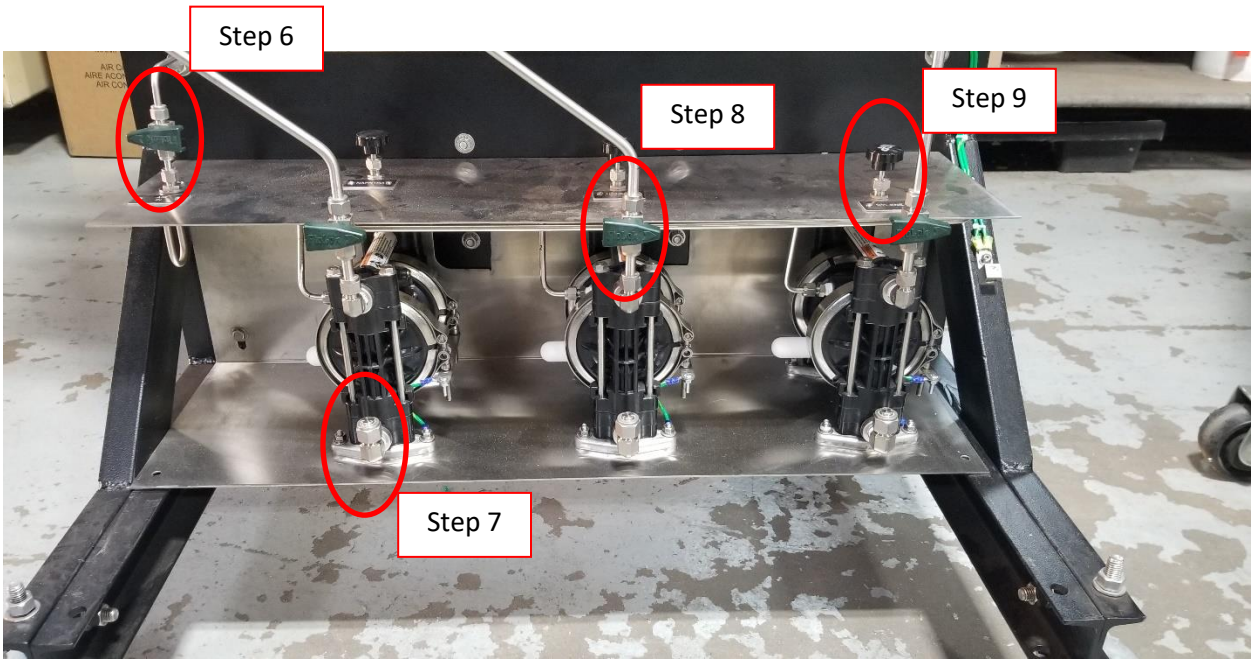
1. Turn the analyzer offline.
2. Navigate to the service screen.
3. Turn off the tank air pressure. This is done via the valve after the upper regulator between the upper enclosure and the customer connection box (see below).



4. Bleed off existing tank pressure. This is done via the valve on the right side of the tank assemblies (can vary) when facing the rear of the unit (see below).

5. If you have a filling station installed on your system, skip to step 6. Otherwise remove the plugs at the top of the tank and carefully pour your solvent into the tank. Use the color-coded liquid level indicators on the tank's front face as a guide. Repeat for other tanks as necessary. The tanks hold roughly 10 gallons (37.8 liters). Replace the plugs when finished and skip to step 10.
6. Make sure the air supply to the solvent filling station is on (see below).
7. Connect a flexible tube (Teflon or braided SS) from the filling station pump (pumps are labeled per solvent - 1/2" Swagelok connection) to your solvent holding vessel (see below).
8. Open the supply valve (positions vary) (see below).

9. Slowly open the needle valve labeled with the correct solvent (see below). The pump will make a "knocking" sound when pumping. When the liquid has been completely pumped, the "knocking" sound will speed up.
10. Close the needle valve from step 9.
11. Close the supply valve from step 8.
12. Remove the flexible tube from step 7 and replace cap.
13. Close air supply valve from step 6 (optional).



14. Close the tank bleed valve from step 4.
15. Open tank pressure valve from step 3.
16. Bleed solvent lines per Chapter 3.
17. You are now ready to resume operations.

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.

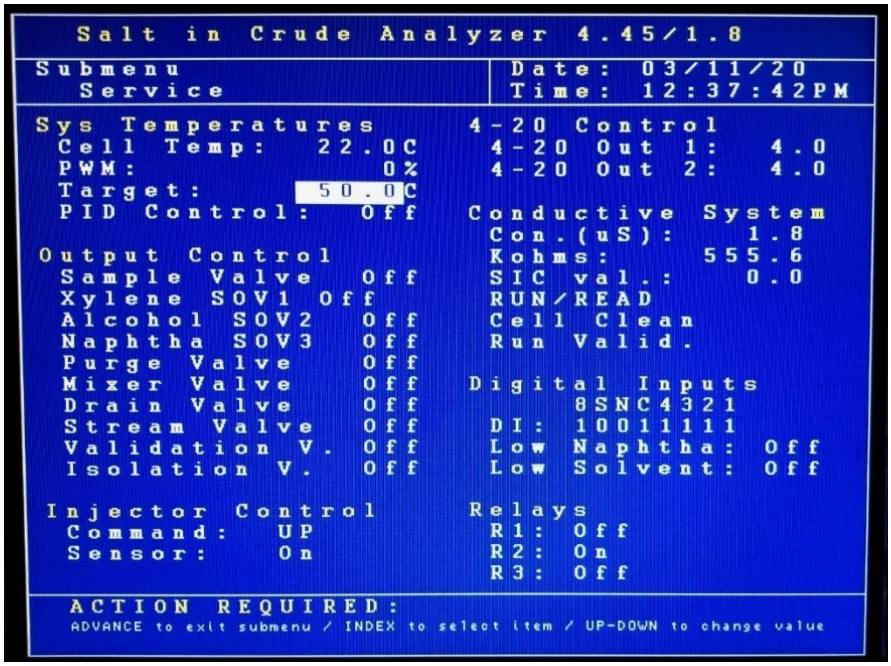
Entering the Service Screen requires the Analyzer to be offline; if it is online, it will automatically be taken offline when the Service menu is accessed. To prevent you from inadvertently taking the Analyzer offline, the message box appears for confirmation.

The Service screen is divided into following sections:

- **Sys Temperatures**
  Cell Temp – displays current cell temperature;
  PWM – displays current power (in %) to TE Peltier modules;

Target – set point temperature for the measurement cell. Can be changed for testing.

PID Control – automatic cell heater control (ON / OFF).



- **Output Control**

  Sample Valve – allows you to activate (ON) and deactivate (OFF) the sample loop;

  Xylene SOV1 – controls the flow of sample and solvent to the syringe (OFF = from solvent lines; ON = to detection cell. See Figure 6-1.

  Alcohol SOV2 – controls the flow of alcohol and/or xylene and naphtha to the Xylene SOV1 solenoid valve. See Figure 6-1.

  Naphtha SOV3 – controls the flow of xylene or naphtha to Alcohol SOV2;

  Purge Valve – controls the solenoid that pressurizes the detection cell;

  Mixer Valve – controls the flow of instrument air to the sample loop and measurement cell;

  Drain Valve – allows you to open (ON) and close (OFF) the drain solenoid.

  Stream Valve – controls external stream solenoid valve (not a standard setup);

  Validation V. – controls external validation solenoid valve (not a standard setup);

  Isolation V. – controls external isolation solenoid valve (not a standard setup);

- **Injector Control**

  Command – allows you to move the injector Up and Down;

  Sensor – displays the status of the syringe sensor. It should read ON when the injector is up and OFF when the injector is down;

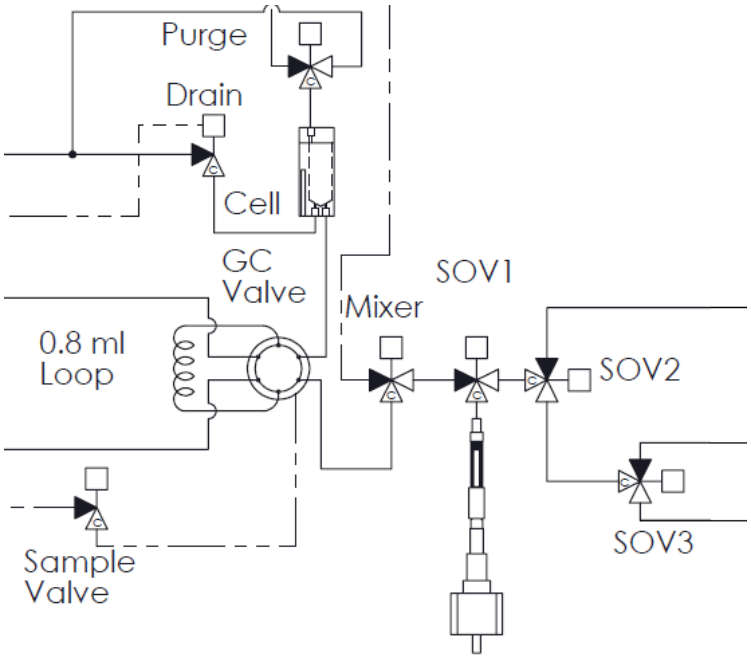


Figure 6-1: Internal Solenoid Valves

- **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 channel. 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 channel. Use the up/down arrow keys to increase/decrease the output value.

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

- **Conductivity System**
  - *Con. (uS) –* display last conductance reading;
  - *Kohms –* for Factory use only;
  - *SIC val. –* displays calculated salt in crude value;
  - *RUN/READ –* command to take conductance reading;
  - *Cell Clean –* command to run cell clean with Naphtha;
  - *Run Valid. –* command to run single validation cycle;

- **Digital Inputs**
  - *DI –* digital input status from high (8) to low (1); 0 = off, 1 = on;
  - *Low Naphtha –* *Naphtha's tank level switch status (Off = tank filled, On = tank empty);*

Low Solvent – *Solvent's tank (Xylene or Alcohol) level switch status (Off = tank filled, On = tank empty);*

- **Relays**
  - *R1 –* relay1 command (Off = deenergized, On = energized);
  - *R2 –* relay2 command (Off = deenergized, On = energized);
  - *R3 –* relay3 command (Off = deenergized, On = energized);

Calibration

This Analyzer's menu allows you to create custom calibration table. The maximum size of the table is 10 data points. The Analyzer's software will use that table to perform quadratic regression in order to find the formula for calculating Salt in Crude concentration.

	**NOTE: Bartec Orb recommends a minimum of four calibration samples (data points) for calibration table.**

Calibration submenu consists of the following menu items:

- **Value –** concentration value of a standard used for calibration cycle;
- **Start Cal Cycle –** command to initiate calibration cycle;
- **Default Table –** load saved table from flash memory. The table can be saved to memory from Factory screen;
- **Reset Table –** clear the whole table;
- **SiC Offset –** offset applied to the final measurement result (-5.0 to 5.0);
- **Entries –** number of data point for calibration table;
- **SiC –** Salt in Crude concentration value (y point);
- **Conductance –** Conductance value (x point);
- **Delete –** command to delete data line in the same row.

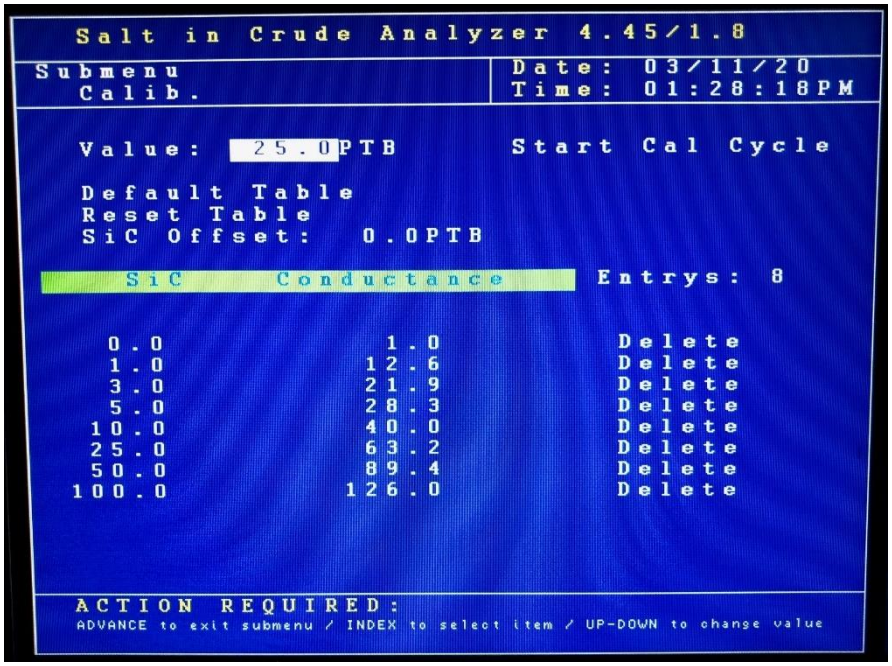
Calibration is performed as follows:

1. Connect sample to Crude Oil sample loop.
2. Set concentration value of a standard sample that's going to be used for calibration.
3. Index to "Start Cal Cycle" and tap Enter key. Confirm your selection.
4. The analyzer will run 3 standard cycles, average results, and input that value to the table.
5. The results should be similar. Run calibration at least twice to confirm.
6. Repeat the steps for other standards. Modify the table if needed by removing or adding entries.

Other Calibration method:

1. The zero value should remain consistent from factory calibration but can always be re-run by circulating de-salted neutral oil through the analyzer.
2. Run the Analyzer on the process line and note conductance reading from the Run screen. At the same time, get the Salt in Crude concentration from the lab and manually input those values into the calibration table.

3. The other data point should be outside the expected range and can be obtained through linear extrapolation (most calibration curves seen are linear or near linear).



Example (0-75 PTB calibration):

Take conductance for “0” Salt in Crude concentration from the current table or Factory QIR.
Take conductance reading from Main run screen and Salt in Crude concentration from the lab.
Use the following formula to calculate higher Salt in Crude concentration data point:

Slope = ($Conductance_2$ - $Conductance_1$) / (SiC_2 - SiC_1)
Intercept = 15.8 (zero point)
Calculated Conductance = Desired SiC x Slope + Intercept

Slope = (53.8 – 15.8) / (32 – 0) = 1.1875
Calculated Conductance = 75 x 1.1875 + 15.8 = 104.9 (rounded up)

SiC (PTB)	Conductance (µS)
0	15.8
32 (from the Lab)	53.8 (from the Analyzer)
75 (new point)	104.9 (calculated)

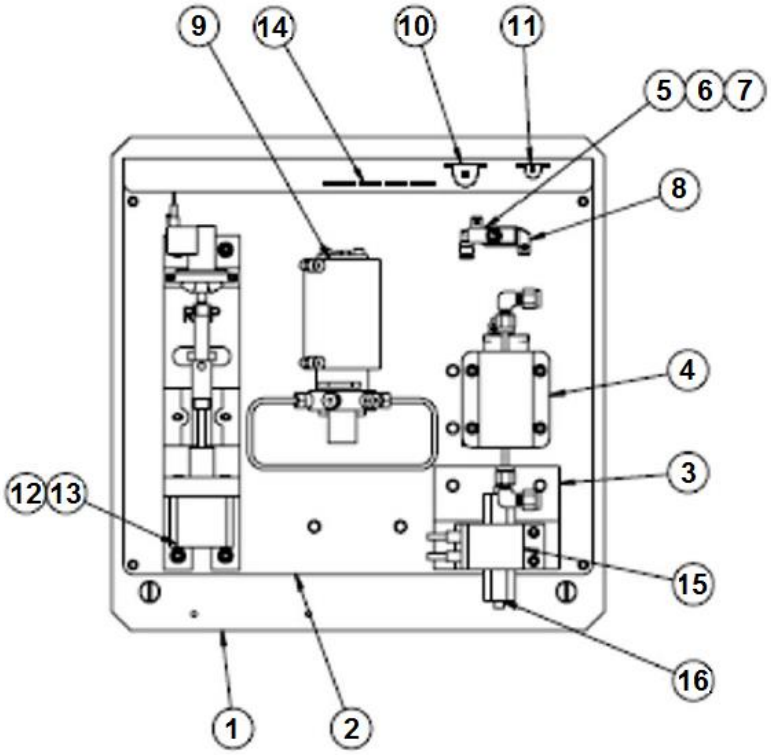
Troubleshooting

Problem / Symptom	Cause	Corrective Action
Display blank	No electrical power to the Analyzer	Apply electrical power
	Screen saver activated	Touch keypad with magnetic pencil
	Faulty display or display PCB	Replace as required

Problem / Symptom	Cause	Corrective Action
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 Faulty RTD Faulty TE module	Provide proper ambient conditions or increase cell temperature set point Replace as required Replace as required
Salt concentration result too low	No sample Faulty electrode	Check sample line for blockage and clear as required Check sample valve for proper operation and replace as required 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 Faulty syringe Faulty solvent valve Faulty mixer valve No or insufficient air supply Incorrect valve wiring	Drain solvent tank and replace with correct solvent mix Check and replace as required Check and replace as required Check and replace as required Check and correct as required Consult Bartec Orb

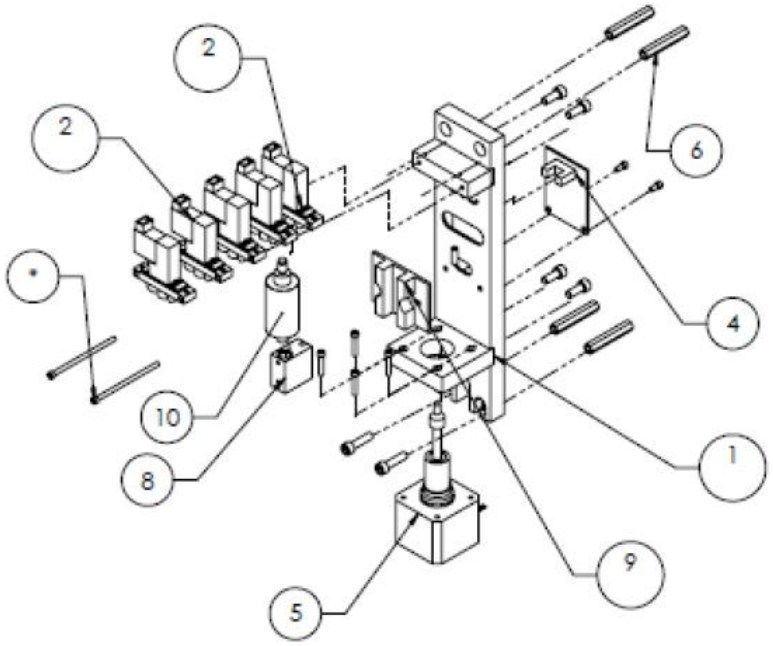
Assembly Drawings

MEASUREMT ENCLOSURE



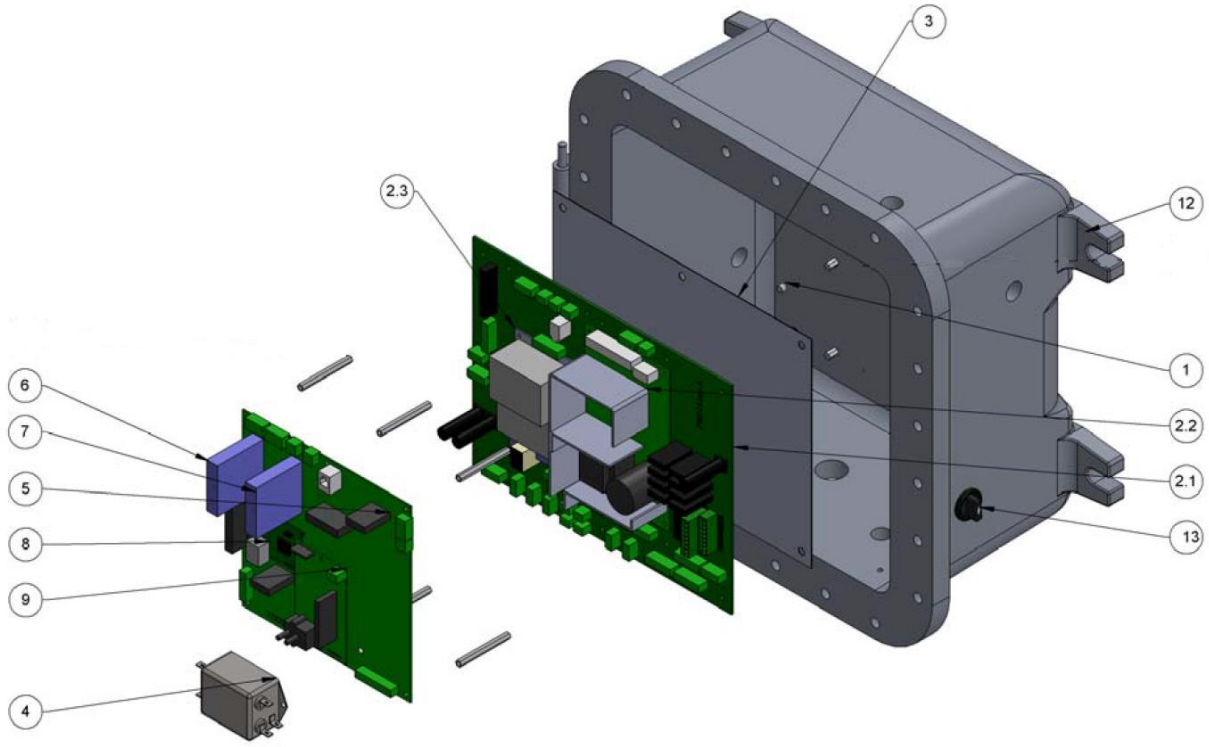
Item No.	Quantity	Part Number	Description
1	1	700524	Exp Proof Analyzer Enclosure Back Plate
2	1	700792	Detection Cell Back Plate
3	1	700796	Drain Solenoid Bracket
4	1	701389	Measurement Assembly
5	1	650019	4-way Air Solenoid Valve
6	1	650218	1/8” Quik-Connect Elbow
7	1	650219	1/8” Quik-Connect
8	1	650199	4-way Air Solenoid Bracket
9	1	650184	6-port Spider Valve
10	1	600001	5 Ohm / 50 Watt Resistor (TE modules)
11	1	600002	33 Ohm / 10 Watt Resistor (Stepper Motor)
13	1	702653	Syringe & Valve Assembly
14	1	798078	SIC / Interconnection PCB Assembly
15	1	651006	SIC Air Operated Drain Valve
16	2	650142	1/8” Adapter Bushing / Cover

STEPPER MOTOR ASSEMBLY



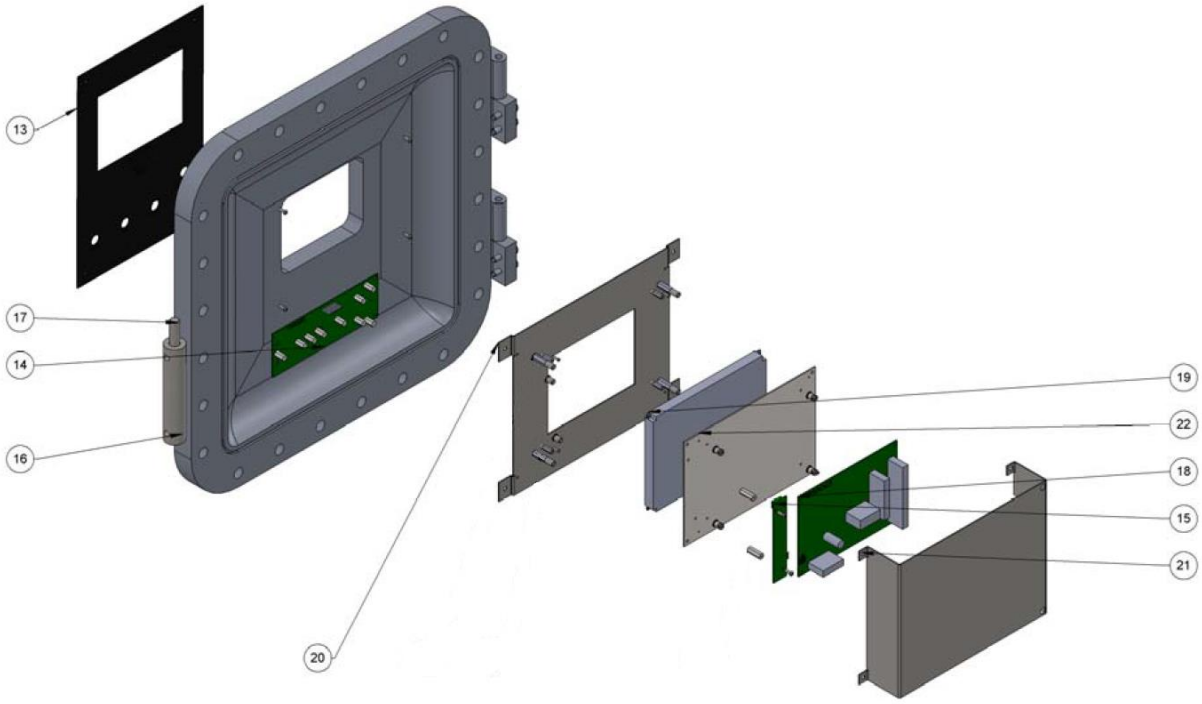
Item No.	Quantity	Part Number	Description
1	1	702654	SIC Stepper Motor Assembly
2	5	651139	3 Way Solenoid
4	1	700100	Optical PCB
5	1	640001	Stepper Motor
8	1	702213	Syringe Adapter
9	1	702202	Syringe Guide
10	1	690024	5 mL Syringe

UPPER CONTROL ENCLOSURE



Item No.	Part Number	Description	Qty
1	701910	Mounting Plate for Main PCB	1
2.1	798115	Main Power Distribution PCB	1
2.2	620038	Power Supply (+24 VDC)	1
2.3	620037	Power Supply (+5, +/- 12VDC)	1
3	701911	Fish Paper for Main PCB	1
4	620076	Line Filter	1
5	700318	Main PCB	1
6	620081	RTD Input Module (0 – 100°C)	1
7	620080	4-20mA Output Module	1
8	600025	Rabbit Microprocessor	1
9	798177	Salt-in-Crude Adapter PCB	1
12	700298	Upper Enclosure (Modified)	1
13	620149	Selector Switch	1

CONTROL ENCLOSURE DOOR



Item No.	Part Number	Description	Qty
13	701321	Keypad Overlay	1
14	798030	Magnetic Keypad	1
15	620600	Backlight Driver PCB	1
16	700348	Magnetic Pencil Holder	1
17	700701	Magnetic Pencil Assembly	1
18	798063	Display Controller PCB	1
19	620583	Graphics Display	1
20	702972	Display Bracket	1
21	700793	Display Cover	1
22	700062	Display Mounting Plate	1

Chapter VII: Spare Parts

Spare Parts Kits

Description	Part Number
1-YEAR PARTS KIT	**700641**
3-way Solenoid (5 each)	651139
4-way Solenoid (1 each)	650019
Drain Solenoid (1 each)	651006
5 mL Syringe (2 each)	690024
Salt-in-Crude Tubing Kit (1 each)	700633
2-YEAR PARTS KIT	**700642**
3-way Solenoid (5 each)	651139
4-way Solenoid (1 each)	650019
Drain Solenoid (1 each)	651006
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 (250VAC, 15A)	1	600051
Fuse (250VAC, 10A)	2	600052
Power Supply (+5, +/- 12VDC)	1	620037
Syringe Stepper Motor	1	640001
3-way Solenoid	1	651139
RTD Sensor	1	660001
Optical PCB	1	700100
Graphics Display Assembly	1	620583
Backlight Driver PCB	1	620600
Cable Assembly	1	700289
Main Control PCB	1	700318
Power Supply, +24 VDC	1	620038
4-way Solenoid	1	650019
Drain Solenoid	1	651006
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 Adapter PCB Assembly	1	798177
Display Controller PCB	1	798063
Salt-in-Crude Interconnect PCB	1	798078
Main Distribution PCB	1	798115