



**ATEX Zone 1 II B + H2 T6**

**NEC Class 1 Div 1 Group B, C + D**



# *Process Analyzer* **User Manual**

**P-700 REID VAPOR PRESSURE ANALYZER**

## **FOREWORD**

---

### **FOREWORD**

Table of Contents .....	i
Warranty .....	v

### **INTRODUCTION - SECTION 1**

Analyzer Overview .....	1-1
Principle of Operation.....	1-1
Component Identification .....	1-3
Front View.....	1-3
Control Enclosure .....	1-4
Measurement Enclosure.....	1-5
Menu Structure.....	1-6

### **SPECIFICATIONS - SECTION 2**

Models.....	2-1
Performance.....	2-1
Sample Requirements.....	2-2
Signal Inputs/Outputs.....	2-2
Utility Requirements .....	2-2
Analyzer Enclosure .....	2-2
Available Options and Accessories.....	2-3

### **INSTALLATION AND STARTUP - SECTION 3**

Site Requirements.....	3-1
Location .....	3-1
Mounting.....	3-1
Piping .....	3-3
Process Sample Lines.....	3-5
Validation Sample Line.....	3-5
Measurement Cell Purge Air Line.....	3-5
Measurement Cell Drain.....	3-5
Wiring .....	3-6
Electrical Power.....	3-6
Control Room Signals.....	3-7
Analog Output .....	3-7
Relay Output .....	3-7
Serial Output .....	3-7
Modbus .....	3-7
Dry Contacts .....	3-7
Customer Alarm.....	3-8
Remote Standby.....	3-8
Validation Request .....	3-8
Stream Select .....	3-8
Startup.....	3-8

**PROGRAMMING – SECTION 4**

Main Run Screen ..... 4-1

Menu Navigation ..... 4-1

    Advance Screen Key ..... 4-2

    Index Key ..... 4-2

    Enter Key ..... 4-2

    Up/Down Arrow Keys ..... 4-2

Main Menu ..... 4-2

    Analyzer Status ..... 4-2

    Alarm History ..... 4-2

    Validation History ..... 4-2

    Service ..... 4-3

    Setup ..... 4-3

    Security ..... 4-3

Setup Sub-Menu ..... 4-3

    Output Settings ..... 4-4

        4-20 Out 1 / 4-20 Out 2 / 4-20 Out 3 ..... 4-4

        RVP History ..... 4-4

        Validation ..... 4-5

        Absolute Cell Pressure ..... 4-5

        Cell Temperature ..... 4-5

    Alarm Settings ..... 4-6

        Stream 1 ..... 4-6

        Stream 2 ..... 4-6

    Other Settings ..... 4-7

        General Settings ..... 4-7

            Stream Select ..... 4-7

            Stream Delay ..... 4-7

            OP Mode ..... 4-7

            Pressure Units ..... 4-7

            Temperature Units ..... 4-7

            Standby Mode ..... 4-7

            Come Read ..... 4-8

            Number Cycles ..... 4-8

            Maximum Cycles ..... 4-8

            Heater SP ..... 4-8

        Validation Settings ..... 4-8

            Validation Expected Value ..... 4-8

            Validation Bandwidth ..... 4-8

        Pressure Factors ..... 4-8

            Slope ..... 4-8

    Digital Inputs ..... 4-8

        Customer Alarm ..... 4-8

        Remote Standby ..... 4-8

        Stream Select ..... 4-8

        Validation ..... 4-8

    Screen Saver ..... 4-8



- Reload Defaults ..... 4-8
- Relays ..... 4-9
  - Relay..... 4-9
  - Choice..... 4-9
  - Conditions..... 4-9
- Communications ..... 4-10
  - Serial Port C..... 4-10
  - ModBus ..... 4-10
  - Serial Port B ..... 4-10
  - Ethernet Setup ..... 4-10
- RVP Air State Table ..... 4-11
- Time/Date Setup..... 4-13
- Factory Setup ..... 4-13

**NORMAL OPERATION – SECTION 5**

- Main Run Screen ..... 5-1
  - Analysis Results ..... 5-1
  - Date & Time..... 5-1
  - History Display..... 5-1
  - Message Line ..... 5-1
  - Component Status..... 5-1
  - Operational Parameters ..... 5-1
- 4-20 mA Analog Output..... 5-2
- Serial Output ..... 5-2
- Modbus Output..... 5-3
- Alarms ..... 5-3
  - Types of Alarm Conditions ..... 5-3
    - Warning..... 5-3
    - Critical ..... 5-3
    - Come Read..... 5-3
    - Maintenance..... 5-3
    - Informational ..... 5-3
- Alarm History..... 5-4
- Taking the Analyzer Off-Line..... 5-4
  - Locally..... 5-4
  - Remotely..... 5-4
- Performing a Validation Measurement..... 5-4
  - Validation History..... 5-4
- Switching Sample Streams ..... 5-5
- Loss of Power Restart..... 5-6
- Internal Sample Leak ..... 5-6

**ROUTINE MAINTENANCE & SERVICE – SECTION 6**

- Recommended Routine Maintenance Schedule ..... 6-1
- Service and Operational Checks ..... 6-1
  - Output Control ..... 6-2
  - Functions ..... 6-2
  - Digital Inputs ..... 6-2



4-20 Control ..... 6-3

  Injector ..... 6-3

  Cell Temperature Control ..... 6-3

  Barometer ..... 6-3

  Cell Pressure ..... 6-3

  Cell Temperature ..... 6-3

Troubleshooting ..... 6-4

Calibration ..... 6-5

Component Replacement ..... 6-7

  Syringe Replacement ..... 6-7

  Adjusting the Syringe Zero Point ..... 6-9

  Tubing Replacement ..... 6-11

Leakage Troubleshooting ..... 6-13

Assembly Drawings ..... 6-14

  Measurement Enclosure ..... 6-14

  Control Enclosure ..... 6-15

  Control Enclosure Door ..... 6-16

  Syringe Assembly ..... 6-17

  Micro Filter Assembly ..... 6-18

**SPARE AND REPLACEMENT PARTS – SECTION 7**

Spare Parts Kits ..... 7-1

Replacement Parts ..... 7-2

**DRAWINGS AND SCHEMATICS – SECTION 8**

Figure 8-1 Dimensional Drawing ..... 8-1

Figure 8-2 Flow Schematic ..... 8-2

**APPENDIX — SECTION 9**

Crude Oil Sampling System ..... 9-1

  General Description ..... 9-1

  Principle of Operation ..... 9-2

    Recharging ..... 9-2

    Analysis ..... 9-2

  Recommended Routine Maintenance Schedule ..... 9-3

  Micro-Filter Cleaning ..... 9-3

ModBus Map ..... 9-5



## **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

This manual serves as the operator's guide for BARTEC-ORB P-700 RVP Analyzer.

### ANALYZER OVERVIEW

The BARTEC-ORB Model P-700 RVP Analyzer is on-line instrument designed for the continuous measurement of Reid Vapor Pressure in hydrocarbon product streams such as gasoline, crude oil, and petroleum condensate.

Extremely rugged and simple to operate, this compact Analyzer combines rapid analysis, exceptional measurement accuracy, and unmatched operational dependability to deliver highly reliable and repeatable measurements day in, day out, month after month.

- Rapid analysis — 5 minutes or less typical cycle time.
- Superior repeatability — RVP  $\pm 0.05$  PSI (0.0035 bar) or better
- Exceptional uptime — 99% or better.

For optimum installation and applications versatility, the P-700 RVP Analyzer incorporates a wide variety of standard features, including:

- Isolated 4-20 mA analog outputs.
- RS232 or optional RS485 serial output.
- Dry contact alarm relays.
- Optional ModBus output.
- Separate control and measurement enclosures.
- NEC Class 1, Division 1, Group C, D or European ATEX Zone 1, Group II hazardous area classification.

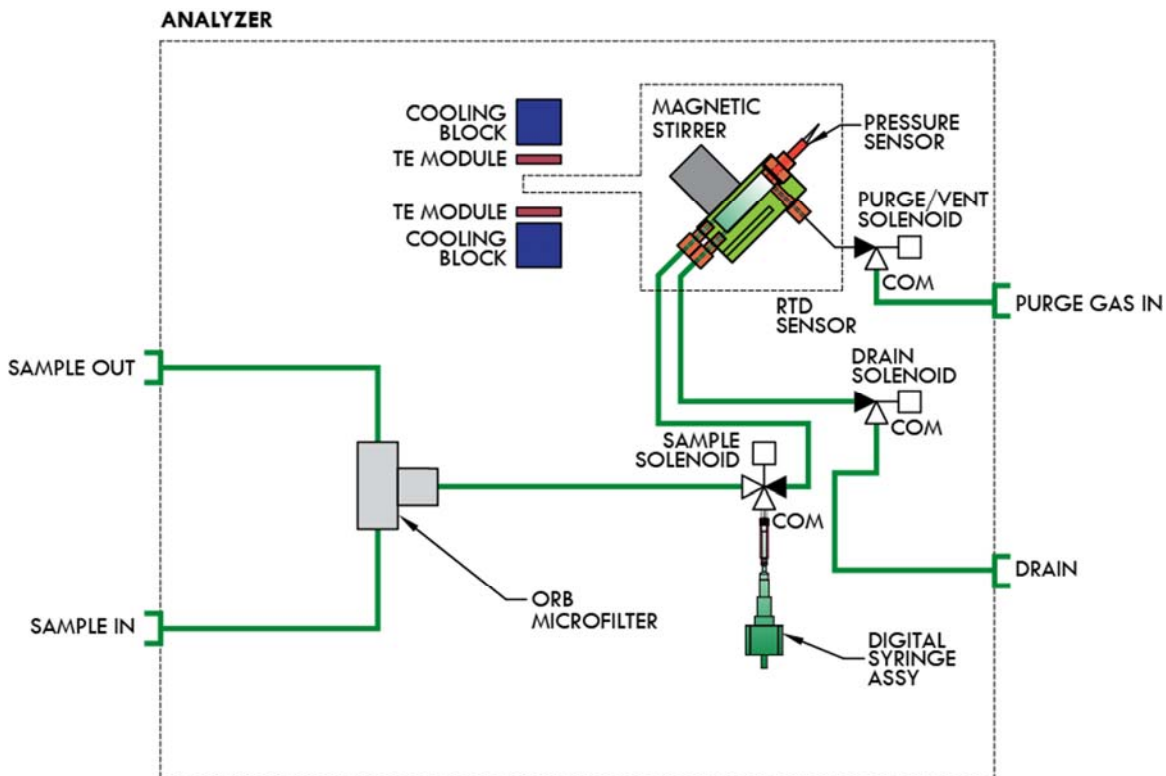
### PRINCIPLE OF OPERATION

The P-700 RVP Analyzer's measurement cycle is based on ASTM D-323, D-4953, and D-5482 and correlates to D-5191. It utilizes a digitally-controlled syringe sampling system, micro-volume solenoid valves, and an angled, temperature-controlled measurement cell with magnetic stirrer and high-resolution pressure sensor to precisely meter sample and measure vapor pressure. As with the ASTM methods, the P-700 RVP Analyzer uses a 4:1 gas to fluid ratio and a 100°F (37.8°C) test temperature.

A typical measurement cycle takes about five minutes and is performed as follows:

1. The sample drain and measurement chamber vent valves are opened and the sample chamber evacuated. To ensure the complete removal of all fluid and vapors, cell purge is applied.
2. The measurement chamber and pressure sensor are normalized and the measurement baseline established.
3. The sample syringe draws a known gas volume from the measurement cell, thus creating a partial vacuum.
4. The sample syringe injects a known volume of sample into the measurement cell, establishing the required 4:1 ratio of gas to fluid.
5. Sample solenoid to measurement cell closes and the measurement cycle is initiated.
6. Prior to the measurement phase, a magnetic stirrer is activated and operated for the duration of the analysis cycle.
7. When equilibration is achieved, the final pressure measurement is taken and the results displayed on the local readout. A corresponding analog signal is also generated.
8. Purge gas and drain solenoids to the measurement cell open to remove spent sample from measurement cell.

9. Purge gas solenoid closes, allowing measurement cell pressure to stabilize at atmospheric.
10. Analyzer auto-zeros pressure sensor.
11. New measurement cycle initiated.

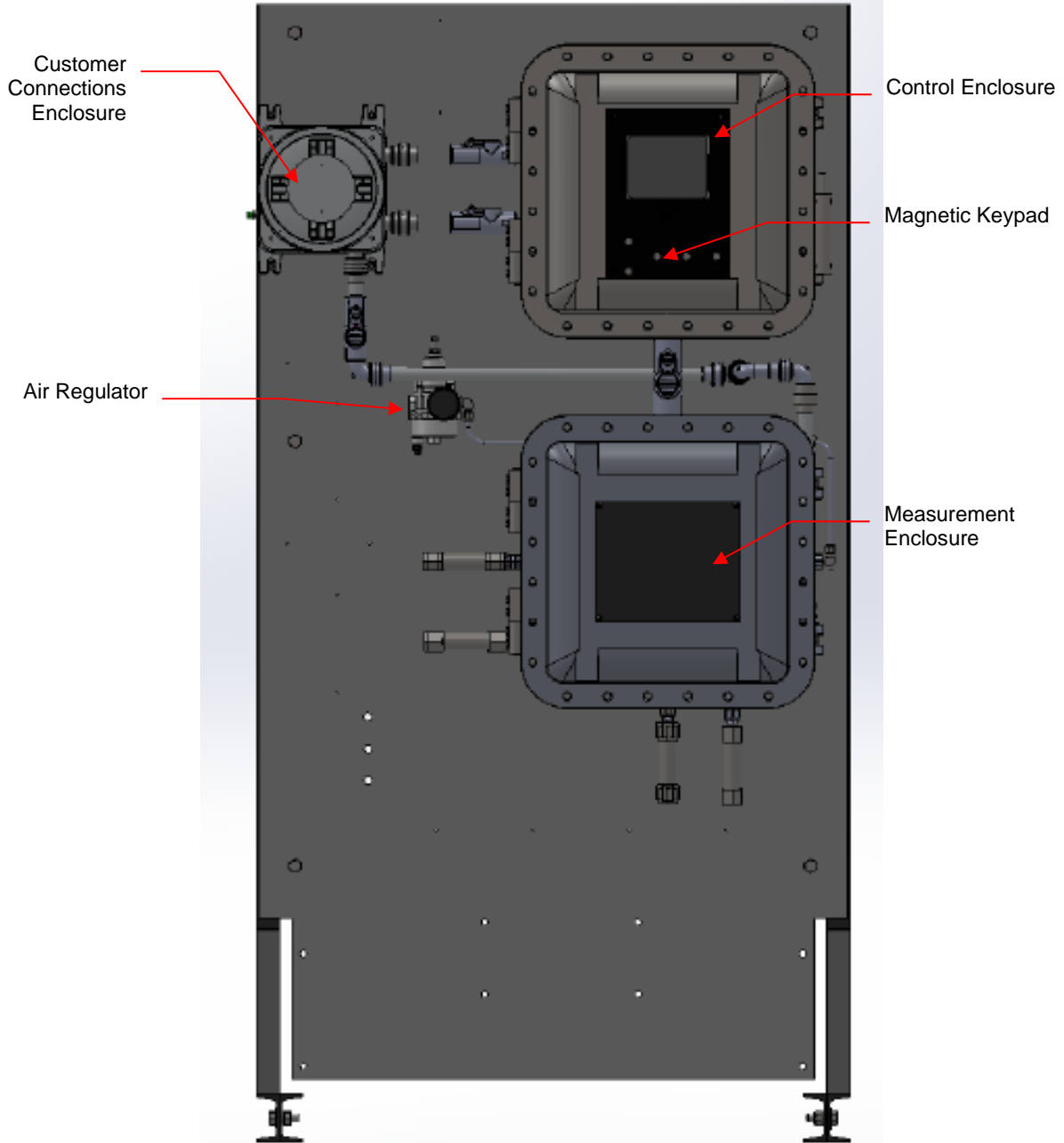


**Figure 1-1:**  
**P-700 RVP Analyzer Flow Schematic**



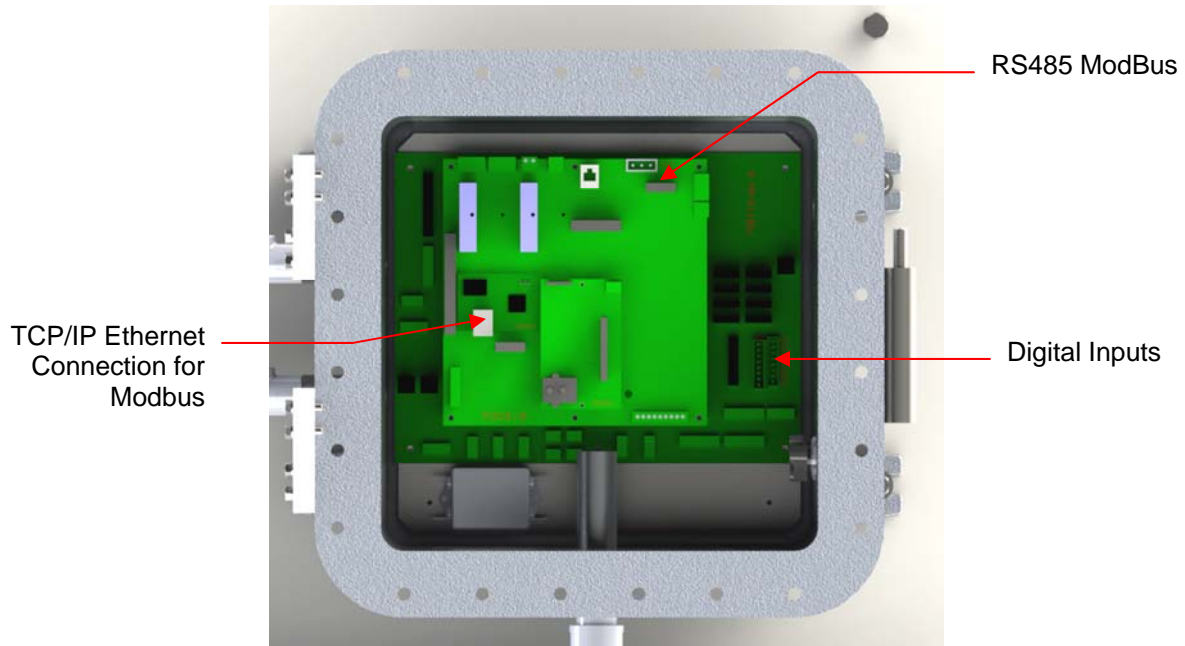
**COMPONENT IDENTIFICATION**

**FRONT VIEW**



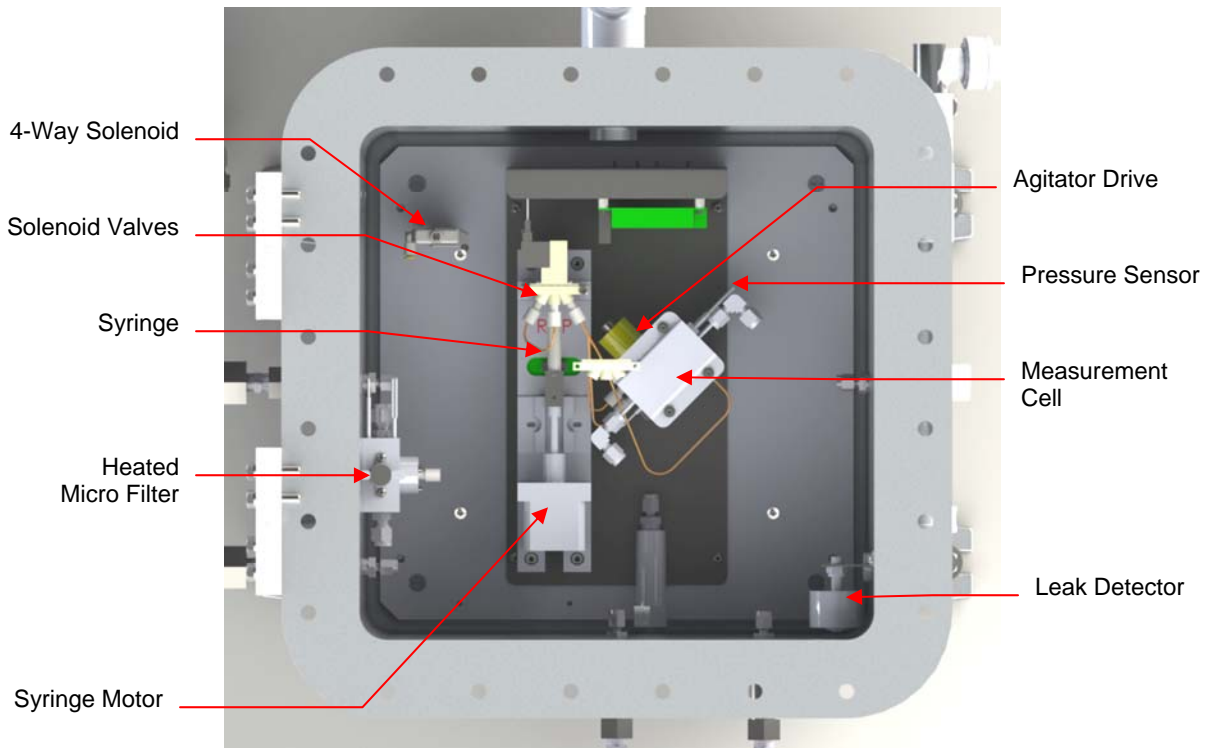
**Figure 1-2: Front View**

**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
Validation History	—	—	Display only
Service	—	Output Control Functions Digital Inputs 4-20 Control Injector Cell Temperature Control Barometer Cell Pressure Cell Temperature	Used to verify operation of various components Used to initiate cell rinse, cell clean, and filter clean cycles Displays status of the digital inputs Outputs external calibration signal Used to verify operation of sample injector Used to verify operation of TE modules Display only Display only Display only
Setup	Output Settings	4-20 Out 1 4-20 Out 2 4-20 Out 3 RVP History Validation Absolute Cell Pressure Cell Temperature	4 mA value / 20 mA value / offset 4 mA value / 20 mA value / offset 4 mA value / 20 mA value / offset Enable / Disable / Scale Enable / Disable / Scale Enable / Disable / Scale / Period Enable / Disable / Scale / Period
	Alarm Settings	Warning Alarms RVP Stream 1 RVP Stream 2 Critical Alarms Remote Standby	Low Alarm / High Alarm Low Alarm / High Alarm Enable / Disable
	Other Settings	General Stream Select Stream Delay OP Mode Pressure Units Temperature Units Standby Mode Come Read Number Cycles Max Cycles Heater Setpoint Validation Validation EV Validation BW Pressure Factors Slope Digital Input Customer Alarm Remote Standby Stream Select Validation	Stream 1 / Stream 2 / Alternate / Auto Select Time delay when Alternate is selected RVP-323 PSI / hPa / kPa / kg/cm <sup>2</sup> / bar °F / °C ON / OFF Amount of time the relay is activated Display only – current number of cycles run Sets number of cycles for Maintenance reminder Heater setting for optional micro filter Expected value of validation sample Acceptable range of validation sample Calibration factor applied to unit's pressure readings Enable / Disable Enable / Disable Enable / Disable Enable / Disable

	Other Settings (continued)	Screen Saver Reload Defaults Relay Setup Relay Choice Condition	Sets screen saver activation time parameter Restores factory default settings  R1 / R2 / R3 Alarm Warning / Alarm Critical / Maintenance / Stream 1 / Stream 2 / Filter / Come Read RVP / In Validation / Validation Pass / Off Normal / Failsafe
	Communications Setup	Serial Port C Mode Period Rate ModBus ID Mode Serial Port B Rate Ethernet Setup Our IP Address Router Address Network Mask	R = Result / D = Data Dump Update frequency Baud rate  ID assigned to Analyzer Ethernet / ModBus  Display only  Analyzer IP address Address of router Analyzer is connected to Network mask address
	RVP Air State Table	—	Steps in measurement cycle
	Time/Date Setup	—	Time Format (12 or 24 hour) / Date Format (US or EU) / Date / Time
	Factory Setup	—	For factory use only
Security	—	—	Enable / Disable

[THIS PAGE INTENTIONALLY BLANK]

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

P-700-1100	For NEC Class I, Division 1, Group C and D areas.
P-700-1200	For ATEX Zone I, IIC + H2 T4 areas.
P-700-1400	NEC explosion-proof.

**PERFORMANCE**

RVP Measurement Range (user selectable)	0 to 35 PSI; 0 to 2.4 Bar 0 to 2413 mBar; 0 to 241.3 kPA; 0 to 2413 hPA. 0 to 2.46 Kg/cm <sup>2</sup>
Repeatability	±0.05 PSI (±0.0035 bar)
Reproducibility	±0.1 PSI (±0.007 bar)
Resolution	±0.01 PSI (±0.0007 Bar)
Measurement Accuracy	Meets or exceeds ASTM Methods D-323, D-4953, D-5482, and D-5191.
Pressure Accuracy	±0.01% of full scale
Temperature Accuracy	±0.1°C (±0.2°F) of full scale
Measurement Cycle Time	Less than 6 minutes
Operating Temperature Range	5°C (40°F) minimum; 40°C (105°F) maximum

### SAMPLE REQUIREMENTS

Sample Pressure	20 PSI (1.4 Bar) minimum; 35 PSI (2.4 Bar) maximum. Optional sample conditioning system available.
Sample Temperature	2°C (35°F) minimum; 40°C (105°F) maximum.
Sample Bypass Flow Rate	0.04 liters/minute minimum; 0.1 liters/minute maximum.
Sample Return Pressure	Atmospheric to 35 PSI (2.4 Bar) maximum. Optional high pressure sample recovery system available.
Sample Composition	Homogeneous, single-phase sample. Must be free of water or water moisture; particulate matter must be smaller than 10 µm. Optional sample conditioning system available.

### SIGNAL INPUTS/OUTPUTS

Analog Output	Up to three isolated 4-20 mA outputs.
Serial Communication	Bi-directional RS232 or RS485 (optional)
Relay Output	Three SPDT failsafe relay contacts rated at 3A resistive load at 250 VAC. May be wired for normally open or normally closed operation. Programmable for the following conditions: Measurement value alarm; system fault alarm; RVP measurement complete (come read); maintenance required; validation measurement in progress.
ModBus	Optional; consult BARTEC-ORB

### UTILITY REQUIREMENTS

Power	Auto-selecting 100 to 125 VAC (±10%) and 200 to 240 VAC (±10%), 50/60 Hz, single phase, 10A.
Measurement Cell Purge Air	Clean, dry instrument air supplied at a pressure of 25 PSI (1.7 BAR).

### ANALYZER ENCLOSURE

Dimensions (W x H x D)	610 x 940 x 242 mm (24.0 x 37.0 x 9.5 inches)
Weight	Approximately 272 kg (600 pounds)
Certification	CSA/US and CE certified
Hazardous Classification	Class I, Division I, Group B, C, and D, T6




**AVAILABLE OPTIONS AND ACCESSORIES**

Validation/Grab Sample System (p/n 700474)	For introducing or removing sample from system for validation purposes.
Dual Stream Sampling System (p/n 700475)	For analyzing two separate sample points, streams, or processes with a single analyzer.
Sample Conditioning System – Standard Panel Mount (p/n 700538)	Application specific. Customizable for free water, emulsified water, heavy and light particulates, below atmospheric sampling, environmental concerns, and sample temperature conditioning.
Sample Conditioning System – MPC Design (p/n 700537)	For areas with space constraints. Application specific. Customizable for free water, emulsified water, heavy and light particulates, below atmospheric sampling, environmental concerns, and sample temperature conditioning.
Sample Conditioning Panel (p/n 700495)	For sample pressures from 2.4 to 8.3 bar (35 to 120 psi) and sample particulate greater than 10 µm. Macro flow.
Micro Sample Recovery System (p/n 700172)	For sample return pressures from 2.5 to 8.3 bar (35 to 120 psi).
Macro Sample Recovery System (p/n 700228)	For sample return pressures from 2.5 to 24.1 bar (35 to 350 psi).
High Pressure Sample Recovery System (p/n 799482)	Consult factory.
Fast Loop Pump Assembly – NEC version (p/n 700720)	Consult factory.
Fast Loop Pump Assembly – ATEX version (p/n 700721)	Consult factory.
Filter Coalescer Assembly (p/n 700621)	Consult factory.
Free-standing Mounting Rack (p/n 700174-P820)	For installations where wall mounting is not possible or undesirable.

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

[THIS PAGE INTENTIONALLY BLANK]

**INSTALLATION AND STARTUP****SECTION 3**

	<b>WARNING:</b> 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**

The 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 Analyzer.

**LOCATION**

For ease of operation, the 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.

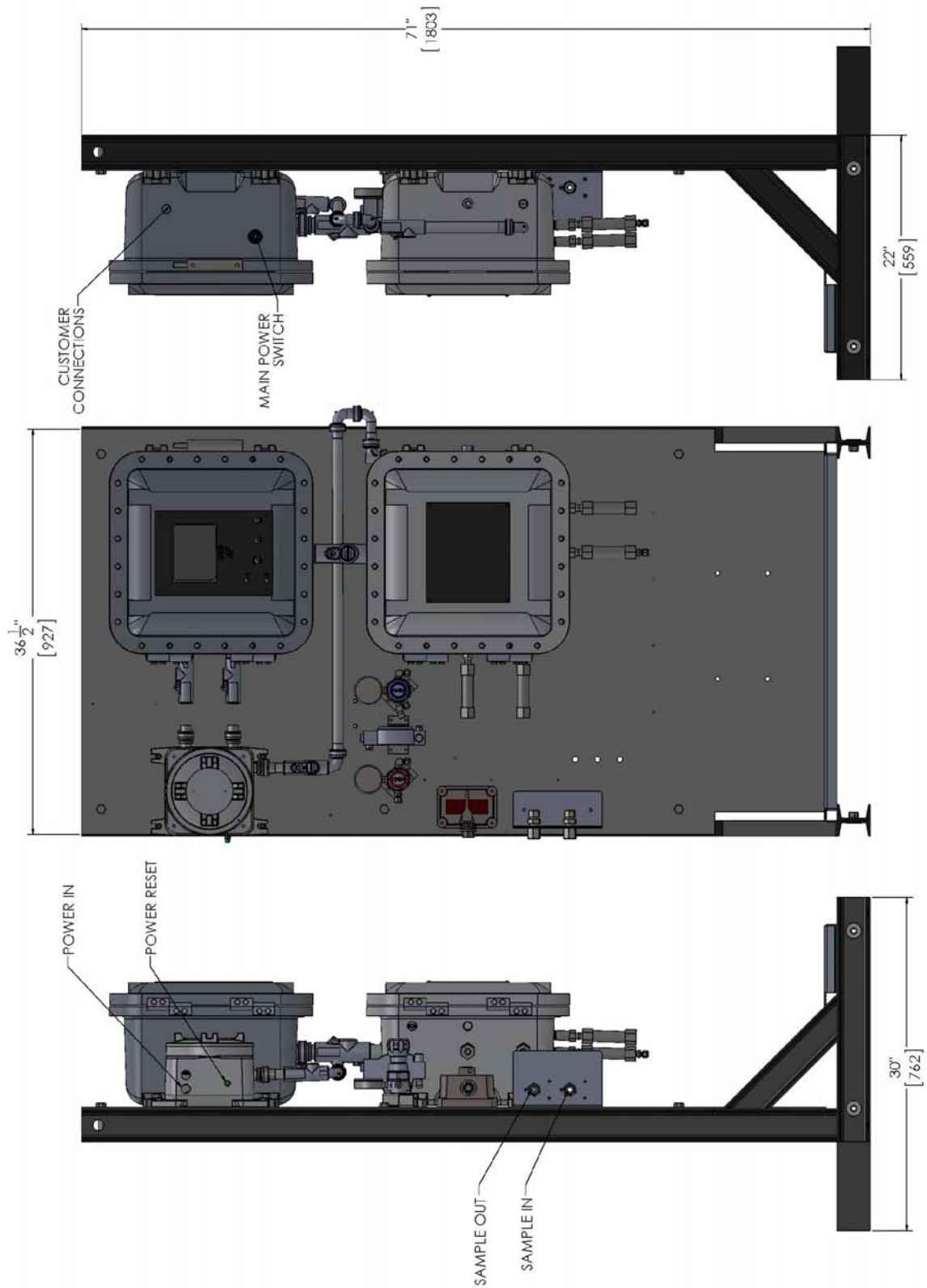
**MOUNTING**

	<b>NOTE:</b> An optional free-standing mounting rack is available.
--	--

The Analyzer is housed in a dual-chamber enclosure designed for wall mounting. It should be located on a flat, vertical surface and isolated from intense vibration. The cabinet incorporates mounting ears to facilitate installation.

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

See Figure 3-1.

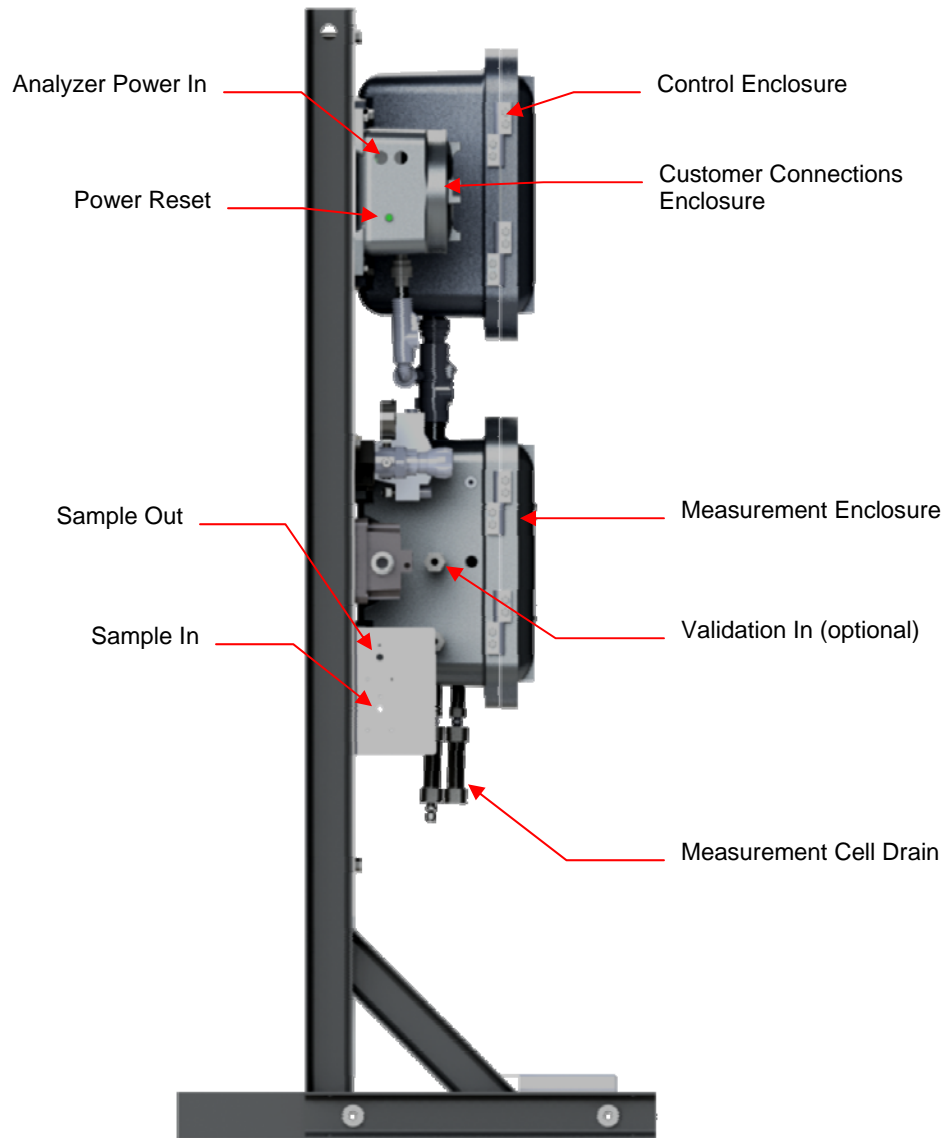


**Figure 3-1: Dimensional Drawing**

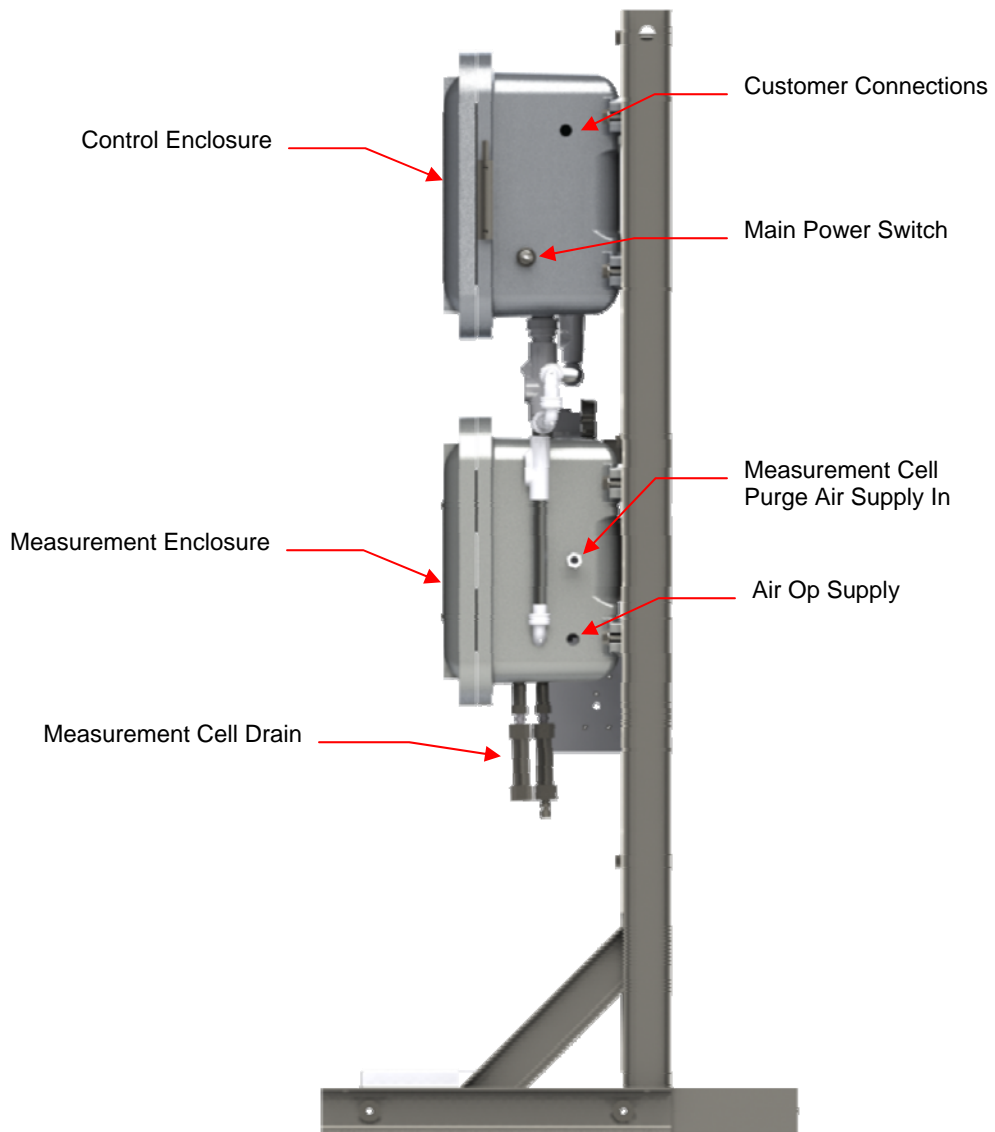
**PIPING**

The Analyzer incorporates fittings for connecting process sample, purge gas lines, and an atmospheric drain. There is also a fitting for connecting a validation sample line if this option has been installed on the Analyzer. These fittings are located on the sides of the instrument.

See Figures 3-2 and 3-3.




**Figure 3-2: Left Side View**




**Figure 3-3: Right Side View**

**PROCESS SAMPLE LINES**

	<p><b>NOTE:</b> It is the user's responsibility to assure that a representative sample, free of moisture and particulate matter, is presented to the instrument for analysis. BARTEC-ORB can assist in specifying sample conditioning requirements and the selection/development of an appropriate sample conditioning system.</p>
---	--

The Analyzer is designed to analyze samples from up to two different process streams. These lines are connected to the ¼ inch NPT fittings labeled "Sample 1 In" and "Sample 2 In" located on the left side of the lower enclosure (Figure 3-2). Process samples should be provided at a pressure between 25 and 45 PSI (1.7 and 3.1 Bar) and a bypass flow rate 25 to 100 cc/minute. The temperature of the sample should be between 2° and 70°C (35° and 158°F). Higher sample temperatures possible; consult Factory.

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

**VALIDATION SAMPLE LINE**




The connection for the validation sample line is also located on the left side of the lower enclosure (Figure 3-2). A ¼ inch NPT fitting, labeled "Validation In", is provided for this connection.

**MEASUREMENT CELL PURGE AIR LINE**

Instrument air is required to maintain the 4:1 air/liquid ratio required for RVP measurements and purging of spent sample from the measurement system. The gas should be supplied at a pressure of 25 PSI (1.70 BAR). The measurement cell purge gas connection is made at the ¼ inch NPT fitting labeled "Purge Air Supply In" on the right side of the lower enclosure (Figure 3-3).


**MEASUREMENT CELL DRAIN**


The Analyzer incorporates an atmospheric drain for the removal and collection of spent sample. The ¼ inch NPT fitting for this connection is located on the Measurement enclosure.

	<p><b>CAUTION:</b> The drain should not contain any traps, dips, or depressions in which liquid can accumulate. For optimum performance, it should pitch straight downhill from the Analyzer into an appropriate collection device.</p>
	<p><b>NOTE:</b> If the Analyzer is equipped with the optional High Pressure Sample Recovery System, the measurement cell drain should be connected to a vent and piped outside the instrument shelter.</p>
	<p><b>WARNING:</b> A suitable flame arrestor should be installed on the measurement drain fitting in accordance with local codes and safety requirements. The design of the flame arrestor should be such that pressure cannot build up.</p>

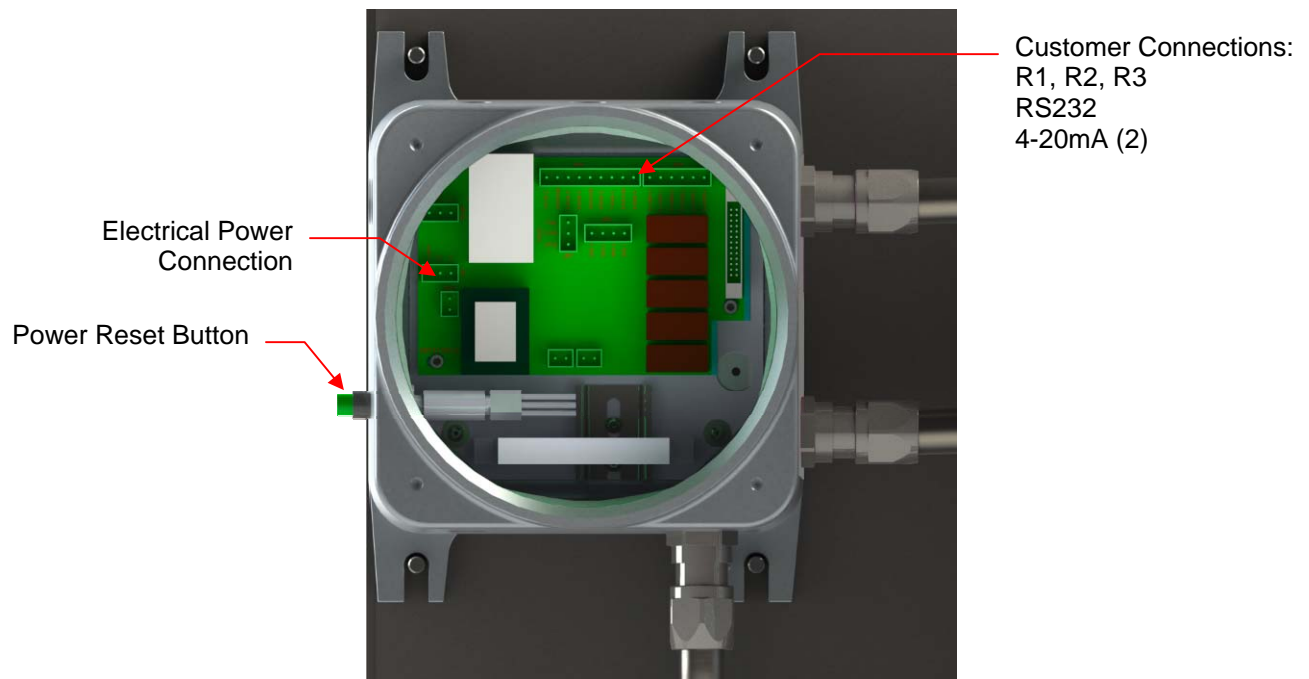
**WIRING**

**ELECTRICAL POWER**


	<p><b>WARNING:</b> This Analyzer is designed to meet the requirements of either the National Electrical Code (NEC) for installation in Class I, Division 1, Group C and D or European ATEX Zone 1, Group II hazardous areas. It is the user's responsibility to complete the electrical connections and comply with all pertinent codes.</p>
---	--

	<p><b>WARNING:</b> All electrical connections should be made by a licensed, qualified electrician. Proper building codes and safety regulations should be followed.</p>
---	---

The Analyzer requires an independent 100 to 240 VAC ( $\pm 10\%$ ), 50/60 Hz. power supply. The system is self-selecting and automatically adjusts to accommodate the incoming supply voltage. AC power connections are made through the Customer Connections box attached to the upper left of the top enclosure (Figure 3-2 and Figure 3-4). The electrical connection is made as follows:



**Figure 3-4: Customer Connections Enclosure**

	<p><b>WARNING:</b> A 360° terminated shielded cable and grounding cable glands must be used for AC power connections on instruments in ATEX Zone 1, Group II hazardous areas. A Fair-Rite clamp (supplied with Analyzer) with 1 turn (2 passes) must be installed on the incoming AC lines (including ground). It should be located as close as possible to the point of entry.</p>
---	---



## **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 these control room signals are made through the Customer Connection ports on the Customer Connections and Measurement enclosures (see Figures 3-2, 3-3, and 3-4).

### **Analog Output**

The Analyzer incorporates up to three isolated 4-20 mA analog outputs. See Figure 3-4.

### **Relay Output**

The Analyzer incorporates three SPDT relay contacts rated at 3A resistive load at 250 VAC (Figure 3-4). The relays may be programmed for either normal (non-energized) or failsafe (energized) operation and used to signal a variety of operational conditions. See Section 4 for information on alarm programming.

### **Serial Output**

The Analyzer incorporates either RS232 or optional RS485 bi-directional serial output (Figure 3-5). The maximum allowable external cable length on the RS232 output is 30 meters (98 feet); an auxiliary communications module is required for RS485 output (consult factory).

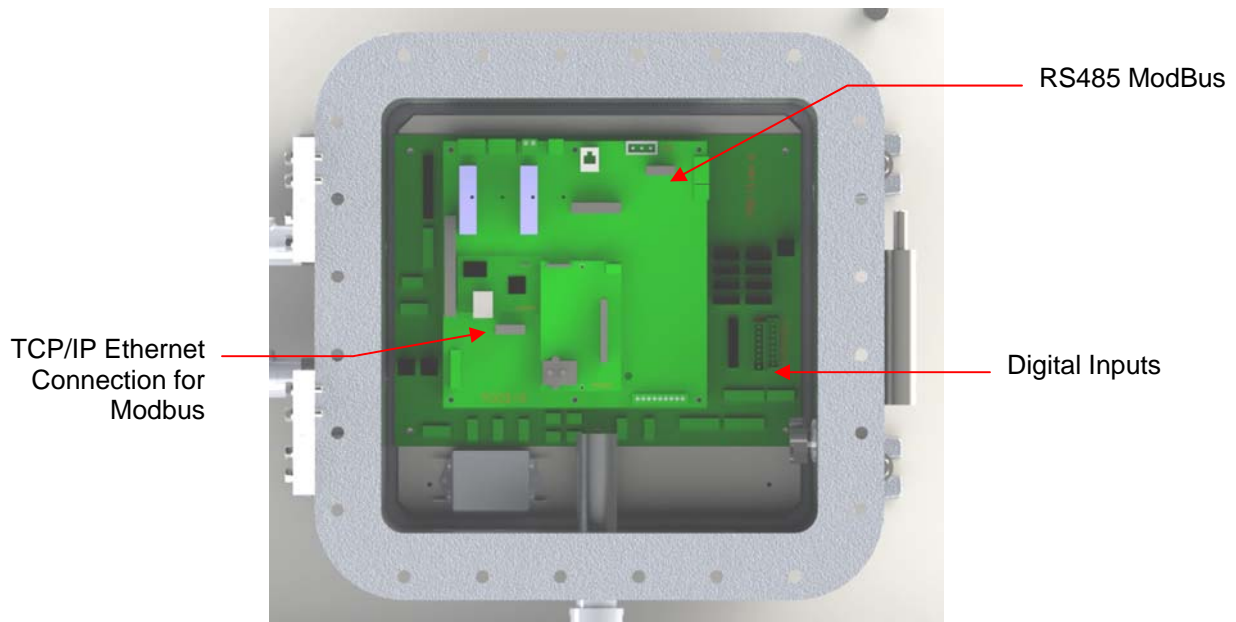
Serial communication operates at a selectable baud, no parity, 8 start bits, 1 stop bit. Data is comma delimited. Output is user-selectable: result (date, time, RVP) or data dump (date, time, temperature, pressure, barometer, result). A <CR> is used to designate the end of the data stream. See Section 4, for communications setup information.

### **ModBus**

ModBus is available as a factory-installed option which utilizes the Analyzer's serial output (Figure 3-5). Consult BARTEC-ORB for more information.

### **Dry Contacts (Digital Inputs)**

The Analyzer incorporates four 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 3-5). Wiring is brought into the enclosure through the Customer Connection #2 and #3 ports on the right hand side of the enclosure.



**Figure 3-5: Control Enclosure – Digital Inputs and Modbus Connections**


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

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


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

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

Digital Input	Terminals	Function
D0	1-2	Customer alarm
D1	3-4	Remote standby
D2	5-6	Validation
D3	7-8	Stream select
D4	9-10	For future use
D5	11-12	For future use
D6	13-14	For future use
D7	15-16	Run RVP

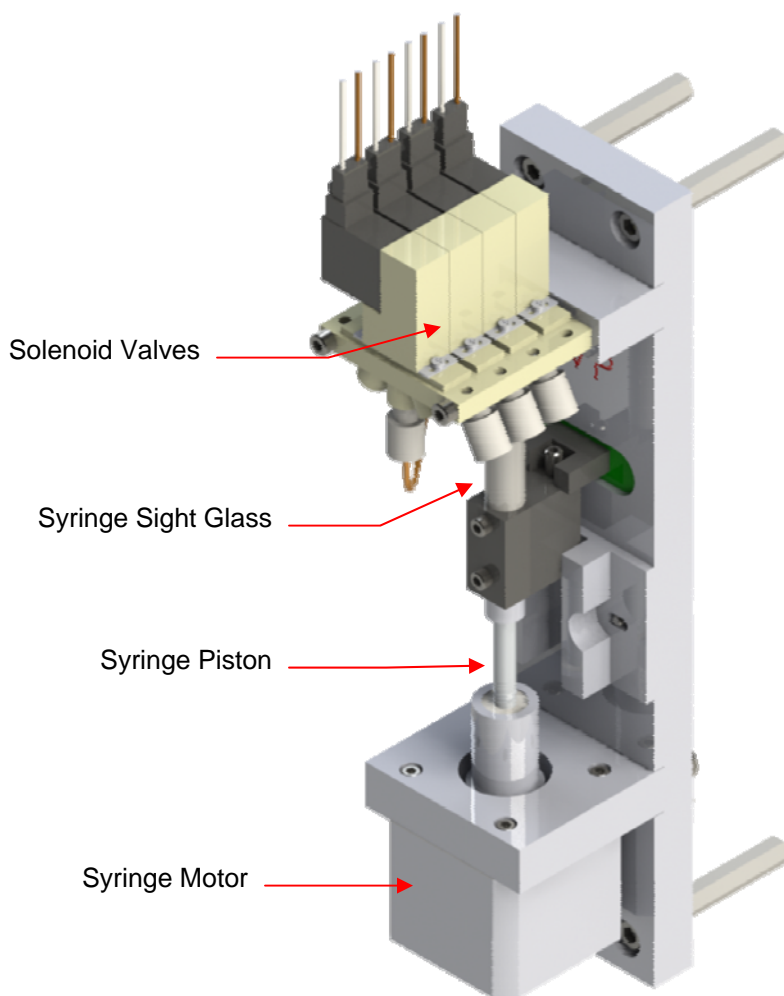
	<p><b>NOTE:</b> Although the Validation Request and Stream Select contacts may be present, these functions are only available on Analyzers which incorporate these options.</p>
---	---

**STARTUP**

	<p><b>WARNING:</b> It is the user's responsibility to ensure that the area is free of flammable or explosive gases whenever the Analyzer enclosures are open, such as during Analyzer startup or maintenance.</p>
---	---

1. Start the flow of measurement cell purge air and verify that it is regulated at 20 PSI (1.4 bar).
2. Set the process supply pressure regulator at 20-30 PSI (1.4 to 2.1 bar).
3. Verify that the flow meter valve is fully open.
4. Adjust the process supply back pressure regulator until the sample flow is about 50 cc/minute. This will be about half scale on BARTEC-ORB supplied flow meters. Sample flow must be between 20 cc/minute minimum and 200 cc/minute maximum; consult factory if flow is outside this range.
5. Check the interior of the Measurement enclosure for leaks.
6. Verify that the power switch on the right side of the Control enclosure is in the OFF position.

7. Remove the cover of the Customer Connections enclosure and then apply mains power to the Analyzer.
8. Press the green reset button on the left side of the Customer Connections enclosure. A red LED adjacent to the electrical power connection should light.
9. Place the power switch on the right side of the Control enclosure in the ON position.
10. Access the Main Menu (see Section 4: Programming) and verify that the Analyzer's settings match the QIR you received with the instrument.
11. Conduct 4-20 mA loop and alarm relay checks as required.
12. Place the Analyzer on-line and observe operation for a few measurement cycles. Pay particular attention to the injector cell, watching for bubbles in the sample, smooth piston operation, etc.



**Figure 3-6: Injector**

13. Close and bolt the enclosure doors.
14. 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).

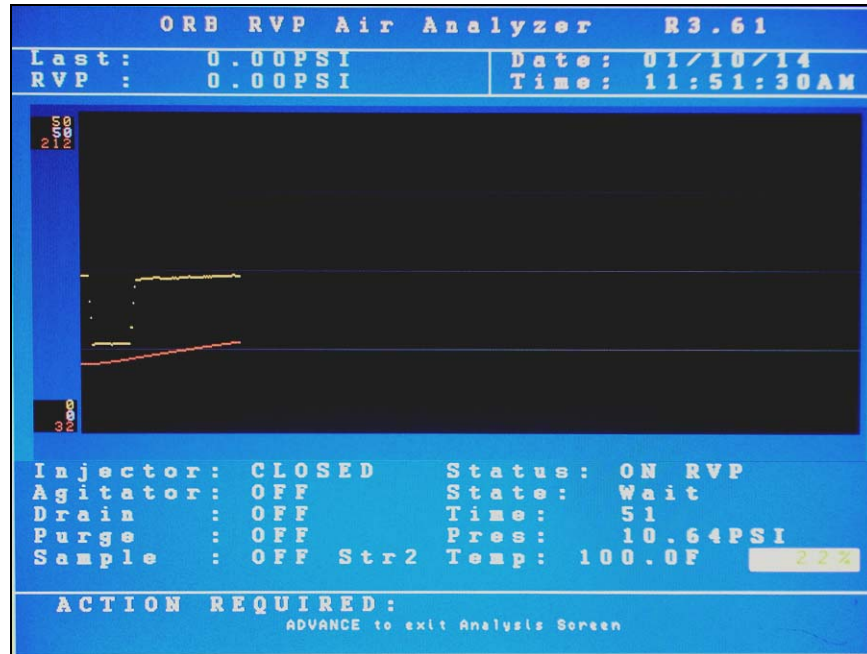
[THIS PAGE INTENTIONALLY BLANK]

## PROGRAMMING

## SECTION 4

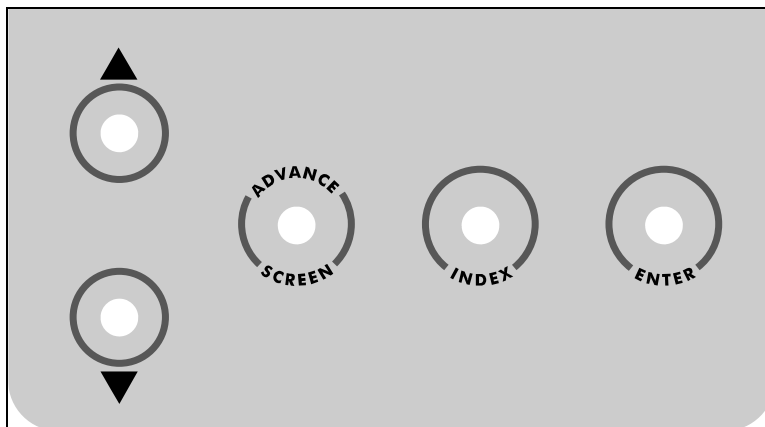
### MAIN RUN SCREEN

When the Analyzer is powered up, a short initialization program runs and then the Main Run Screen appears on the display. The Analyzer is programmed at the factory to power up in the Off-Line mode. The instrument can be programmed to power up in the On-Line mode. See the Systems Settings section below for more information.



### MENU NAVIGATION

The 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.

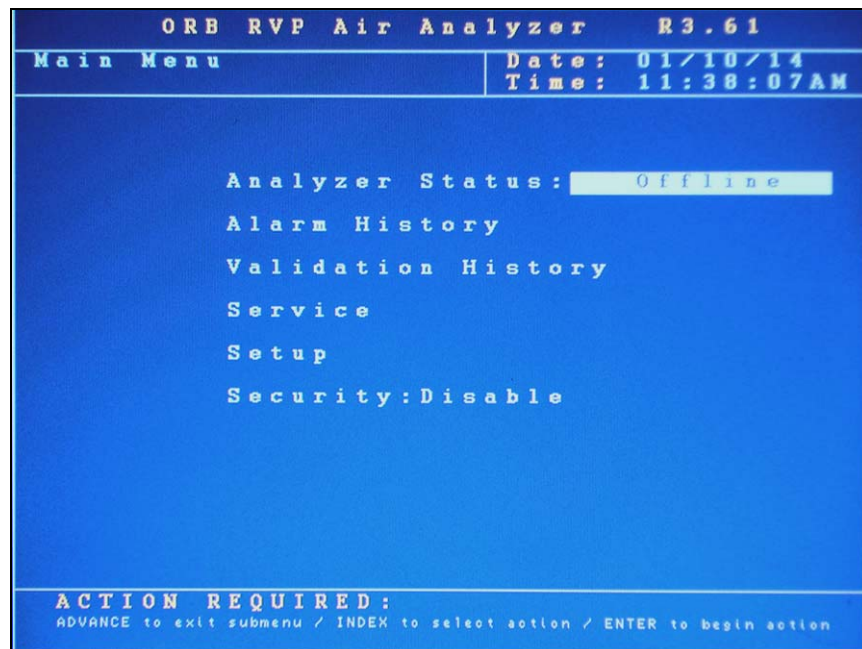
**Index Key** — Touching this key scrolls the Analyzer through the various items available within a specific menu. The “active” menu line is highlighted by reversing the background and foreground colors. Once you reach the last menu item, the indicator returns to the top of the menu.

**Enter Key** — Touching this key advances you to the sub-menu or other item associated with a selected menu item. It is also used to accept displayed numerical values which have been entered.

↑↓ **(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, toggle the display through the 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. The Main Menu is displayed by touching the Advance Screen key when the Main Run screen is displayed. 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.

### **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 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 system components, test the analog output, and view selected sensor readings. It is described in detail in Section 6 – Routine Maintenance & Service. Touch the Enter key to access this sub-menu.

## SETUP

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

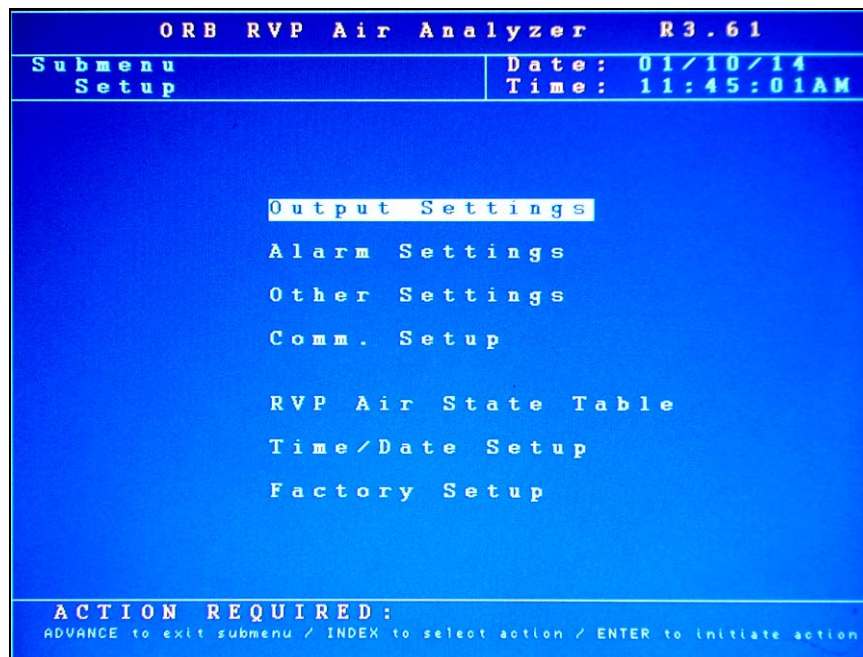
To return to the Main Run screen, touch the Advance Screen key.

## SECURITY

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

## SETUP SUB-MENU

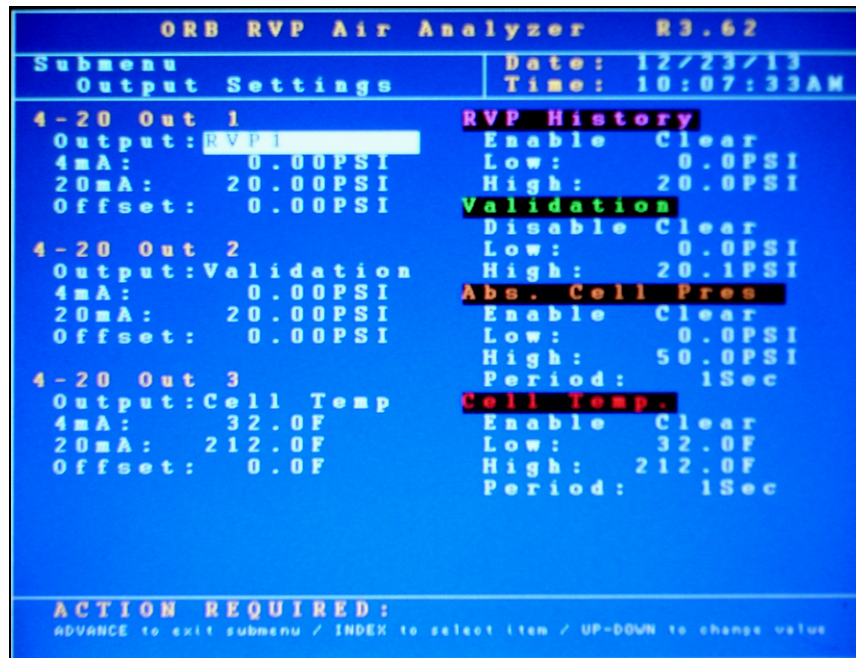
The Setup sub-menu is used to establish the Analyzer's various operating parameters.



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

## OUTPUT SETTINGS

This menu item is used to program the Analyzer's analog outputs. 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 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.

**4-20 Out 1 / 4-20 Out 2 / 4-20 Out 3** — The Analyzer's analog outputs can be programmed to output various types of information, as well as the range of the analog signal and an offset.

**Output** — This menu item allows you to select the type of information that will be output using the selected analog signal. The choices are: RVP1 (stream 1), RVP2 (stream 2), Cell Temperature, Cell Pressure, Validation, and Off.

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

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

**Offset** — This menu selection allows you to offset the analog output signal by the programmed value. For example, if the offset is set to 2.75, the Analyzer will generate an 18.25 PSI analog signal when the actual measured (and displayed) RVP value is 15.50 PSI.

**RVP History** — When enabled, the Analyzer will graph and display the instrument's RVP measurements. It also allows you to establish the display range for these measurements

**Enable/Disable** — Turns this particular graphing function on/off.

**Clear** — Clears graphed RVP information from the Main Run screen.

**Low** — Establishes the bottom of the RVP history graph scale. The value should be set lower than the lowest expected RVP measurement.

**High** — Establishes the top of the RVP history graph scale. The value should be set higher than the highest expected RVP measurement.



**Validation** — When enabled, the Analyzer will graph and display the instrument's validation result readings. It also allows you to establish the range for these readings.

Enable/Disable — Turns this particular graphing function on/off.

Clear — Clears graphed validation information from the Main Run screen.

Low — Establishes the bottom of the validation graph scale. The value should be set lower than the lowest expected validation measurement.

High — Establishes the top of the validation graph scale. The value should be set higher than the highest expected validation measurement.

**Absolute Cell Pressure** — When enabled, the Analyzer will graph and display the instrument's Absolute Cell Pressure readings. It also allows you to establish the display range for these readings.

Enable/Disable — Turns this particular graphing function on/off.

Clear — Clears graphed cell pressure information from the Main Run screen.

Low — Establishes the bottom of the Absolute Cell Pressure graph scale. The value should be set lower than the lowest expected pressure reading.

High — Establishes the top of the Absolute Cell Pressure graph scale. The value should be set higher than the highest expected pressure reading.

Period — Established how often cell pressure information will be plotted.

**Cell Temperature** — When enabled, the Analyzer will graph and display the instrument's Cell Temperature readings. It also allows you to establish the display range for these readings.

Enable/Disable — Turns this particular graphing function on/off.

Clear — Clears graphed cell temperature information from the Main Run screen.

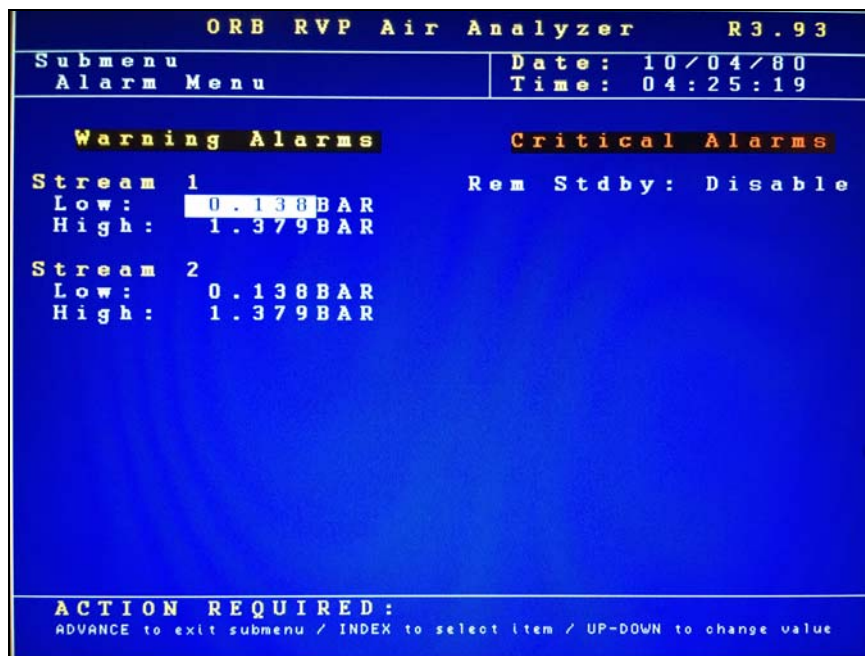
Low — Establishes the bottom of the Cell Temperature graph scale. The value should be set lower than the lowest expected reading.

High — Establishes the top of the Cell Temperature graph scale. The value should be set higher than the highest expected reading.

Period — Established how often cell temperature information will be plotted.

## ALARM SETTINGS

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



Use the Index key to advance to the desired menu item 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.

**Stream 1** — Establishes the values at which the Analyzer's RVP measurement alarm for Stream 1 will be activated.

Low — This menu item allows you to establish the lowest allowable RVP value. Measurements below this value generate an alarm signal/message.

High — This menu item allows you to establish the highest allowable RVP value. Measurements above this value generate an alarm signal/message.

**Stream 2** — Establishes the values at which the Analyzer's RVP measurement alarm for Stream 2 will be activated.

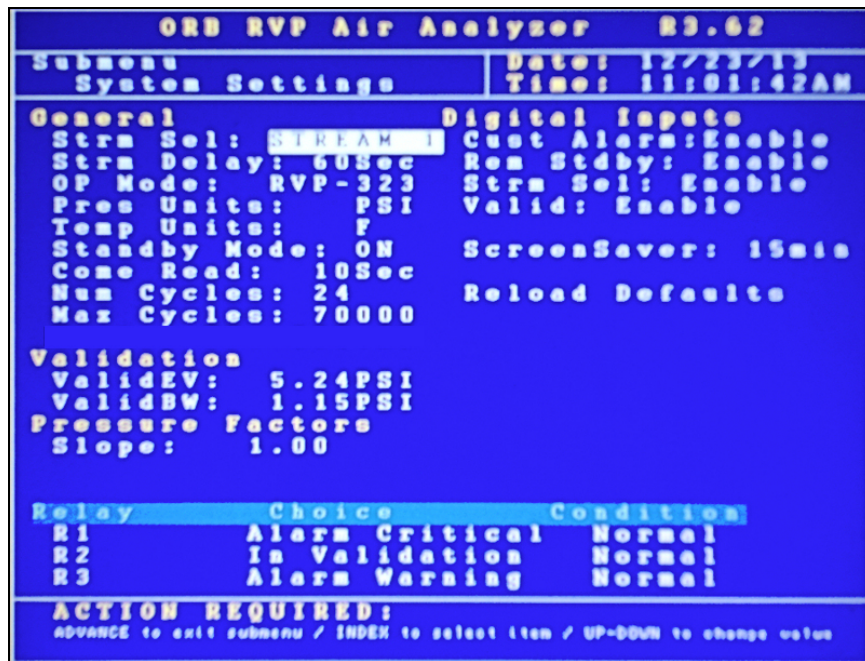
Low — This menu item allows you to establish the lowest allowable RVP value. Measurements below this value generate an alarm signal/message.

High — This menu item allows you to establish the highest allowable RVP value. Measurements above this value generate an alarm signal/message.

**Remote Standby** — This is used to program the state (enabled/disabled) of the critical alarm relay whenever the unit is placed in remote standby.

## OTHER SETTINGS

The Other 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.

### General Settings

**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.

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

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

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

**Stream Delay** — This menu item appears only when Alternate is selected under Stream Select (above). It allows for a time delay (0 to 600 seconds) when switching sample streams to ensure that the sample from the previous stream has been fully flushed from the sample line. It is most useful when stream switching is being initiated at a point remote from the Analyzer.

**OP Mode** — This menu setting establishes how RVP measurements will be performed. The only OP mode for the P-700 RVP Analyzer is RVP-323.

**Pressure Units** — This menu item establishes the unit of measure for the Analyzer's RVP measurements. The choices are: PSI, hPa, kPa, Kg/Cm<sup>2</sup>, and bar.

**Temperature Units** — This menu item establishes the unit of measure for the Analyzer's temperature measurements. The choices are degrees C or degrees F.

**Standby Mode** — This menu item establishes 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.

**Come Read** — This menu item establishes the length of time the Analyzer’s “come read” relay will be activated upon the completion of a measurement cycle.

**Number 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

**Maximum Cycles** — This menu item allows the operator to set the number of measurements which can be performed before the Analyzer’s Maintenance Alarm is activated. Use the Up/Down Arrow keys to change the displayed value.

**Validation Settings**

**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.

**Pressure Factors**

**Slope** — This is a calibration factor applied to the Analyzer’s pressure readings. It should not be changed unless the results of a calibration measurement indicate that adjustment is required.

**Digital Inputs**


These menu items selectively enable/disable the Analyzer’s digital inputs. See Section 3 for information on wiring these inputs.

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

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


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

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

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

**Screen Saver** — Establishes how long the screen will remain lit without any keypad activity. Touching any of the magnetic keys re-activates the display.

**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? Enter = Yes, Advance Screen = No” Touch the appropriate Arrow key to make your selection.

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

**Relays**

These menu items selectively enable/disable the alarm relays. They also allow the selection of the type of alarm each relay will signal and how it operate (normal or failsafe).

**Relay** — Designates which alarm is being programmed. See Section 3 for alarm relay wiring information.

**Choice** — Designates the type of alarm. The choices are:

Alarm Warning — Indicates an out of range measurement. This alarm does not disrupt analysis.

Alarm Critical — Indicates Analysis has stopped because one of the following conditions has been detected:

- Syringe limit switch failure
- Syringe optics failure
- Temperature sensor failure
- Temperature control failure
- Inability to auto-zero
- Customer alarm
- Remote standby enabled
- Machine not running

Maintenance — Activated when the number of measurement cycles has exceeded the user-set limit (Limit Cycle setting).

Stream 1 — Activated when Stream 1 is being measured.

Stream 2 — Activated when Stream 2 is being measured.

Filter — Indicates that the micro filter is being cleaned (back-flushed).

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

In Validation — Activated when the Analyzer is performing a validation measurement.

Validation Pass — Activated when the validation measurement value is within the acceptable range.

Off — Alarm relay disabled.

**Conditions** — 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

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

```

ORB RVP Air Analyzer R3.61
-----
Submenu          Date: 01/10/14
Comm. Menu       Time: 11:48:21AM

Serial Port C
Mode: Result    Period: 15Sec
Rate: 9600
MODBUS
ID: 1
Mode: Ethernet
Serial Port B
Rate: 9600

Ethernet Setup
Our IP Address 192.168. 1. 20
Router Address 192.168. 1. 1
Network Mask: 255.255.255. 0

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

**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. R = RVP result; D = data dump (temperature, pressure, barometer, and result). Period indicates how often data will be output and is user-settable.

**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.

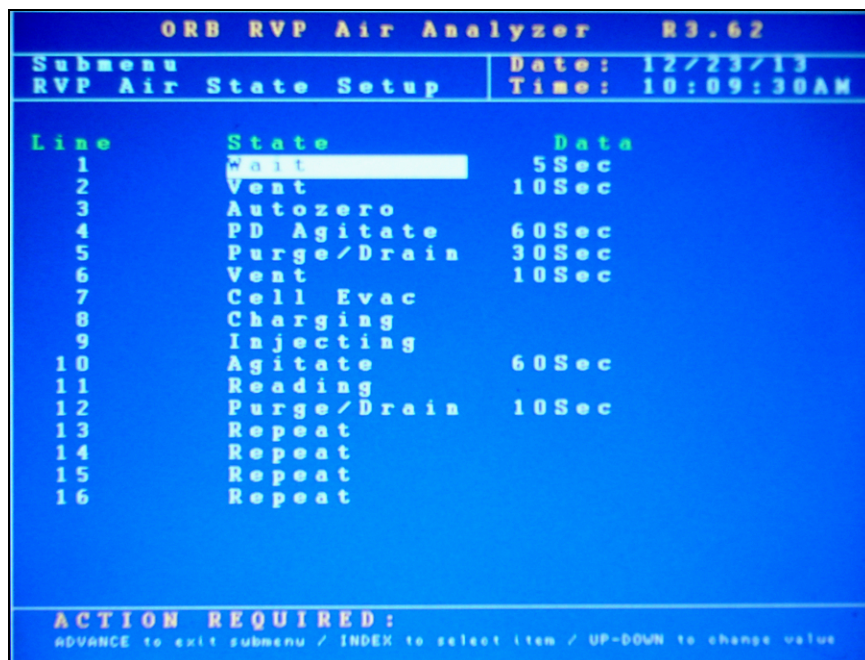
**Router Address** — This is the address of the router the Analyzer is connected to.

**Network Mask** — This is the network mask address.

### RVP AIR STATE TABLE

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

	<p><b>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.</b></p>
---	---



Any of the following steps may be included in an RVP measurement cycle. Steps highlighted in **bold face** type 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 for the flushing of sample lines in multi-stream applications and/or extend cycle times.

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

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

**PD Agitate** — This activates the magnetic pellet to ensure that any entrapped liquid is removed; it also opens both the purge and drain valves.

**Purge / Drain** — This opens the purge drain to ensure that all volatile vapors are removed from the measurement cell.

**Cell Evac** — Opens the sample solenoid and removes a fixed air volume.

**Charging** — This cycles the syringe up and down to remove any bubbles and obtain fresh sample.

**Inject** — This injects the proper amount of sample into the measurement cell.

**Agitate** — This activates the magnetic driver to speed equilibration.

**Reading** — This step is used to read the measurement pressure or temperature. The user-programmed time period associated with this step allows the reading to stabilize.

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

**Filter Wash** — This is a backwashing step for Analyzers equipped with the optional micro filter with cleaning fluid. The entered value indicates the interval at which it will be performed (number of measurements between cleanings).

**Rinse** — This step is used to quickly flush the measurement cell with sample product after a cleaning cycle has been performed. It is also useful for applications where more than one stream is being analyzed. The entered value indicates the interval at which a rinse step will be performed (number of measurements between cleanings). The recommended interval is 20 to 50 measurements.

**Drain** — This step is for special applications. Consult factory.

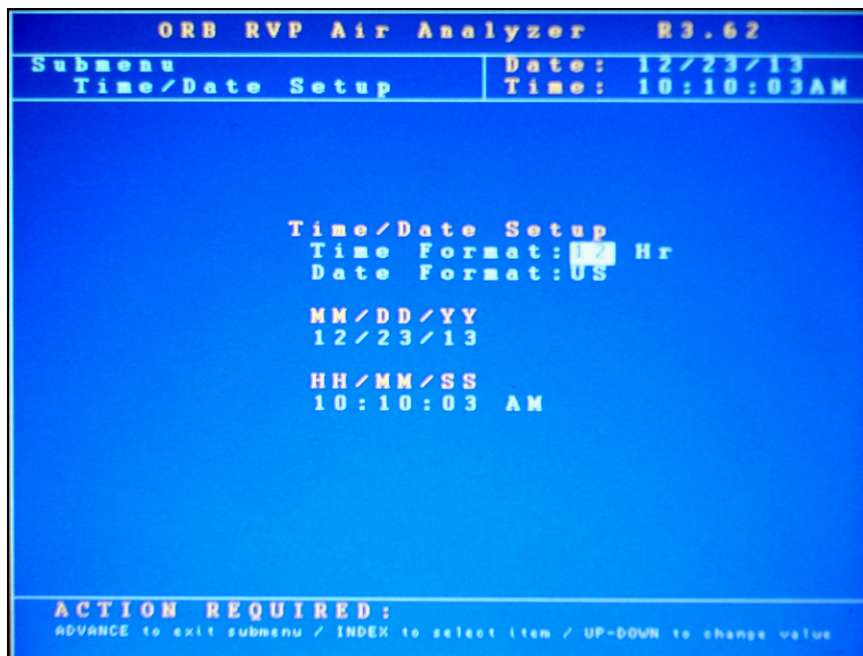
**Repeat** — This should always be the last step in the State table. It tells the Analyzer to return to step 1.

Factory Default State Table	
Step	Time Period
Wait	5 seconds
Vent	15 seconds
Autozero	0 seconds
PD Agitate	60 seconds
Purge Drain	30 seconds
Vent	10 seconds
Cell Evac	0 seconds
Charging	0 seconds
Inject	0 seconds
Agitate	60 seconds
Reading	15 seconds
Purge Drain	10 seconds
Repeat	0 seconds



### 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.

[THIS PAGE INTENTIONALLY BLANK]

# NORMAL OPERATION

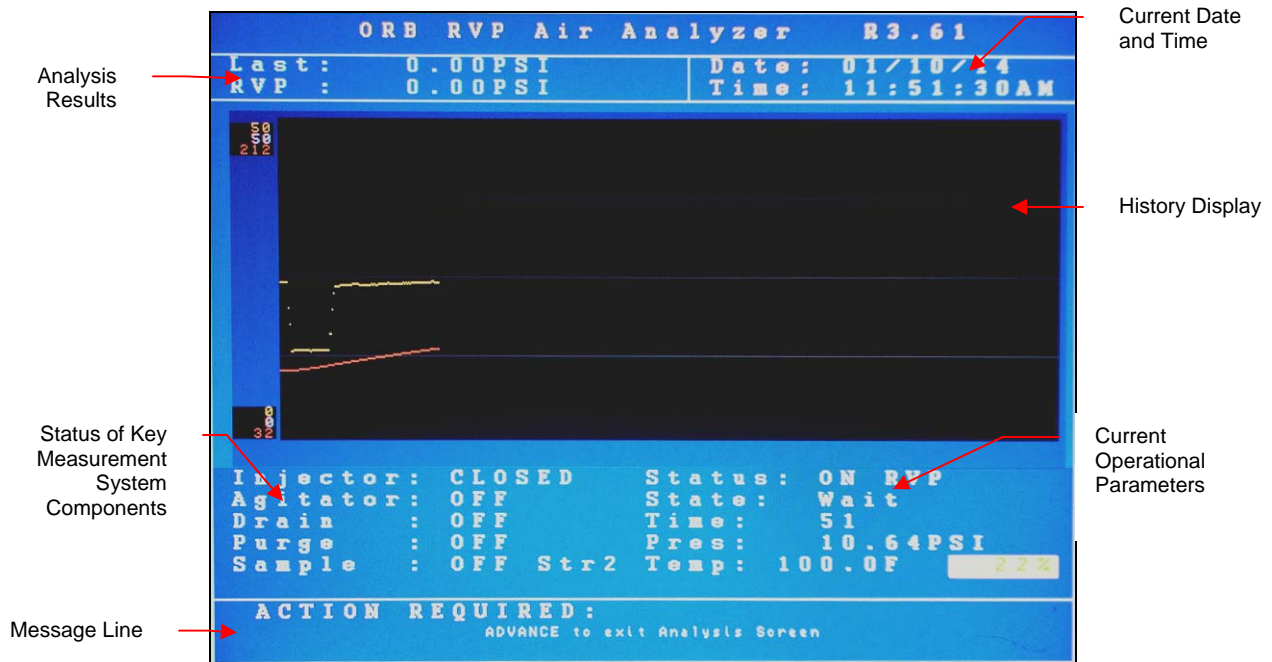
# SECTION 5

The Model P-700 RVP Analyzer is an on-line process instrument designed for the continuous measurement of Reid Vapor Pressure in hydrocarbon process streams, such as gasoline, crude oil, and petroleum condensate.

In normal operation, 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 the Main Run screen. Depending on how the Standby mode has been set up (see Section 4 – Programming), the instrument may power up in either the on-line (analyzing) or 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:



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

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

**History Display** — Displays user-selected measurement and/or operational data. If two sample streams are being analyzed, data appears in different colors. If power is lost or disrupted, the graphical data is lost.

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

**Component Status** — Displays the status of key measurement system components. The status of these items changes as the Analyzer performs a measurement.

**Operational Parameters** — Indicates the status of the Analyzer (on line, off line); current step (State) in the measurement process; the time remaining in the step; the current cell pressure reading; and the current cell temperature.

#### 4 – 20 MA ANALOG OUTPUT

The Analyzer outputs up to three analog signals. The parameter being output and its range is user-programmable (see Section 4 – Programming).

#### SERIAL OUTPUT

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

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

Depending on how communications were programmed (see Section 4), the information contained in the data stream is output as follows:

Description	Result	Data Dump
Date	MM/DD/YY	MM/DD/YY
Time	HR/MIN/SEC	HR/MIN/SEC
Data Output	XXXX PSI	TEMPERATURE PRESSURE BAROMETER XXXX PSI (most recent result)

#### MODBUS OUTPUT

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

#### ALARMS

A message is displayed on the Main Run screen whenever an alarm condition is detected. 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

**Warning** — A warning alarm indicates that either the measured value is outside the acceptable programmed limits or the Analyzer cannot hold the desired vacuum pressure. Analysis continues.

**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 the new result has been output. Analysis continues.

**Maintenance** — This signals that routine maintenance is required. Analysis continues.

**Informational** — These alarms are intended to provide control room personnel with operational information, such as which stream is being measured, that a validation is being performed, etc.. 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.

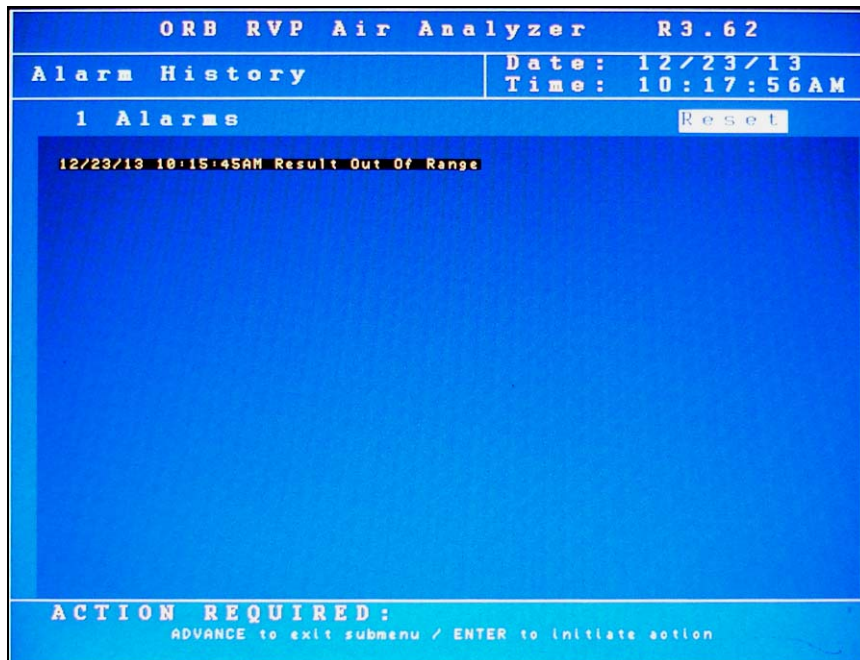
Type	Alarm Message or Condition	Analyzer State
Alarm Warning	Reading out of range	Analysis continues
Alarm Critical	Limit switch failure	Analysis stops
Alarm Critical	Optics failure	Analysis stops
Alarm Critical	Temp. sensor failure	Analysis stops
Alarm Critical	Temp. control failure	Analysis stops
Alarm Critical	No auto zero	Analysis stops
Alarm Critical	System goes off	Analysis stops
Alarm Critical	Digital input – customer alarm	Analysis stops
Alarm Critical	Digital input – remote standby	Analysis stops
Come Read	Measurement cycle complete	Analysis continues
Maintenance	Routine maintenance required	Analysis continues
Stream 1 / 2	Indicates stream currently being measured	Analysis continues
In Validation	Validation measurement is being performed	Analysis continues
Validation Pass	Most recent validation measurement was within expected values	Analysis continues
Filter	Filter wash cycle in progress	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 Alarms History sub-menu. To access this sub-menu, go to the Main Menu, select Alarms History, and touch Enter. The Alarms History screen will appear.



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

### **TAKING THE ANALYZER OFF-LINE**

The 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 Screen Advance 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.

### PERFORMING A VALIDATION MEASUREMENT

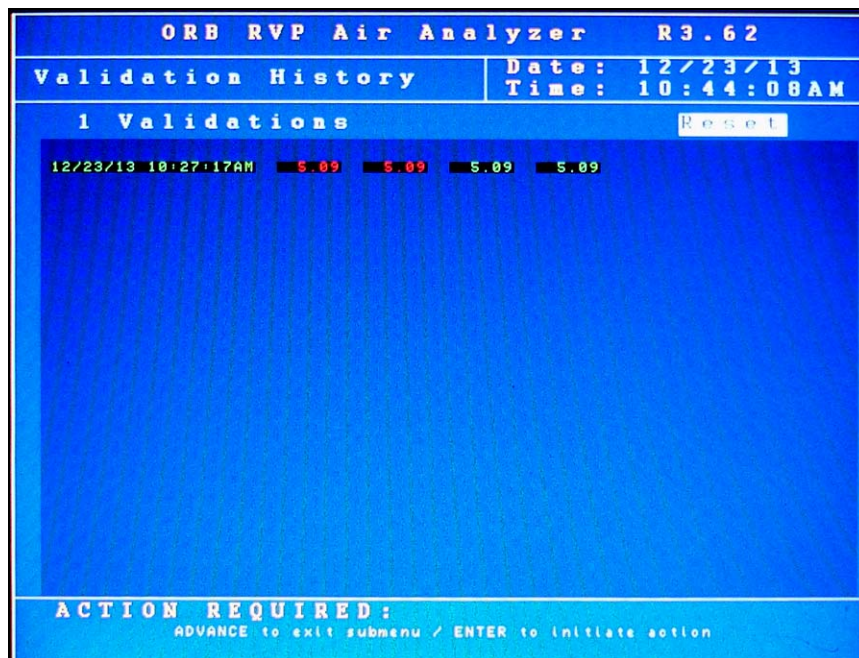
If the Analyzer is equipped with the Validation option, operating personnel can check measurement accuracy using a sample with a known value. This procedure is initiated via a control room contact closure (see Section 3).

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

	<p><b>NOTE:</b> When a validation measurement is being performed, any 4-20 mA programmed to output an RVP measurement value is held at the last measured value. The signal is not updated until a new RVP measurement is performed.</p> <p>The measured value of the validation sample can be output as an analog signal is the 4-20 mA output is programmed to do so. See Section 4 Setup/Output Settings.</p>
---	---

### VALIDATION HISTORY

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



### SWITCHING 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 contact closure (see Section 3). 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 Section 4 Setup/Other Settings).

## LOSS OF POWER RESTART

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

## INTERNAL SAMPLE LEAK

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




## ROUTINE MAINTENANCE & SERVICE

## SECTION 6

	<p><b>WARNING:</b> 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.</p>
---	---

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

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

### RECOMMENDED ROUTINE MAINTENANCE SCHEDULE

Check measurement cell purge gas pressure	Weekly
Check sample pressure	Weekly
Inspect for internal sample leaks	Monthly
Inspect sample conditioning system	Monthly
Replace syringe	Every six months
Replace internal tubing	Every six months

### SERVICE AND OPERATIONAL CHECKS

The Analyzer incorporates a special Service screen from which the operator can perform a variety of verification and diagnostic functions, including:

- Exercise the Analyzer's alarm relays, agitator, injector, dry contacts, and solenoid valves
- Output a fixed analog signal to check/calibrate external devices
- Check the PID control
- Check measurement cell temperature and integrity

The Service screen is accessed from the Main Menu by selecting Service and touching the Enter key with the magnetic pencil.

```

    ORB RVP Air Analyzer  R3.66
    Submenu                Date: 03/21/14
    Service                 Time: 11:35:09AM

    Output Control         Digital Inputs
    Agitator              OFF  DI: 11111111
    Drain Valve           OFF  4-20 Control
    Purge Valve           OFF  4-20 Out 1: 4.0mA
    Sample Valve          OFF  4-20 Out 2: 4.0mA
    Stream Valve          OFF  4-20 Out 3: 4.0mA
    Valid. Valve          OFF  Injector
    Wash Valve            OFF  Command: UP
    Relay 1:              OFF  Sensor: OFF
    Relay 2:              OFF  Stp1:OFF Stp2:OFF
    Relay 3:              OFF  Stp3:OFF Stp4:OFF
    Functions              Cell Temp. Control
    Cell Rinse            PID Control: OFF
    Cell Clean            Heat:OFF
    Filter Clean          Cool:OFF

    Barometer: 551mmHg
    Cell Pres: 28.67PSI
    Cell Temp: 83.6

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

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

*Agitator* — The agitator in the measurement cell is activated when this menu item is switched from OFF to ON.

*Drain Valve* — The Analyzer's measurement cell drain valve is opened when this menu item is switched from OFF to ON.

*Purge Valve* — The Analyzer's measurement cell purge valve is opened when this menu item is switched from OFF to ON.

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

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

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

*Wash Valve* — The Analyzer's wash valve is opened when this menu item is switched from OFF to ON.

*Relay 1* — Alarm relay 1 will activate when this menu items is switched from OFF to ON.

*Relay 2* — Alarm relay 2 will activate when this menu items is switched from OFF to ON.

*Relay 3* — Alarm relay 3 will activate when this menu items is switched from OFF to ON.

**Functions** — Used to initiate the selected function. To select, highlight the desired function and touch Enter. Once a function is started, it must be allowed to run to completion.

*Cell Rinse* — Injects process sample into the cell to flush out wash/cleaning solvent after a clean process has been performed.

*Cell Clean* — Performs a thorough cleaning of the cell by injecting wash/cleaning solvent into the cell.

*Filter Clean* — Performs a cleaning process by injecting wash/solvent into the cell. Also back flushes the micro filter to clear debris from the filter.

**Digital Inputs** — Displays the status of the Analyzer's digital inputs.

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

*4-20 mA Out 1 / 4-20 mA Out 2 / 4-20 mA Out 3* — When any of these menu items is selected, a continuous analog signal equivalent to the displayed value is generated on that 4-20 mA output channel.

**Injector** — These menu selections allow you to test the operation of the Analyzer's sample injector.

*Command* — The injector is raised/lowered using this menu item. The Up/Down Arrow keys are used to change the status.

*Sensor* — This is an information only display linked to the injector. It will read CLOSE when the injector is UP and OPEN when the injector is DOWN.

*Step 1 / Step 2 / Step 3 / Step 4* — These are information displays that indicate the position of the stepper motor as the injector is raised or lowered.

**Cell Temperature Control** — These menu selections allow the testing of the heating/cooling capabilities of the TE modules. When heat/cooling is applied, the system temperature information should change accordingly. The Up/Down Arrow keys are used to change the value or status of the highlighted selection.

*PID Control* — This menu item must be set to OFF in before testing TE Heat or TE Cool.

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

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

**Heater Temperature Control** — These items control temperature to the optional micro filter.

*PID Control* — This menu item must be set to OFF before testing TE Heat to the micro filter.

*TE Heat* — The micro filter is heated when this menu item is switched from OFF to ON.

**Barometer** — This is an information only display that shows the current barometric reading as measured by the Analyzer's internal barometer.

**Cell Pressure** — This is an information only display that shows the current pressure in the measurement cell. The displayed value will change as the measurement cell sample, purge, and drain solenoids are opened and closed.

**Cell Temperature** — This is also an information only display. It shows the current temperature of the measurement cell.

**Heater Temperature** — This is an information only display present on Analyzers with the optional micro filter. It shows the current temperature of the micro filter.

**TROUBLESHOOTING**

Symptom	Possible Cause	Solution
RVP reading high	Cell temperature high Calibration constant Solenoid problems Delivery volumes	Faulty RTD; replace as required. High ambient temperature; increase sample flow. Faulty pressure transducer; replace as required. Recalibrate as required. Purge gas pressure set too high; reduce as required. Faulty purge pressure solenoid; replace as required. Consult factory.
RVP reading low	Cell temperature low Calibration constant Solenoid problems Delivery volumes	Faulty RTD; replace as required. Faulty TE modules; replace as required. Faulty pressure transducer; replace as required. Recalibrate as required. Faulty drain solenoid; replace as required. Consult factory.
RVP reading erratic	Solenoid problems	Faulty purge pressure or drain solenoid; replace as required.
Display screen not working	Screen saver on Electronics problem	Touch magnetic pencil to keypad. Consult factory.
Agitator not working	Cell needs cleaning Electronics problem	Varnish build-up on cell; clean cell as required. Consult factory.
Keypad not working	Electronics problem	Consult factory.
Syringe drive not working	Electronics Faulty syringe motor Problem with Optical sensor	Consult factory. Replace syringe assembly or motor as required. Replace syringe assembly or optical sensor board as required.
Bubbles in syringe	Supply pressure too low	Check for proper supply pressure; correct as required.
Cell temperature control not working	TE modules faulty RTD sensor problem Electronics problem	Consult factory. Replace as required. Check fuses on TE driver board; replace as required. Faulty electronics board; consult factory.

## CALIBRATION

Should the BARTEC-ORB P-700 RVP Analyzer require a calibration shift to match a Lab value (expected reading), the following procedure should be used:

1. Allow the Analyzer to read and stabilize on the current sample (3-5 cycles).
2. When pulling a sample to compare the BARTEC-ORB Analyzer against the Lab, watch the Main Run screen (this should be the default screen on the Analyzer; if the screen saver is On, press any key to illuminate the screen).
3. In the lower right hand corner of the Main Run screen, watch the “STATE” of the instrument. You want to pull the sample when the State = “INJECT”. This will ensure that you are comparing the same sample.

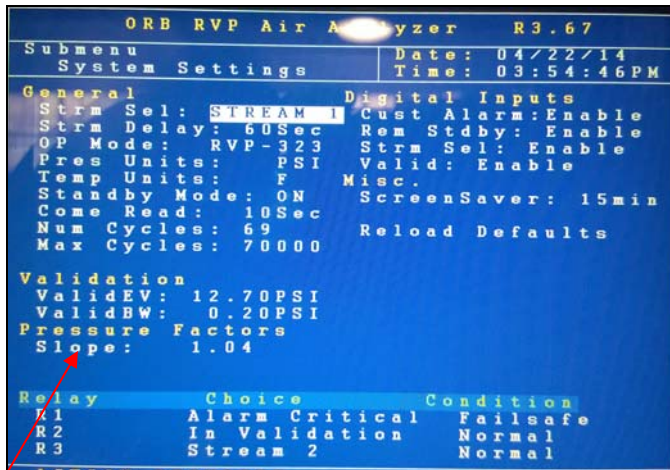


Pull Lab sample when State = Inject

4. Watch the BARTEC-ORB Analyzer finish its cycle and write down the RVP reading. You will use this to calculate the new calibration scope.
5. Run the pulled sample on the Lab unit.
6. Once both values have been obtained, perform the following from the Main Run screen at the Analyzer:
  - A. Advance to the Main System menu.
  - B. Index to the Set Up menu and press Enter.
  - C. Index to System Settings menu and press Enter.
  - D. Index to the Pressure Factors – “Slope” setting.
7. Use the following formula to calculate the new slope:

$$\text{Current RVP Slope} \times \frac{\text{Lab (expected) RVP reading}}{\text{Analyzer RVP reading}} = \text{New RVP Slope}$$

8. The Slope and the RVP output from the Analyzer are directly proportional. Lowering the Slope value results in lowering the RVP output and vice versa.
9. The calculation used in step 7 will get you very close. If you wish to make further refinements, you can do so by using the rule of thumb indicated in step 8.
10. The slope value under Systems Settings is limited to two decimal places. If even further fine-tuning is needed, the slope can be changed in the Factory screen → Calibration → Sample Slope. Slope values can be entered to three decimal places on this screen.



System Settings Screen

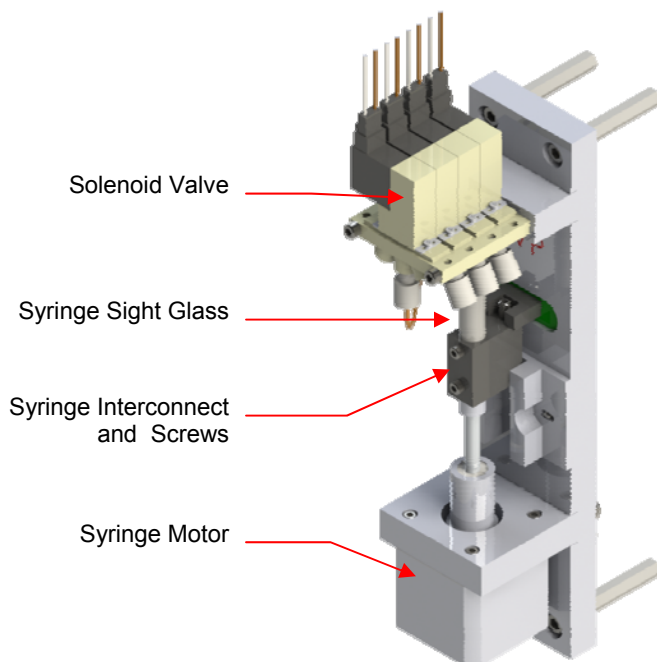
This is the Calibration setting



Factory Calibration Screen

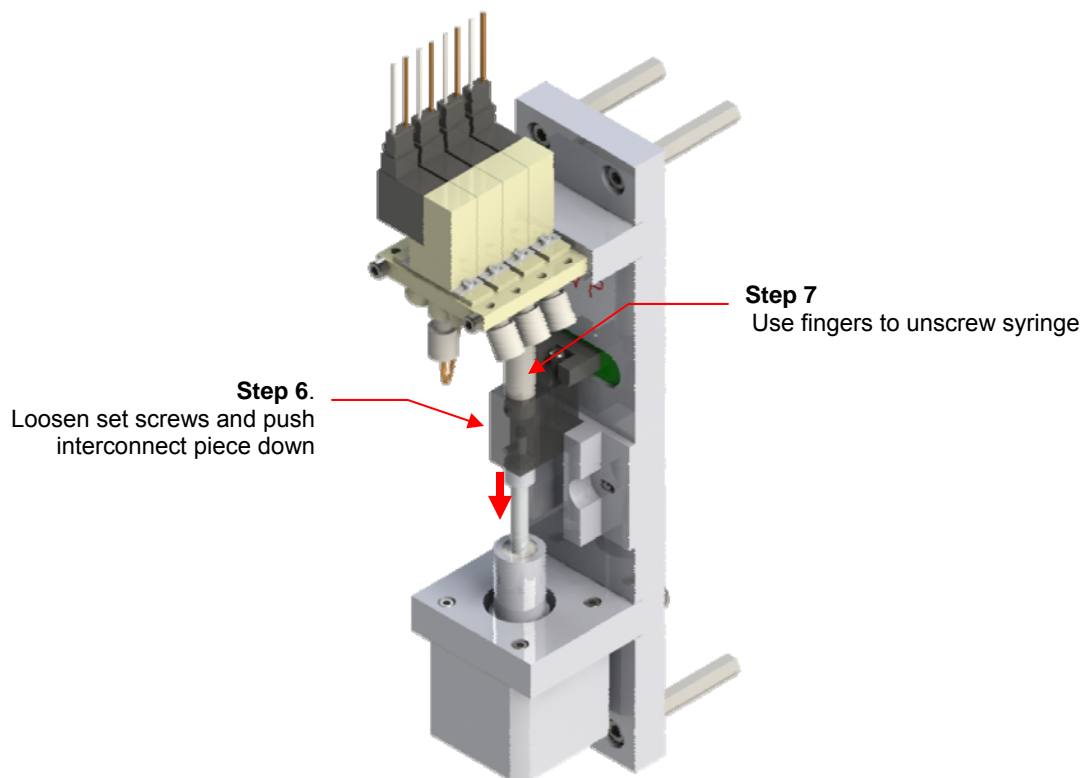
**COMPONENT REPLACEMENT**

**NOTE:** BARTEC-ORB recommends that syringe and tubing replacement be performed at six month or more frequent intervals.

**SYRINGE REPLACEMENT**

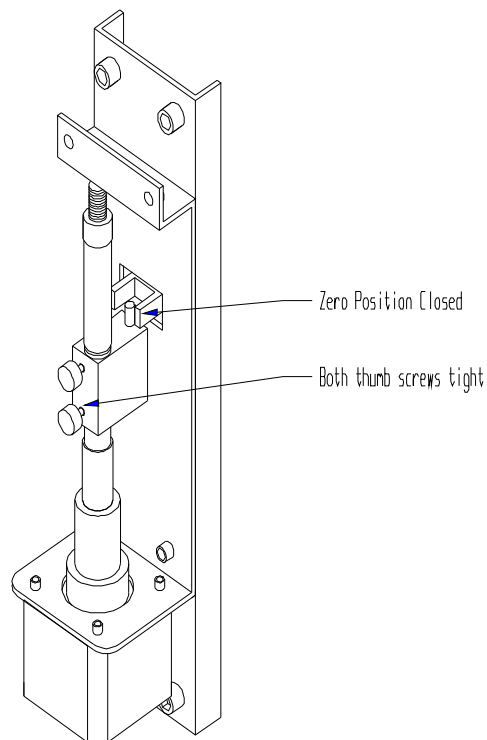
**Figure 6-1: Syringe Assembly**

1. Place the Analyzer in the Off-Line mode.
2. Stop the flow of sample to the Analyzer.
3. Open the Measurement enclosure.
4. Access the Service screen and (A) change the status of the Sample Solenoid to ON and (B) change the status of the Injector to UP.
5. Loosen the screws on the Syringe Interconnect fitting.

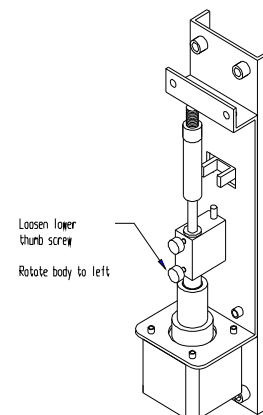


6. Place the Injector in the DOWN position (via Service screen). This will disengage the syringe motor from the syringe.
7. Unscrew the glass syringe from the solenoid valve.
8. Screw the replacement syringe into the solenoid valve until it is hand tight and then tighten just a bit more. Do not over-tighten.
9. Manually pull the syringe piston down and into the Syringe Interconnect fitting, making certain that it butts against the bottom of the fitting.
10. Tighten the thumbscrew on the Syringe Interconnect fitting.
11. Place the Injector in the UP position (via Service screen).
12. Change the status of the Sample Solenoid to OFF.
13. Turn the flow of sample to the Analyzer back on.
14. Check for leaks around the syringe assembly.
15. Place the Purge Solenoid in the ON position (via Service screen). The measurement cell pressure should increase until it equals the incoming measurement cell purge pressure.
16. Place the Purge Solenoid in the OFF position (via Service screen). The measurement cell pressure should hold at its previous value.
17. Close the Measurement enclosure.
18. Exit the Service screen.
19. Place the Analyzer back in the On-Line mode.

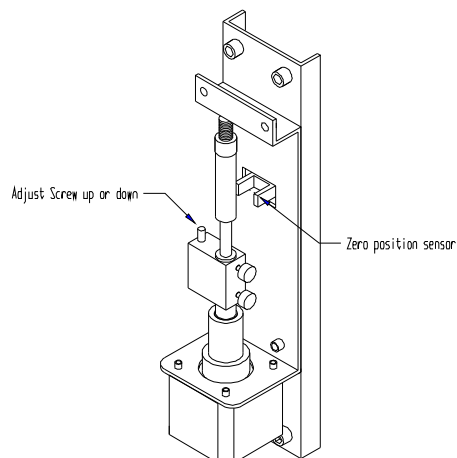



**ADJUSTING THE SYRINGE ZERO-POINT****Figure 6-2: Syringe Zero Position**

1. Place the Analyzer in the Off-Line mode.
2. Stop the flow of sample to the Analyzer.
3. Open the Measurement enclosure.
4. Access the Service screen and place the Injector in the DOWN position.




5. Rotate the adjustment screw on the syringe interconnect fitting as needed to increase/decrease the range of Injector travel. A clockwise rotation of the screw allows for further upward travel. A counter-clockwise rotation of the screw reduces the travel distance of the injector (stops the injector before it reaches the zero position).
6. Press the Up arrow key and observe the Injector's final resting point.
7. Repeat steps 5 and 6 as required until the Injector reaches the zero position with little or no air gap at the top.



	<p><b>CAUTION:</b> The Injector should be adjusted so that it just reaches the zero point, with little or no gap. If there is too large of a gap at the top of the syringe, there's a possibility of introducing air bubbles into the cell during analysis. If the top of the syringe pushes against the top of the zero point, a stepper motor alarm will be triggered. Ideal gap size after the syringe travels to the zero position is about 1/32" or less, but must not cause the stepper motor to continue to run once it reaches the zero position.</p>
---	---

8. Turn the flow of sample to the Analyzer back on.
9. Check for leaks around the syringe assembly.
10. Place the Purge Solenoid in the ON position (via Service screen). The measurement cell pressure should increase until it equals the incoming measurement cell purge pressure.
11. Place the Purge Solenoid in the OFF position (via Service screen). The measurement cell pressure should hold at its previous value.
12. Close the Measurement enclosure.
13. Exit the Service screen.
14. Place the Analyzer back in the On-Line mode.

**TUBING REPLACEMENT**

	<p><b>RECOMMENDATION:</b> BARTEC-ORB recommends that tubing replacement be performed at six month intervals in conjunction with syringe replacement. Tubing connections will be most accessible immediately after Step 8 of the syringe replacement procedure (removal of the old syringe).</p>
---	---

The RVP Analyzer’s measurement system incorporates six plastic and metallic tubes. The plastic tubes must be replaced every six months or sooner. Three of these tubes have Swag-lok fittings on one end and are used to make the connections between the sample inlet, measurement purge gas supply inlet, and atmospheric drain and their associated solenoid valves.

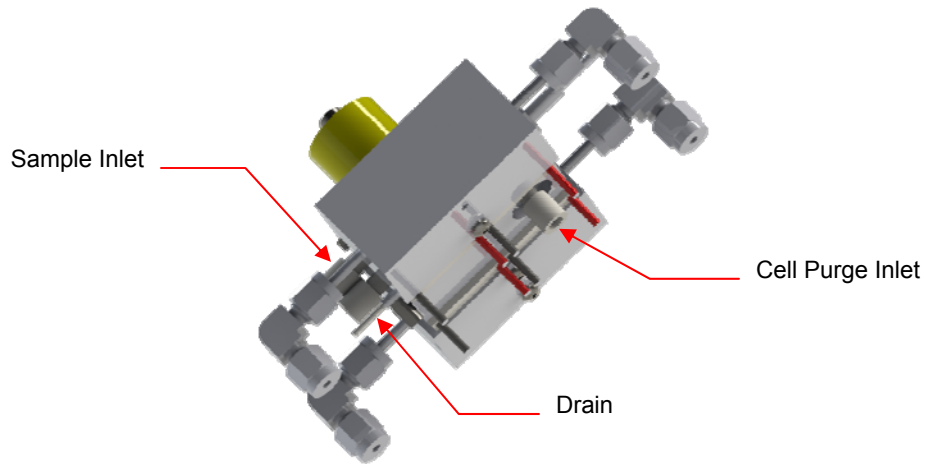
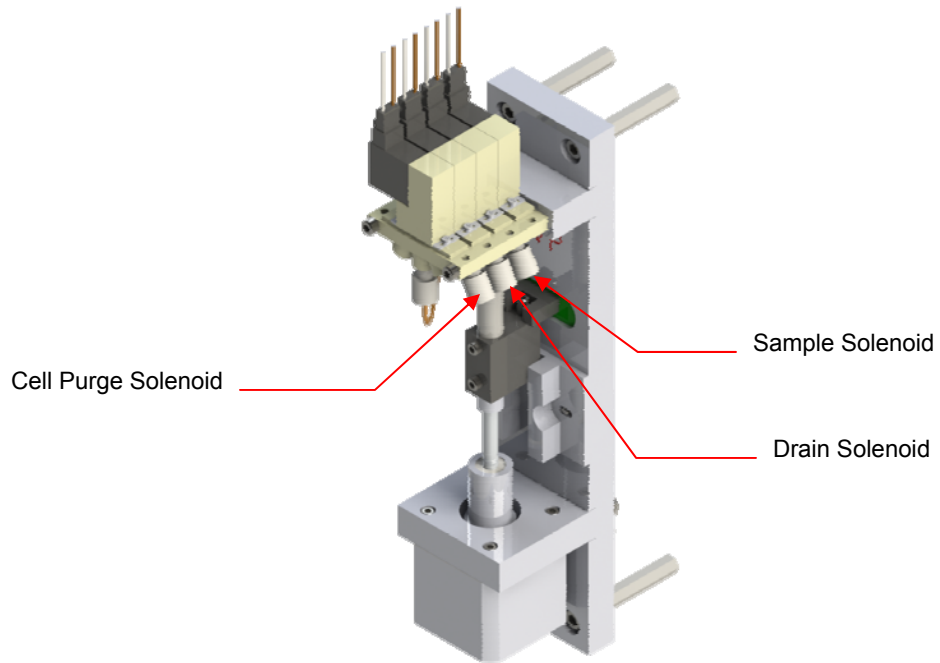
Tubing replacement is performed as follows (See Figure 6-3):

1. Place the Analyzer in the Off-Line mode.
2. Stop the flow of sample to the Analyzer.
3. Open the Measurement enclosure.
4. Remove the old tubes.
5. Install the replacement tubes according to the following table

	Tubing Length	Solenoid Connection		
		Left	Bottom Middle	Right
Cell Purge Solenoid (front solenoid)	10-inch	Not used	To measurement cell purge gas supply inlet*	To purge gas inlet on measurement cell
Drain Solenoid (middle solenoid)	5-inch	Not used	To atmospheric drain*	To drain on measurement cell
Sample Solenoid (rear solenoid)	5-inch	To sample supply inlet*	Syringe connection	To measurement cell inlet

\*Swag-lok fitting on one end of tube.

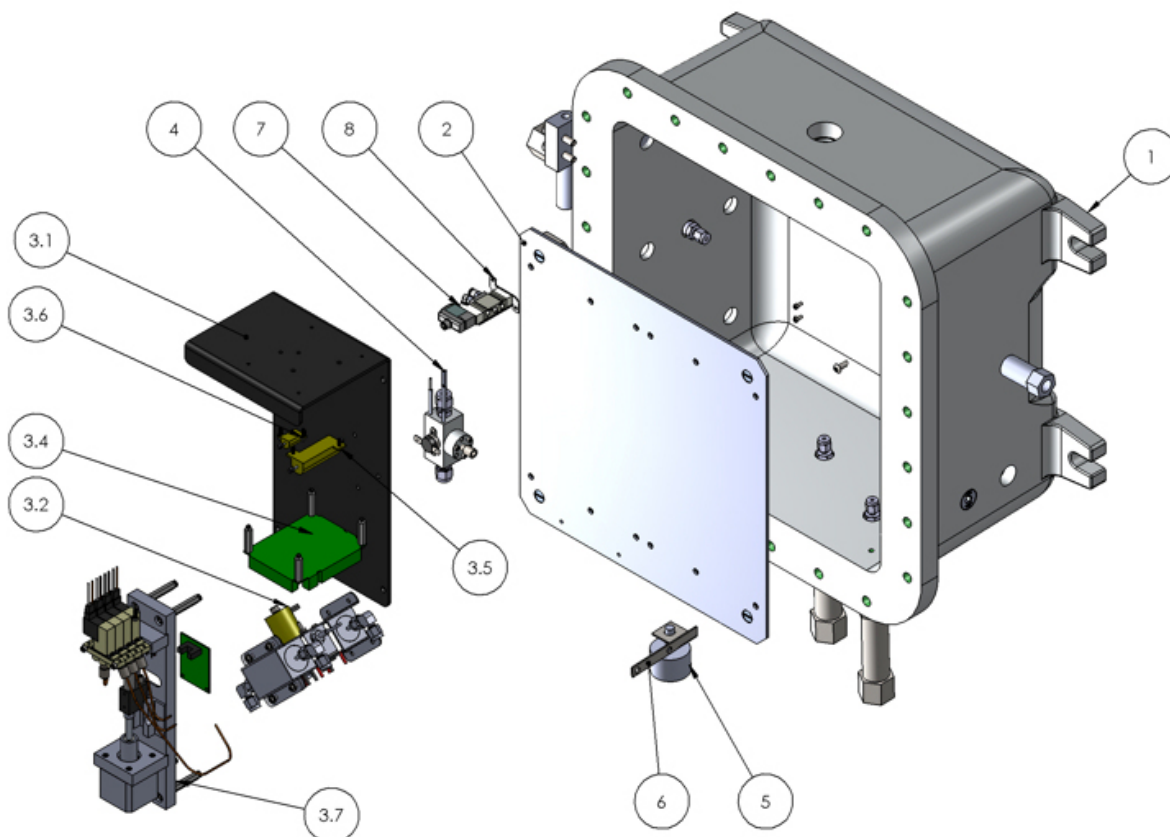
6. Turn the flow of sample to the Analyzer back on.
7. Check for leaks around the tubing connections.
8. Close the Measurement enclosure.
9. Place the Analyzer back in the On-Line mode.



**Figure 6-3: Measurement Cell Tubing Connections**

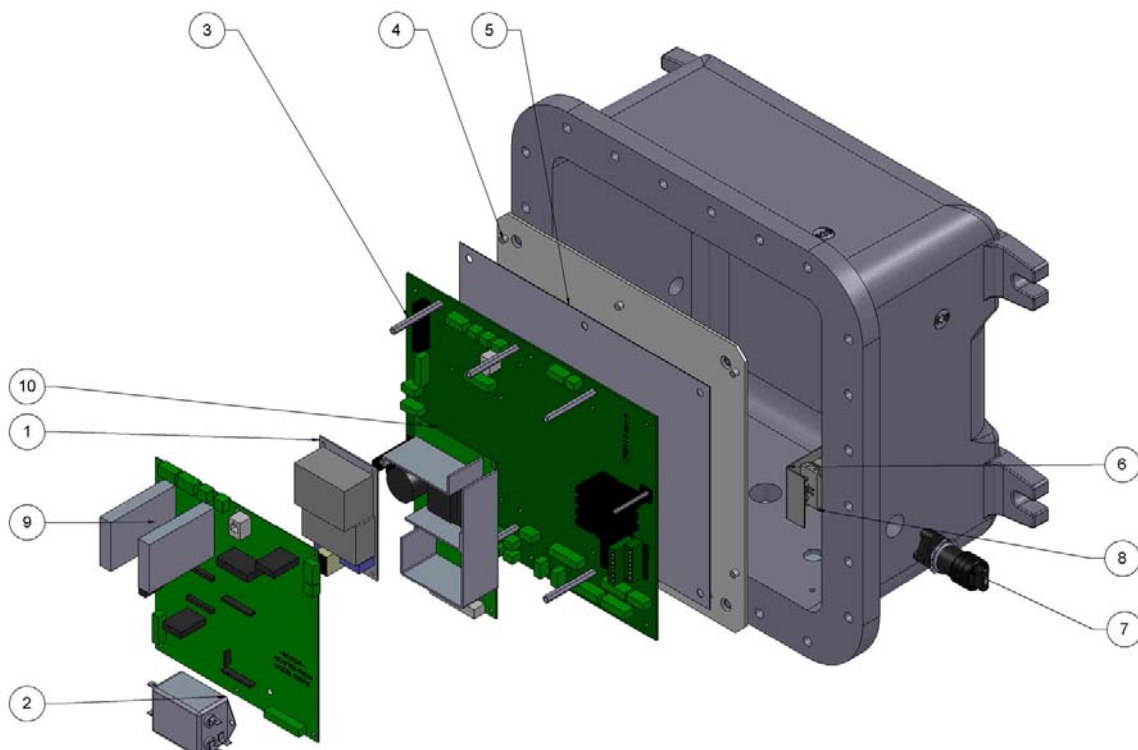
**LEAKAGE TROUBLESHOOTING**

1. Place the Analyzer in the Off-Line mode .
2. Access the Service screen.
3. **Drain Solenoid** — Move the cursor to the Drain solenoid menu selection and toggle to the ON position (open). Toggle the solenoid to the OFF position (closed). If the cell pressure increases substantially, there may be a leak in the Purge solenoid. To check, detach the Purge tubing at the solenoid that goes to the detection cell and connect a temporary tube in its place. Place the open end of the replacement tube in water and check to see if air bubbles appear when the solenoid is closed.
4. **Purge Solenoid** — Move the cursor to the Purge solenoid menu selection and toggle ON and then OFF. If the cell pressure drops, there may be a leak in the Drain solenoid. To check, apply pressure to the detection cell and connect a temporary tube to the drain exhaust. Place the open end of the temporary tube in water and check for air bubbles.
5. **Detection Cell** — Move the cursor to the Purge solenoid menu selection and toggle ON. Check the detection cell with Snoop.

**ASSEMBLY DRAWINGS**
**MEASUREMENT ENCLOSURE**


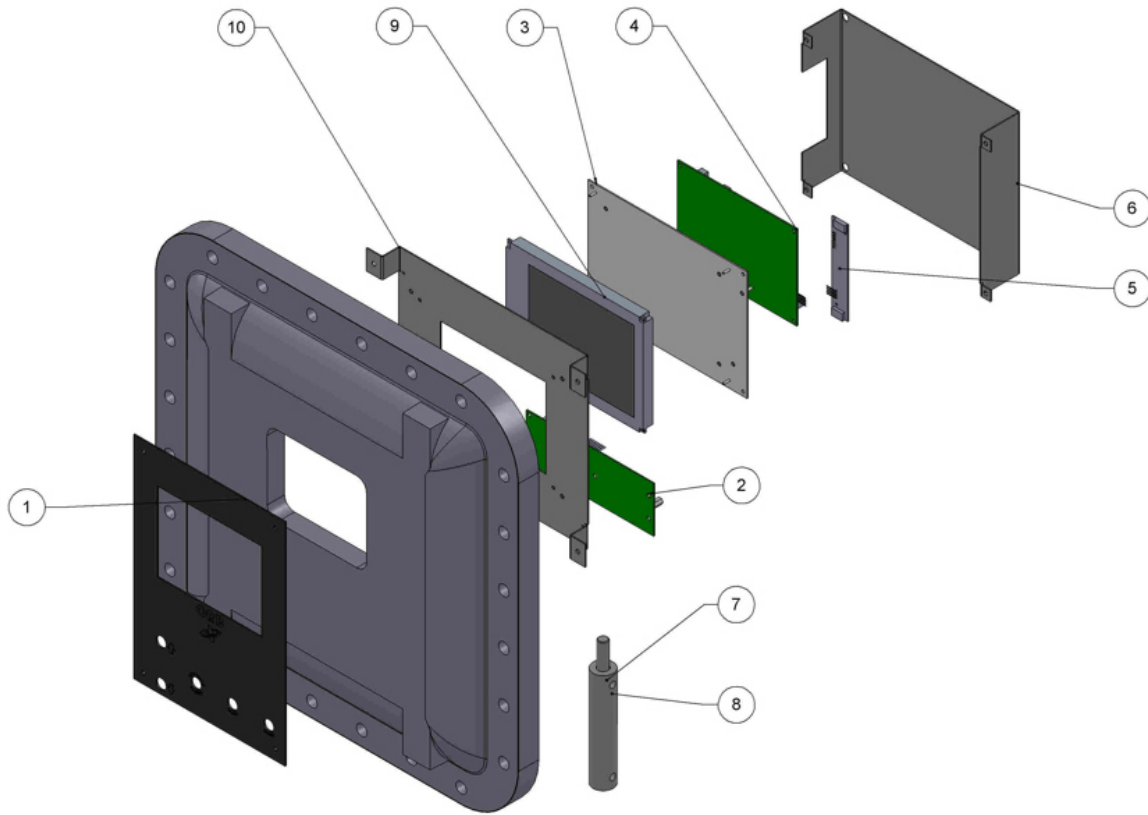
ITEM NO.	PART NUMBER	DESCRIPTION
1	680009	RVP/VL20 LOWER ENCLOSURE
2	700524	EXP PROOF ANALYZER ENCLOSURE BACKPLATE
3	700406	RVP/VL20 ANALYSIS MODULE
3.1	700329	MOUNTING PLATE
3.2	700402	DETECTION CELL ASSY
3.4	700115	RVP INTERFACE PCB
3.5	600001	5 OHM/50 WATT RESISTOR
3.6	600002	33 OHM/10 WATT RESISTOR
3.7	701474	SYRINGE & VALVE ASSY
4	700819	MICRO FILTER
5	660005	FLOAT SWITCH
6	701289	FLOAT BRACKET
7	650019	4-WAY VALVE
8	650199	4-WAY AIR SOLENOID BRKT

**CONTROL ENCLOSURE**



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

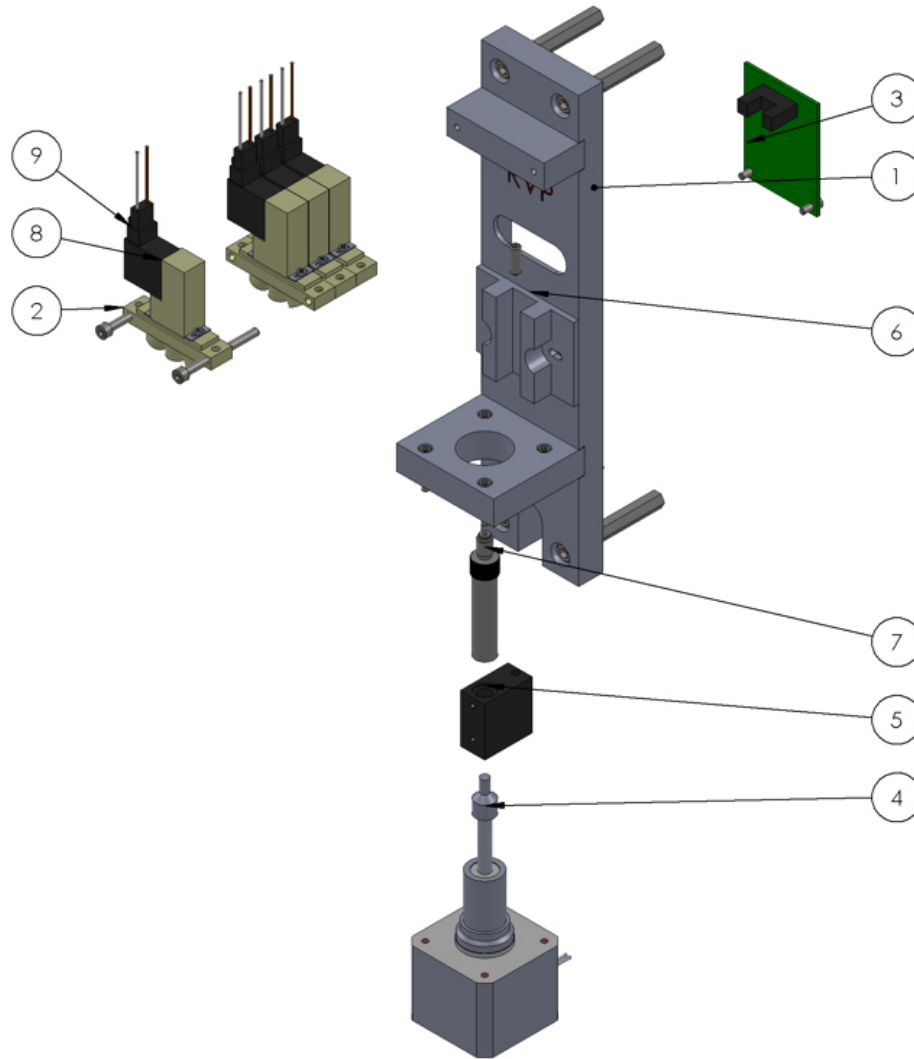
**CONTROL ENCLOSURE DOOR**



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

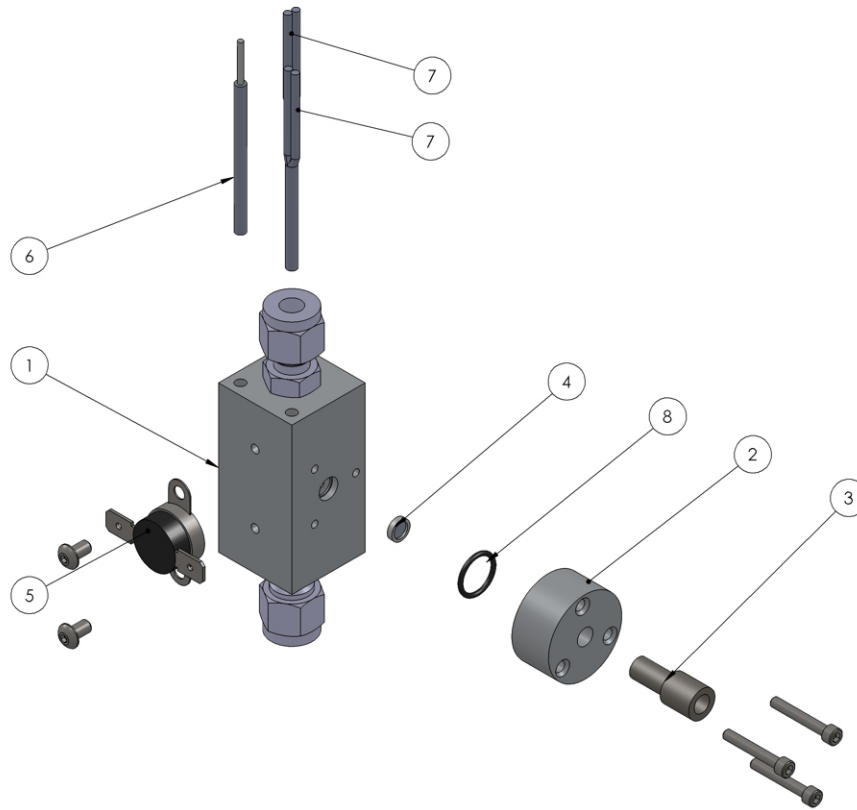


**SYRINGE ASSEMBLY**



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	701049	STEPPER MOTOR MOUNT ASSY	1
2	650005	3 WAY SOLENOID	4
3	700100	OPTICAL SENSOR PCB	1
4	640001	SYRINGE STEPPER MOTOR	1
5	700338	SYRINGE ADAPTER	1
6	702202	SYRINGE GUIDE,TEFLON SUPPORT	1
7	690023	1 ML SYRINGE	1
8	650004	2 WAY SOLENOID	4
9	620062	SOLENOID CABLE PLUG	4

**MICRO FILTER ASSEMBLY**



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	700807	MICROFILTER BODY WELDMENT	1
2	700818	MICROFILTER CAP	1
3	690102	1/4-28 SUPER FLANGELESS NUT	1
4	650159	20 MICRON SS FRIT	1
5	701288	MICROFILTER THERMOSTAT	1
6	660001	RTD SENSOR	1
7	620123	MICROFILTER HEATER 120V	2
8	650166	O-RING	1



# SPARE AND REPLACEMENT PARTS

# SECTION 7

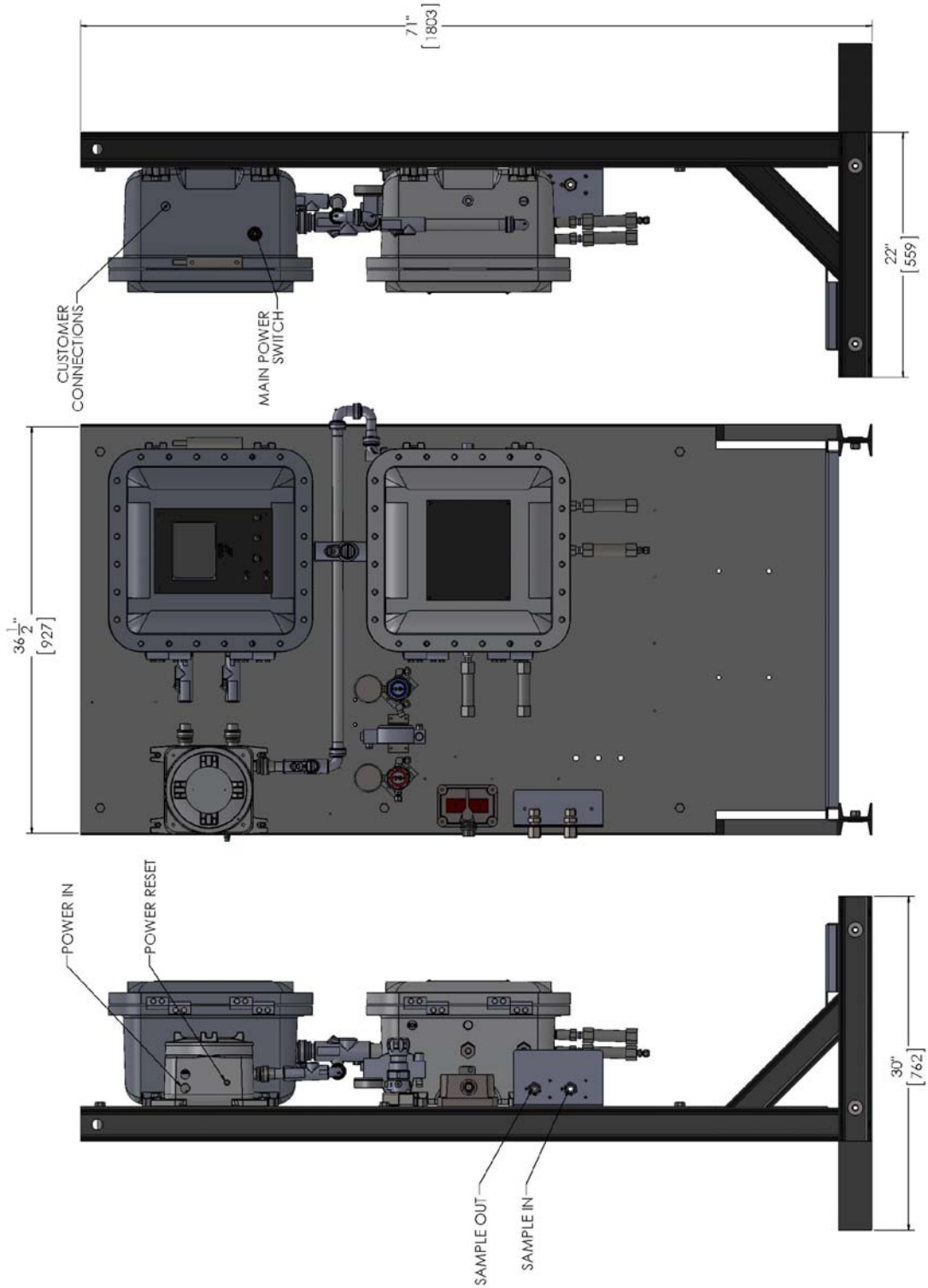
## SPARE PARTS KITS

Description	Part Number
<b>1-YEAR PARTS KIT.....</b>	<b>700175</b>
Kalrez O-ring, 1 each.....	650003
1 mL sample syringe, 2 each.....	690023
RVP cell tubing kit, 2 each.....	690003
<b>2-YEAR PARTS KIT.....</b>	<b>700176</b>
2-way solenoid valve, 1 each .....	650004
3-way solenoid valve, 1 each .....	650005
Kalrez O-ring, 2 each.....	650003
1 mL sample syringe, 4 each.....	690023
RVP cell tubing kit, 4 each.....	690003

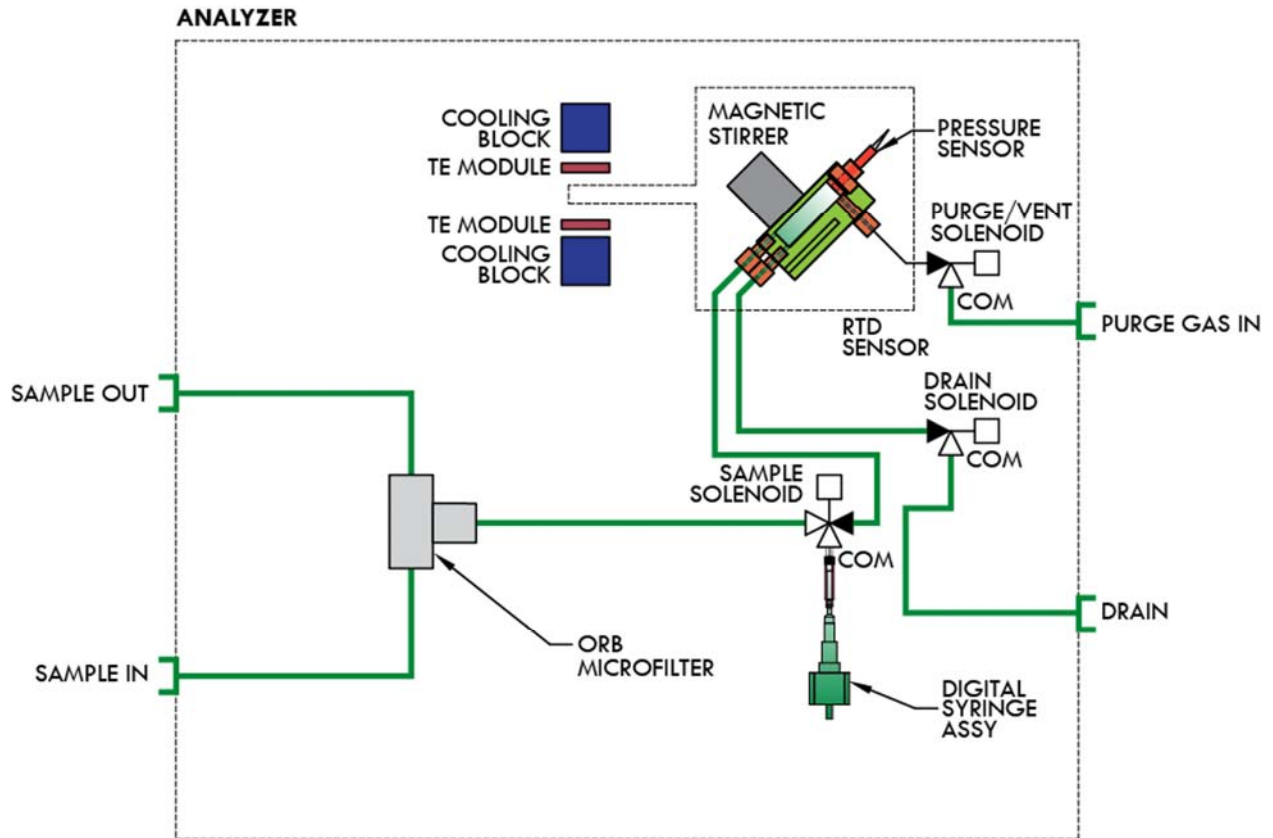
**REPLACEMENT PARTS**

Description	Part Number
Fuse (250 VAC, 15 A), 1 each.....	600051
Fuse (250 VAC, 10 A), 2 each.....	600052
Power Supply (+5, ±12 VDC), 1 each .....	620037
Power Supply (+24 VDC), 1 each .....	620038
Magnetic plug agitator, 1 each .....	630001
Syringe stepper motor, 1 each .....	640001
Agitator drive magnet, 1 each.....	650002
Kalrez O-ring, 1 each.....	650003
2-way solenoid, 1 each.....	650004
3-way solenoid, 1 each.....	650005
RTD sensor, 1 each.....	660001
1 mL sample syringe, 1 each.....	690023
RVP cell tubing kit, 1 each.....	690003
Absolute pressure sensor, 1 each.....	700311
Optical PCB, 1 each .....	700100
Interconnect PCB, 1 each.....	700115
Magnetic Keypad Assembly, 1 each .....	798030
Graphics Display Assembly, 1 each.....	700286
Display Controller PCB, 1 each.....	798063
Backlight Driver PCB, 1 each .....	700288
Cable Assembly, 1 each.....	700289
Main Control PCB, 1 each.....	700318
RVP adapter PCB, 1 each.....	700321
Main Distribution PCB, 1 each.....	798115
RVP/VL20 analysis module, 1 each .....	700406

**Figure 8-1 Dimensional Drawing**



**Figure 8-2 Flow Schematic**



## APPENDIX

## SECTION 9

### CRUDE OIL SAMPLING SYSTEM

#### GENERAL DESCRIPTION

BARTEC-ORB's Crude Oil Sampling System is a factory installed option that may or may not be included with the Model P-700 RVP Analyzer or Model P-780 RVP / VL20 Analyzer. It is designed to properly heat and condition crude oil samples for delivery to the analyzer's detection cell.

The Crude Oil Sampling System consists of a high pressure process pump, high pressure analyzer pump, switching valve, surge tank housed, and various valves reliefs housed in a SCS enclosure. The system also incorporates a toluene cylinder mounted to the side of the analyzer frame and a micro-filter located in the analyzer enclosure. All timing is controlled by the Model P-700 RVP Analyzer or Model P-780 RVP / VL20 Analyzer.

**High Pressure Process Pump** — Delivers process sample to the switching valve at 100 cc/minute. It is designed to handle abrasive materials and operates continuously, regardless of state of the switching valve.

**High Pressure Analyzer Pump** — Delivers process sample from the switching valve to the analyzer at 60 cc/minute. It is also designed to handle abrasive materials and operates continuously, regardless of state of the switching valve.

**Switching Valve** — A six-port valve that directs sample to the analyzer as needed.

**SCS Enclosure** — Heated to 70°C (140°F).

**Surge Tank** — Facilitates the return of excess sample to process. It is equalized at the process pressure.

**Toluene Cylinder** — Stores the solvent used to back-flush the micro-filter.

**Micro-Filter** — Removes particulate from sample. It is controlled at a user-set temperature (60°C/140°F recommended) and back-flushed with toluene on a user-set cycle (every 10 to 20 measurements recommended) to remove accumulated particulate.

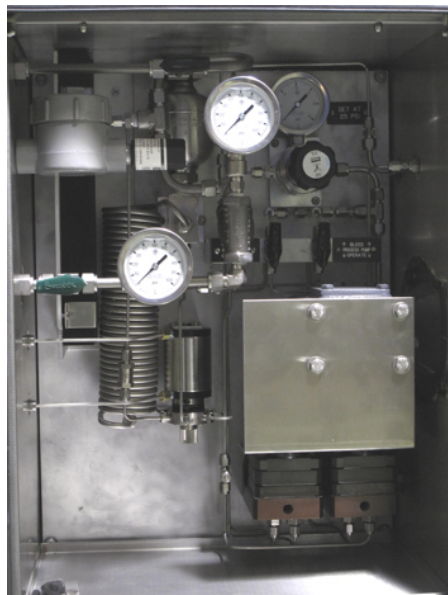


Figure 9-1: Crude Oil Sampling System

## PRINCIPLE OF OPERATION

### Recharging

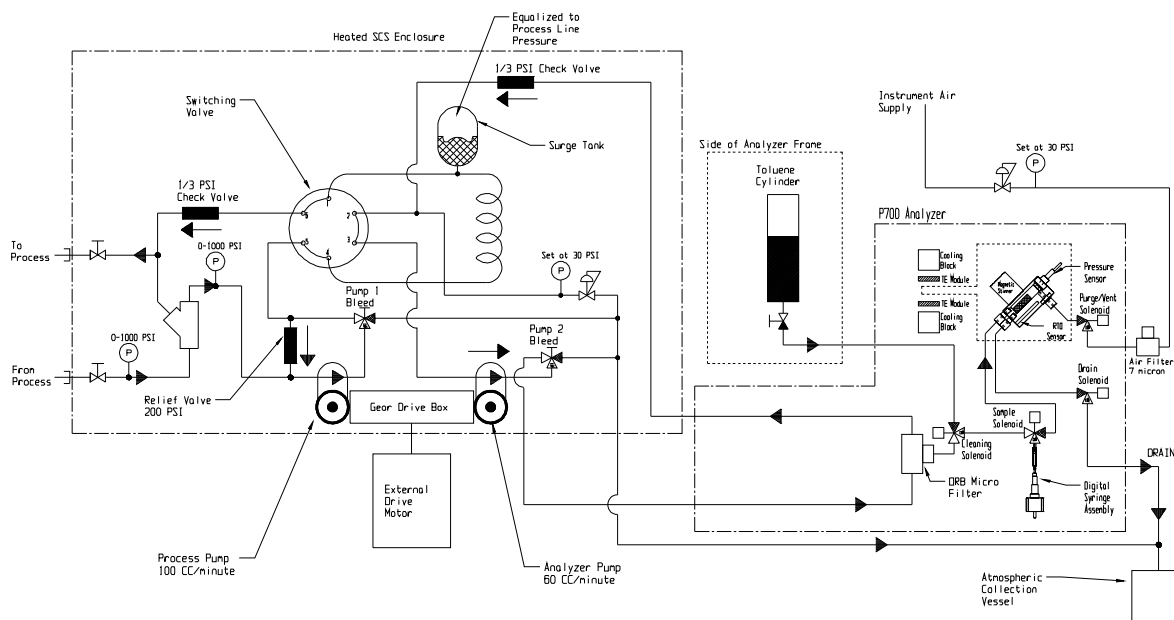
See Figure 9-2.

The recharging cycle refreshes the crude oil sample that will be made available to the analyzer.

The switching valve is rotated to 1-6, 2-3, and 4-5 common ports.

The process pump pumps sample through the valve, into the process loop, and into the surge tank until the pressure within the tank is equal to that in the return line to the process stream. Pumping continues to fully fill the sample loop with fresh sample.

The analyzer pump pumps sample in a re-circulating loop through the micro-filter.



**Figure 9-2: Crude Flow - Recharging**

### Analysis

See Figure 9-3.

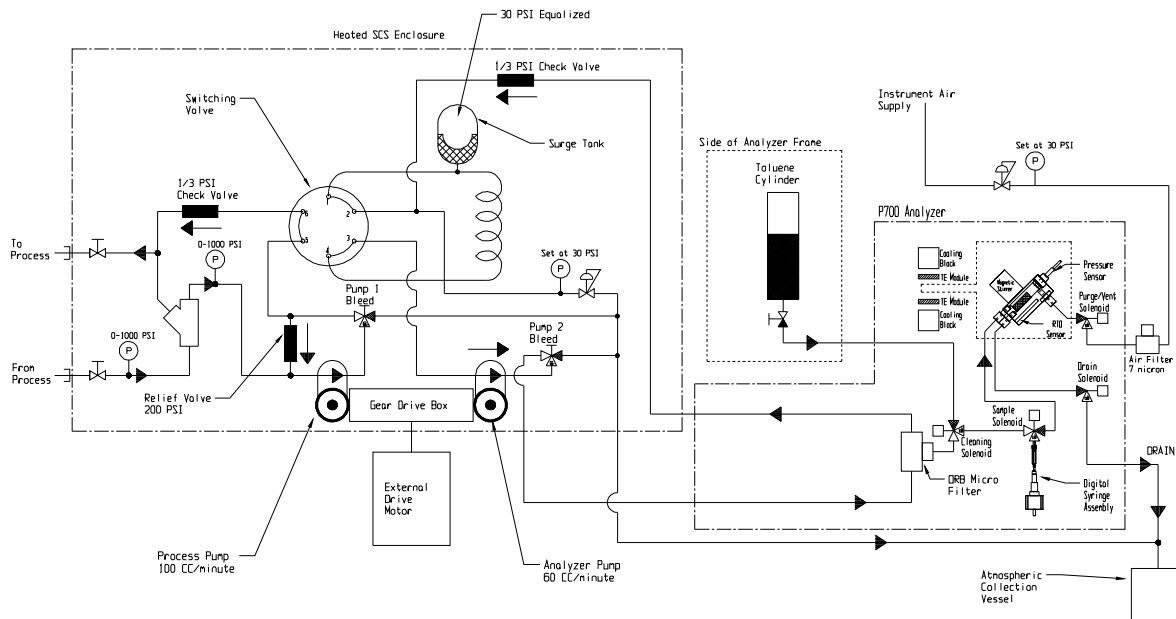
The analysis cycle refreshes the crude oil sample that will be presented to the analyzer.

The switching valve is rotated to 1-2, 3-4, and 5-6 common ports. The pressure in the surge tank is bled down to 30 PSI by letting sample pass through a relief valve into the atmospheric drain tank. A 1/3 PSI check valve protects the internal analyzer low pressure solenoid valves from the high pressure that built up in the surge tank.

The analyzer pump circulates fresh sample through the micro-filter and to the analyzer for analysis.

The process pump pumps sample from the process line through a short loop and back to process.





**Figure 9-3: Crude Flow – Analysis**

### **RECOMMENDED ROUTINE MAINTENANCE SCHEDULE**

Check process inlet and outlet pressure	Weekly
Check toluene supply	Monthly
Clean micro-filter	Monthly

### **MICRO-FILTER CLEANING**

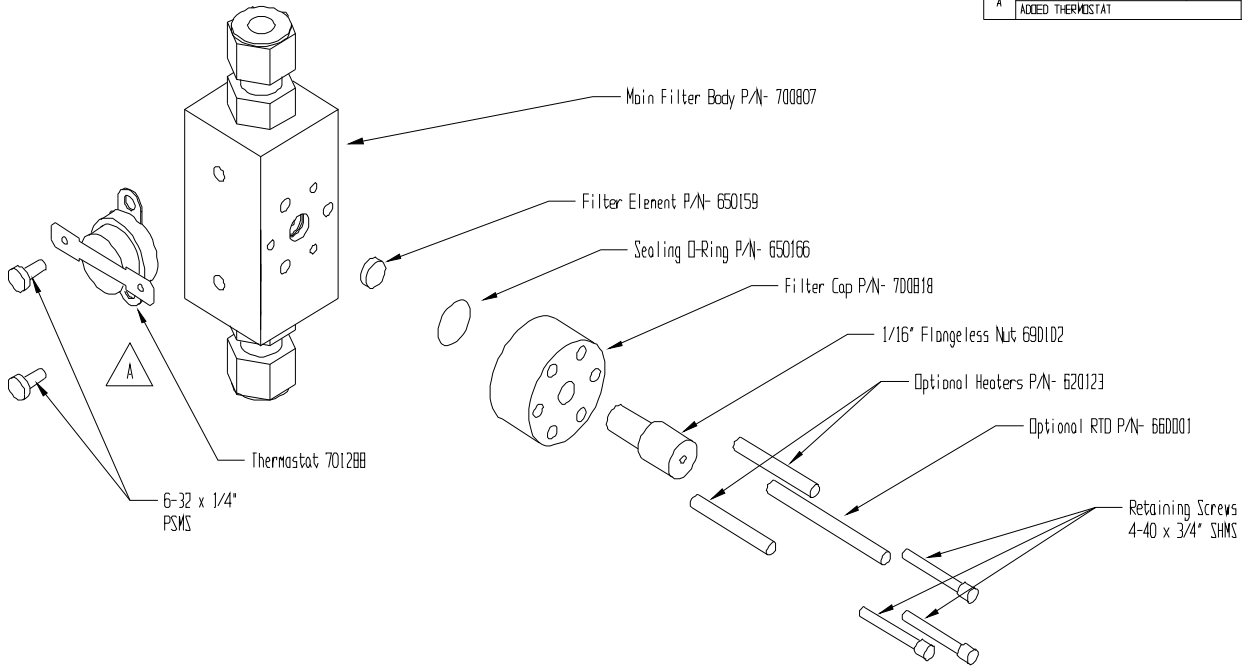
See Figure 9-4.

1. Place the Analyzer in the Off-Line mode.
2. Stop the flow of sample to the Analyzer.
3. Open the Measurement enclosure.
4. Remove the three retaining screws that hold the filter cap to the filter body.
5. Remove the optional heater elements and optional RTD from the filter cap.
6. Remove the filter cap, O-ring, and filter element from the main filter body.
7. Inspect the O-ring for damage; replace if required.
8. Clean the filter element with an appropriate solvent. Replace filter element if damaged.
9. Insert filter element in main filter body.
10. Insert O-ring.
11. Place filter cap on main filter body.
12. Insert optional heater elements and optional RTD.
13. Re-insert retaining screws.

14. Close the Measurement enclosure.
15. Re-initiate sample flow.
16. Place the Analyzer back On-Line.

ALL RIGHTS RESERVED  
 THE DESIGN AND RELATED INFORMATION CONTAINED HEREIN IS THE SOLE PROPERTY OF ORB INSTRUMENTS, INC. NO PART OF THIS PUBLICATION MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT PERMISSION IN WRITING FROM ORB INSTRUMENTS, INC.

REVISION				
REV	EN	OR/DR	DATE	
-	-	OK / OK	6-13-08	
RELEASE NEW DRAWING				
-	-	JES/JES	10-21-08	
A	ADDED THERMOSTAT			



1. TO ORDER: A I M N C E N C P S									
2. SUPPLY MATERIALS: NONE									
3. PARTS TO BE ORDERED: NONE									
4. PARTS TO BE ORDERED: NONE									
5. NO. OF EACH OF ABOVE PARTS: NONE									
MODEL NO.	Canon								
P/N	6-13-08								
DATE	OK								
REV	NONE								

ORB Instruments, Inc.  
 Heated

Figure 9-4: Micro-Filter

**MODBUS MAP**

<b>Function Code 1, Read Coils (output bits)</b>	
1	Mixer
2	Drain / Vacuum Valve
3	Purge Valve
4	Sample Valve
5	Validation Valve
6	Wash Valve
7	Stream Valve
7- 13	Not used
14	Alarm Relay 1
15	Alarm Relay 2
16	Alarm Relay 3

<b>Function Code 2, Read Digital Inputs</b> (Logic is inverted)	
1	Customer Alarm
2	Remote Standby
3	Validation Request
4 - 7	Not used

<b>Function Code 3, Read Holding Registers</b> Registers 1 through 99 are big endian 16 bit signed integers. Fractional values are coded as multiple of that value. E.g., if a variable's value is 12.76, it would be read as 1276 or $12.76 * 100$ .	
1	Main Board ADC Channel 1 0-4095 = 0-100C
2	Main Board ADC Channel 2 0-4095
3	Main Board DAC Channel 1 0-1023 = 4 mA – 20 mA
4	Main Board DAC Channel 2 0-1023 = 4 mA – 20 mA
5	Main Board PWM Channel 1 0-1023 Heater PWM
6	Main Board PWM Channel 2 0-1023 Cooler PWM
7	Main Board PWM Channel 3 0-1023 Not used
8	Main Board PWM Channel 4 0-1023 Not used
9	External Inputs 8 bits
10	External Outputs 8 bits
11	RVP Board ADC Channel 1 0-4095 = 0-30 PSI
12	RVP Board ADC Channel 2 0-4095 Not used
32	Analysis Status 0 = Idle 1 = Running
33	Current Analytical Operation 0 = Idle 1 = Initializing 2 = Agitate 3 = Zero 4 = Purge/Drain 5 = Read 6 = Vent 7 = Cell Evacuation 8 = Injecting 9 = Charging 10 = Wait 11 = Purge/Drain/Agitate 12 = Abort 13 = Injector Cleaning 14 = Filter Wash 15 = Rinse 16 = Drain 17 = Purge 18 = Repeat 19 = Remote Rinse 20 = Remote Standby 21 = Cell Clean 22 = New Stream Rinse 23 = Validation Rinse
34	Operation Timer/Counter in seconds

35	Absolute Cell Pressure *
36	Relative Cell Pressure *
37	Cell Temperature * 10.0 in current units
38	Barometer Reading in mmHg
39	Current Stream 0 = Stream 1 1 = Stream 2 2 = Validation
40	RVP or VL20 Stream 1 *
41	RVP or VL20 Stream 2 *
42	Last Validation Result *
48	Validation Phase 0 = Off 1 = Validation Requested 2 = Pre-rinse 3 = In process 4 = Post-rinse 5 = Complete
49	Validation Counter: Validations completed for the cycle
50	Validation Status 0 = Valid Cycle Failed 1 = Valid Cycle Passed 2 = Valid Cycle in Process
51	Temperature Control Status 0 = Off 1 = Heating 2 = Cooling
52	Temperature Control Power 0 – 100%
53	Stepper Motor Task Status 0 = No Faults 1 = Motor Injecting 2 = Motor Drawing 3 = Failure
54	Agitate Task Status 0 = Idle 1 = Running
55	Temperature Scale 0 = F 1 = C
56	Pressure Scale 0 = PSI 1 = HPA 2 = KPA 3 = KGCM 4 = Bar 5 = mmHg

57	Operation Mode 0 = RVP 323 1 = RVP 5191 2 = RVP EPA 3 = VL20
58	Alarm Word: Bit map of all alarms or information in force
59	Latest Alarm:

Alarm Type	Bit Weight	Alarm
Warnings	0001H	Bad Result
	0002H	Bad Validation
Informative	0010H	Stream
	0020H	Validation Request
	0040H	In Validation
	0080H	Cleaning Cycle
	0100H	Rinse Cycle
	0200H	Maintenance
	0400H	Remote Standby
	Fatal	0100H
0200H		RTD Failure
0300H		Temp. Control Failure
0400H		Motor Failure
0500H		Vacuum Failure
0600H		VL20 Temperature Failure
0700H		External User Alarm

NOTE: Warning and Informative alarms are bit mapped. Fatal Alarms are exclusive; they are not bit mapped, just typed.

60	TVP stream 1 *
61	TVP stream 2 *
* All integer representations of pressure depend on the current pressure scale. HPa and mmHg = Pressure * 1.0 Kpa = Pressure * 10.0 Kg/Cm = pressure * 1000 PSI = pressure * 100	

Floating Point Holding Registers	
100	Cell Temperature in current units
102	Relative pressure in current units
104	Barometer
106	RVP or VL20 for Stream 1
108	RVP or VL20 for Stream 2
110	TVP Stream 1
112	TVP Stream 2

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

**[THIS PAGE INTENTIONALLY BLANK]**