BARTEC

Process Analyzer

User Manual

P-500 FLASH POINT ANALYZER

September 22nd, 2022
Version 1.2

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BARTEC ORB
4724 South Christiana Avenue
Chicago, IL 60632
USA

Foreword

Warranty Policy

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

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

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

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

LIMITATIONS

This warranty does not cover:

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

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

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

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

LIMITATION OF REMEDIES

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

Revision History

Rev.	Description / Changes	Date
1.2	Updated digital inputs information	September 22nd, 2020
1.1	Editorial changes	March 25th, 2020
1.0	First version of the new Manual	September 16th, 2020

Chapter I: Introduction

Analyzer Overview

The Bartec Orb Model P-500 Flash Point Analyzer is an on-line instrument designed to continuously measure the flash point of mid-distillate products. Extremely rugged and simple to operate, the compact P-500 Flash Point Analyzer combines exceptional measurement accuracy with unmatched operational dependability to deliver highly reliable and repeatable flash point determinations.

- Rapid analysis — 5 minutes or less typical cycle time;
- Superior repeatability — ±1.0°C (1.8°F) or better;

For optimum installation and applications versatility, the P-500 Flash Point Analyzer incorporates a wide variety of standard features, including:

- Isolated, self-powered 4-20 mA analog output (optional second output available);
- Three SPDT dry contact alarm relays;
- Optional Modbus output (Ethernet TCP/IP or RS-485 RTU);
- RS-232 serial output;
- Optional sample conditioning and high pressure sample delivery/return systems available;
- Class I, Division 1, Group B, C, D or European ATEX Zone 1, Group II B + H2 T6 hazardous area classification.

Principle of Operation

The P-500 Flash Point Analyzer is designed to provide flash point measurements in correlation with ASTM Methods D-56 (Tag) and D-93 (Pensky-Martens Closed Cup). It incorporates a highly reliable, yet sophisticated flash detection system consisting of a small, stainless steel flash chamber, sample mixing and heating tube, spark ignition circuitry, and pressure detection system (used for flash detection).

A typical measurement cycle proceeds as follows:

1. Sample and combustion air are mixed (air line integrity protected via a check valve) and then flow into the sample mixing/heating tube (MHT) within the measurement enclosure. This specially designed component facilitates uniform mixing and controlled heating of the continually flowing sample.
2. The air/sample mixtures leave the MHT and enters the stainless steel flash chamber where it separates into liquid and flammable vapors.
3. A spark ignition source is applied at a controlled rate to the vapors within the flash chamber; a detection circuit (based on pressure wave detection from sample ignition) continuously monitors for actual flash. When flash is detected, the incoming sample temperature is recorded and reported.
4. The sample heater is then turned off and the sample allowed to cool for a specific time or to a specific temperature below the reported flash point temperature.

By continuously tracking analyzer conditions during the analysis cycle, internal diagnostics are able to quickly detect abnormal events.

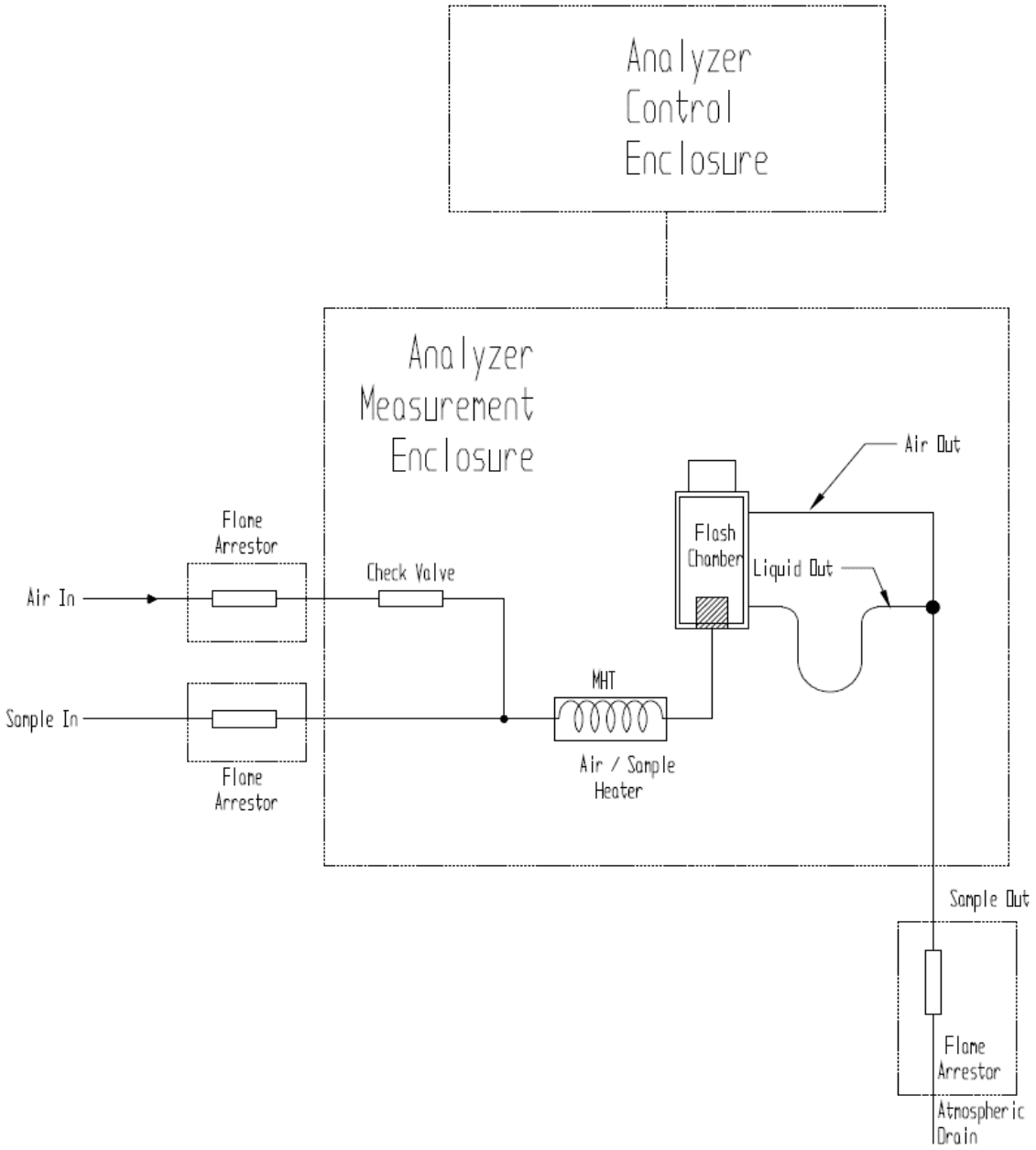


Figure 1-1: Analyzer Flow Schematic

Component Identification

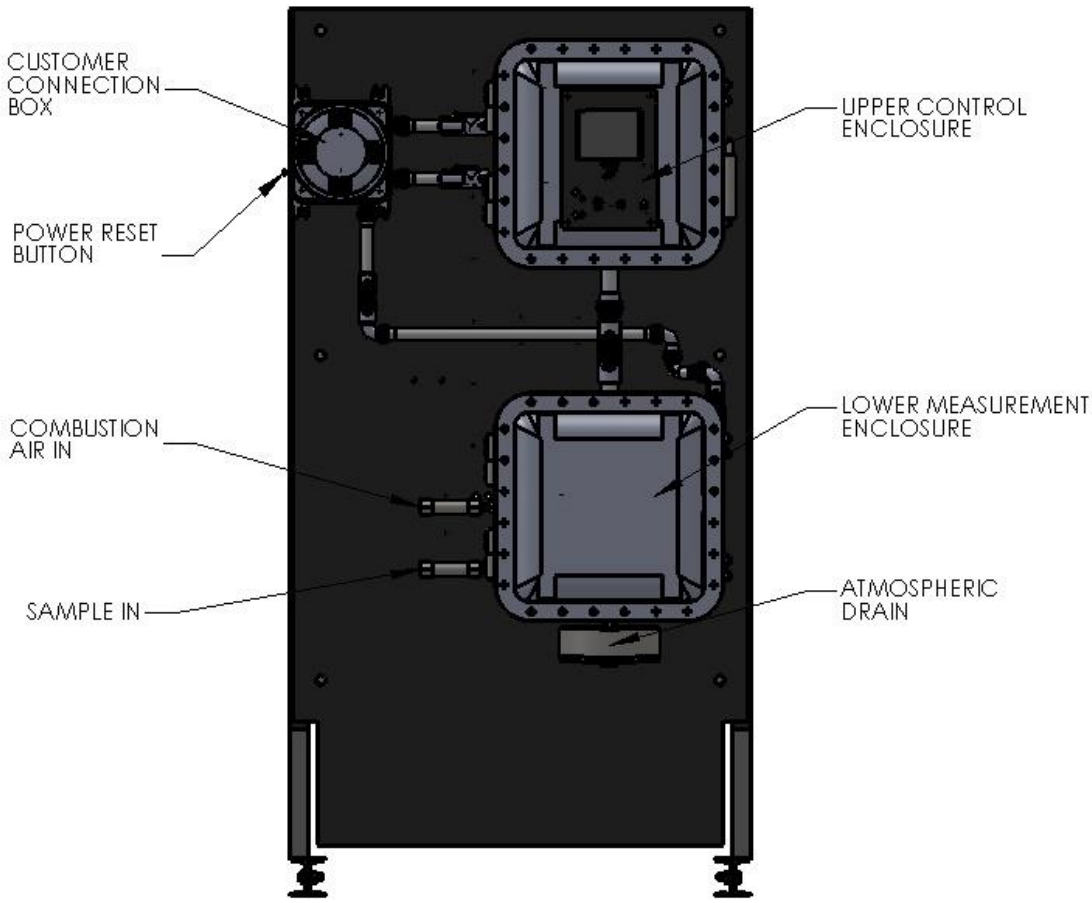


Figure 1-2: Front View

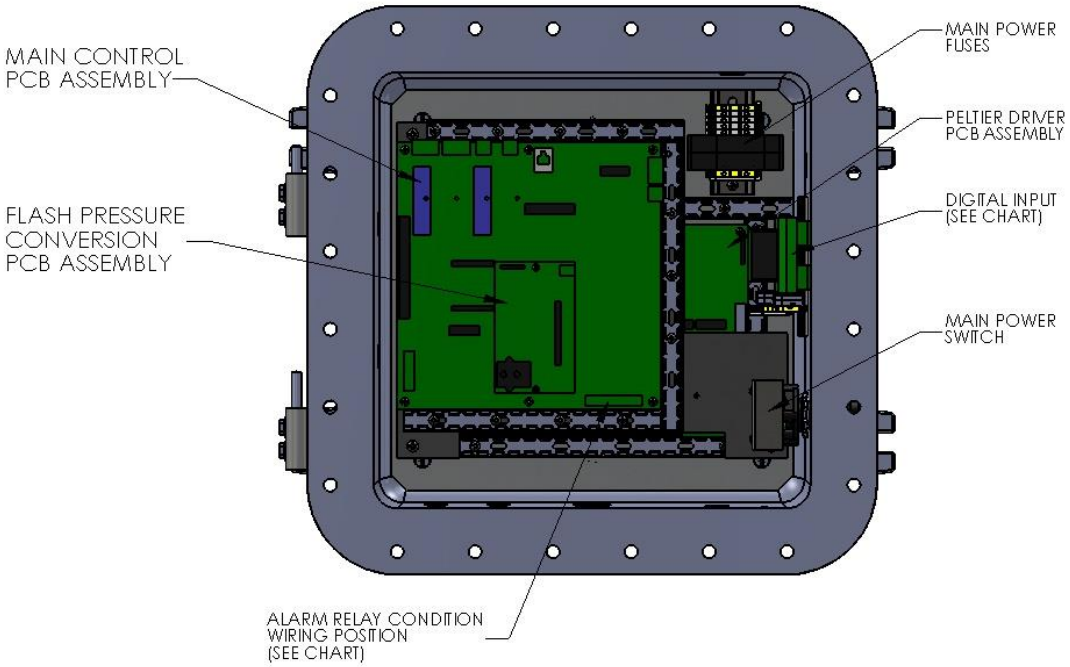


Figure 1-3: Upper Control Enclosure

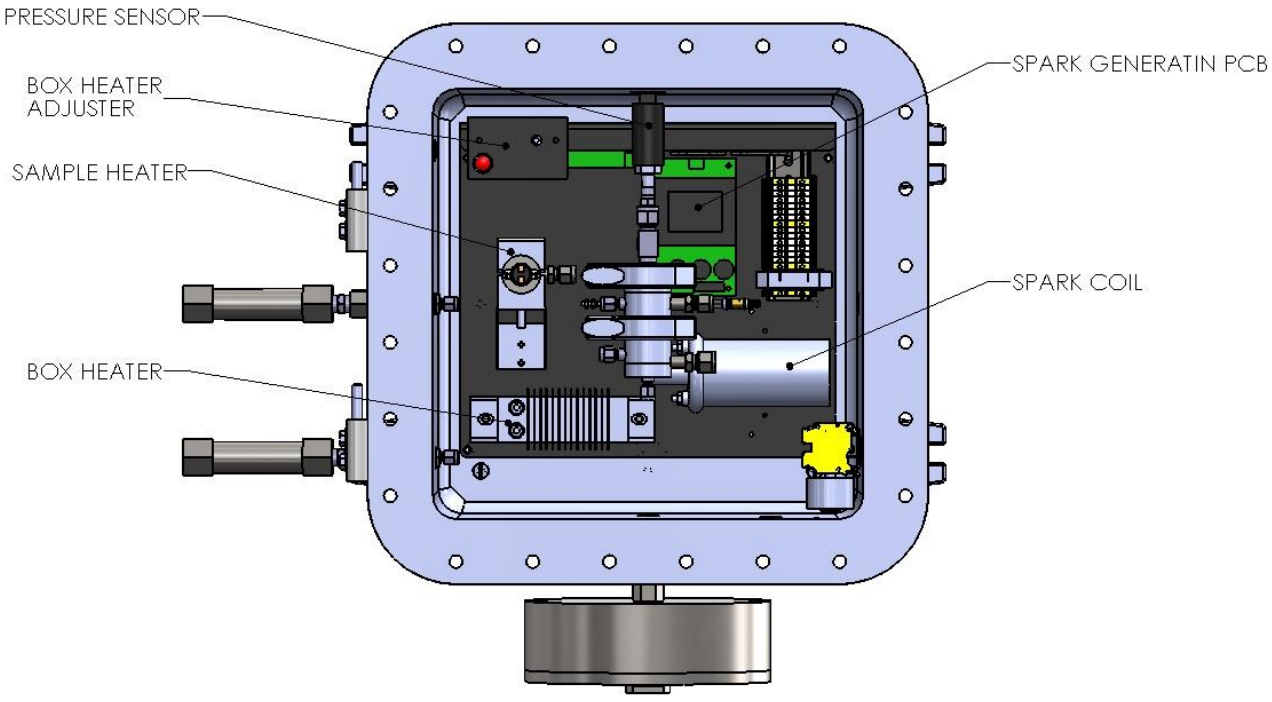


Figure 1-4: Lower Measurement Enclosure

Menu Structure

Main Menu	Submenu	Items	Choices / Settings / Comments
Analyzer Status	–	–	Online / Offline
Alarm History	–	Reset	Reset Alarms log
Validation History	–	Reset Req. Valid.	Reset Validation log Request Validation
Service	–	Mechanical (Used to verify operation of various solenoids)	Air Purge Spark Validation Stream Select Flushing
		Detector (Used to check detection circuit)	AutoZero Detect Level Clear Latch Detect Latch
		Sample Heat (Used to check sample heater)	Temp. PWM Load Heater
		Run Autozero Run Validation	Run Autozero state Run 1 Validation cycle
		4-20mA Outputs (Used to check 4-20mA signals)	Output 1 Output 2
		Alarms (Used to check alarm relays)	R1 R2 R3
		Digital Inputs (Used to check status of digital input port)	Customer Alarm Remote Standby Validation Stream 2

Main Menu	Submenu	Items	Choices / Settings / Comments
	–	Digital Inputs	Low Flow
			Dig. In. #6
			Dig. In. #7
			Sample Over-temp
		Pressure	Detector reading
		Barometer	Barometer reading
Setup	Output Settings	4-20mA Out 1	Program 4-20mA channel 1
		Output	Off / Sample Temp / Flashpoint 1 / Validation / Flashpoint 2
		4mA	4mA value
		20mA	20mA value
		Offset	Offset value
		4-20mA Out 2	Program 4-20mA channel 2
		Output	Off / Sample Temp / Flashpoint 1 / Validation / Flashpoint 2
		4mA	4mA value
		20mA	20mA value
		Offset	Offset value
		Graphics	Program graphs settings
		Clear All	Clear All graphs history
		Sample Temp	Disable / Enable
			Low and High range
			Period
		Flashpoint	Disable / Enable
			Low and High range
		Validation	Disable / Enable
			Low and High range
	Alarm Settings	Warning Alarms	Warning alarms settings
		Flash Point:	
		Stream 1	Low and High values for stream 1

Main Menu	Submenu	Items	Choices / Settings / Comments
Setup	Alarm Settings	Stream 2	Low and High values for stream 2
		Sample Temp	Low Alarm for sample temp.
		Critical Alarms	Critical Alarm settings
		Sample Temp	
		High Alarm	Max. Sample Temp. setting
		No Detect	
		Time	Max. Heat state time
		Cool Temp	Cool Temp state settings
		Time	Max. time for cooling
		Alarm Critical	Disable / Enable Critical
		Remote Standby	Critical when in rem. Standby
		Dig. In.	Digital inputs: DI6 / DI7
		Alarm Info	Optional alarm info
		Type	Al. Type: Warning / Critical
		Logic	Al. Logic: Open / Close
	System Settings	General	
		Temp. Units	°F / °C
		Stdby Mode	On / Off
		Come Read	0 – 90 seconds
		Num Cycles	Cycles counter
		Max Cycles	10000 – 75000 limit for maintenance alarm
		Screen Saver	0 – 60 minutes
		Validation	
		Expected Value	Validation target
		Bandwidth	Validation range (+/-)
		Digital Inputs	
		Customer Alarm	Disable / Enable
		Remote Standby	Disable / Enable
		Validation	Disable / Enable

Main Menu	Submenu	Items	Choices / Settings / Comments
Setup	System Settings	Stream Select	Disable / Enable
		Low Flow	Disable / Enable
		DI6	On / Off
		DI7	On / Off
		Stream Select Type	Stream 1 / Stream 2 / Alternate / Auto
		Rinse Time	0 – 600 seconds
		Str. 1 Reps	1 – 100 cycles (only for alt.)
		Str. 2 Reps	1 – 100 cycles (only for alt.)
		Detect Control	
		Frequency	Spark generation frequency
		Spark On	Length of time for spark on
		Spark Off	Length of time for spark off
		Delta Tmp	Temp. difference from last Flashpoint to start sparking
		Detect Level	Sensitivity of detection
		Sample Heat Ctrl	
		Init Heat	Initial heater power
		Heat Step	Increase in power per step
		Inc. Heat	Increase power step time
		Dec. Heat	Decrease power step time
		Cool Mode	Keep heater on/off during cooling
		Reload Defaults	Loads default customer settings
		Relay	R1 / R2 / R3
		Choice	OFF / Alarm Warning / Alarm Critical / Maintenance / Stream 1 / Stream 2 / Come Read / In Validation / Valid. Pass
		Condition	Normal / Fail Safe

Main Menu	Submenu	Items	Choices / Settings / Comments
Setup	Communications	Serial Port C	Comm. settings for RS-232
		Mode	None / Data / Result
		Rate	9600 / 19200 / 38400
		MODBUS	Modbus comm. settings
		ID	1 – 250
		Mode	Ethernet / RTU
		Serial Port B	RS-485 RTU settings
		Rate	9600 / 19200 / 38400
		Ethernet Setup	Modbus TCP/IP settings
		Our IP Address	Analyzer's IP address
	Communications	Router Address	Router Address
		Network Mask	Network Mask
	State Table Setup	Reset Defaults	Loads default state table
		Line	1 – 12 states
		State Type	Heat / Spark Purge / Cool Time / Cool Temp / Plug Clean / Wait / AutoZero Spark Blast / Repeat
		Data	seconds or temp. degrees (depends on state)
	Time/Date Setup	Time Format	12 / 24 Hr
		Date Format	US / EU
		Date	Set current date
		Time	Set current time
	Factory Setup	–	For factory use only
Security	–	–	Disable / Enable

Chapter II: Specifications

Models

P-500-1400	For NEC Class I, Division 1, Group B, C and D areas.
P-500-1500	For ATEX Zone I, II B + H2 T6 areas.
P-500-1600	For IECEx Zone I, II B + H2 T6 areas.

Performance

Measurement Range	25° to 125°C (77° to 257°F) selectable; lower ranges available (consult Bartec Orb).
Repeatability	±1.0°C (1.8°F)
Reproducibility	±1.0°C (1.8°F)
Resolution (temperature sensor)	±0.02°C (0.036°F)
Measurement Accuracy	Correlates to ASTM Methods D56 (Tag) and D-93 (Pensky-Martens Closed Cup).
Temperature Accuracy	±0.1°C (±0.18°F)
Measurement Cycle Time	5 minutes or less
Operating Temperature Range	Minimum: 5°C (41°F) Maximum: 40°C (104°F)
Ambient Temperature Range	Minimum: -20°C (-4°F) Maximum: 40°C (104°F)

Sample Requirements

Sample Flow Rate	Minimum: 10 cc/min Maximum: 50 cc/min
Sample Pressure	Minimum: 1.4 bar (20 psi) Maximum: 10.0 bar (145 psi)
Sample Return Pressure	Atmospheric (optional high-pressure sample recovery system available)
Sample Temperature	At least 5°C (9°F) below expected flash point; No more than 35°C (63°F) below expected flash point; Maximum process temperature of 100°C (212°F); Optional sample cooling available (consult Bartec Orb).

Sample Particulates	Less than 10 µm; optional sample conditioning system available.
Sample Conditions	Homogeneous, single-phase sample. Must be free of water or water moisture.

Signal Inputs/Outputs

Analog Output	One isolated 4-20 mA output standard Optional second isolated 4-20 mA output available Signal output information is programmable
Serial Communication	RS-232 (output only) / RS-485 (Modbus)
Relay Output	Three SPDT relay contacts rated at 3A resistive load at 250VAC. May be programmed for normal or failsafe operation. The conditions activating these relays are programmable.
Modbus	Optional (Ethernet TCP/IP or RS-485 RTU) Consult Bartec Orb for details

Utility Requirements

Power	110-120VAC (±10%), 50/60 Hz, 5A 230-240VAC (±10%), 50/60 Hz, 2.5A
Combustion Air Supply	Clean, dry instrument air controlled at 100 to 500 cc/min at approximately 0.7 to 1.4 bar (10 – 20 psi)

Analyzer Enclosure

Dimensions (W x H x D)	955 x 1854 x 762 mm (38 x 73 x 30 inches)
Weight	Approximately 227 kg (500 lbs)
Enclosure Rating / Material	Explosion-proof cast aluminum copper free alloy (maximum copper content 0.3%).
Hazardous Classification	P-500-1400: CSA/CUS Class I, Division1, Group B, C and D P-500-1500: ATEX II 2G Ex db IIB+H2 T6 Gb P-500-1600: IECEx II 2G Ex db IIB+H2 T6 Gb

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

Chapter III: Installation and Startup

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

Site Requirements

Your particular site, application, and installed options will ultimately determine the need for any accessories or auxiliary equipment. This chapter defines the various parameters to be considered. Consult Bartec Orb for specific recommendations regarding your P-500 Flash Point Analyzer.

LOCATION

For ease of operation, your Analyzer should be installed as close as possible to the process stream to be monitored. To optimize performance, it should be housed in an appropriate shelter and protected against direct sunlight, moisture, and other adverse conditions. The shelter's ambient temperature should always remain between -20°C and 40°C (-4°F and 104°F).

MOUNTING

The P-500 Flash Point Analyzer is mounted on a free-standing rack or (optional) equipped with brackets for wall mounting. It should be located on a flat surface and isolated from intense vibration. 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. mounted on a free-standing rack housed (see Figure 3-1).

Piping

The P-500 Flash Point Analyzer incorporates fittings for connecting process sample and combustion air lines. These fittings are located on the left side of the instrument (see Figures 3-2).

PROCESS SAMPLE LINES

	**NOTE: It is the user's responsibility to assure that a representative sample, free of moisture and particulate matter, is presented to the instrument for analysis. Bartec Orb can assist in specifying sample conditioning requirements and the selection/development of an appropriate sample conditioning system.**

The P-500 sample inlet is located on the left side of the analyzer's measurement enclosure. This line should be connected to the 1/4-inch NPT fitting labeled "Sample In" (see Figure 3-2). Process samples should be provided at a pressure between 1.4 and 10 bar (20 and 145 psi) at a flow rate of 10 to 50 cc/min. The temperature of the sample should be at least 5°C (9°F) below the expected flash point temperature and no more than 35°C (63°F) below the expected flash point temperature while remaining under the maximum process temperature of 100°C (212°F).

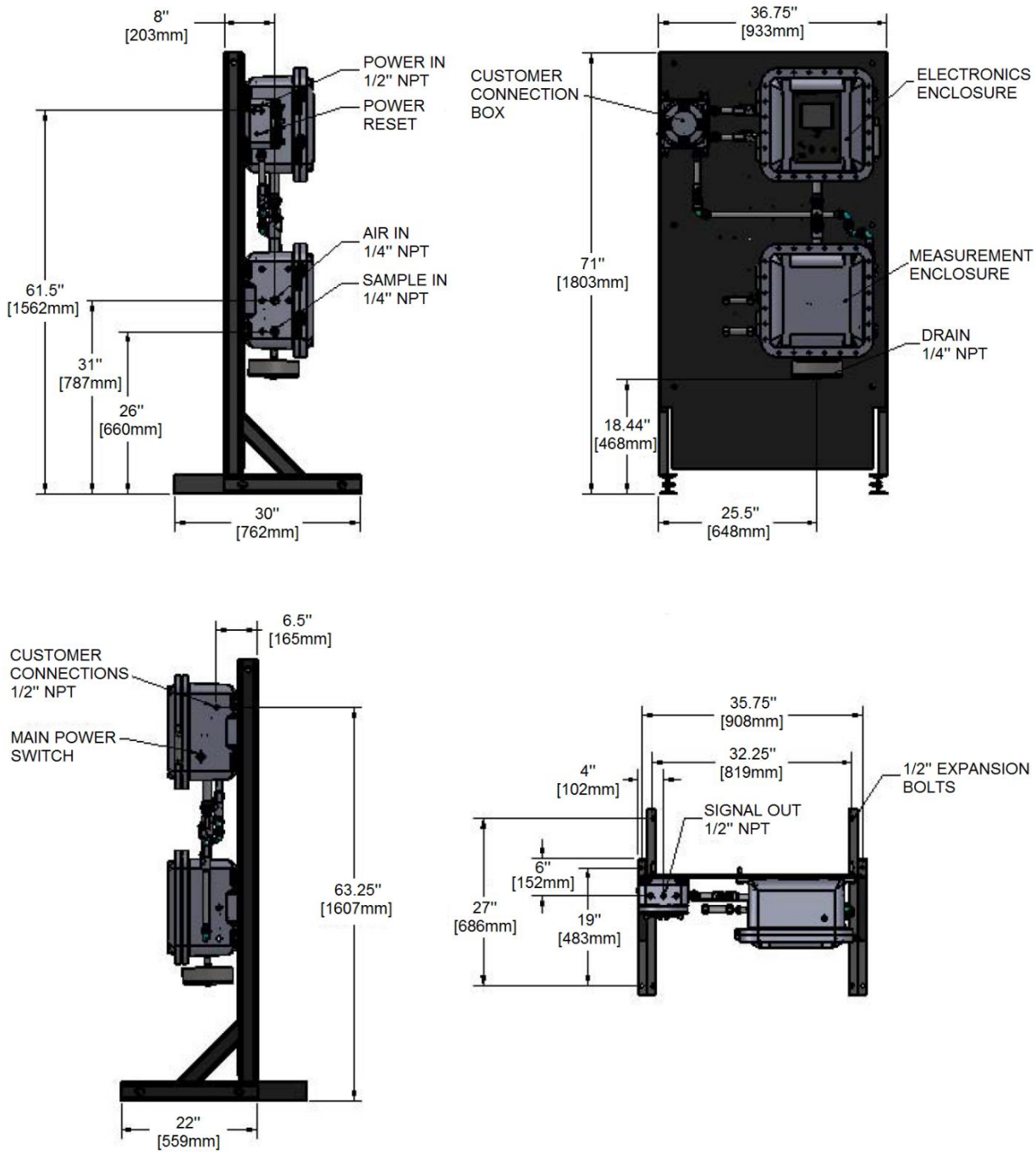


Figure 3-1: Dimensional Drawing

COMBUSTION AIR SUPPLY

Clean, dry instrument air is required for proper analyzer operation. It should be supplied to the analyzer at a controlled flow rate between 100 and 500 cc/min. The instrument air line is connected to the 1/4-inch NPT fitting labeled “Combustion Air” (or to the pressure regulator) on the left side of the measurement enclosure (see Figure 3-2).

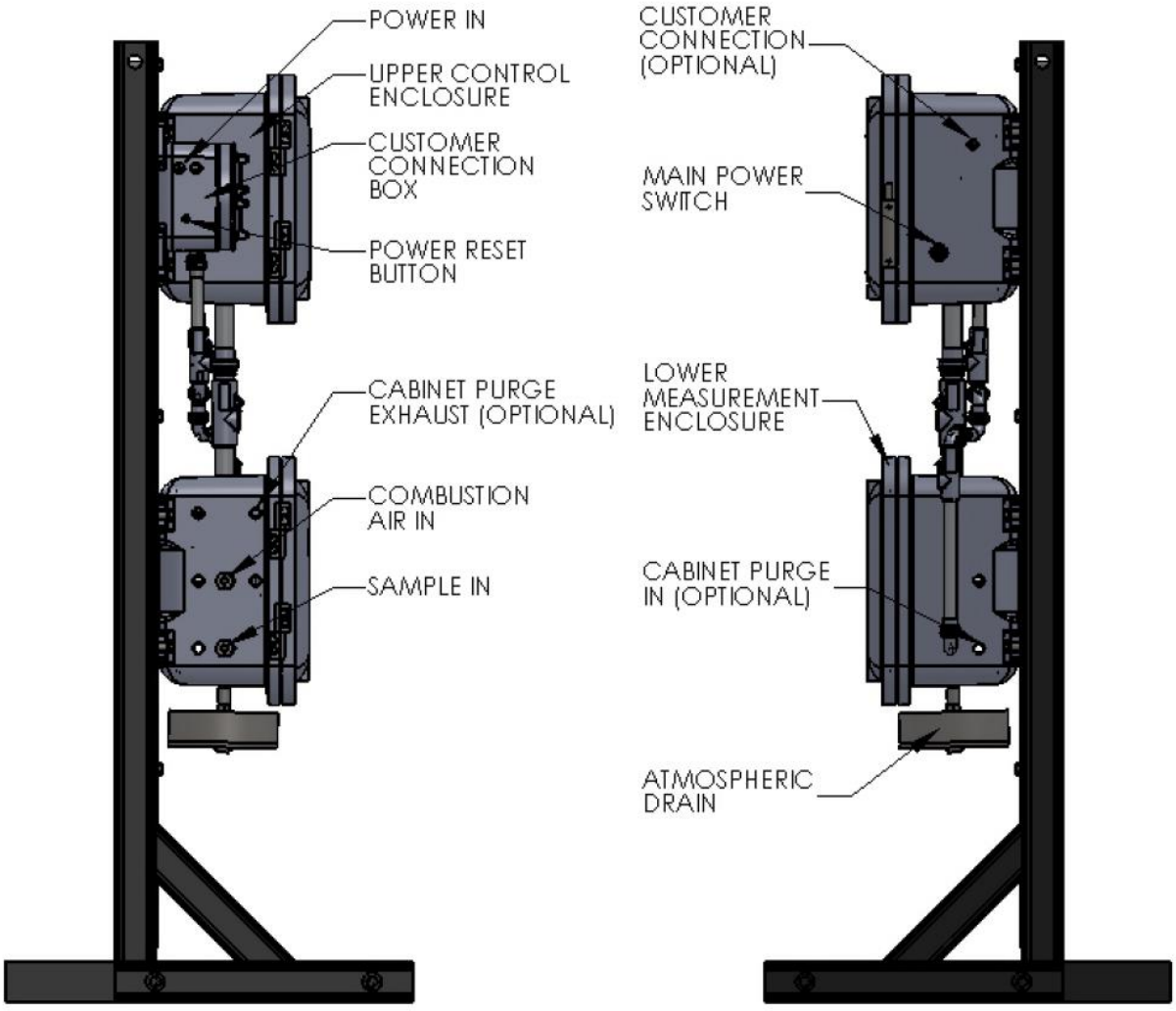


Figure 3-2: Left and Right Side Views

Atmospheric Drain

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

Wiring

The P-500 Flash Point Analyzer's power and customer connections are made in the Customer Connections enclosure located near the top left of the mounting rack (see Figure 3-3).

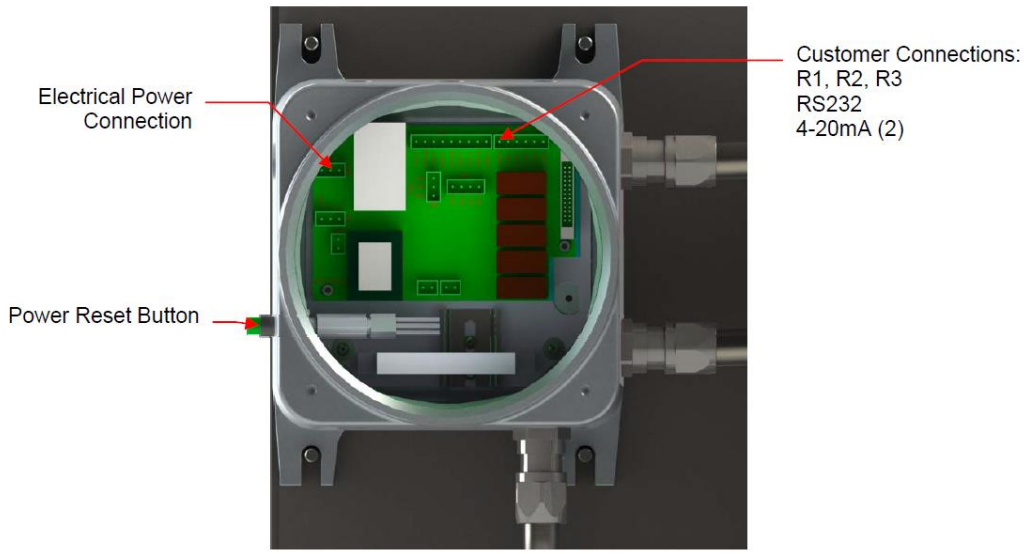


Figure 3-3: Customer Connections Enclosure

	**CAUTION: Conduit Seals, if used, must be suitably rated a minimum of Ex d IIB + H2 for a minimum ambient of 40°C and carry a valid ATEX Certificate to EN60079-1. Cable Glands, if used, must be suitably rated a minimum of Ex d IIB + H2 for a minimum ambient of 40°C and carry a valid ATEX Certificate to EN60079-1.**

ELECTRICAL POWER

	**WARNING: This Analyzer is designed to meet the requirements of either the National Electrical Code (NEC) for installation in CSA/CUS Class I, Division 1, Group B, C and D or ATEX II 2G Ex db IIB+H2 T6 Gb or IECEx II 2G Ex db IIB+H2 T6 Gb hazardous areas. It is the user's responsibility to complete the electrical connections and comply with all pertinent codes.**

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

The P-500 Flash Point Analyzer requires an independent 110-120 or 230-240VAC (±10%), 50/60Hz power supply. The system is jumper selectable 110-120/220-240VAC (±10%) 50/60 Hz, single phase, 5A. AC power connections are made through the Customer Connections box attached to the upper left of the top enclosure (see Figure 3-2).

⚠	**CAUTION: It is the installer's responsibility to verify that the jumpers on HD2 (798112 Rev. B) in Customer Connection Box are configured properly for the supply voltage (see Figure 3-4).**

Figure 3-4: Voltage selection header (shown 220VAC, pin2-3)

The P-500 Flash Point Analyzer has internal and external grounding harnesses that tie all enclosures and power distribution contained within together to a grounding lug mounted to the analyzer frame leg. The grounding wire is 10 gauge with a green/yellow spiral Teflon insulation and a 36 x 26 strand. Customer earth connection is made at this point (Figure 3-5).

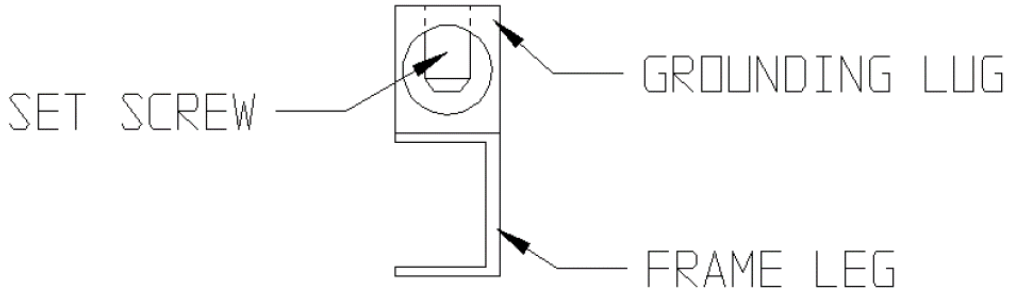


Figure 3-5: Customer Earth Connection

⚠	**CAUTION: A 360° terminated shielded cable and grounding cable glands must be used for AC power connections on instruments in ATEX Zone 1, Group II B + H2 T6 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.**

CONTROL ROOM SIGNALS

The Analyzer incorporates analog, serial, and relay output capability. Modbus output may be provided as a factory installed option.
The connections for control room signals are made in the either the Customer Connections Enclosure or the Upper Control Enclosure (see Figures 3-3 and 3-6).

Analog Output

One isolated 4-20mA output is standard on the P-500 Flash Point Analyzer. An optional second 4-20mA output may be provided (see Figure 3-3).

Relay Output

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

Serial Output

The P-500 Flash Point Analyzer incorporates RS-232 serial output. The connection is made in the Customer Connections Enclosure (Figure 3-3).
Serial communication operates at a selectable baud, no parity, 8 start bits, 1 stop bit. Data is comma delimited and output in the following sequence: Date, Time, Flash Point result, sample temperature, stream number. Output is user selectable as a result or data dump. A <CR> is used to designate the end of the data stream.
The maximum allowable external cable length on the RS-232 output is 30 meters (98 feet).

Modbus

Modbus is available as a factory-installed option which utilizes the Analyzer's Ethernet TCP/IP or RS-485 RTU serial output. This connection is made in the Upper Control Enclosure (Figure 3-6). Consult Bartec Orb for more information.

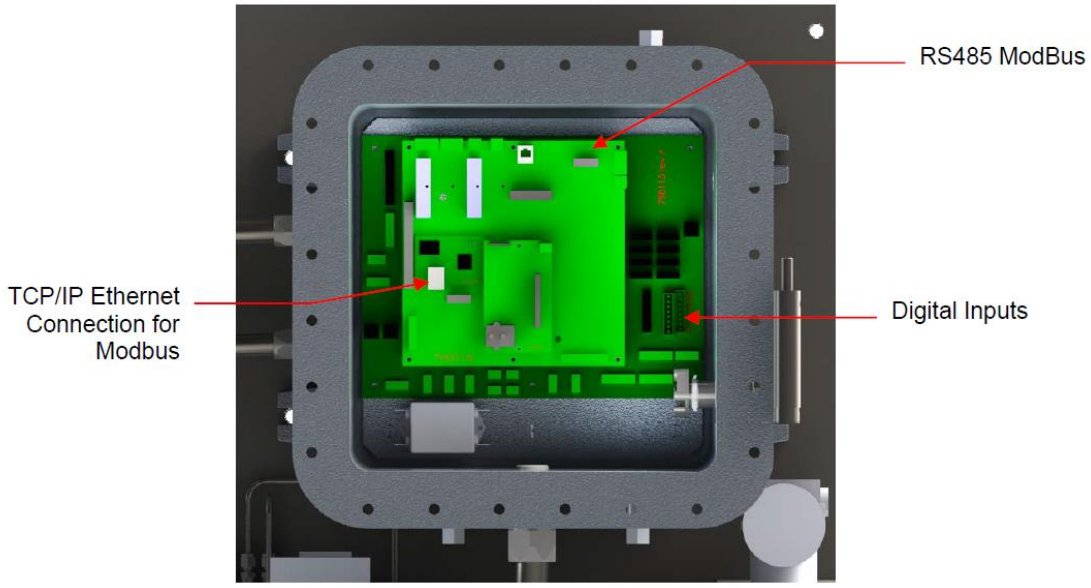


Figure 3-6: Upper Control Enclosure

Digital Inputs

The Analyzer incorporates four sets of dry contacts that allow the control room to remotely activate selected functions. The connections for these digital inputs are made inside the Upper Control Enclosure at JP2 terminal (see Figure 3-6). Wiring is brought into the enclosure through ports on the right-hand side of the enclosure.

Digital dry contacts inputs are as follows:

- **Customer Alarm** — This connection is used to stop the analysis, put the Analyzer Offline and activate Alarm Critical and Alarm Warning relays**.**
- **Remote Standby** — This connection is used to place the Analyzer in a Remote Standby Mode. Analysis will stop until the signal is removed.
- **Validation Request** — This connection is used to initiate a validation cycle.
- **Stream Select** — This connection is used to switch to Stream 2 sample.
- **Low Flow** — This connection is used for low flow sample signal to stop the analysis.
- **Digital Input 6** — This connection is used for programmable alarm.
- **Digital Input 7** — This connection is used for programmable alarm.
- **Sample Over-temp** — This connection is used for heater's thermostat signal.

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

Digital Input	Terminals (JP2)	Function
DI1	RCC1 – RCC2	Customer Alarm
DI2	RCC3 – RCC4	Remote Standby
DI3	RCC5 – RCC6	Validation Request
DI4	RCC7 – RCC8	Stream Select
DI5	RCC9 – RCC10	Low Flow
DI6	RCC11 – RCC12	Digital Input 6
DI7	RCC13 – RCC14	Digital Input 7
DI8	RCC15 – RCC16	Sample Over-temp

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

Startup

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

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

1. With power removed from the Analyzer, start flow of sample to the Analyzer and verify that it is regulated at a pressure between 1.4 to 10.0 bar (20 and 145 psi) and at a flow rate of 10 to 50 cc/min.
2. Check for sample leaks at all sample line connections, the atmospheric drain connection, and within the measurement enclosure itself.
3. Start the flow of instrument air to the Analyzer and verify that it is regulated at flow of 100 to 500 cc/min.
4. Install lid to Customer Connection box enclosure and install door bolts on both the Control and Measurement enclosures, ensuring a minimum bolt yield of stress of 240 N/mm² (hand tight plus 1/4 turn).

	**NOTE: Upon initial application of external power to the Analyzer, only the Customer Conn. enclosure is energized. Power will not be routed to other system components until the Power Reset button on the left side of the Customer Connections enclosure is pressed.**

5. Apply power to the Analyzer.
6. Press the Power Reset on the left side of the Customer Connections enclosure.
7. Place the Power Switch on the right side of the electronics enclosure (Figure 3-2) in the ON position.

	**NOTE: The Power Reset button must be pressed to re-initialize the Analyzer whenever power is lost due to either an external event or internal power disruption (such as the detection of a leak within the measurement enclosure).**

8. The Analyzer's LCD should light up. The instrument's main menu screen will appear on the display. The unit should power up in the Offline mode (default).
9. You may now begin flash point analysis using the Analyzer's factory default settings or customize its performance (see Chapter IV: Programming).

BOX HEATER ADJUSTMENT

A manual thermostat and heater have been incorporated in the Measurement enclosure (Figure 3-7) to improve performance when analyzing samples with higher viscosities or flash point temperatures. This thermostat should be set 5°C to 10°C (9°F to 18°F) below the expected flash point temperature. A clockwise rotation increases cabinet temperature; a counterclockwise rotation decreases cabinet temperature. Consult Bartec Orb for additional information.

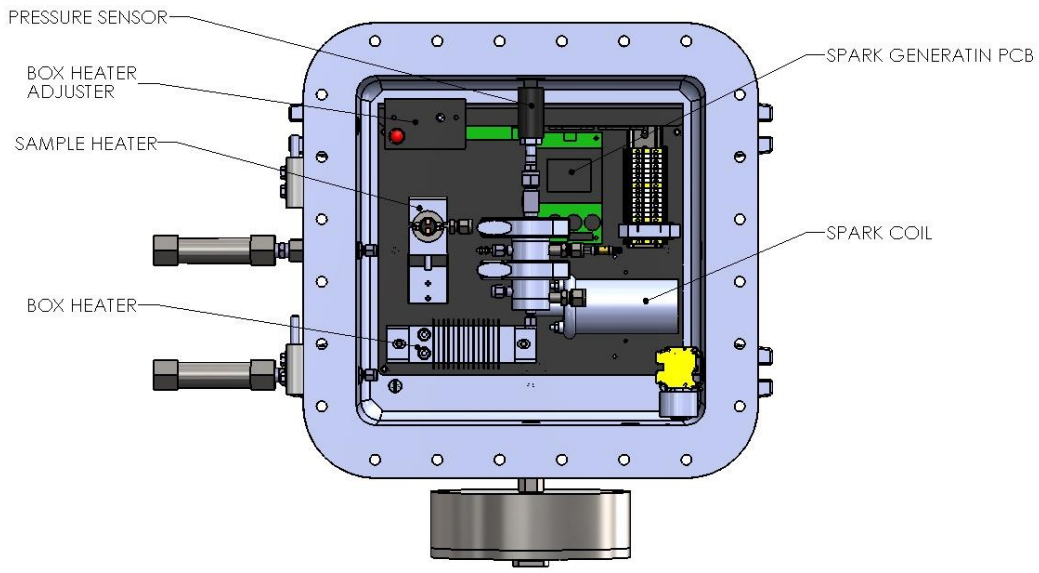


Figure 3-7: Lower Measurement Enclosure

BASIC OPERATION

The Bartec Orb Model P-500 Flash Point analyzer is an on-line instrument that, once started, requires little user intervention for normal operation. For information on system Programming and more advanced Operation, see Chapters IV and V.

	**WARNING: The Analyzer should never be operated with the enclosures open unless deemed appropriate by proper safety authorities and with proper hot work permits.**

Chapter IV: Programming

Menu Navigation

The P-500 Flash Point Analyzer is programmed and controlled via a magnetic keypad on the front of the Upper Control Enclosure (see Figure 4-1). This eliminates the need for opening the enclosure to change operational settings. A magnetic pencil is supplied with the instrument for this purpose.

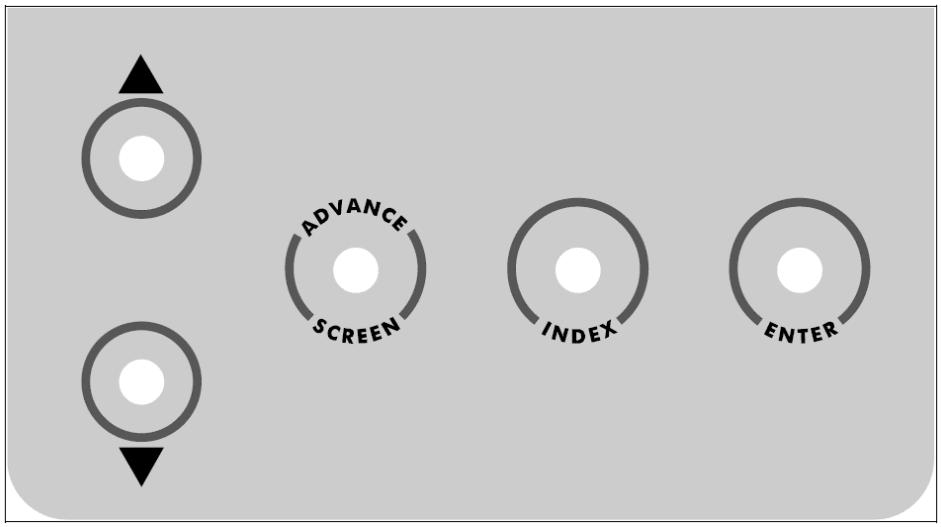


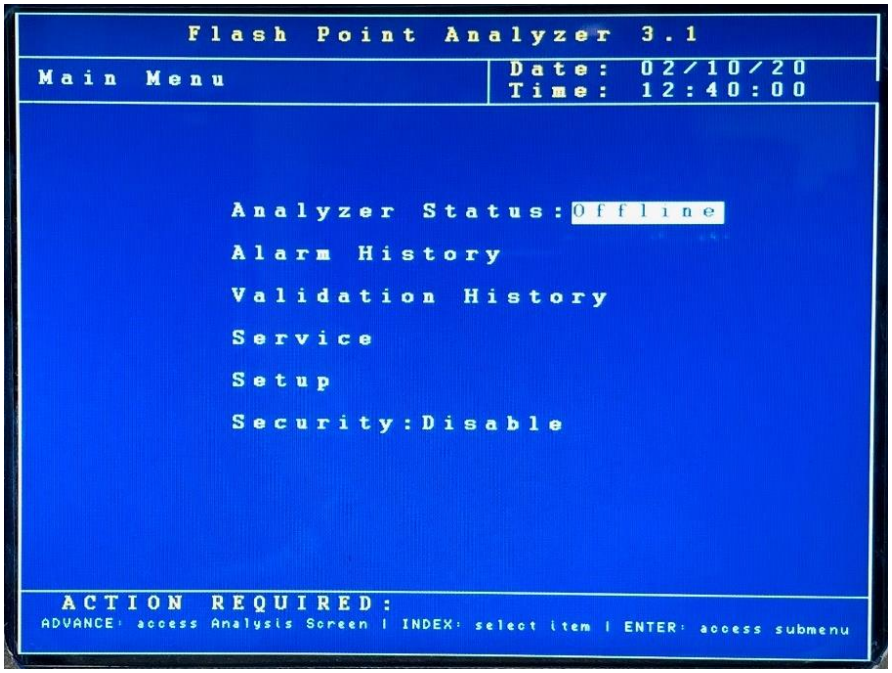
Figure 4-1: Magnetic Keypad

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

- **Advance Screen Key —** controls displayed screen. It moves out of the submenus (screen by screen) to the highest hierarchy screen, which is Main Run screen. From there, tapping Advance Screen Key will cycle between Main Menu and Main Run screen. It is also used to decline window messages.
- **Index Key —** scrolls through the various items available within a specific screen. The “active” menu line is highlighted (white bar) by reversing the background and foreground colors. Once you reach the last menu item, the indicator returns to the top of the menu.
- **Enter Key —** accesses submenu or runs a command associated with a selected menu item. It is also used to confirm window messages.
- **▲▼ (Up/Down Arrow) Keys —** change the displayed value for the indicated item. Depending on the specific item, it will either change the status of the selection, cycle through a list of available selections, or increase/decrease the value.

Main Menu

This menu is used to place the Analyzer Online and Offline. It also provides access to the all the various submenus. To access the Main Run screen (see page 34), touch the Advance Screen key. From the Main Run screen, touch Advance Screen again to return to the Main Menu. Touch the Index key to advance to the next menu selection.



ANALYZER STATUS

This field indicates the current status of the Analyzer. Touch the up/down arrow keys to change the status. Window message will appear to confirm or decline your choice.

ALARM HISTORY

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

VALIDATION HISTORY

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

SERVICE

This menu item provides access to the Service submenu; entering it automatically takes the Analyzer offline, if it was running. The Service menu allows you to activate various measurement system components, test the analog output, and view selected sensor readings. It is described in detail in Chapter VI: Maintenance & Service. Touch the Enter key to access this submenu. A screen will appear asking if you are sure to enter the Service menu; this is intended to prevent you from inadvertently taking the Analyzer Offline.

SETUP

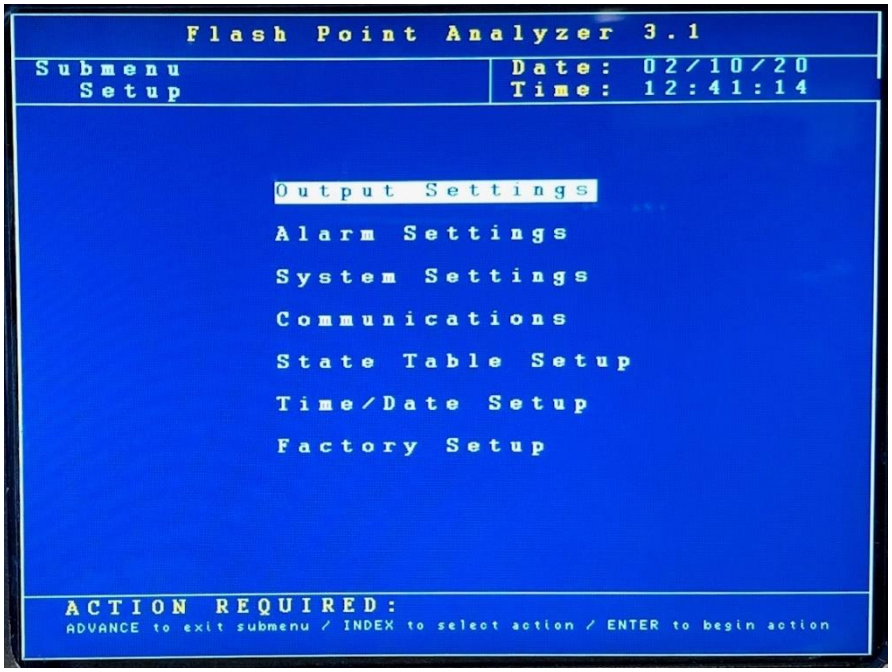
This menu provides access to the Analyzer's Setup submenus. It is accessed by touching the Enter key when this menu item is highlighted.

SECURITY

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

Setup Submenu

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

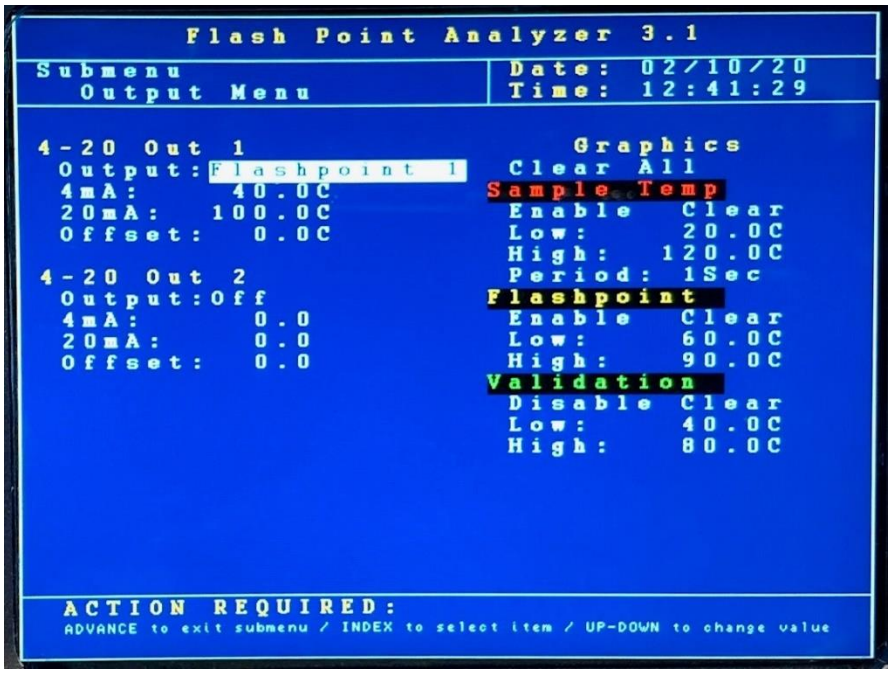


Use the Index key to move to the desired (highlighted) menu selection. Touch the Enter key to access the selected submenu.

Output Settings

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

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



4-20mA Outputs

The P-500 Flash Point Analyzer's analog outputs (Channel 1 standard; Channel 2 optional) can be programmed to output various types of information, as well as the range of the analog signal and an offset.

- **Output —** This menu item allows you to select the type of information that will be output using the selected analog signal. The choices are: Off, Sample Temperature, Flashpoint 1, Validation, and Flashpoint 2.
- **4 mA —** This menu item is used to set the value at which a 4mA signal will be output.
- **20 mA —** This menu item is used to set the value at which a 20mA signal will be output.
- **Offset —** This menu selection allows you to offset the analog output signal by the programmed value. For example, if the offset is set to +1.5, the Analyzer will generate an analog signal corresponding to 61.5 when the actual measured (and displayed) Flash Point value is 60.0.

Graphics

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

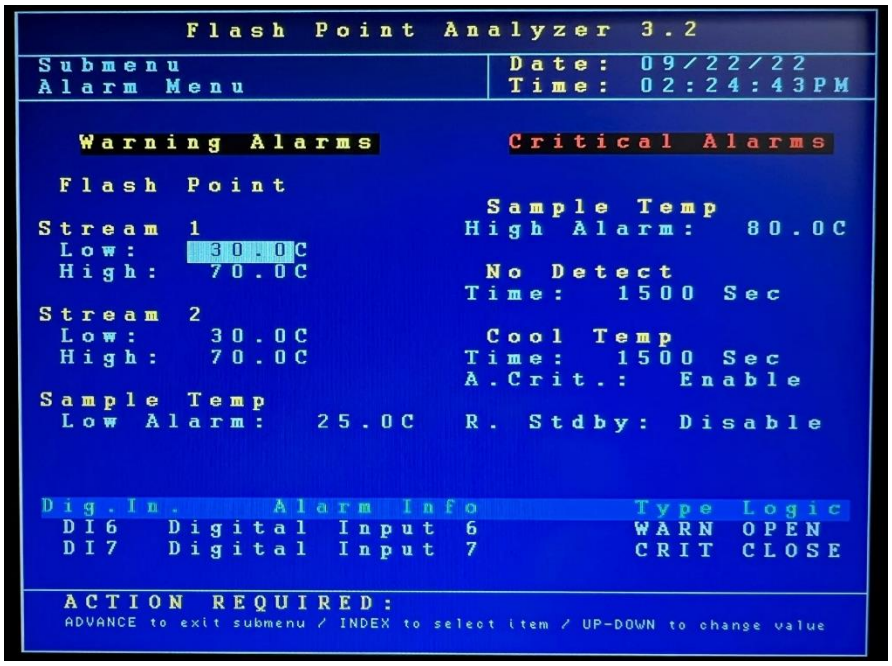
- **Sample Temp —** When this menu item is enabled, sample temperature is graphed.
- **Flashpoint –** Flashpoint measurement result.
- **Validation –** Validation measurement results.
  Enable/Disable — Turns graphing for this item on and off.
  Clear — clears current graph.
  Low — This establishes the bottom of the trend graph's scale.
  High — This establishes the top of the trend graph's scale.
  Period – graph's time variable (only for Sample Temp)

"**Clear All**" selection (Enter key to initiate) clears all graphs.

	NOTE: If Flash Point or Validation graphing is enabled, the graph is updated at the end of each measurement.

Alarm Settings

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



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

Warning Alarms

Those types of alarms do not stop the analysis. "Result out of range" warning alarm is activated when the measured concentration exceeds the indicated value. For Stream 1 and Stream 2:

- **Low —** This menu item allows you to establish a low alarm level. Flash Point measurements below this value generate a warning alarm signal/message. Analysis will continue.
- **High —**This menu item allows you to establish a high alarm level. Flash Point measurements above this value generate a warning alarm signal/message. Analysis will continue.

Sample temperature:

- **Low Alarm —** Sample temperature below that setpoint will generate a warning alarm signal/message. Analysis will continue.

Critical Alarms

Those types of alarms stop the analysis. Sample temperature:

- **High Alarm —** This menu item allows you to establish a maximum allowable sample temperature. Sample temperatures above this value generate a critical (fatal) alarm signal/message and stops analysis.

No Detect settings:

- **Time —** the maximum programmable time (in seconds) for Heat state (Flash Point detection) before going into “No Detection” Critical Alarm and stopping analysis.

Cool Temp settings:

- **Time —** the maximum programmable time (in seconds) for Cool Temp state. If the sample cannot be cooled down below programmable setpoint (set in State Table menu), the analysis will either stop or restart (see next A. Crit. setting).
- **A. Criti. –** setting for programming type of Cool Temp Alarm. If enabled, “Cool-Temp Limit” Alarm will cause Alarm Critical and stop analysis. If disable, it will be treated as Alarm Warning.

“**R. Stdby**” settings Enables or Disables Alarm Critical when in Remote Standby mode.

Programmable Digital Inputs

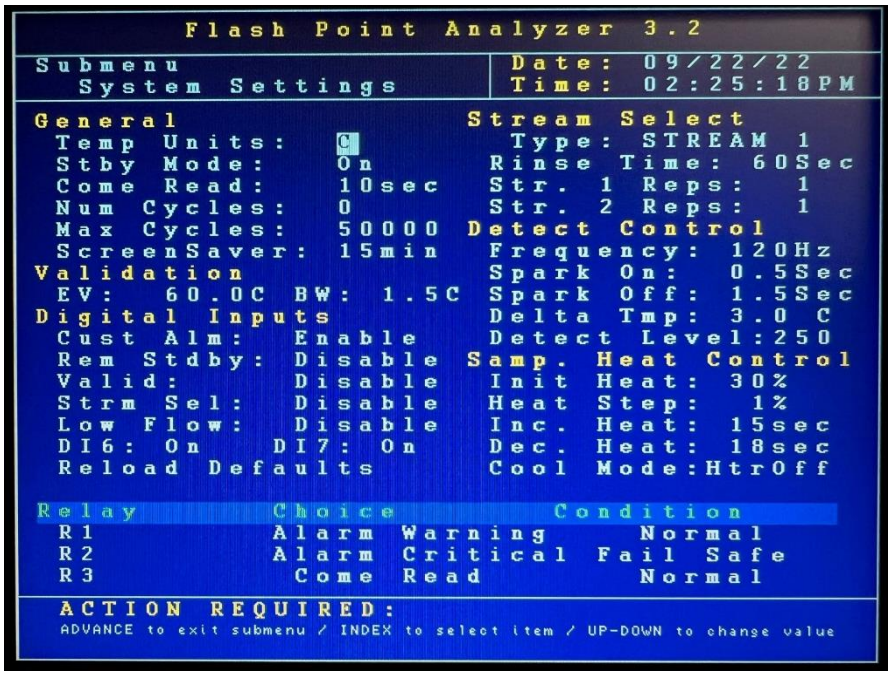
These menu items allow you to program digital inputs, set the alarm information, indicate the type of alarm and its logic.

- **Dig. In. —** This column lists digital input number: DI6 and DI7.
- **Alarm Info —** This selection can assign specific message to the digital input alarm: “Digital Input 6”, “Low Valid. Tank”, “Valid. Tank Overpress.”, “Digital Input 7”.
- **Type —** This specifies how alarm will be treated: Warning or Critical.
- **Logic —** This settings determines if alarm is triggered on “Open” or “Close” contact.

	**NOTE: Programmable digital inputs have to be activated (“On” setting for DI6 or DI7) in System Settings in order to operate.**

System Settings

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



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

General

Those are general setting for Analyzer's operation.

- **Temp Units —** This menu selection allows you to select the temperature scale. The choices are °C or °F.
- **Stdby Mode —** this controls how the Analyzer will operate upon application of power. When OFF is selected, the instrument will begin performing analysis automatically when power is applied. When ON is selected, the instrument will power up in the Offline mode and must be manually placed Online.
- **Come Read —** This menu item allows you to set the length of time (in seconds) the Analyzer's "Come Read" relay will be activated upon the completion of a measurement cycle.
- **Num Cycles —** This is the number of measurements which have been performed since the cycle counter was last reset. To reset the counter, touch the Enter key.
- **Max Cycles —** This menu item allows the operator to set the number measurements which can be performed before the Analyzer's Maintenance Alarm is activated.
- **ScreenSaver —** This establishes how long the screen will remain lit without any keypad activity. Touching any of the magnetic keys re-activates the display. A value of zero disables the screen saver.

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

Validation

- **EV —** This is the expected value of the validation sample.
- **BW —** 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.

Digital Inputs

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

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

Stream Select

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

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

Detect Control

- **Frequency –** This is the electrical frequency used during spark generation. It may be set at 50, 60, 100, or 120 Hz.
- **Spark On –** This sets the 'on' portion of the spark duty cycle during flash point detection.
- **Spark Off –** This sets the 'on' portion of the spark duty cycle during flash point detection.
- **Delta Tmp –** This sets the starting point (in degrees) for spark initiation. The value is the number of degrees below the last detected flash point temperature at which spark initiation will begin.
- **Detect Level –** This is a pressure sensitivity setting that establishes the threshold that must be exceeded to signal flash point detection. In general, lower values should be used when measuring the flash point of lighter samples and high values used when measuring the flash point of heavier samples.

Sample Heater Control settings

- **Init Heat –** This is the percentage of total power that will be applied to the sample heater during Heat state (it is initial heater power only for the first cycle if Incremental Heat is larger than zero).

- **Heat Step –** This sets how much heater power will be increased each time the programmed period of time elapses (Incremental Heat, next setting) during Heat state.
- **Inc. Heat –** This sets the time parameter for increasing heater power. Each time the programmed period of time elapses during the Heat state, heater power will be increased by the percentage established in the Heat Step. If set to zero, heater power will be fixed based on Init Heat setting.
- **Dec. Heat –** This sets the time parameter for decreasing heater power. Each time the programmed period of time elapses during the cooling cycle, heater power will be increased by the percentage established in the Heat Step (only if Incremental Heat is larger than zero).
- **Cool Mode –** This sets the overall parameter for cooling state. When set to "HtrOff", the sample heater is completely off during cooling. When set to "HtrDec", power to the heater is gradually decreased using the parameter programmed under Decremental Heat.

Reload Defaults

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

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

Relay Setup

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

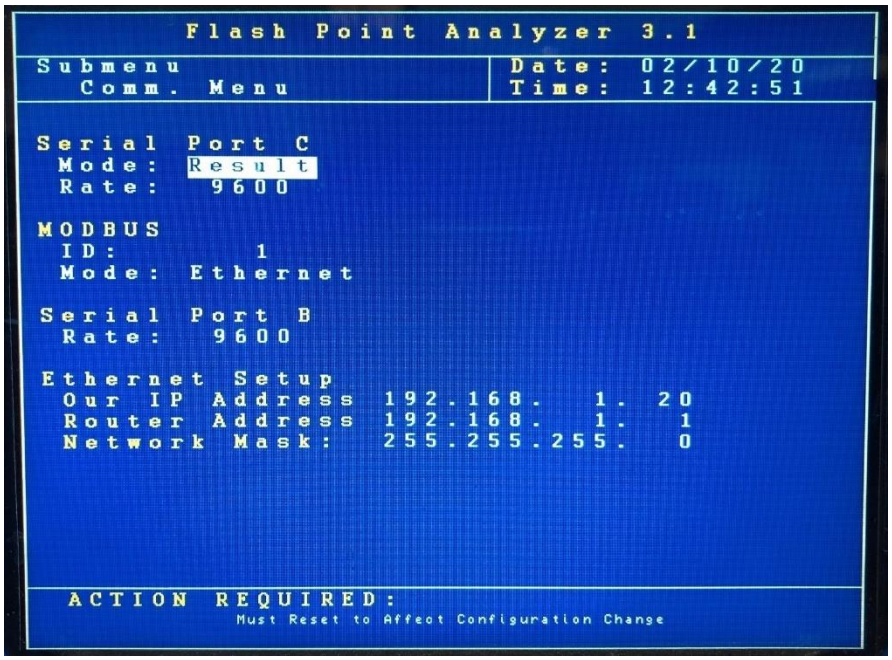
- **Relay —** This designates which alarm is being programmed. See Chapter III for alarm relay wiring information.
- **Choice —** This designates the type of alarm (see page 36 for detailed description).

Off –	Alarm relay disabled.
Alarm Warning –	Activated when one of the warning alarms conditions has been detected. Warning alarms do not disrupt analysis.
Alarm Critical –	This type of alarm indicates Analysis has stopped because one of the critical conditions has been detected.
Maintenance –	Activated when the number of measurement cycles has exceeded the Max Cycles setting.
Stream 1 –	Stream 1 is being measured.
Stream 2 –	Stream 2 is being measured.
Come Read –	Activated for a programmed period of time (Come Read setting) upon the completion of a measurement cycle.
In Validation –	Validation cycle is being performed.
Valid. Pass –	Validation cycle passed.

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

Communications Setup

The Communications submenu allows you to configure the Analyzer's Serial and Modbus settings.



Serial Port C

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

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

Modbus

This configures the Analyzer's Modbus output.

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

Serial Port B

- **Rate —** This is the baud rate used for serial communications (RS-485, Modbus RTU) through this port (9600 / 19200 / 38400).

Ethernet Setup

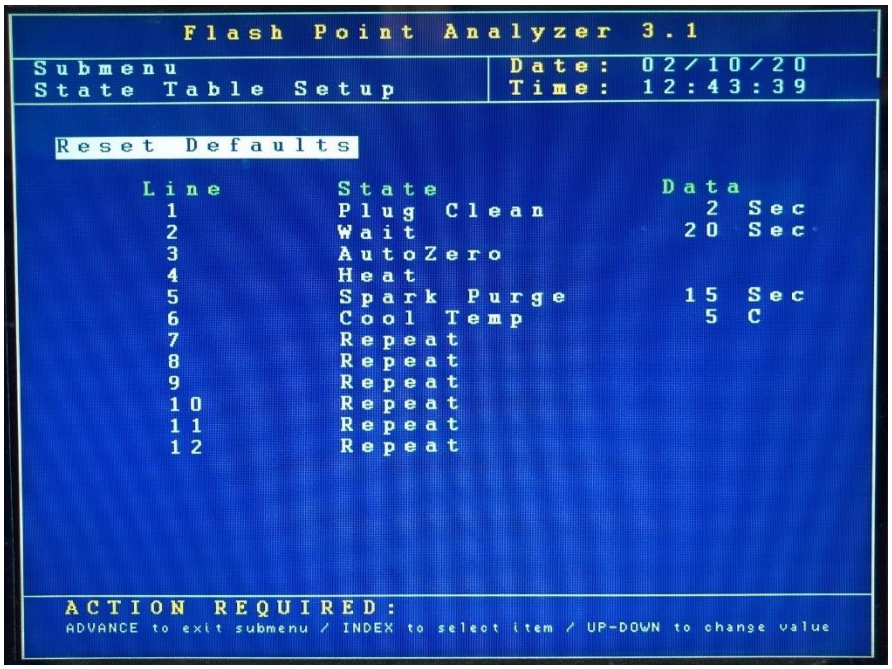
This allows you to configure the Analyzer's IP, router, and network mask addresses when Ethernet Modbus communications is selected.

- **Our IP Address —** This is the IP address assigned to the Analyzer.
- **Router Address —** This is the address of the router the Analyzer is connected to.
- **Network Mask —** This is the network mask address.

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

State Table

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



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

Any of the following steps can be included in a flash point measurement cycle. Steps that are underlined are required. The last step in any measurement cycle must be Repeat.

- **Heat —** This state is used to detect the flash point. The sample is heated, and spark ignition is activated until the detection.
- **Spark Purge —** This state is used to help cool and clean the spark electrode and flash cup. The programmed data value is the amount of time (in seconds) that the purge solenoid will be open.
- **Cool Time —** During this state the sample is cooled for programmed time (data value in seconds) after flash point is detected. This step must be included in a measurement cycle unless Cool Temp (below) is selected.
- **Cool Temp —** During this state the sample is cooled below the last flash point detected. The programmed data value is the number of temperature degrees. For example, if flash point was

detected at 75°C and the programmed value is 10, the sample will be cooled to 65°C. This step must be included in a measurement cycle unless Cool Time (above) is selected.

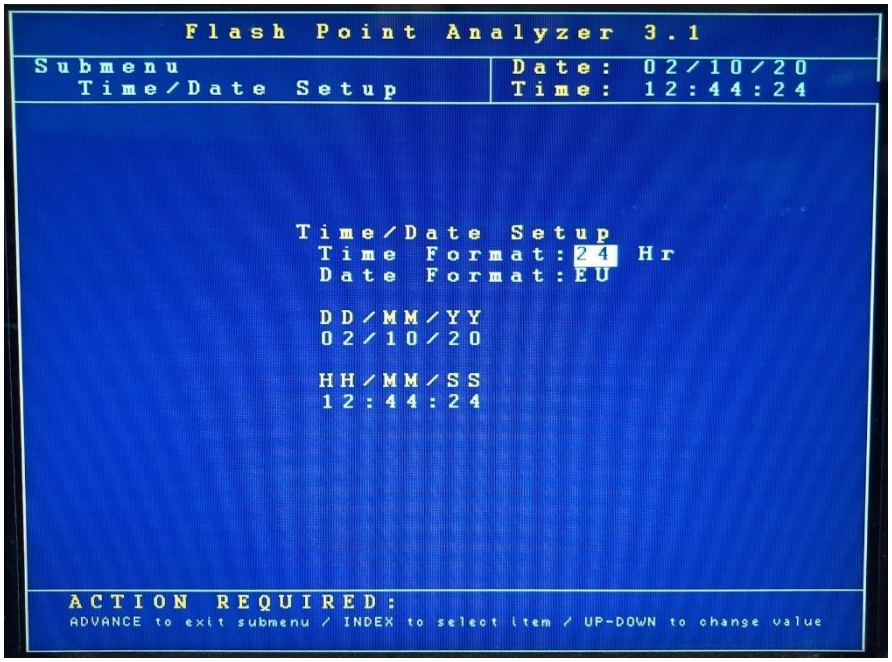
- **Plug Clean —** This state is used to burn residue off the spark electrode. The programmed value is the amount of time (in seconds) that spark will be applied.
- **Wait —** This state idles the Analyzer for a programmed period of time. It is generally used to allow a component or function to stabilize before proceeding to the next step. It is set in seconds.
- **AutoZero —** During this state the pressure detection system is set to its baseline value.
- **Spark Blast –** This state is similar to Plug Clean. It applies the spark plus opens the purge solenoid.
- **Repeat —** This should always be the last step in the State table. It tells the Analyzer to return to state #1.

The default states are as follows:

Line	State Type	Data
1	Plug Clean	2
2	Wait	20
3	AutoZero	-
4	Heat	-
5	Spark Purge	15
6	Cool Temp	5
7	Repeat	-

Time/Date Setup

The Time/Date Setup submenu is used to set the Analyzer's internal calendar and clock.



- **Time Format —** This menu item allows you to select either a 12- or 24-hour time format. Touch the Up/Down Arrow keys to change the displayed value.
- **Date Format —** This menu item allows you to select the format in which the date will be displayed. The selections are US (month/day/year) or EU (day/month/year). Touch the Up/Down Arrow keys to change the displayed value.
- **Date —** This menu item allows you to program the Analyzer with the current date. To change the displayed date, use the Up/Down Arrow keys.
- **Time —** This menu item allows you to program the Analyzer with the current time. To change the displayed time, use the Up/Down Arrow keys.

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

Factory Setup

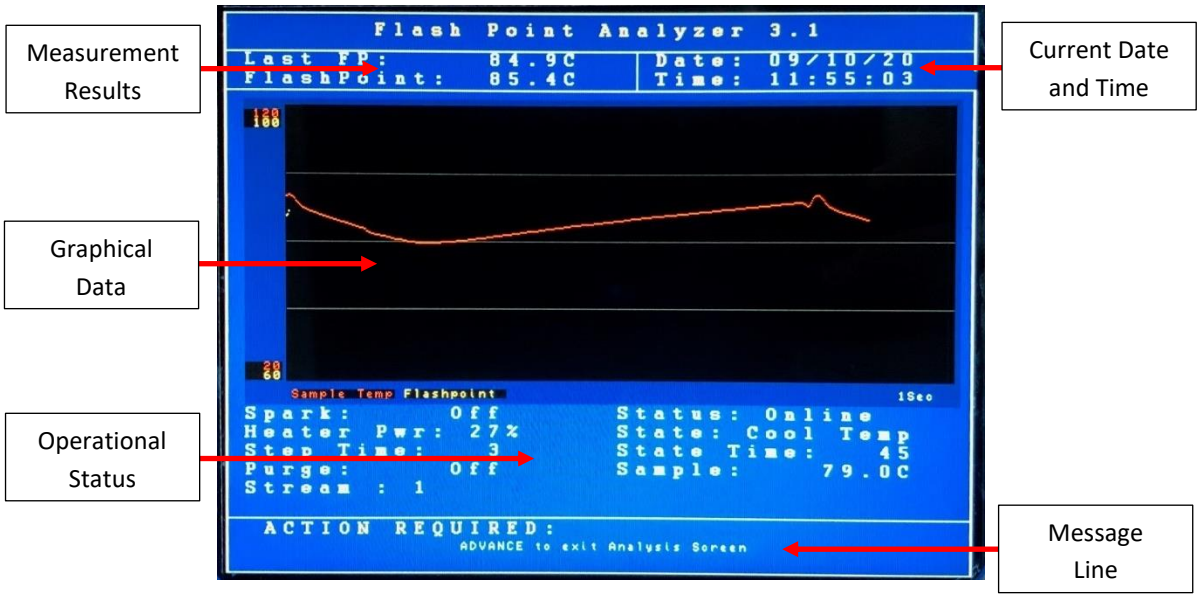
This is a password protected submenu intended for factory use only.

Chapter V: Normal Operation

In normal operation, the P-500 Flash Point Analyzer continuously measures the flash point of petroleum products. These measurements and other pertinent monitoring information are displayed on the Analyzer's display in the Main Run screen. Measurement data are also output as analog and/or digital signals. Upon the application of power, the Analyzer displays either the Main Run screen or the Main Menu, depending on how the Standby mode has been set up (see Chapter IV).

Main Run Screen

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



- **Measurement Results —** The two most recent measurements. Measurement data are displayed in either °C or °F and are updated at the end of each measurement cycle.
- **Date & Time —** The current date and time as tracked by the Analyzer's internal calendar and clock.
- **Graphical Data Display —** Displays measurement results and sample temperature. If power is lost or disrupted, the displayed graph is lost.
- **Operational Status —** Identifies the status and state of various Analyzer components and systems.
  - *Spark* — Indicates the status of the spark electrode.
  - *Heater Pwr* — Indicates the percentage power being applied to the sample heater.
  - *Step Time* — Indicates the timer for Incremental and Decremental Heat setting.
  - *Purge* — Indicates the status of the purge solenoid.
  - *Stream* — Shows the current stream being analyzed.
  - *Status* — Shows the current Analyzer's status (Offline or Online).
  - *State* — Indicates the Analyzer's current activity.
  - *State Time* — Displays current state timer.
  - *Sample* — Indicates the temperature of the sample.

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

Signal Outputs

4-20mA Analog Output

The P-500 Flash Point Analyzer outputs an analog signal proportional to the last measured value. The range of the analog signal is user programmable (see page 23). This signal is updated at the end of the measurement cycle.

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

RS-232 Serial Output

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

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

Depending on how communications were programmed (see page 30), the information contained in the data stream is output as follows:

Description	**Format**
Date	Current date (US or EU format)
Time	Current time (US or EU format)
Result	Flash Point result (in current unit settings)
Temperature	Sample temperature (in current unit settings)
Stream	Current stream

Modbus Output

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

Alarms

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

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

Alarm Type	Alarm Message	Description	Alarm Relay Choice
Informative	"Maintenance Required"	Num Cycles counter in System Settings reached Max Cycles settings	Maintenance
Informative	"Validation Requested"	Validation cycle has been requested	-
Informative	"Validation in progress"	Analyzer is in validation cycle	In Validation
Informative	"Remote Standby Active"	Analyzer is in remote standby mode	Alarm Warning; Critical (optional)
Informative	-	Current stream in operation	Stream 1 Stream 2
Informative	-	New result	Come Read
Warning	"Low Flashpoint"	Result is below the set range (low)	Alarm Warning
Warning	"High Flashpoint"	Result is above the set range (high)	Alarm Warning
Warning	"Cool-Temp Limit Alarm" *	Sample didn't cool below set value during set time	Alarm Warning
Warning	"Low Sample Temperature"	Sample temp. is below the set point	Alarm Warning
Warning	"Digital Input 6" or other programmable info	Digital Input #6 activated alarm	Alarm Warning
Warning	"Digital Input 7" or other programmable info	Digital Input #7 activated alarm	Alarm Warning
Critical	"High Sample Temperature"	Sample temp. is above the set point	Alarm Critical
Critical	"RTD Failure"	Defective/open RTD	Alarm Critical

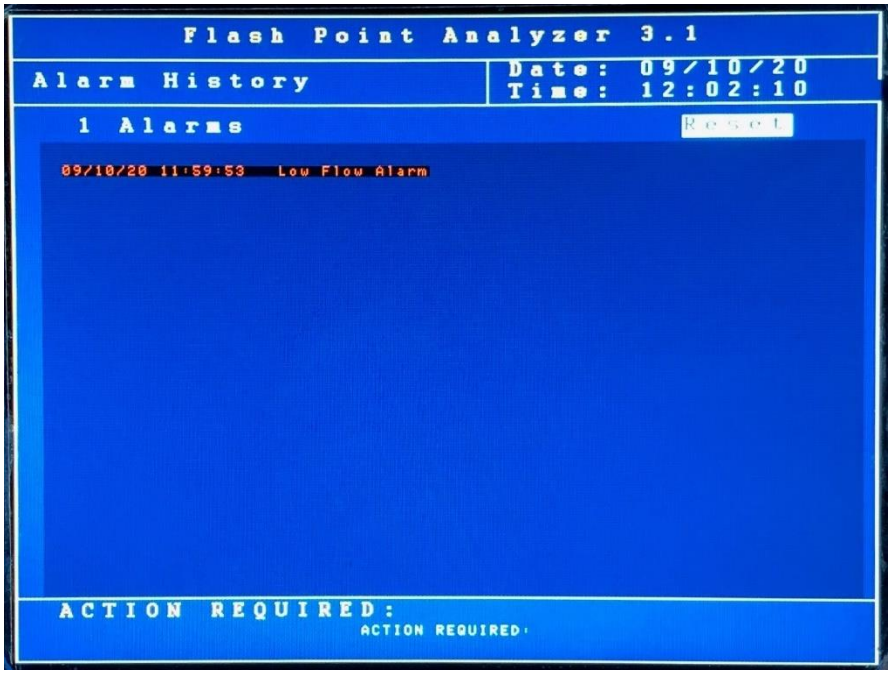
Critical	"No Detection"	Heat state timer exceeded set value	Alarm Critical
Critical	"Ext. Over-temp. Switch"	Sample temperature above 300°F (148.9°C) or defective thermostat	Alarm Critical
Critical	"Customer Alarm"	Digital Input signal for external alarm	Alarm Critical
Critical	"AutoZero Alarm"	Detection circuit or pressure sensor failure	Alarm Critical
Critical	"Cool-Temp Limit Alarm" *	Sample didn't cool below set value during set time	Alarm Critical
Critical	"Low Flow Alarm"	Digital Input signal from flow meter. Low or no sample flow	Alarm Critical
Critical	"Digital Input 6" or other programmable info	Digital Input #6 activated alarm	Alarm Critical
Critical	"Digital Input 7" or other programmable info	Digital Input #7 activated alarm	Alarm Critical

* "Cool-Temp Limit Alarm" can be set as Alarm Warning or Critical in Alarm Settings menu.

	**NOTE: Alarm Warning relay choice activates together with Alarm Critical.**

Alarm History

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



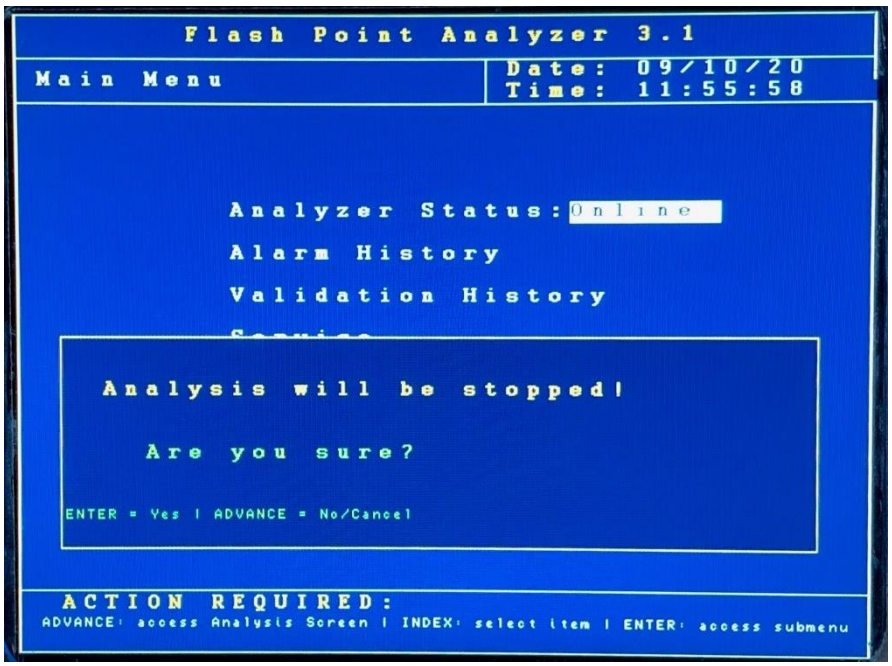
To clear the alarm history, tap the Enter key when Reset is highlighted and confirm.

Taking the Analyzer Offline

The P-500 Flash Point Analyzer may be taken offline either locally or remotely.

Locally

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



Remotely

The Analyzer may also be taken offline via an optional remote dry contact digital input closure (see Chapter III). The instrument will remain idle until the signal is removed. A message indicating that the instrument has been remotely idled is displayed on the Main Run screen.
Modbus communication can also be used to control analyzer status.

Validation

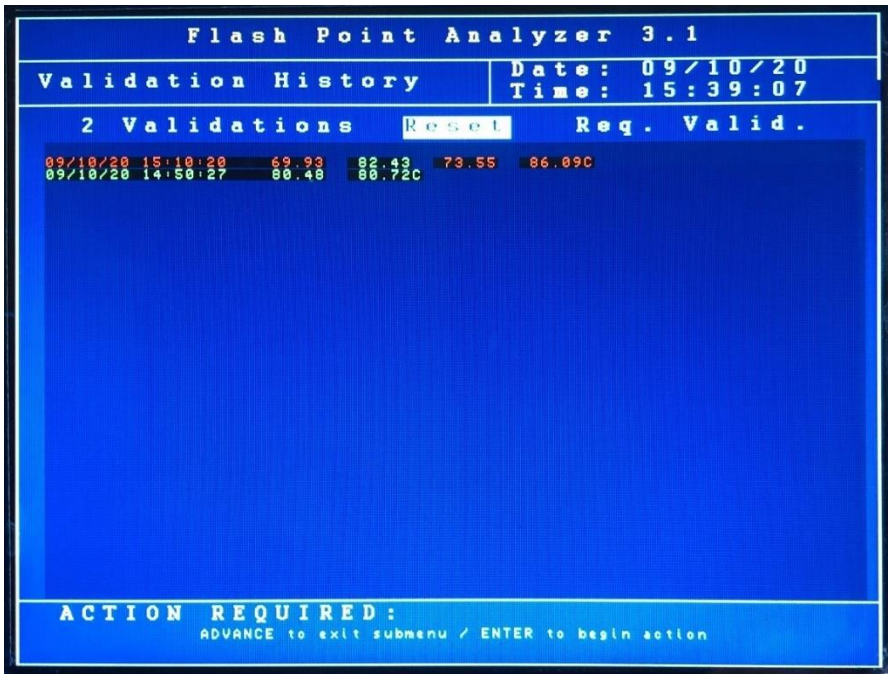
If the Analyzer is equipped with the Validation option, it will run a series cycles (following state table) on a known product when validation is requested. A passed validation is considered if the test results of two consecutive readings, within maximum numbers of five attempts, are within a programmable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

Example:

Programmed Expected Value (In System Settings Screen): 70°C
Programmed Bandwidth (In System Settings Screen): 2°C
Results from Validation Test #1: 67.9, 70.6, 72.8, 69.4, 72.1 = FAIL
Results from Validation Test #2: 72.9, 70.6, 70.9 = PASS

Request of Validation

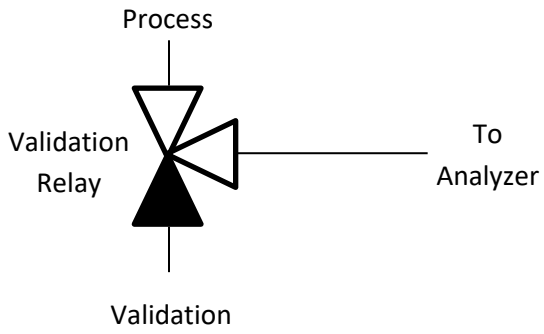
The validation protocol is a requested procedure which does not take precedence in the operational hierarchy. Therefore, the current cycle will always complete before moving to the validation protocol. Validation is requested by writing a command (value = 1) to the associated Modbus address (see current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



Validation Supplied Hardware & Its Function

Validation relay (SPST, 250VAC, 5A rating) will be activated automatically by the analyzer software. It is assumed that the output terminals will be connected to energize externally located solenoid valves. Its function is as follows:

- Following the validation request and completion of the current cycle, the “Validation” relay will be activated during the entire validation protocol. Its purpose is to choose between the process sample and the validation sample.



Validation Rinse State

The analyzer allows the user to program in a time period for a pre-rinse state. This variable is located in the Factory Setup menu (default set to 90 seconds). This will allow the validation sample to reach flash cup and the time variable is dependent on the distance of the validation container to the analyzer inlet as well as the supplied volumetric flowrate.

Validation Results

In the Validation History Menu, the results of the validation are listed and color coded:

RED = FAIL
GREEN = PASS

If the analog output channel is programmed as such, the last validation measured value will be transferred. If one of the three programmable relays are programmed to “Validation”, the relay will energize upon the first successful validation protocol and will remain on until the system power is cycled or there is a failed validation protocol.

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

Sample Streams

On Analyzers equipped with the stream switching option, the sample stream being analyzed can be changed from 1 to 2 via a control room digital input contact closure (see Chapter III). When the signal is removed, the instrument goes back to analyzing stream 1.
The Analyzer can also be programmed to alternate between two streams (see page 27).
Modbus write command can also be used to switch between streams.

Sample Flushing

In order to deliver fresh sample to the flash cup, “Pre-flush” timer can be set as a delay before start of the analysis. That pre-flushing state only runs once at the beginning of the first cycle.
Similarly, “Post-flush” timer can be set as a delay before putting Analyzer Offline. During post-flushing state a flushing relay will also be energized. This can be used to add a solenoid valve that will run cleaning solution thru the system.
Pre and Post Flush settings can be programmed between 0 – 300 seconds from Factory menu. Both of those states run independently of alarms. Consult Bartec Orb for details.

Loss of Power Restart

In the event of a power loss, the P-500 Flash Point Analyzer will automatically begin monitoring when power is restored if the Standby mode (see page 27) is set to OFF. If the Standby mode is set to ON, the Analyzer will have to be placed Online manually from the Main Menu.

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

Internal Sample Leak

The Analyzer incorporates a sample leak detector (Figure 5-1) mounted on the bottom of the Measurement enclosure. Should an internal sample leak occur, accumulation of fluid in the bottom of the enclosure activates the leak detector and immediately removes power from the Upper Control and Lower Measurement enclosures. To restore power once the leak has been corrected and fluid removed from the enclosure, press the Power Reset Button on the side of the Customer Connections enclosure. The Analyzer will restart.

Figure 5-1: Leak Detector

Chapter VI: Maintenance & Service

	**WARNING: Service should only be performed by qualified service personnel. Before performing any of the following procedures, disconnect unit from its electrical source. If electrical power is required, exercise extreme care as "LINE VOLTAGE" is present.**
	**WARNING: Be sure to obtain all necessary permits and perform any required gas testing before opening the instrument's enclosures.**
	**WARNING: To prevent injury, the Analyzer must be shut off from the process. Personnel must avoid contact with hot equipment or sample.**

Recommended Routine Maintenance Schedule

Normal operation requires very little user intervention. What is recommended are occasional checks of the utility and sample supplies to ensure that they are within the range set forth in Chapter II and close to the most recent user set points. Variations in process conditions may cause system instability and possible system damage. The following checks should be made to maintain maximum system efficiency:

Check sample flow and pressure	Weekly
Check air flow and pressure	Weekly
Inspect flash cup, spark electrode, and combustion air tube	Quarterly or as required
Clean spark electrode and air purge tube	Quarterly or as required
Replace spark electrode	Every 6 months
Replace spark coil wire	Annually

Service and Operational Checks

The P-500 Flash Point Analyzer incorporates a special Service screen from which the operator can perform a variety of verification and diagnostic functions, including:

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

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

The Service screen is divided into following sections:

- **Mechanical**
  - *Air Purge* – controls air purge solenoid;
  - *Spark* – controls spark electrode;
  - *Validation* – controls validation solenoid valve or relay;
  - *Stream Sel* – controls stream solenoid valve or relay;
  - *Flushing* – controls flushing relay;

- **Detector**
  - *AutoZero* – displays and sets current offset for pressure sensor reading;
  - *Detect Level* – displays and sets detect sensitivity level for flash point detection circuit;
  - *Clear Latch* – allows to clear latch for flash point detection;
  - *Detect Latch* – shows the current state of flash point detection signal;

- **Sample Heat**
  - *Temp.* – displays current sample temperature;
  - *PWM Load* – sets the percentage of power applied to the sample heater;
  - *Heater* – turn the sample heater On and Off;

- **Run Autozero –** runs autozero state;
- **Run Valid.** – runs single validation cycle;

- **4-20mA Outputs**
  - *Output 1 –* this menu item allows you to output an analog signal via the Analyzer's first 4-20 mA output channel. Use the up/down arrow keys to increase/decrease the output value;
  - *Output 2 –* this menu item allows you to output an analog signal via the Analyzer's second 4-20 mA output channel. Use the up/down arrow keys to increase/decrease the output value.

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

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

- **Digital Inputs**
  - *Cust Alrm –* Customer Alarm digital input status;
  - *Rem Stdby –* Remote Standby digital input status;
  - *Validation –* Validation digital input status;
  - *Stream 2 –* Stream 2 digital input status;
  - *Low Flow –* Low Flow digital input status (if On -> in alarm);
  - *Dig.* In. #6 – Digital Input #6 status;
  - *Dig.* In. #7 – Digital Input #7 status;
  - *Smpl Ovrtmp –* Sample over-temp. digital input status (if On -> in alarm);

- **Pressure –** displays reading from pressure sensor;
- **Barometer –** displays reading from barometer circuit;

Taking the Analyzer Down for Service

Take the Analyzer Offline via the procedure outlined in Chapter V and then remove power via the switch on the right-hand side of the Control Enclosure. Remove power from the customer connection box (via external power switch or breaker panel) and lock out system supply voltage per local guidelines.

Close sample and instrument air supply valves and lock those valves closed as well.

Open instrument enclosures and allow system at least fifteen minutes to cool down from process temperatures. The system is now ready for periodic maintenance practices.

	**WARNING: Never attempt to replace any consumables on the system live as the spark circuitry operates at 10,000 VDC.**

Troubleshooting

Problem / Symptom	Cause	Corrective Action
Flash Point not detected	No spark	Dirty or faulty spark electrode; clean or replace as required.
		Faulty spark coil wire; check and replace as required.
		Faulty spark coil; replace as required.
	Sample not being heated	Faulty heater; check heater operation and replace as required.
	No sample	Check for proper sample flow and pressure.
	No combustion air	Check for proper combustion air flow and pressure.
	Faulty pressure sensor	Check and replace as required or recalibrate adapter PCB.
Inaccurate Flash Point measurements	Detect level set too high or too low	Check and adjust as required.
	Flow of combustion air too low	Check and adjust as required.
		Check and adjust as required.
	Faulty RTD	Replace as required.
	Sample temperature too high	Consult factory.
	Faulty pressure sensor	Check and replace as required or recalibrate adapter PCB.
Display screen not working	Screen saver 'ON'	Touch magnetic pencil to keypad.
	Electronics problem	Consult factory.
Keypad not working	Electronics problem	Consult factory.

Component Cleaning & Replacement

FLASH CUP

The flash cup should be opened and inspected on a regular basis and cleaned as required. A suitable solvent and stiff bristled brush should be used to remove coking, etc. from all interior surfaces.

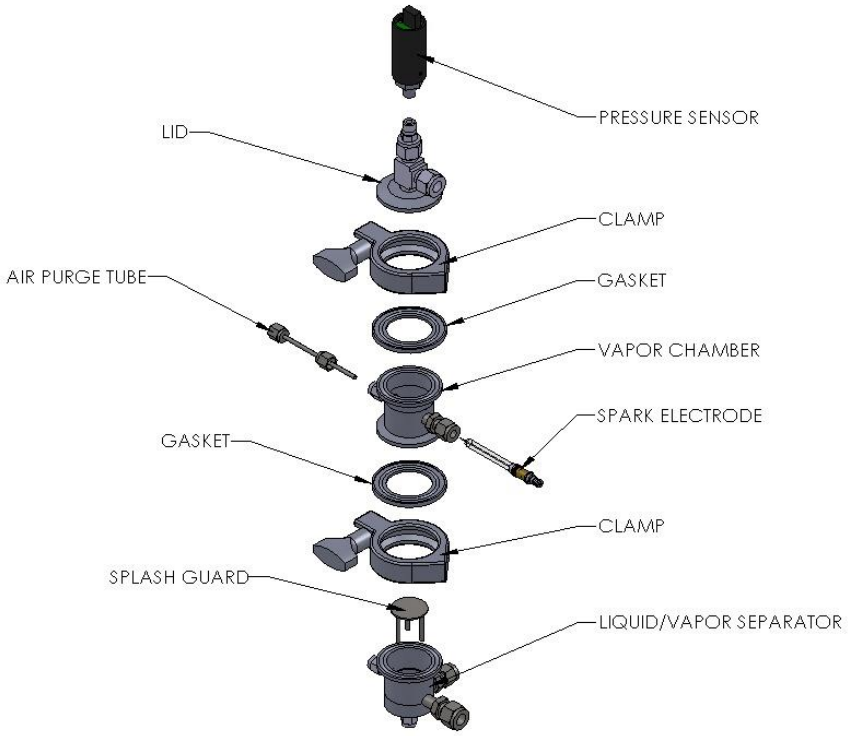


Figure 6-1: Flash Cup & Components

AIR PURGE TUBE

The air purge tube should be inspected on a regular basis and cleaned as required.

1. Remove the air purge tube from the flash cup.
2. Wipe with a suitable solvent to remove as much coke, etc. as possible. Polish tip with an emery cloth, if necessary.
3. Re-installed air purge tube in flash cup.

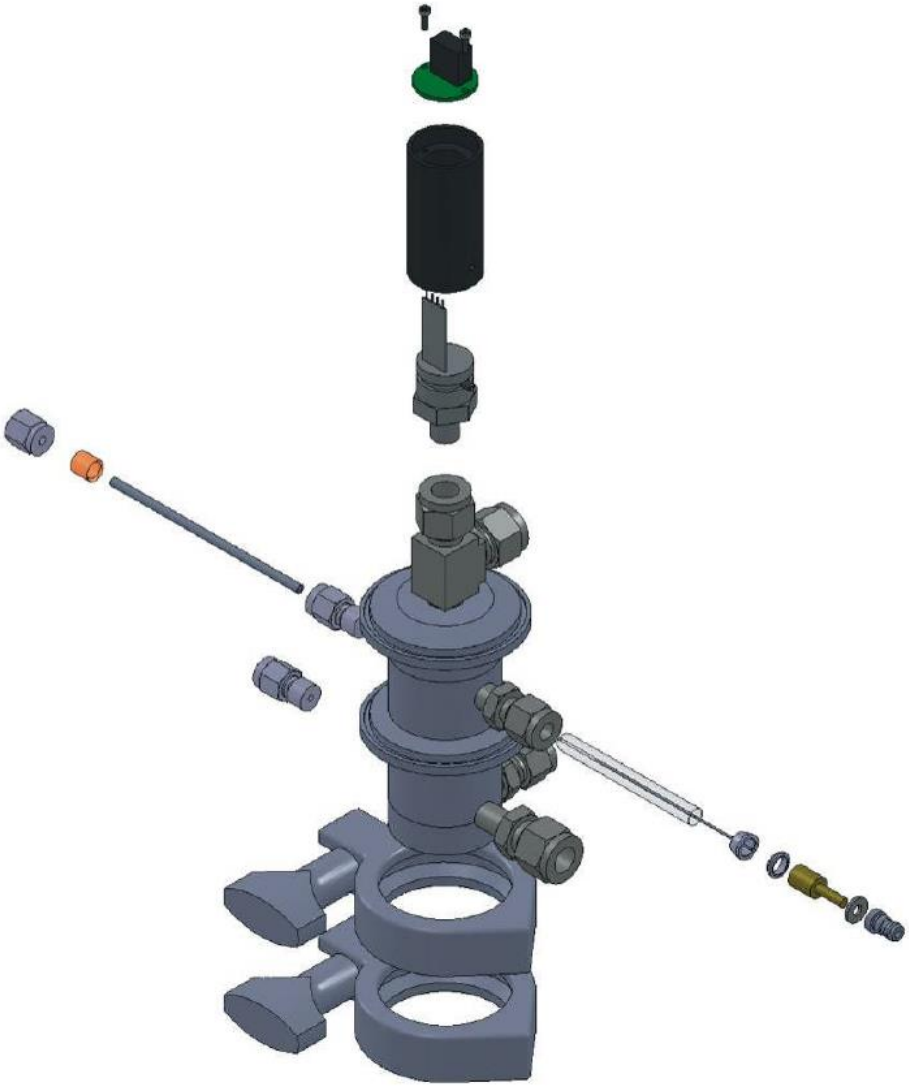
SPARK ELECTRODE

The spark electrode should be inspected on a regular basis and cleaned/replaced as required.

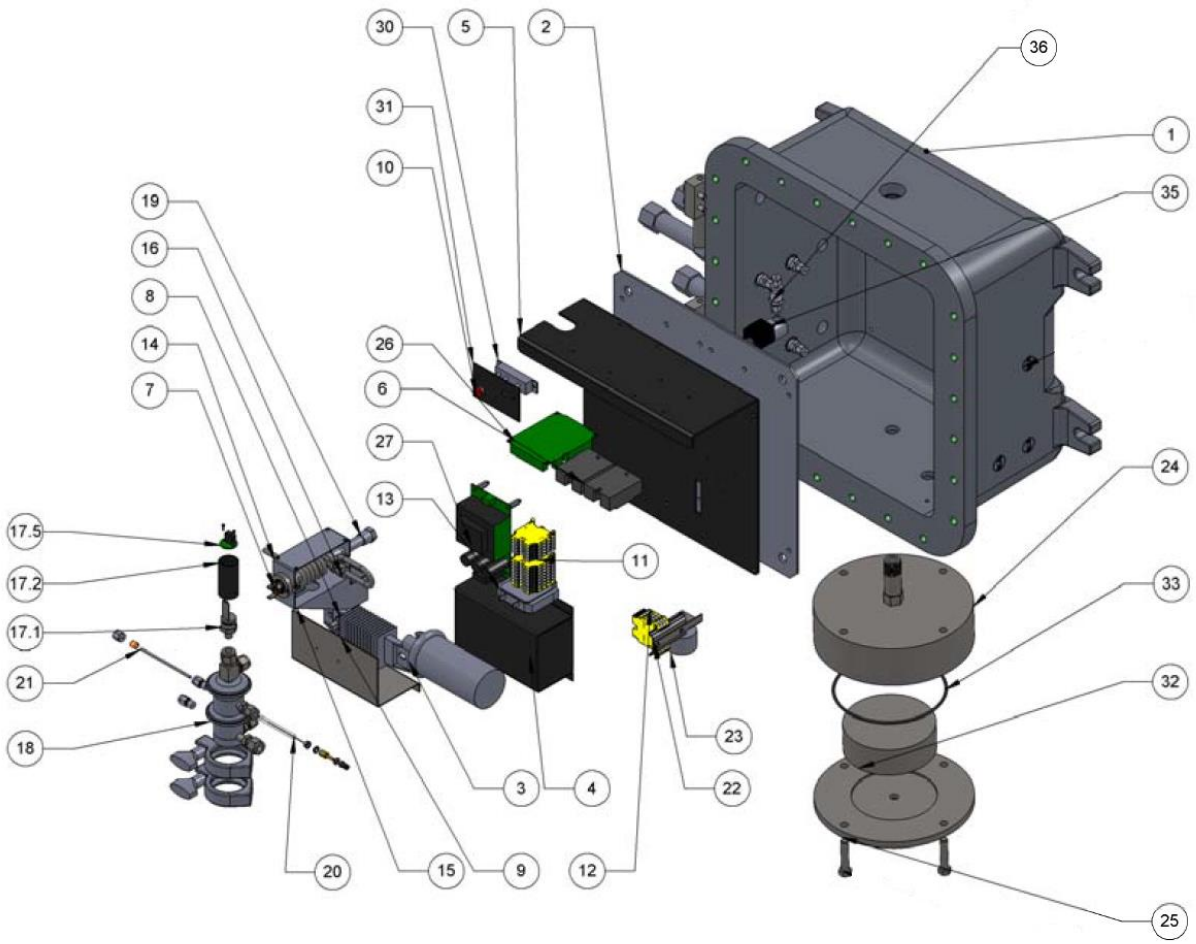
1. Remove spark electrode from flash cup.
2. Wipe with a suitable solvent to remove as much coke, etc. as possible. Replace electrode if damaged or worn.
3. Re-install spark electrode in flash cup.

Assembly Drawings

FLASH CUP



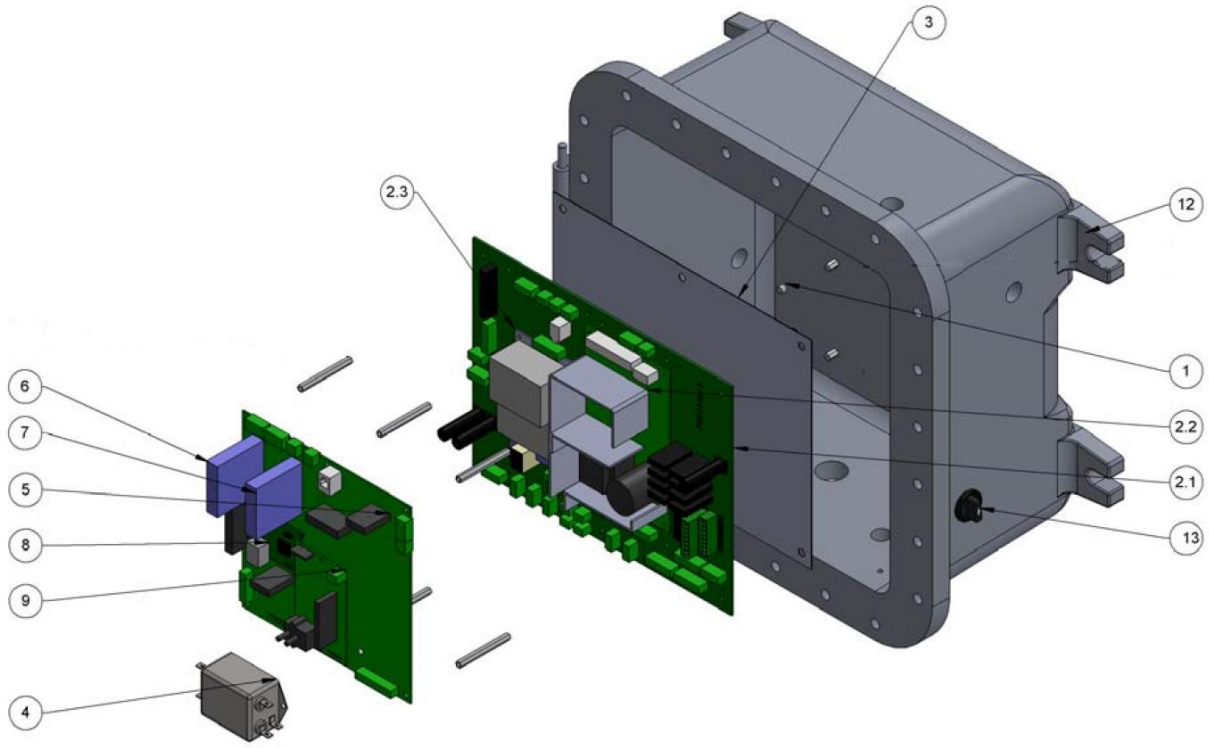
LOWER MEASUREMENT ENCLOSURE



Item No.	Part Number	Description	Qty
1	680009	Lower Explosion Proof Enclosure	1
2	700524	Lower Enclosure Mounting Plate	1
3	620087	Flash Point Spark Igniter	1
4	701322	Spark Igniter Cover	1
5	701321	Flash Point Electronics Backplate	1
6	620111	Solid State Relay	1
7	620083	Thermostat	1
8	620164 / 620193	Enclosure Heater 240V / 120V	1
9	701386	Heater Cover	1
10	620174	Neon Light	1

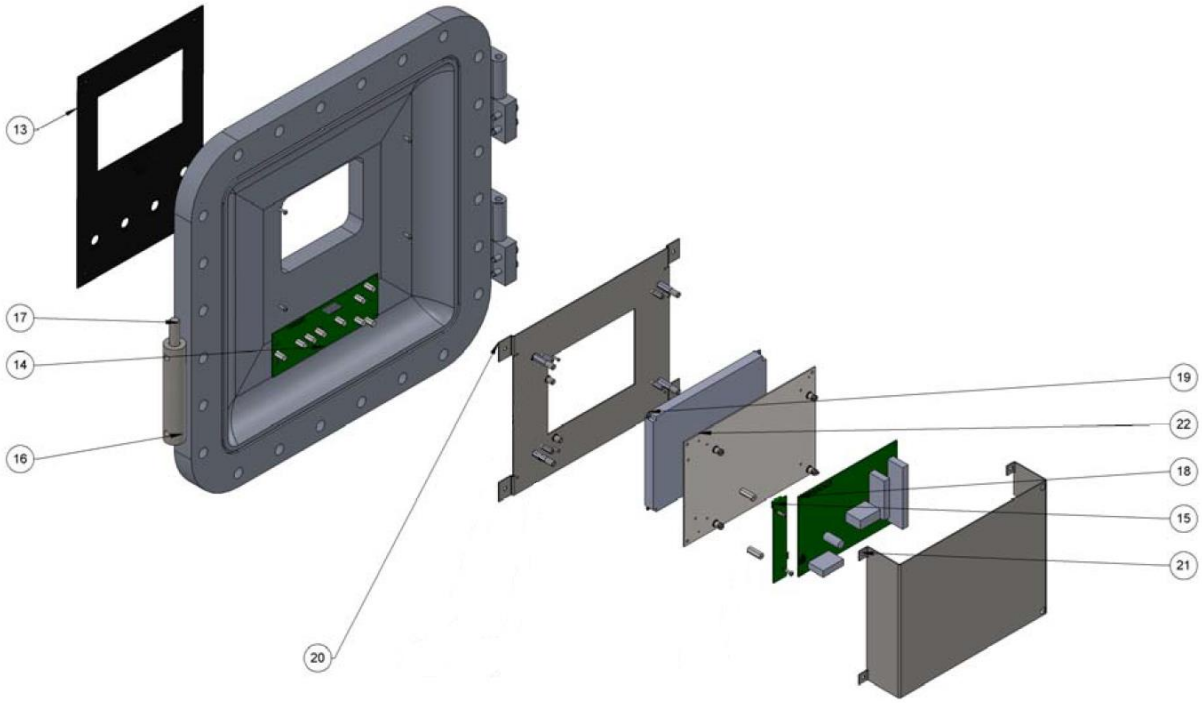
Item No.	Part Number	Description	Qty
11	620057	Terminals	12
12	620058	Ground Terminals	6
13	620184	Relay (24V, DPDT)	1
14	701324	Heater Retaining Bracket / Upper	1
15	701323	Heater Retaining Bracket / Lower	1
16	701495	Heat Tube Weldment	1
17.1	660008	Flash Point Pressure Sensor	1
17.2	701331	Pressure Sensor Cover Tube	1
17.5	798099	Flash Point Pressure Sensor PCB	1
18	701464	Flash Cup Assembly	1
19	620163 / 620192	Cartridge Heater 220V / 110V	1
20	700660	Spark Electrode	1
21	700661	Air Purge Tube	1
22	701289	Float Bracket	1
23	660005	Float Switch	1
24	670007	Flame Arrestor Weldment	1
25	701443	Flame Arrestor Housing Top	1
26	798102	Flash Point Transfer PCB	1
27	798096	Spark Control PCB	1
30	620165	Thermostat for Enclosure Heater	1
31	701476	Thermostat Cover plate	1
32	650278	Drain Flame Arrestor	1
33	690007	Flame Arrestor Housing O-Ring	1
35	650447	Purge Solenoid	1
36	650190	Check Valve	1

UPPER CONTROL ENCLOSURE



Item No.	Part Number	Description	Qty
1	701910	Mounting Plate for Main PCB	1
2.1	798115	Main Power Distribution PCB	1
2.2	620038	Power Supply (+24 VDC)	1
2.3	620037	Power Supply (+5, +/- 12VDC)	1
3	701911	Fish Paper for Main PCB	1
4	620076	Line Filter	1
5	700318	Main PCB	1
6	620081	RTD Input Module (0 – 100°C)	1
7	620080	4-20mA Output Module	1
8	600025	Rabbit Microprocessor	1
9	798090	Flash P. Detection Adapter PCB	1
12	700298	Upper Enclosure (Modified)	1
13	620149	Selector Switch	1

CONTROL ENCLOSURE DOOR



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

Chapter VII: Spare Parts

Spare Parts Kits

Description	Part Number
1-YEAR PARTS KIT	**700613**
Spark Electrode (2 each)	700660
2-YEAR PARTS KIT	**700614**
Spark Cable (1 each)	620166
Pressure Sensor Assembly (1 each)	701332
Spark Electrode (4 each)	700660

Replacement Parts

Description	Recommended Quantity	Part Number
Fuse (250VAC, 15A)	1	600051
Fuse (250VAC, 10A)	2	600052
Power Supply (+5, +/- 12VDC)	1	620037
Power Supply (+24 VDC)	1	620038
Spark Igniter	1	620087
Cartridge Heater (110 VAC)	1	620192
Cartridge Heater (220 VAC)	1	620163
Drain Flame Arrestor	1	650278
RTD Sensor	1	660001
Pressure Sensor Assembly	1	701332
Graphics Display	1	620583
Backlight Driver PCB	1	620600
Main Control PCB	1	700318
Spark Electrode	1	700660
Spark Cable	1	620166
Magnetic Keypad	1	798030
Display Controller PCB	1	798063
Flash Point Transfer PCB	1	798102
Spark Control PCB	1	798096
Flash Point Detection Adapter PCB	1	798090
Main Power Distribution PCB	1	798115
Flash Cup Assembly	1	701464