SureFire

Burner Management Systems

BMS-300

Installation and

Operations Manual

INTRODUCTION

BMS-300

The BMS-300 is designed for heavy duty oilfield applications and is certified to UL and ISA standards for hazardous areas. The BMS-300 is designed to operate with the FT Ignition units, to provide optimal ignition.

The controller's display is designed to operate in ambient temperature from –40°F to 131°F, and is coated for corrosion resistance. The unit is mounted in a NEMA 4X enclosure supplied with a UV resistant keypad. Each unit includes function indicator lights, and a status code chart printed on the overlay to provide assistance in troubleshooting. The units require 12 VDC or 24 VDC power, and is solar ready with a specific solar power termination port.

The system monitors target temperature with an enhanced RTD circuit; and indicates temperatures from 0°F to 500°F. The system controls both the pilot and main burner gas valves as necessary, and is designed as a fail safe system. High temperature and flame failure shutdowns are available, along with an audible startup warning. The system's failsafe run status alarm function allows for remote monitoring for environmental and regulatory compliance. Standard remote features include temperature indication, remote ON and OFF utilizing RTU and PLC.

The BMS-300 process may also be controlled using the alt sense input. Multiple connections for additional standby and shutdown requirements are also provided.

Every SureFire system must pass complete factory QA/QC. Also available are: control solenoids valves, resistance temperature detector (RTD), flame sensor, loss of fuel or standby pressure switches, and an FT-series ignition unit

We are dedicated to providing quality American-made safety control systems for industrial burners. The system has been developed through thousands of hours of critical design, engineering, and field testing.

TABLE OF CONTENTS

CERTIFICATIONS AND WARNINGS

Suitable for use in Class I, Division 2, Groups C, D, T6 Hazardous (Classified) and Ordinary Location

Operation - 40°C (- 40°F) ≤ Amb. Temp ≤ 55 °C (131°F)

CERTIFIED TO:

CSA C22.2 NO. 61010-1

CSA C22.2 NO. 213

CONFORMS TO:

UL 61010-1

ISA 12.12.01

WARNING -

EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2;

AVERTISSEMENT -

RISQUE D'EXPLOSION – LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE I, DIVISION 2

WARNING -

EXPLOSION HAZARD - DO NOT REPLACE FUSES UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS;

AVERTISSEMENT -

RISQUE D'EXPLOSION - COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX AVANT DE REPLACER LE FUSE.

WARNING -

EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS;

AVERTISSEMENT -

RISQUE D'EXPLOSION - AVANT DE DECONNECTER L'EQUIPEMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX.

WARNING -

EXPOSURE TO SOME CHEMICALS MAY DEGRADE THE SEALING PROPERTIES OF MATERIALS USED IN THE FOLLOWING DEVICES: Panasonic Relay, Model JW2SN-DC12V, and Hamlin Relay, Model HE721A0500

AVERTISSEMENT -

L'exposition à certains produits chimiques peuvent dégrader les FERMETURE PROPRIETES des matériaux utilisés dans les appareils suivants: Panasonic Relais, modèle JW2SN-DC12V, et Hamlin Relais, modèle HE721A0500

Warranty Statement

SureFire warrants all equipment of its own manufacture to be free of defects in material and workmanship for a period of twenty-four (24) months from the date of manufacture. SureFire's sole obligation hereunder shall be expressly limited to repair or exchange free of charge, F.O.B. Aztec, NM, USA of such defective equipment. SureFire's obligation under this warranty is limited to the above and does not apply to claims which are a result of improper installation, misuse, maladjustment, abnormal operating conditions, or lack of routine maintenance as determined by SureFire. Nor does the warranty include the furnishing of service for maintenance or problems arising from the foregoing causes. No claims for labor, installation, removal, transportation, or other expenses will be recognized. Notwithstanding any stipulation of the purchaser to the contrary, all other obligations, representations, warranties and conditions, express or implied, statutory or otherwise, including any implied warranties or conditions of merchantability, quality or fitness are hereby excluded and, SureFire shall not be liable for any loss, cost or damages, of any kind whatsoever, whether consequential, indirect, special or otherwise, arising out of or in connection with the equipment or any defect therein, even if caused by the negligence of SureFire, its employees or agents. The provisions hereof relating to the warranty and limitations hereon and limitation of liability shall continue to be enforceable between the parties notwithstanding termination of the within agreement for any reason including fundamental breach. Equipment not of SureFire manufacture shall pass through to the end user the vendor's or manufacturer's standard warranty.

Enclosure

The SureFire BMS-300 System uses a polycarbonate NEMA 4X enclosure to house the circuit board. The graphic overlay with membrane keypad is mounted on the exterior enclosure.

The NEMA 4X enclosure provides a high level of protection from harsh outdoor elements:

- *Windblown Dust Protection*
- *Water Damage Protection - Rain, Sleet, Snow, Splashing and Direct Water Contact*
- *Corrosion Protection*
- *External Formation of Ice Protection*

The Enclosure is IP66 certified, meaning it has been tested to the following:

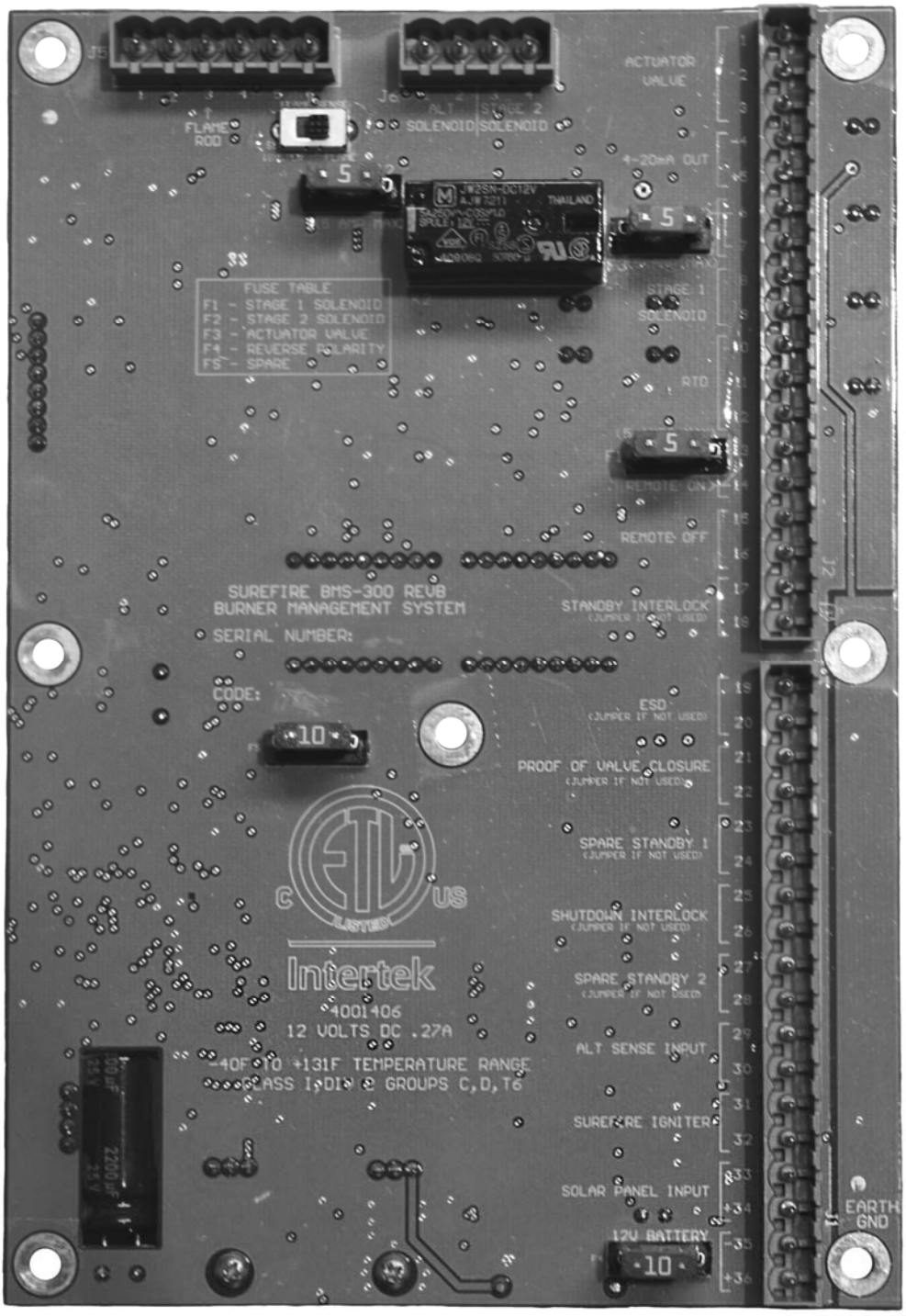
- *Dust tight, no ingress of dust; complete protection against contact*
- *Water projected in powerful water jets (12.5mm nozzle) against the enclosure from any direction shall have no harmful effects.*

WARNING:

When drilling holes in the enclosure, ensure IP66 fittings are used to maintain the IP66 standard. Failure to use IP66 standard fittings nullifies the IP66 certification.

BMS-300 Circuit Board

The SureFire BMS-300 System is controlled by state of the art non-arcing electronics that monitor and control all burner functions. It comes with 4 LED indicators and a Status Code LED Display. It also comes with individual terminal blocks, ground lug, and power connector to ease wiring and installation.



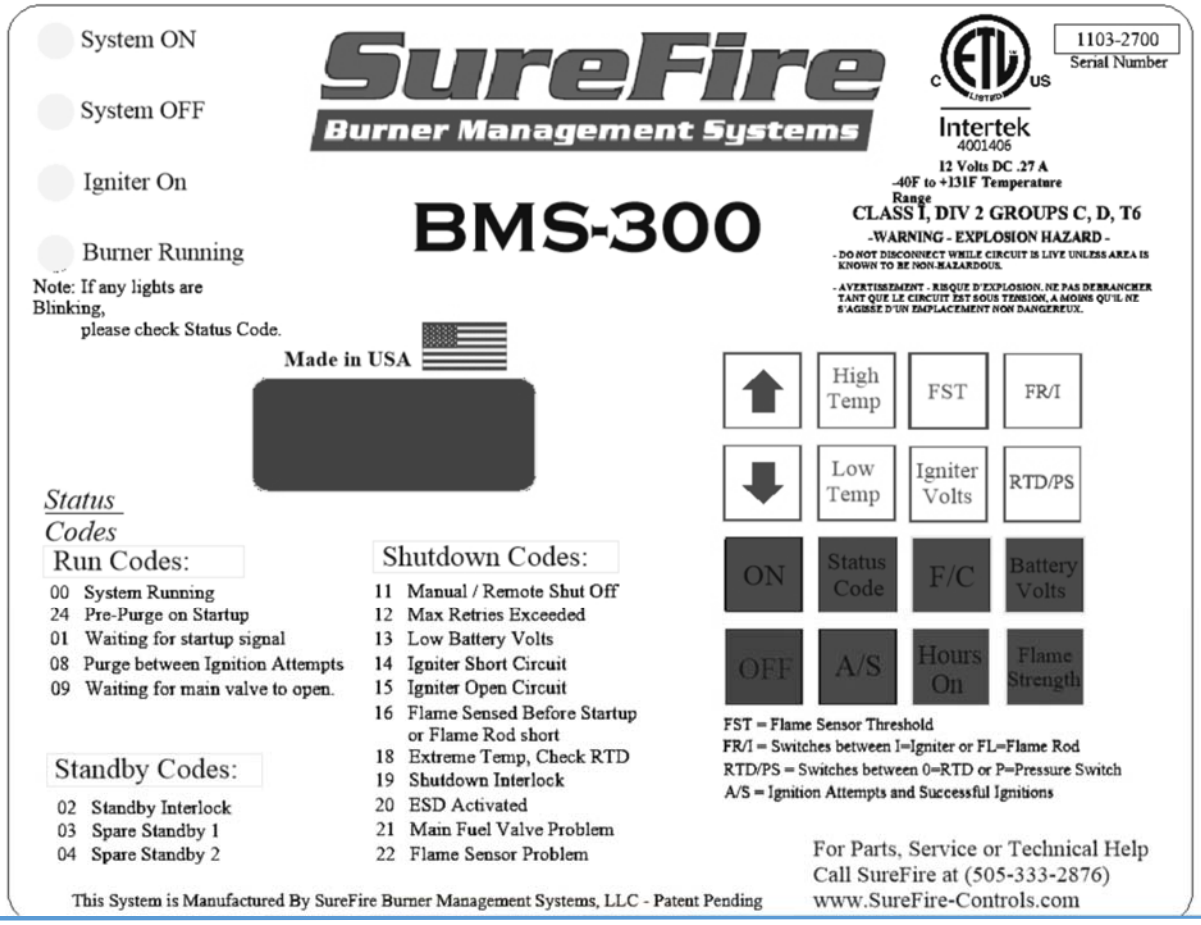
LED Indicators

The circuit boards LEDs illuminate through the lid of the enclosure. The LEDs indicate the following:

LED Indicator	*Status*
GREEN	LED ON - Indicates that the system is on and operating properly
	Blinking - Indicates a standby interlock is activated
RED	LED ON - Indicates that the system is off
	Blinking - Indicates a shutdown failure or interlock has been activated
AMBER	LED ON - Indicates igniter is on.
	Blinking - Indicates an igniter failure.
BLUE	LED ON - Indicates stage 1 solenoid and/or actuator is opening

Graphic Overlay

The overlay has status codes printed on the face. The overlay is used for interfacing with the system and acquiring troubleshooting information.



16 Button Keypad

The SureFire BMS-300 System has a 16 Button Key Pad to control and monitor the system. The buttons perform the following functions:

BUTTON	***FUNCTION/DISPLAY***
UP Arrow	-Increases the current value. Press & hold with the Hours On button for 5 seconds to unlock unit
DOWN Arrow	-Decreases the current value
High Temp	-Displays High Temperature setting
Low Temp	-Displays Low Temperature setting
FST	-Displays current flame sensor threshold value
Igniter Volts	-Displays current voltage received by the Igniter.
FR/I	-Displays current flame sensing device FR = Flame Rod I = Igniter
RTD/PS	-Displays current controlling device 0 = RTD P = Alternative Sensor
ON	-Turns system ON
OFF	-Turns system OFF
Status Code	-Displays code that corresponds with the current unit status. -Hold for 5 seconds to display current Pilot Mode. 1 - Intermittent Pilot 2 - Standing Pilot
A/S	-Displays Ignition Attempts & successful Ignitions . -Hold for 5 seconds to display Flame Proof Timing.
F/C	-Displays current temperature being used, Fahrenheit or Celsius.
Hours On	-Displays hours of operation. Press & hold with the Up Arrow button for 5 seconds to unlock unit
Battery Volts	-Displays the voltage being supplied to the unit.
Flame Strength	-Displays current flame strength for the Flame Rod or Igniter. -Hold for 5 seconds to display current solenoid timing between stage 1 and stage 2 opening.

SureFire FT-Series Ignition Units

The SureFire BMS-300 is compatible with any of the FT series igniters. Each unit is designed for specific Applications.

FT-1-S:

The unit above is utilizing the Igniter as a flame sensing mechanism.

Piloted System

FT-1 Systems are designed for long life in burner applications as a pilot. The FT-1 series offers flame sensing through the igniter or flame rod.

NOTE: Please consult local SureFire Field Tech Support for proper pilot placement proper orifice sizing selection.

Optional Flame Sensors

FT-1-SF:

The unit above is utilizing a Flame Rod as a flame sensing mechanism.

Flame Rod

- Nichrome flame rod rated 2600°F
- Armored wiring harness to 1000°F duty / 1500°F flash
- Enclosed fire tube service
- Direct termination to BMS-300 controller

Igniter

- Utilizes ohms resistance reading to verify flame
- Capable of enduring high temperatures
- Direct termination to BMS-300 controller

Pilotless Systems

The pilotless systems offer ease of installation for a range of applications. Each of these units are available with flame rod flame sensing.

- FT-2 Systems are suitable for pilotless 1" burner applications, rated at 125,000btu/H
- FT-4 Systems are suitable for pilotless 2" burner applications, rated at 500,000btu/H
- FT-6 Systems are suitable for pilotless 3" burner applications, rated at 1,000,000but/H

NOTE: Please consult local SureFire Field Tech Support for proper pilot placement and proper orifice sizing selection.

FT-2-AF:

The unit above is utilizing a Flame Rod as a flame sensing mechanism.

FT-4-AF (above) and FT-6-AF (below):
These two units are utilizing a Flame Rod as a flame sensing mechanism.

COMPONENT DESCRIPTION

12 Volt SureFire Actuator

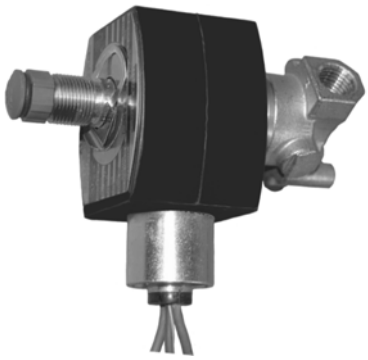
Part #: 51901065

- The 12V SureFire actuator is designed to control the main fuel gas to the main burner.
- No adjustment necessary! The actuator is factory programmed and pre-wired.
- 1” NPT X 1” NPT connection, full port
- Simple 3 wire termination.
- Applications include– pilotless single stage operations , non-venting fuel trains, and flare systems.

1in. SureFire Solenoid Valve

Part #: 51900605

- The 1in. SureFire solenoid valve is a fail closed device, meaning if power is lost, the unit defaults to a closed state.
- 1” NPT X 1” NPT connection, full port
- No adjustment necessary! Simple 2 wire termination.
- Applications include– pilotless single stage, non-venting fuel trains, and flares.



1/4 in. ASCO Solenoid Valve

Part #: 51900601

- The 1/4 in. ASCO solenoid valve is a fail closed device, meaning if power is lost, the unit defaults to a closed state.
- 1/4” NPT X 1/4” NPT connection
- No adjustment necessary! Simple 2 wire termination.
- Applications include– direct pilot control valve (#72 orifice) and pneumatic valve operation.

Pressure Switch

Part #: 51901001

- The pressure switch can be used to:
  - Sense loss of fuel gas and initiate system shut down
  - Sense if gas is being vented and initiate system shut down.
  - 1/4” NPT X 1/2” NPT connection
  - Provide operation flexibility: switch can be set as normally open or normally closed.

Resistance Temperature Detector

- Used to detect the process temperature.
- Temperature range is 0°F — 528°F.
- Simple three wire termination.
- 1/2” NPT X 1/2” NPT connection
- Available in the following sizes: 5”, 6”, 9”, 12”, and 18”.

Please Contact SureFire for appropriate product part number.

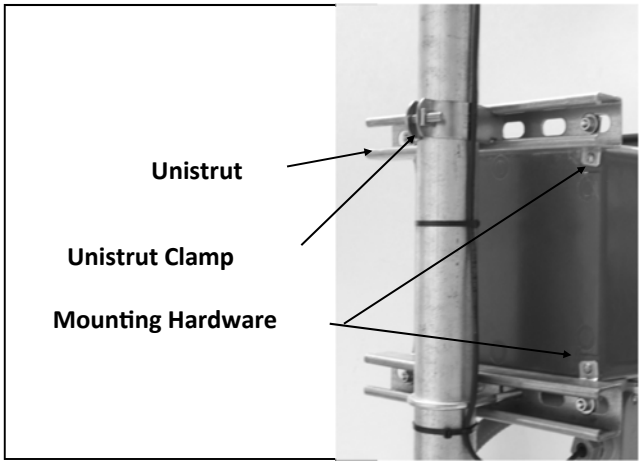
Slow Flow Valve

Part #: 51901043

- Reduces the inrush of fuel gas into the diaphragm valve for smooth and reliable ignition.
- Required on all pilotless installations when not using an actuator valve.
- 1/4” NPT X 1/4” NPT connection
- Recommended for piloted installations to assure optimum performance and reliability.

Enclosure Installation

1. The enclosure is to be mounted on a pole or a building that is capable of supporting 10 lbs.
2. Position the enclosure so that the LED display is clearly visible for the operator
3. Install conduit seal-off fittings for ALL electrical connections at the box
4. Installation must comply with the local electric code.



NOTE: After completing your installation and confirming proper operation, lock or tag your control unit box to prevent unwanted or unauthorized modifications.

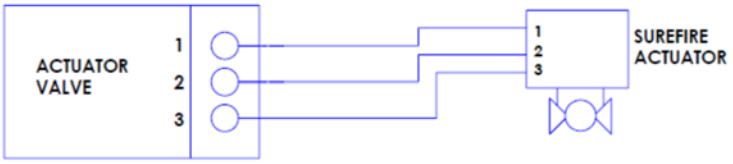
WARNING: Before any welding is attempted, disconnect all wires going to the circuit board. Any damage caused by welding to your SureFire is NOT covered under warranty.

WARNING: Before terminating any wires, be sure no power is supplied to the controller.

Actuator Valve Installation

1. Install the SureFire approved Actuator Valve
2. Terminate the Actuator wires (1, 2 and 3) at the Actuator Valve terminals (1, 2 and 3)

NOTE: Actuator 1 terminate @ SureFire 1
Actuator 2 terminate @ SureFire 2
Actuator 3 terminate @ SureFire 3



NOTE: Must use SureFire Actuator valve or an actuator approved by SureFire.

PLC/Scada Connection

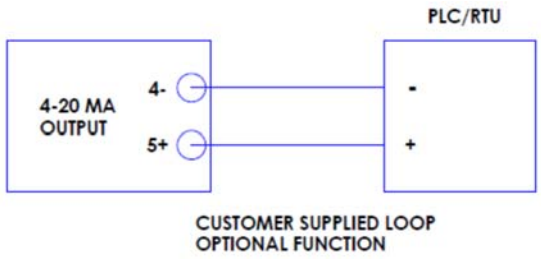
4-20mA

The proper connection method for the 4-20mA remote circuit monitoring is as follows

1. Ensure there is no power to the BMS-300 or PLC before connecting the wires.
2. Connect positive side of the power supply from the remote monitoring equipment to port 5 and the negative wire to port 4.
3. If a 1-5 V signal is desired instead of the 4-20m, please install a 250 Ω resistor (at the remote monitoring equipment) to the return in the step 2 and connect the other end of the resistor to the NEG side of the power supply. Monitor the VDC signal at the 250 Ω resistor (return wire).

NOTE: Scale accordingly: 4mA = 0°F/-17°C

Scale accordingly: 20mA = 529°F/ 276°C



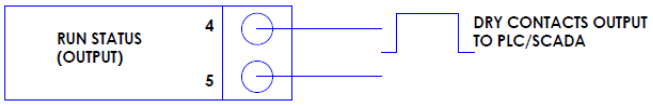
WARNING: Deviation may produce undesired results and damage to the circuit board.

Run Status

1. Make the connections from the RTU/PLC to the Run Status terminals (Port 4-5)

NOTE: The terminals are left un-touched if not used.

NOTE: Please see operation table on page 37.

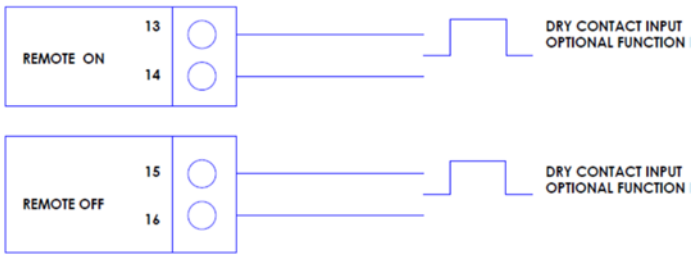


Remote ON / Remote OFF

1. Terminate connections from the RTU/PLC at the Remote ON terminals (Ports 13-14) and Remote OFF terminals (Ports 15-16)

NOTE: The remote ON / OFF receives a signal from a momentary switch from the PLC/SCADA to turn unit ON / OFF remotely.

NOTE: During a Shutdown error, unit cannot be reset remotely.

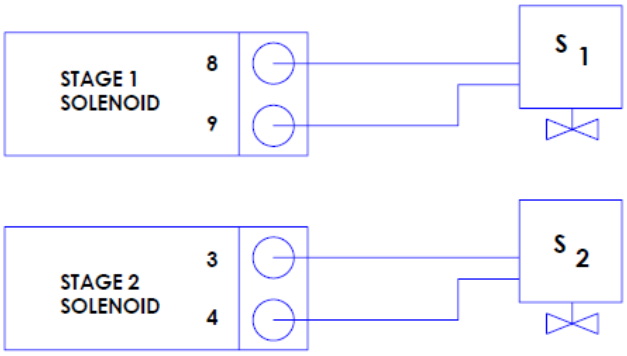


Solenoid Valve

1. Ensure supply gas is shut off.
2. Locate the instrument gas supply line controlling the main burner control valve.
3. Cut the tubing, allowing enough room for the solenoid to be installed in close proximity to the SureFire Controller.
4. Use two 1/4” NPT x 3/8” tubing fittings and connect the solenoid in-line.
5. Trim GREEN wire short and cap it off with a wire nut as this will not be used.
6. Use the proper conduit and connectors; wire the solenoid valve to the SureFire system.

NOTE: Reference solenoid body for proper flow direction.

1 = Outlet *2 = Inlet*

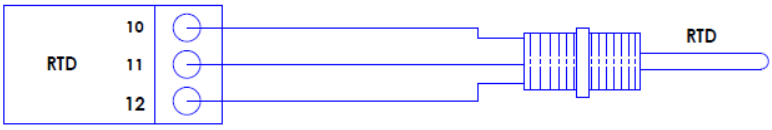


For stage 2 solenoid reference block J6, terminals 3 and 4.

RTD

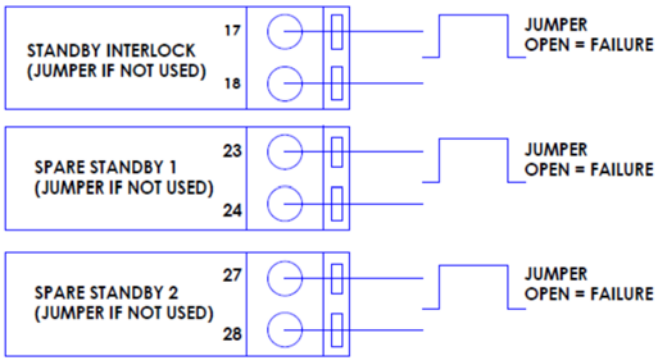
1. Install the RTD into the provided thermo-well on the vessel.
2. Connect the two negative wires to the negative terminals 10 and 11 on the circuit board.
3. Connect the one positive wire to the positive terminal 12.

NOTE: Software version 3.3 and above. When system recognizes temperature at 4ºF or less a 30 minute timer starts. If system does no recognize a temperature increase above 4ºF, the system will shutdown on code 18.



Standby

1. Install a switching device in one of the assigned terminal (Ports 17-18, 23-24 & 27-28)
2. If a switching device is not installed, place a jumper in the assigned terminal.



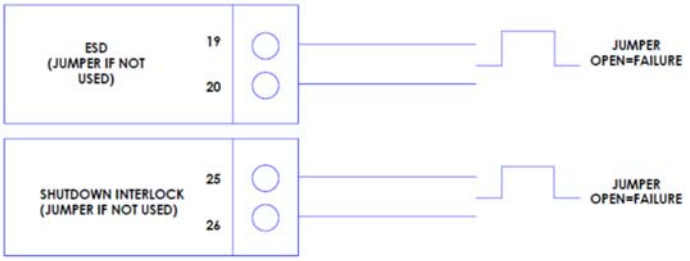
NOTE: Closed Contact = Normal Operation

Open Contact = Failed Operation

NOTE: Standby does not require a local reset to re-start system.

Shutdown

1. Install a switching device in one of the assigned terminal (Ports 19-20 & 25-26)
2. If a switching device is not installed, place a jumper in the assigned terminal.



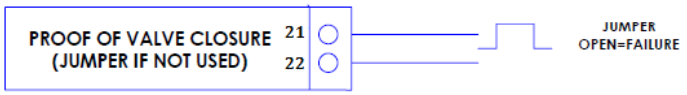
NOTE: Closed Contact = Normal Operation

Open Contact = Failed Operation

NOTE: Shutdown requires a local reset to re-start system.

Proof of Valve Closure

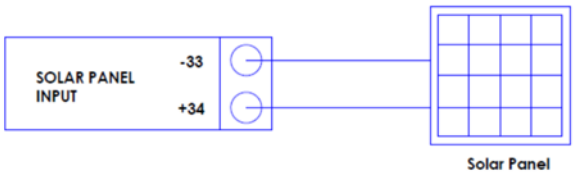
1. Install a main burner valve with a switch to provide proof of closure and terminate at ports 21 & 22.
2. If not used, place a jumper in the assigned terminal.



NOTE: Do Not use as a Shutdown

Solar Panel

1. Install 12 VDC Solar Panel and mount facing southeast.
2. Make the connection from the positive side of the Solar Panel to the positive terminal (port 34)
3. Make the connection from the negative side of the Solar Panel to the negative terminal (port 33)



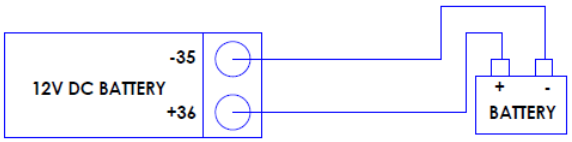
NOTE: If using a 24 VDC power supply, use the Solar Panel port not the 12V DC port.

NOTE: 75 Watt solar panel is the maximum allowable solar panel size.

NOTE: Requires internal regulator to trickle charge 12 VDC battery.

Battery

1. Install a 12VDC SLA battery within an enclosure separate of the BMS-300 enclosure.
2. Make the connection from the positive side of the battery to the positive terminal (port 36)
3. Make the connection from the negative side of the battery to the negative terminal (port 35)
4. Install a 10 Amp rated circuit breaker/ disconnect switch inline between the battery/solar panel and the circuit board for an accessible disconnect of power.

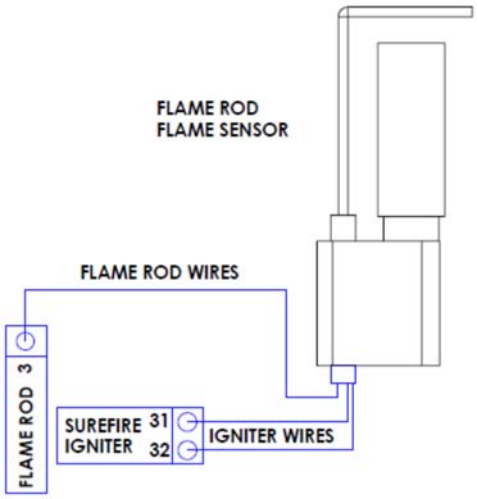


NOTE: If battery is more than 10 feet away from SureFire controller, use larger wire as needed.

NOTE: If utilizing 12 VDC power supply, set voltage @ 13.4 VDC. Power supply should be rated for 90 + watts.

SureFire Ignition Unit

1. Ensure all supply gas is turned off and locked out/ tagged out.
2. Install the FT unit in the fire tube.
3. The igniter has two wires that are white in color. These wires are not polar sensitive and are capable to handle high temperatures encountered in burner tubes. Terminate wires to ports 31 and 32.
4. Verify continuity for all wiring prior to reinstalling burner into the fire tube.



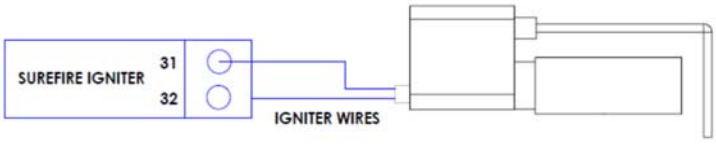
Flame Sensing

Flame sensing mechanism will be dependent on the ignition unit being utilized.

- For flame rod flame sensing terminate flame rod wire at designated port on upper left hand corner of the circuit board. Terminate to port 3 on the J5 block.
- Flame sensing switch needs to be on Flame Rod.

NOTE: Earth grounding is required when using a flame rod. Please check for proper grounding by connecting a multi-meter between the nozzle and the ground lug on the circuit board..

- For igniter flame sensing terminate the two white igniter wires to the designated ports. Terminate to ports 31 & 32.
- Flame sensing switch needs to be on Igniter.

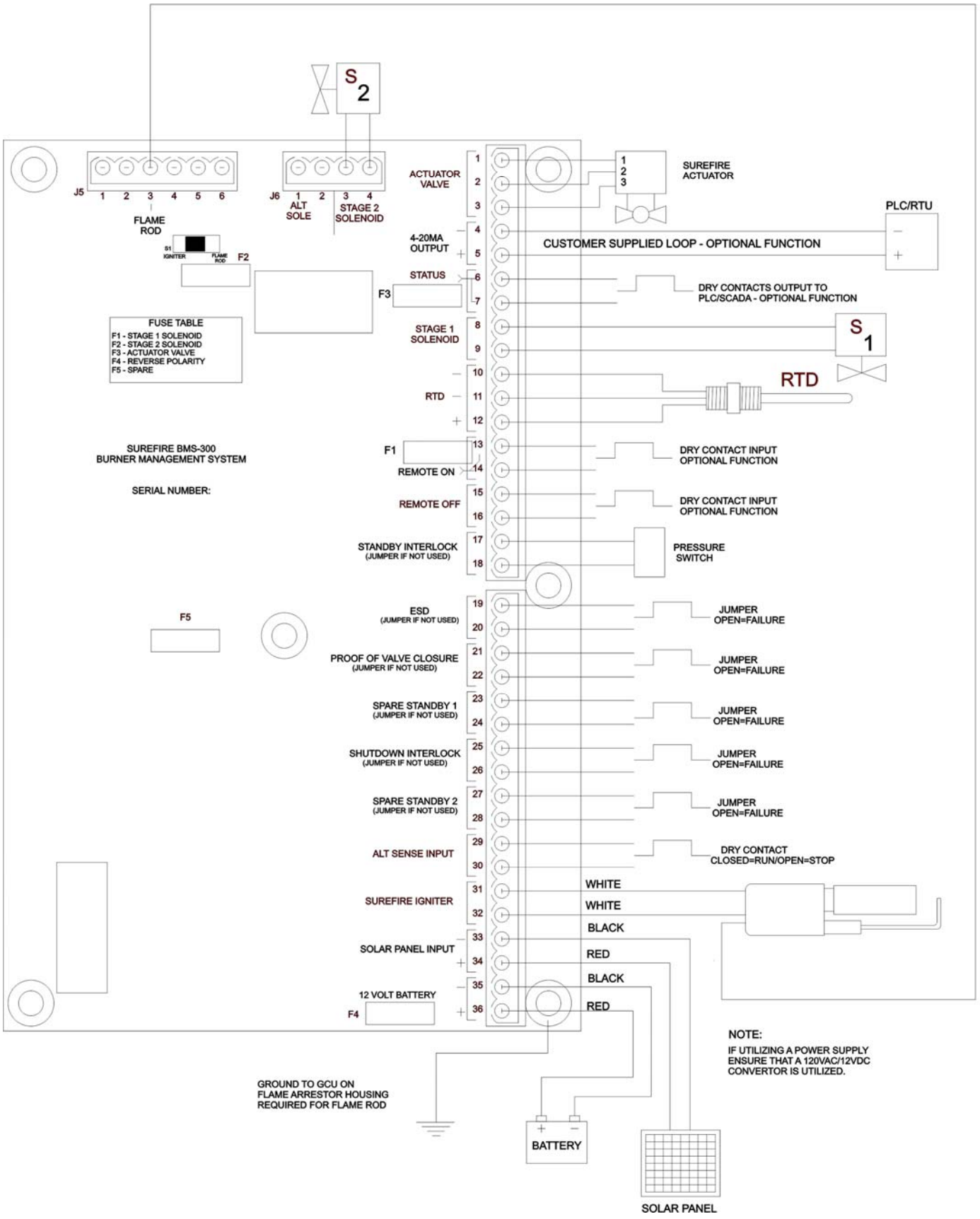


NOTE: Reference fig. 1 on page 23 for flame sensing switch.

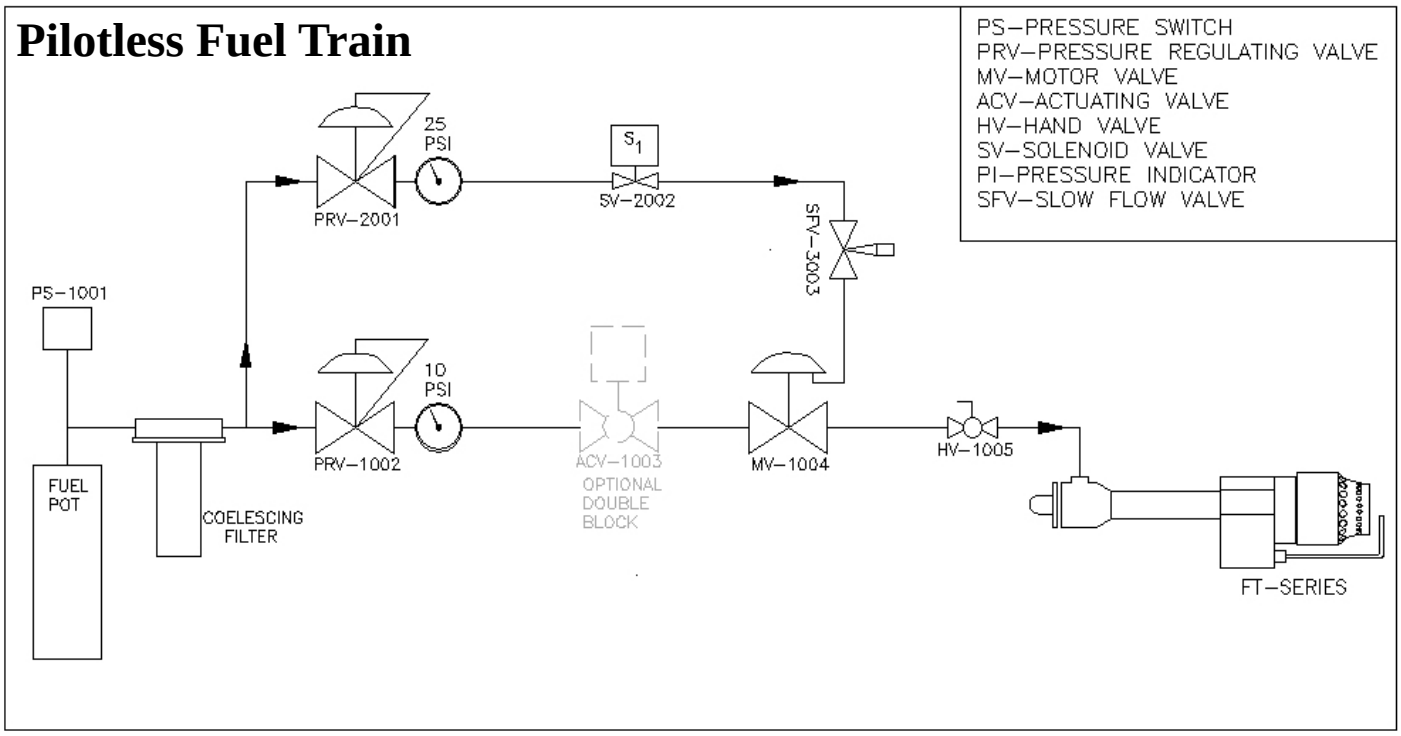
For proper FT unit positioning, contact tech support @ 505-333-2876

Or the local SureFire representative

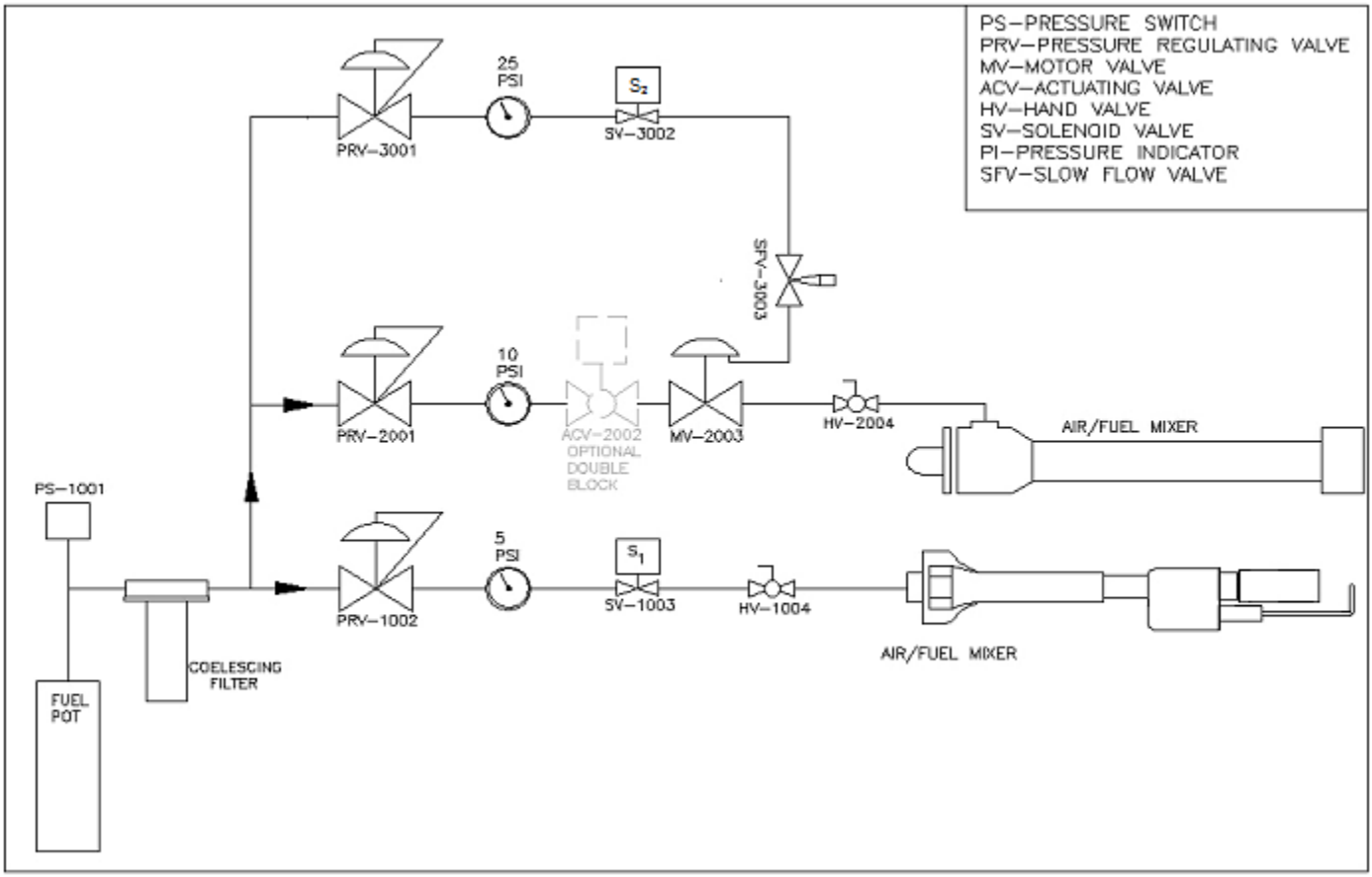
INSTALLATION WIRING DIAGRAM



Pilotless Fuel Train



Piloted Fuel Train



High Temperature

- The High Temp button displays the current high temperature setting.
- To set or change the High Temperature, follow these steps:
    1. Unlock the system by pressing and holding the hours on and up arrow buttons for 5 seconds until a series of zeros appear.
    2. Press and hold the high temp button and use the up or down arrow buttons to adjust the temperature setting. (Press and hold the up or down arrows for 3 seconds to scroll.)

NOTE: High temp factory setting is 150°F/65°C

Low Temperature

- The Low Temp button displays the current low temperature setting.
- To set or change the Low Temperature, follow these steps:
    1. Unlock the system by pressing and holding the hours on and up arrow buttons for 5 seconds until a series of zeros appear.
    2. Press and hold the low temp button and use the up or down arrow buttons to adjust the temperature setting. (Press and hold the up or down arrows for 3 seconds to scroll.)

NOTE: Low temperature factory setting is 60°F/15°C

NOTE: The SureFire System comes standard with a built in minimum 4° F temperature span to prevent undue wear associated with equipment short cycling.

Flame Sense (FR/I)

- The flame sensing button displays the current flame sensing device.
- To set or change the flame sensor, follow these steps:
    1. Position the flame sensing switch to desired setting: Flame Rod or Igniter. See Fig. 1
    2. Press the FR/I button and display will show desired setting. See below:
        - ◊ FL = Flame Rod / I = Igniter.

NOTE: If switch is on Igniter, the FR/I button needs to be on "I" and vice versa with Flame Rod.

NOTE: Flame sense factory setting is FL = Flame Rod.

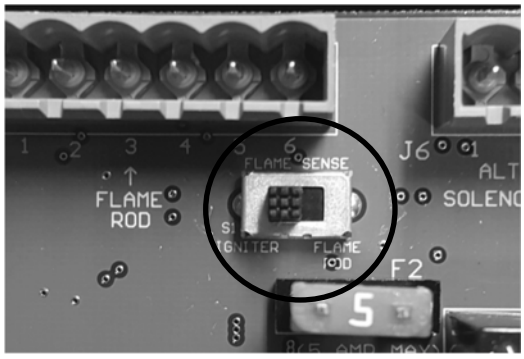


Fig. 1 - Switch is located in the upper left side of the circuit board.

Flame Strength

Primary Function:

- The Flame Strength button displays the current flame strength valve for the Flame Rod and Igniter.
- To check flame strength when using a Flame Rod:
    1. Press the flame strength button.
        - When no flame is present, the value will be above 500.
        - When flame is present the value will be below 6.
- To check flame strength when using an Igniter:
    1. Press the flame strength button
        - When no flame is present, the value will be between 7-17.
        - When flame is present, the value will be between 20-40

Secondary Function:

- The Flame Strength button displays the current solenoid timing between stage 1 and stage 2 opening when held down for 5 seconds.
- To set or change the solenoid timing, follow these steps:
    1. Unlock the system by pressing and holding the hours on and up arrow buttons for 5 seconds until a series of zeros appear.
    2. Press and hold the flame strength button down for 5 seconds and use the up or down arrow buttons to adjust the temperature setting.

NOTE: The flame proof timing factory setting is 60 seconds.

NOTE: The flame strength value in igniter mode is dependent in the Ohm value of the igniter. Values will vary between different igniters.

Flame Strength Threshold (FST)

Utilizing Flame Rod as Flame Sensor

- The FST button displays the current flame sensor threshold value.
- To set or change the threshold value, follow these steps:
    1. Unlock the system by pressing and holding the hours on and up arrow buttons for 5 seconds until a series of zeros appear.
    2. Press and hold the FST button and use the up and down arrow buttons to select the desired value.

NOTE: The FST factory setting is 250 and does not require any field adjustment.

BEST PRACTICE: Ensure continuity between the earth ground screw on the circuit board (located on the lower right corner of the circuit board) to the GCU grounding screw. Please reference the wiring diagram on page 19.

Utilizing the Igniter as Flame Sensor

- The FST button displays the current flame sensor threshold value
- To set or change the threshold, follow these steps:
    1. Unlock the system by pressing and holding the hours on and up arrow buttons for 5 seconds until a series of zeros appear.
    2. Press and hold the FST button and use the up and down arrow buttons to select the desired value.
    3. The value needs to be set 3 value points above the initial flame strength value on initial start-up. Press the FST button before starting system and set value as described.

Example: Initial Flame Strength = 10

Manually set FST at = 13

NOTE: The FST factory setting is 17.

For proper FST selection, contact tech support @ 505-333-2876

Or the local SureFire representative

RTD/PS

- The RTD/PS button displays the current input control device.
- The system can be controlled by two different input devices: RTD or ALT SENSE INPUT.
- To set or change the input device, use the following steps:
    1. Press the RTD/PS button to view the current setting..
        - ◊ 0 = RTD / P = ALT SENSE
    2. Unlock the system by pressing and holding the hours on and the up arrow buttons for 5 seconds until a series of zeros appear.
    3. Press and hold the RTD/PS button and use the up or down arrow buttons to select desired setting.

NOTE: The RTD/PS factory setting is 0.

NOTE: An example of an ALT SENSE INPUT device could be a pressure switch, or a dry contact from a PLC/RTU device.

Fahrenheit or Celsius (F°/C°)

- The F°/C° button displays the current temperature scale being used.
- To set or change the temperature scale, follow these steps:
    1. Press the F°/C° button to view the current setting.
    2. Unlock the system by pressing and holding the hours on and the up arrow buttons for 5 seconds until a series of zeros appear.
    3. Press and hold the F°/C° button and use the up or down arrow buttons to select desired setting.

NOTE: The F°/C° factory setting is F.

Attempts and Successes (A/S)

Primary Function:

- The A/S button displays Ignition Attempts and Successful Ignitions.
- The unit has a built in counter to record the number of Ignition Attempts and Successful Ignitions (A/S). The numbers displayed when the button is pressed once are Successful Ignitions and when pressed twice are Ignition Attempts.
- Ignition Attempts are recorded when the system starts the purge cycle.
- Successful Ignitions are recorded when the 2nd stage solenoid opens.

NOTE: The counter will start at 0000 and will roll over after reaching 9999. Counter is not resettable.

Secondary Function:

- The A/S button displays the current flame proof timing when held down for 5 seconds.
- To set or change the flame proof timing, follow these steps:
    1. Unlock the system by pressing and holding the hours on and up arrow buttons for 5 seconds until a series of zeros appear.
    2. Press and hold the A/S button down for 5 seconds and use the up or down arrow buttons to select the desired setting.

NOTE: The flame proof timing factory setting is 15 seconds.

Hours On

- The Hours On button displays the total hours the main burner flame has been present.
- The unit has a built in counter to record the total hours the main burner flame has been present. The number displayed when the button is pressed are the total hours.

NOTE: The counter starts at 0000 and will roll over after reaching 9999. Counter is not resettable.

Status Code

Primary Function:

- The Status Code button displays the current code that corresponds with current unit status.
- To observe the status of the system, press the status code button to view the current code displayed on the screen. Codes are printed on the overlay of the controller.
- During troubleshooting, if any other button is pressed before pressing the status code button, the code will be erased.

NOTE: Corresponding status code and descriptions are available on page 36.

Secondary Function:

- The Status Code button displays the current pilot mode when held down for 5 seconds.
- The system has two pilot mode options when used in piloted application, Intermittent or Standing Pilot.
- To set or change the pilot mode option, follow these steps:
    1. Press the Status Code button down for 5 seconds to view the current setting.
        - ◊ 1 = Intermittent Pilot / 2 = Standing Pilot
    2. Unlock the system by pressing and holding the hours on and the up arrow buttons for 5 seconds until a series of zeros appear.
    3. Press and hold the Status Code button and use the up or down arrow buttons to select desired setting.

NOTE: See next page for Pilot Option examples.

NOTE: The Pilot Mode Option factory setting is 1.

Secondary Function (Cont.)

1 = Intermittent Pilot Mode

- Stage one and stage two solenoids shut off together once high temperature setting is reached.
- If the process temperature continues to increase 50 degrees above the high temperature set point, the system will shutdown on a code 18

  For Example:
  High Temperature Setting = 150°F
  Low Temperature Setting = 100°F
  @ 100°F — 149°F—both stage one and stage two solenoids are open
  @ 150°F—both stage one and stage two solenoids are closed
  @ 200°F—If the 50° EHTD is reached, the system will shutdown on code 18

2 = Standing Pilot Mode

- Stage two solenoid closes once the high temperature setting is reached but stage one remains open.
- Stage two solenoid re-opens when low temperature is reached.
- If the process temperature continues to increase 10 degrees above the high temperature set point both stage one and stage two solenoids closes and waits for the low temperature to be reached before re-starting
- If the process temperature continues to increase 50 degrees above the high temperature set point, the system will shutdown on a code 18.

  For Example:
  High Temperature Setting = 150°F
  Low Temperature Setting = 100°F
  @ 100°F — 149°F—both stage one and stage two solenoids are open
  @ 150°F—stage two closes, stage one remains open
  @ 160°F—stage two remains closed, stage one closes
  @ 200°F—If the 50° EHTD is reached, the system will shutdown on code 18.

Battery Volts

- The Battery Volts button displays the current voltage being delivered to the controller by the power supply.
- To view the current voltage of the power supply, press the Battery Volts button

Power Supply

- The SureFire controller accepts rated voltages as described in the specifications, page 40. No setup is required. However, the system does have a built-in volt meter to measure battery voltage at all times. To check the battery volts, press the battery volts button. This can be helpful in troubleshooting, but will not replace a battery load tester.

Status Code

Run Codes	*Description*
00	System running
01	Waiting for start up signal
06	Igniter On
07	Verifying flame
08	Purge between ignition attempts
09	Waiting for stage 2 solenoid valve to open

Standby Codes	*Description*
02	Standby interlock activated
03	Spare standby 1 activated
04	Spare standby 2 activated

Shutdown Codes	*Description*
11	Manual or remote shut off (red light solid)
12	Max retries exceeded
13	Low battery voltage
14	Igniter short circuit
15	Igniter open circuit
16	Flame sensor short circuit/ flame sensed before start up
17	Not used
18	Extreme high temperature shutdown or RTD issue
19	Shutdown interlock activated
20	ESD activated
21	Main fuel valve failure
22	Flame detected before start up

Operational Situations

Operational State	*Status*	*Red LED*	*Green LED*	*Blue LED*	*Amber LED*
System OFF or Manual Shutdown	Open	ON	OFF	OFF	OFF
Flame sensed, Burner running, No Errors	Close	OFF	ON	ON	OFF
System ON, Pre-purge complete, Igniter On	Open	OFF	ON	OFF	ON
Shutdown, Igniter Error	Open	Blinking	OFF	OFF	Blinking
Standby Error	Open	OFF	Blinking	OFF	OFF
Shutdown Error	Open	Blinking	OFF	OFF	OFF

Flame Strength Value Information:

Flame Rod	**No Flame Present**	**Flame Present**
Flame Strength Value	Above 500	Below 6
Igniter	**No Flame Present**	**Flame Present**
Flame Strength Value	Between 7-17	Between 20-40

Ignition Process

1) Unlock system.
2) Set desired parameters.
3) Press the ON button.
4) Pre-purge - 120second countdown displayed - *Green LED ON*.
5) Audible Alarm - 5 second countdown- *Green LED ON*.
6) Igniter - 5 second countdown - *Green and Amber LED ON*.
7) Stage 1 Solenoid/Actuator valve opens - ignition unit remains on - *Green, Blue and Amber LED ON*.
8) Ignition is achieved, flame is sensed - *Green and Blue LED ON*.
9) Stage 2 solenoid valve opens - once the timing between solenoids expires - *Green and Blue LED ON*.
10) Unit is now running - Status code 00 - *Green and Blue LED ON*.
11) Process Temperature exceeds High Temp Set point - Stage 1 and Stage 2 solenoids close - *Green LED ON.*
12) Process Temperature reduced to Low Temp Set point - *Restart at step 5.*

Re-Ignition Process - No Flame Sensed

1) Once the system recognizes that no flame is sensed, the system will automatically begin the ignition process.
2) Purge between ignition attempts - 120 second countdown - *Green LED ON*.
3) *Reference step 5 - 10 in the "Ignition Process Section".*

NOTE: If system fails to prove flame on the third attempt, the system shuts down on code 12. Blinking Red LED.

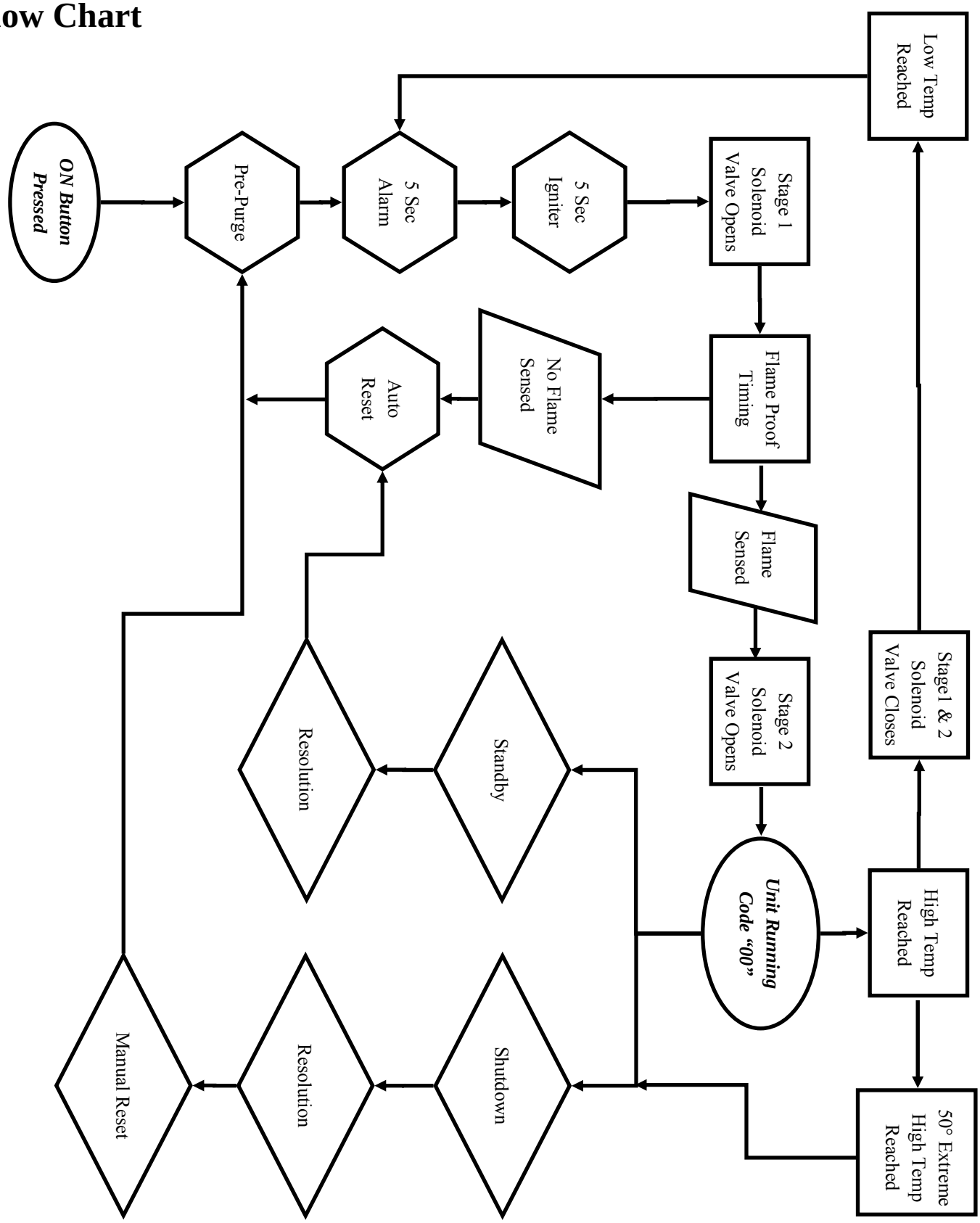
Re-Ignition Process - Standby

1) System in Standby - *Blinking Green LED.*
2) Once the system resolves the Standby issue, the system will automatically begin the ignition process.
3) Pre-purge - 120 second countdown - *Blinking Green LED*.
4) *Reference step 5 - 10 in the "Ignition Process Section".*

Re-Ignition Process - Shutdown

1) The system requires manual reset in the event of a shutdown.
2) System in Shutdown - *Blinking Red LED.*
3) Once the Shutdown issue is resolved, press the OFF and ON button to reset.
4) Pre-purge - 120 second countdown - *Blinking Red LED*.
5) *Reference step 5 - 10 in the "Ignition Process Section".*

Flow Chart


ON Button Pressed
Pre-Purge
5 Sec Alarm
5 Sec Igniter
Stage 1 Solenoid Valve Opens
Flame Proof Timing
No Flame Sensed
Auto Reset
Flame Sensed
Stage 2 Solenoid Valve Opens
Unit Running Code "00"
Resolution
Standby
Manual Reset
Resolution
Shutdown
High Temp Reached
Stage1 & 2 Solenoid Valve Closes
Low Temp Reached
50° Extreme High Temp Reached

Ignition Process

1) Unlock system
2) Set desired parameters
3) Press the ON button
4) Pre-Purge - 120 second countdown displayed– *Red LED ON*
5) Audible Alarm - 5 second countdown - *Green LED ON*
6) Igniter - 5 second countdown- *Green and Amber LED ON*
7) Solenoid/Actuator valve opens - ignition unit remains on - *Green, Blue and Amber LED ON*
8) Ignition is achieved, flame is sensed - *Green and Blue LED ON*
9) Stage 2 solenoid valve opens - once the timing between solenoids expires - *Green and Blue LED ON*
10) Unit is now running - Status code 00 - *Green and Blue LED ON*
11) Process Temperature exceeds High Temp Set point - Stage 2 solenoid valve close - *Green and Blue LED*
    - *If the process temperature exceeds the high temp set point by 10 ºF, the stage 1 solenoid valve will close - Green LED*
    - *If the above occurs, the system will restart at step 5 once process temperature is reduced to low temp set point*
12) Process Temperature reduced to Low Temp Set point - *Restart at step 9*

Re-Ignition Process - No Flame Sensed

1) Once the system recognizes that no flame is sensed, the system will automatically begin the ignition process.
2) Purge between ignition attempts - 120 second countdown - *Green LED ON*.
3) *Reference step 5 - 10 in the "Ignition Process Section".*

NOTE: If system fails to prove flame on the third attempt, the system shuts down on code 12. Blinking Red LED.

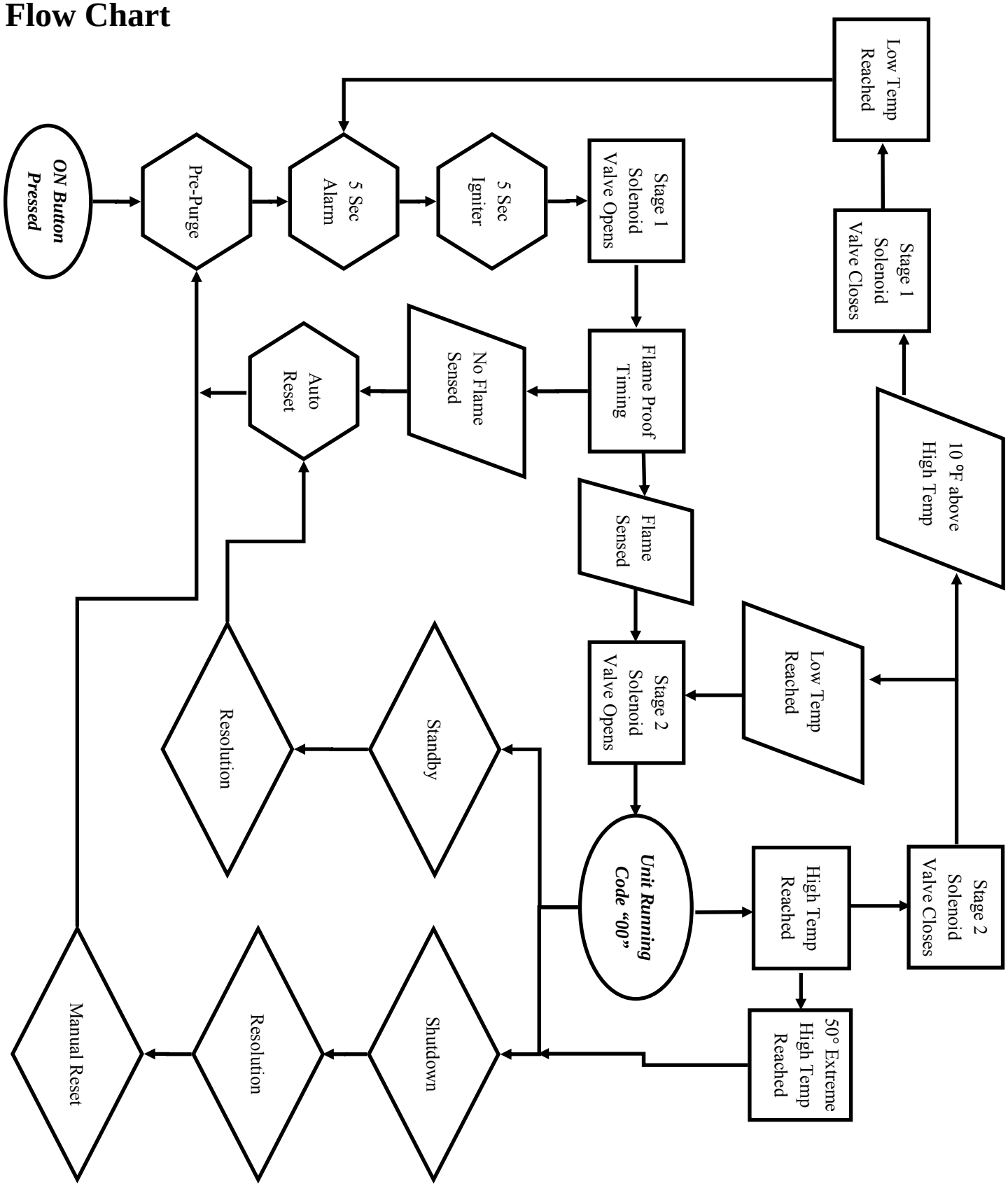
Re-Ignition Process - Standby

1) System in Standby - *Blinking Green LED.*
2) Once the system resolves the Standby issue, the system will automatically begin the ignition process.
3) Pre-purge - 120 second countdown - *Blinking Green LED.*
4) *Reference step 5 - 10 in the "Ignition Process Section".*

Re-Ignition Process - Shutdown

1) The system requires manual reset in the event of a shutdown.
2) System in Shutdown - *Blinking Red LED.*
3) Once the Shutdown issue is resolved, press the OFF and ON button to reset.
4) Pre-purge - 120 second countdown - *Blinking Red LED.*
5) *Reference step 5 - 10 in the "Ignition Process Section".*

Flow Chart


ON Button Pressed
Pre-Purge
5 Sec Alarm
5 Sec Igniter
Stage 1 Solenoid Valve Opens
Flame Proof Timing
No Flame Sensed
Auto Reset
Flame Sensed
Stage 2 Solenoid Valve Opens
Unit Running Code "00"
High Temp Reached
50° Extreme High Temp Reached
Shutdown
Resolution
Manual Reset
Standby
Resolution
Low Temp Reached
Stage 2 Solenoid Valve Closes
10 ºF above High Temp
Stage 1 Solenoid Valve Closes
Low Temp Reached

Ignition Process

1) Unlock system
2) Set desired parameters
3) Press the ON button
4) Pre-Purge - 120 second countdown displayed– *Red LED ON*
5) Audible Alarm - 5 second countdown - *Green LED ON*
6) Igniter - 5 second countdown- *Green and Amber LED ON*
7) Solenoid/Actuator valve opens - ignition unit remains on - *Green and Amber LED ON*
8) Ignitionis achieved, flame is sensed - *Green and Blue LED ON*
9) Unit is now running - Status code 00 - *Green and Blue LED ON*
10) Process Temperature exceeds High Temp Set point - Stage 1 solenoid valve close - *Green and Blue LED*
11) Process Temperature reduced to Low Temp Set point - *Restart at step 5*

NOTE: On a pilotless system, the Stage 2 Solenoid is not used.

Re-Ignition Process - No Flame Sensed

1) Once the system recognizes that no flame is sensed, the system will automatically begin the ignition process.
2) Purge between ignition attempts - 120 second countdown - *Green LED ON*.
3) *Reference step 5 - 10 in the "Ignition Process Section".*

NOTE: If system fails to prove flame on the third attempt, the system shuts down on code 12. Blinking Red LED.

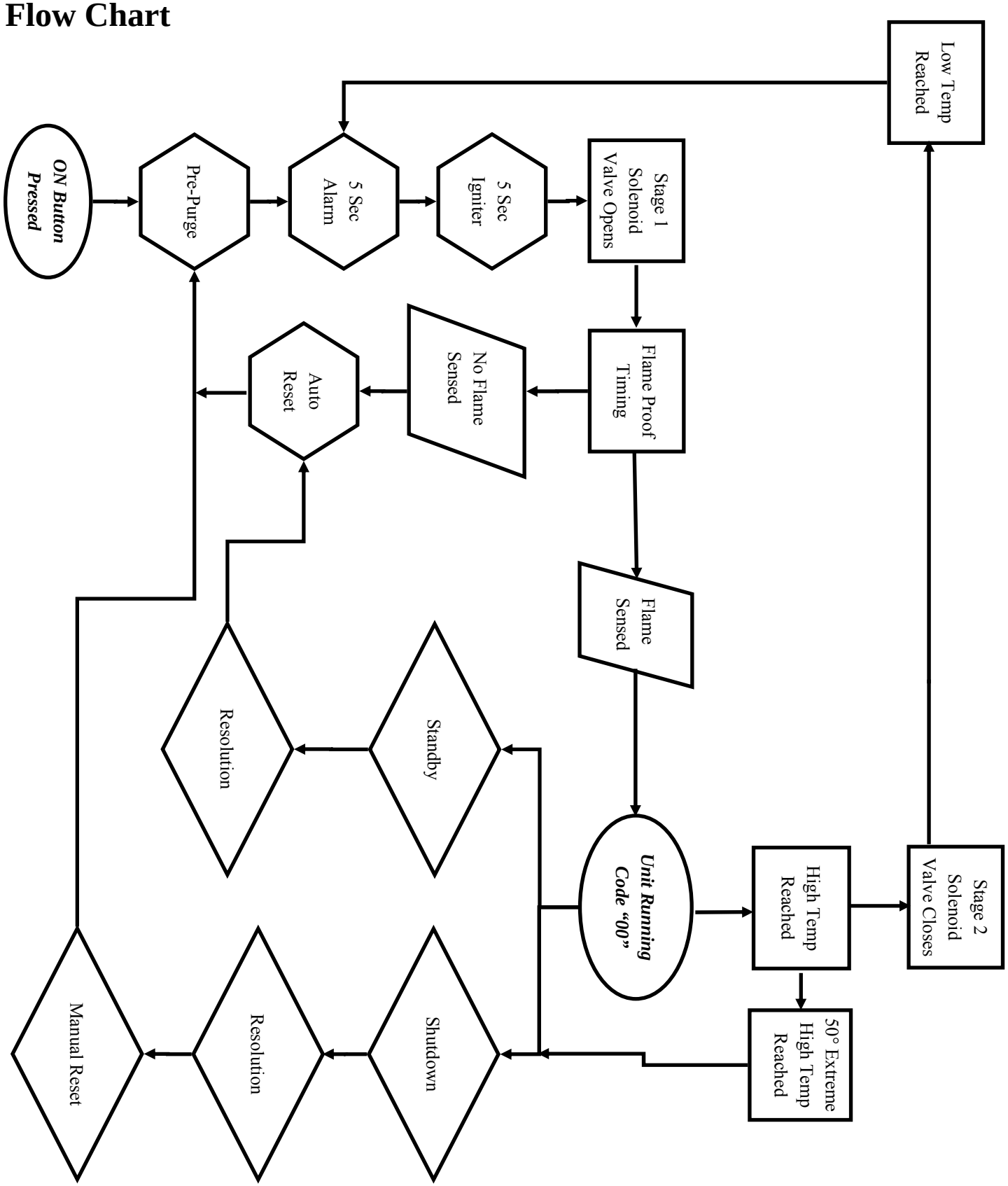
Re-Ignition Process - Standby

1) System in Standby - *Blinking Green LED.*
2) Once the system resolves the Standby issue, the system will automatically begin the ignition process.
3) Pre-purge - 120 second countdown - *Flashing Green LED ON*.
4) *Reference step 5 - 10 in the "Ignition Process Section".*

Re-Ignition Process - Shutdown

1) The system requires manual reset in the event of a shutdown.
2) System in a Shutdown - *Blinking Red LED.*
3) Once the Shutdown issue is resolved, press the OFF and ON button to reset.
4) Pre-purge - 120 second countdown - *Flashing Red LED ON*.
5) *Reference step 5 - 10 in the "Ignition Process Section".*

Flow Chart


ON Button Pressed
Pre-Purge
5 Sec Alarm
5 Sec Igniter
Stage 1 Solenoid Valve Opens
Flame Proof Timing
No Flame Sensed
Auto Reset
Flame Sensed
Unit Running Code "00"
Standby
Resolution
High Temp Reached
Stage 2 Solenoid Valve Closes
Low Temp Reached
50° Extreme High Temp Reached
Shutdown
Resolution
Manual Reset

SPECIFICATIONS

Power Supply Specifications	
Device	*Specification*
Battery Volts	11-15 VDC
12 VDC Power Supply	SET @ 13.4 VDC, 10 Amps
Solar Panel/ 24 Volt Input	12 VDC Type Solar Panel/ 24 Volt Supply, 6.5 Amps
Ignition Unit Specifications	
Device	*Specification*
NOM Good Igniter Ω Range	Less than 4Ω when igniter is cool
Igniter Current Draw	7 Amps Inrush, 2.0 Amps NOM (during normal operation)
Sensor Specifications	
Device	*Specification*
RTD Range	0°F — 528°F
ALT Sense Switch	Dry Contact Switch
Standby or Shutdown Inputs	Dry Contact Switch
Remote ON/OFF	Dry Contact Switch
Relay Specifications	
Device	*Specification*
Stage 1 Solenoid Load	12 VDC, 60 Watt MAX
Stage 2 and ALT Solenoid Load	12 VDC, 60 Watt MAX
Actuator Valve Load	12 VDC, 60 Watt MAX
Other	
Device	*Specification*
Fuses: F1, F2, and F3	5 Amps
Fuses: F4 and F5	10 Amps

RUN CODES

Code	*Symptom*	*Action*	*Visual*
00 System Running	• Pilot/main burner is on.	• Normal operation. • Process is increasing to temperature.	Blue and Green LEDs ON
24 Pre-purge on Startup	• Pilot/main burner is not on.	• Normal operation. • 120 second countdown.	Red LED ON
01 Waiting for Startup Signal	• Pilot/main burner is not on.	• Normal operation. • Process has reached high temp setting. • Waiting for process temp to cool down. • 5 second audible alarm.	Green LED ON
08 Purge between Ignition Attempts	• Pilot/main burner is not on.	• Normal operation. • No ignition on previous attempts. • 120 second countdown.	Green LED ON
09 Waiting for Main valve To Open	• Main burner is on. (Single stage) • Pilot is on but main burner is not. (Dual stage)	• Normal operation. • System is on and flame is proven. • Waiting for 2nd stage solenoid to open (dual stage).	Green and Blue LEDs ON

STANDBY CODES

02 Standby Interlock	• Pilot/main burner is not on. • No activity when system is attempting startup. • Ports 17 and 18 are activated.	• Place jumper in terminal ports 17 and 18 if the standby function is being used. • Customer supplied switch is activated. • Check wire connections. • Resolve issue before system can resume process. The system will then go into a 120 second countdown.	Blinking Green LED.

STANDBY CODES			
Code	***Symptom***	***Action***	***Visual***
03 Spare Standby 1	• Pilot/main burner is not on. • Igniter is not lighting gas. • No activity when system is attempting startup. • Ports 23 and 24 are activated.	• Place jumper in terminal ports 23 and 24 if standby function is not being used. • Customer supplied switch is activated. • Check wire connections. • Resolve issue before system can resume process. The system will then go into a 120 second countdown.	Blinking Green LED
04 Spare Standby 2	• Pilot/main burner is not on. • Igniter is not lighting gas. • No activity when system is attempting startup. • Ports 27 and 28 are activated.	• Place jumper in terminal ports 27 and 28 if standby function is not being used. • Customer supplied switch is activated. • Check wire connections. • Resolve issue before system can resume process. The system will then go into a 120 second countdown.	Blinking green LED
SHUTDOWN CODES			
11 Manual/Remote Shut Off	• Pilot/main burner is not on.	• System was manually or remotely turned OFF. • To startup system press the ON button.	Red LED ON

SHUTDOWN CODES

Code	*Symptom*	*Action*	*Visual*
12 Max Retries Exceeded	• Pilot/main burner is not on. • Ignition failed three consecutive attempts.	• Check fuel supply. • Check power supply. • Check air/fuel mixer. • Ensure burner pressures are with appropriate range. (3-5lbs for pilot, 10-18 lbs. for main). • Check nozzle positioning for piloted system. • Check for plugged or frozen orifice. • Check wiring, fuses, and grounding for the entire unit. • Check temperature settings on the controller • Ensure that all valves and external components are functioning properly. • Check igniter voltage and Ohms.	Blinking Red LED
13 Low Battery Volts	• Pilot/main burner is not on. • Igniter is not lighting gas. • No activity when system is attempting startup.	• Check battery voltage to ensure proper voltage and wiring installation. • Check solar panel to ensure proper charging and wiring installation. • A power outage may have taken place.	Blinking Red LED
14 Igniter Short Circuit	• Pilot/main burner is not on. • System will proceed through startup but will shutdown when igniter receives voltage.	• Ensure that the igniter wires are not touching each other, or grounding to conduit. • Ensure there is not moisture in the conduit.	Blinking Amber and Red LEDs

SHUTDOWN CODES

Code	*Symptom*	*Action*	*Visual*
15 Igniter open Circuit	• Pilot/main burner is not on. • System will proceed through startup but will shutdown when igniter receives voltage.	• Check wiring installation and installation specifications. • Igniter element could have wore out or is broken. • Check power supply.	Blinking Amber and Red LEDs
16 Flame Sensed Before Startup Or Flame Rod Short	• Pilot/main burner is not on. • No activity when system is attempting startup.	• Ensure proper flame sensing mode is selected. • Ensure proper wiring installation. • Check for short/open circuit. • Ensure that ignition unit has not received heat damage. • If using the igniter, ensure that the FST is greater than the cold igniter flame strength.	Blinking Red LED
18 Extreme Temp Shutdown	• Pilot/main burner is not on. • No activity when system is attempting startup.	• Process may have exceed 50°F above the high temp setting. • Process below 4ºF. • Check wire installation of the RTD. • Check the functionality of the RTD.	Blinking Red LED
19 Shutdown Interlock	• Pilot/main burner is not on. • No activity when system is attempting startup. • Ports 25 and 26 are activated.	• Place jumper in terminal ports 25 and 26 if the shutdown function is being used. • Customer shutdown switch is activated. • Ensure proper wiring installation. • Resolve issue and reset the system before the process can resume. The system will then go into a 120 second countdown.	Blinking red LED

SHUTDOWN CODES

Code	*Symptom*	*Action*	*Visual*
20 ESD Activated	• Pilot/main burner is not on. • No activity when system is attempting startup. • Ports 19 and 20 are activated.	• Place jumper in terminal ports 19 and 20 if the shutdown function is being used. • Customer shutdown switch is activated. • Ensure proper wiring installation. • Resolve issue and reset the system before the process can resume. The system will then go into a 120 second countdown.	Blinking Red LED
21 Main Fuel Valve Failure	• Pilot/main burner is not on. • No activity when system is attempting startup. • Ports 21 and 22 are activated.	• Place jumper in terminal ports 21 and 22 if the shutdown function is being used. • Switch on main fuel valve is activated. • Ensure proper wiring installation. • Check main fuel valve. • Resolve issue and reset the system before the process can resume. The system will then go into a 120 second countdown.	Blinking Red LED
22 Flame Sensor Problem	• Pilot/main burner is not on. • No activity when system is attempting startup. • Improper Flame Detection– Igniter	• Ensure proper flame sensing mode has been selected. • There may have been a flame sensed before startup. • Check valves for leaks. • Check for proper wiring installation.	Blinking Red LED

INSTALLATION NOTES

Commissioning Date:

Igniter Ohms:

Pilot Pressure:

Main Burner Pressure:

Battery Volts:

Software Version:

Controller Serial Number:

Ignition Unit Serial Number:

Notes:

SOFTWARE VERSIONS

Software Version	Release Date	Description
V3.0 EP	11/1/2015	Specialized software, all standbys function as shutdowns.
V3.0	2/3/2016	Original software version.
V3.2 EP	5/6/2016	Operation update from V3.0 EP. Specialized software, all standbys function as shutdowns.
V3.2	5/6/2016	Operation update from V3.0.
V3.3	02/01/2017	Operation update from V3.2.

Serial Number: _____

Software Version: _____

BMS-300 Installation and Operations Manual

11/23/2015

Last Update: 01/17/2017

Version 4.0

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