SureFire
BURNER MANAGEMENT SYSTEMS

| BMS 300 USER MANUAL

Save lives. Lower costs. Reduce emissions.

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.

- SureFire BMS

CONTENTS

1.1 | System Introduction

The BMS-300 is designed for fired equipment applications (Heater treater, separator, dehydrator, line heater, tank, etc.) It operates with FT Ignition Units to provide optimal ignition.

The controller's display functions in ambient temperatures from –40°F to 131°F and is coated for corrosion resistance. The unit is housed in a NEMA 4X enclosure with a UV-resistant keypad. Each unit includes function indicator lights and a status-code chart printed on the overlay for troubleshooting support. The system requires 12 VDC power and is solar-ready, featuring a dedicated solar power termination port.

1.2 | Classifications

This Burner Management System is suitable for use in **Class 1, Division 2, Groups C and D locations.**

1.3 | Variations

The BMS-300 monitors a pilot or pilotless burner status using a flame rod as a flame sensor. The SureFire controller manages and monitors both the pilot and main burner valves as needed. The system monitors and controls process temperatures with an RTD circuit. Built-in fail-safe features include:

- Flame failure shutdowns
- Alarm functions
- High-temperature shutdown
- Other safety mechanisms
- Loss of power fail safe solenoid valve

The SureFire BMS-300 provides Modbus communications via RS-485 communication protocols if required.

Every SureFire system undergoes a complete factory QA/QC inspection before shipment.

2.1 | WARNINGS ⚠

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace fuses unless power has been switched off or the area is known to be non-hazardous.
- Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- Exposure to some chemicals may degrade the sealing properties of materials used in the following devices:
  - Panasonic Relay, Model JW2SN-DC12V
  - Hamlin Relay, Model HE721A0500

AVERTISSEMENTS ⚠

Risque d'explosion:

- La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2.
- Couper le courant ou s'assurer que l'emplacement est désigné non dangereux avant de remplacer le fusible.
- Avant de déconnecter l'équipement, couper le courant ou s'assurer que l'emplacement est désigné non dangereux.

Exposition aux Produits Chimiques

L'exposition à certains produits chimiques peut dégrader les propriétés d'étanchéité des matériaux utilisés dans les appareils suivants :

- Panasonic Relais, modèle JW2SN-DC12V
- Hamlin Relais, modèle HE721A0500

2.2 | Certifications

ETL CM LISTED US
Intertek

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

Certified to:

- CSA STD C22.2 NO. 61010-1
- CSA STD C22.2 NO. 213:2017 Ed.3

Operating Temperature Range:
-40°C (-40°F) ≤ Ambient Temp ≤ 55°C (131°F)

Conforms to:

- UL STD 61010-1
- UL STD 121201:2017 Ed.9

3.1 | SureFire Warranty Statement:

SureFire warrants all equipment of its own manufacture to be free from defects in material and workmanship. SureFire's sole obligation under this warranty is expressly limited to the repair or exchange, F.O.B. Farmington, NM, USA, of such defective equipment. This warranty does not apply to claims resulting from improper installation, misuse, maladjustment, abnormal operating conditions, or lack of routine maintenance, as determined by SureFire. Additionally, it does not cover service for maintenance or issues arising from these causes.

No claims for labor, installation, removal, transportation, or other expenses will be recognized. Notwithstanding any stipulation by the purchaser to the contrary, all other obligations, representations, warranties, and conditions—whether express or implied, statutory or otherwise—including any implied warranties or conditions of merchantability, quality, or fitness, are expressly excluded.

SureFire shall not be liable for any loss, cost, or damages of any kind, 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 of this warranty, including its limitations and exclusions, shall remain enforceable between the parties, even upon termination of this agreement for any reason, including fundamental breach.

For equipment not manufactured by SureFire, the original manufacturer's or vendor's warranty shall apply.

Product Description	Warranty Policy Defective Products	Return Policy Customer Return New Product
SureFire Controllers: BMS-100, BMS-300, and BMS-350 Controllers	3 Years from date of purchase	180 Days from date of purchase 20% Minimum Restocking Fee
SureFire FT Ignition Units: FT-1, FT-2, FT-4, FT-6, FT-8 and FTL-F Ignition Units	2 Years from date of purchase	180 Days from date of purchase 20% Minimum Restocking Fee
Additional Components	Manufacturers carry own individual warranty policy on Components.	Manufacturers carry own individual return policy on Components.

The warranty policy is related to manufacturing defects. The return policy is related to the return of product for any reason other than manufacturing defects. Returns must be approved by SureFire in advance of shipment and returned products must be in their original condition. Restocking fees for returns are at the discretion of SureFire and may vary by product.

3.2 | Shipping Cost:

For warranty claims, the cost of shipping the product to SureFire is the customer's responsibility. If SureFire determines the product is covered under warranty, SureFire will cover the cost of return shipping to the customer. If the product is deemed non-warranty, the customer is responsible for return shipping costs.

For return claims, all shipping costs are the customer's responsibility.

3.3 | Warranty Claims Resolution

SureFire will provide one of the following resolutions for warranty claims, determined at its sole discretion:

- SureFire will repair any defective parts free of charge to the customer.
- SureFire will replace the defective product free of charge to the customer.
- SureFire may provide a credit, minus a restocking fee, for approved return claims.

3.4 | Non-Warranty Products

If a product is returned under a warranty claim and is deemed non-warranty by SureFire, the following options may be offered on a case-by-case basis:

- If the product is repairable, SureFire may provide a repair quotation.
- If the product is not repairable, SureFire may either discard the damaged product or return it to the customer upon consent.
- A replacement product may be purchased.

3.5 | Return Material Authorization (RMA)

To obtain a Return Material Authorization (RMA), it is highly recommended to first contact **SureFire's technical support hotline at 505-333-2876** for potential troubleshooting.

If technical support determines that the product qualifies for a warranty or return claim, please **contact the SureFire Returns Department** at **505-333-2878 Ext. 18** or via email at **returns@surefire-controls.com.**

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PRODUCT DESCRIPTIONS

BMS-300 | FT IGNITION UNITS | AUXILIARY COMPONENTS

4.1 | Enclosure

The SureFire BMS-300 system is housed in a polycarbonate NEMA 4X enclosure that contains the circuit board. The graphic overlay, along with the membrane keypad, is mounted on the exterior of the enclosure.

The NEMA 4X enclosure provides a high level of protection against harsh outdoor elements, including:

- Protection from windblown dust
- Protection against water damage, including rain, sleet, snow, splashing, and direct water contact
- Corrosion protection
- Protection from the external formation of ice

The enclosure is IP66 certified and has been tested to meet the following certifications:

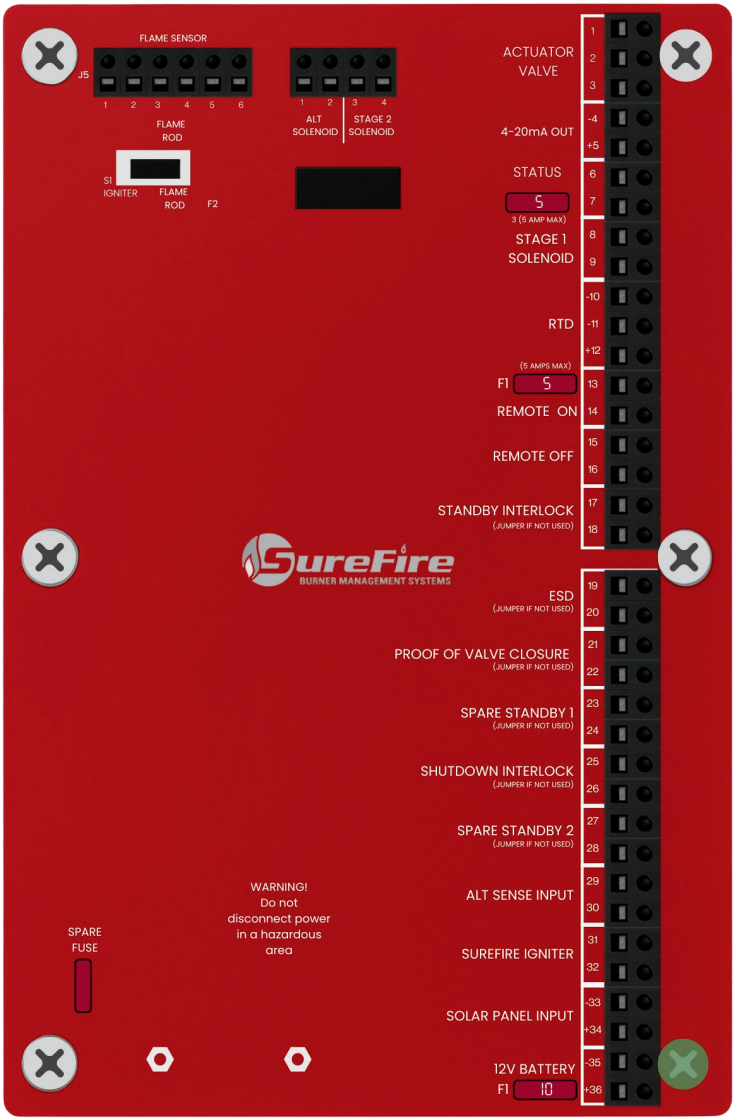
- Dust-tight: No ingress of dust; complete protection against contact.
- Water resistance: Water projected in powerful water jets (12.5mm nozzle) against the enclosure from any direction shall have no harmful effects.

4.2 | Warning ⚠

When drilling holes in the enclosure, ensure that IP66 fittings are used to maintain the IP66 standard. Failure to use fittings that meet the IP66 standard will nullify the certification.

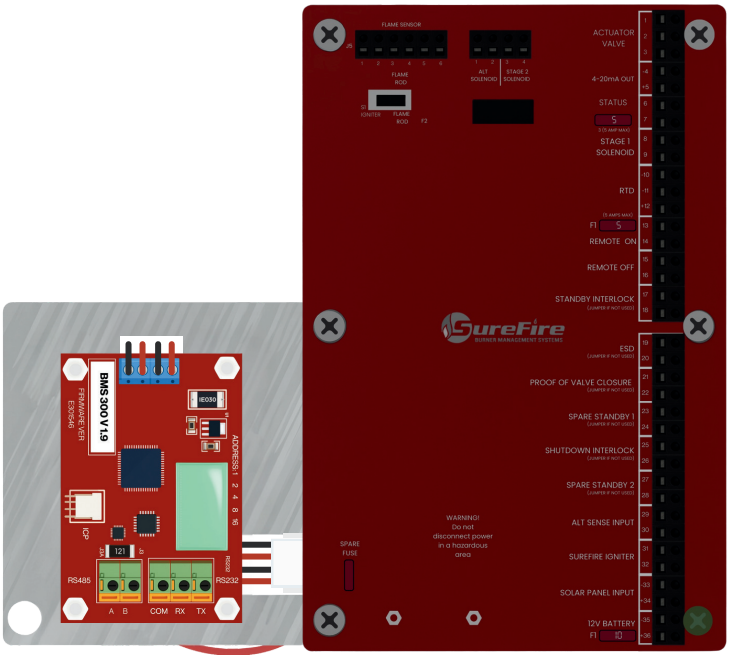
4.3 | BMS-300 Circuit Board

The SureFire BMS-300 system is controlled by state-of-the-art, non-arcing electronics that monitor and control all burner functions. It features four LED indicators and an LED display for easy monitoring. Additionally, the system is equipped with individual terminal blocks and a power connector to simplify wiring and installation.



4.4 | BMS-300 Modbus Card

The SureFire Modbus Card provides Modbus communications via RS-485 communication protocols if required.



4.5 | LED Indicators

The circuit board's LEDs are designed to illuminate through the lid of the enclosure, providing clear visual status indicators. The LEDs indicate the following:

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

4.6 | Graphic Overlay

The graphic overlay is used to interface with the system and acquire system data. It also provides a list of status codes and features a display window that shows data, settings, and other relevant information.

4.7 | 16 Button Keypad

The SureFire BMS-300 system features a 16-button keypad for controlling and monitoring the system. The buttons perform the following functions:

Button	Displayed Value / Functional Operation
	• Increases the current value. • Press & hold with the hours on button for 5 seconds to unlock the system
	• Decreases the current value
High Temp	• Displays high temperature setpoint
Low Temp	• Displays low temperature setpoint
Flame Sensor Threshhold	• Displays current flame sensor threshold value
Igniter volts	• Displays current voltage received by the igniter.
Flame Sensor	• Displays current flame sensing device ◦ FL = Flame rod
RTD/PS	• Displays current controlling device ◦ 0 = RTD ◦ P = Alternative sensor
ON	• Turns system ON
OFF	• Turns system OFF

Button	Displayed Value / Functional Operation

STATUS CODE / PILOT MODE	• 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 / FPT	• 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 the system
BV / EHTD	• Displays the voltage being supplied to the unit. • Hold for 5 seconds to display current EHTD setpoint
FSV / SOLENOID TIMING	• 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.

5.1 | SureFire FT-Series Ignition Units

The **SureFire BMS-300** is compatible with the listed **FT series ignition units**. Each unit is specifically designed for **Firetube** applications. The FT-series ignition units are suitable for both ***piloted*** and ***pilotless*** applications.

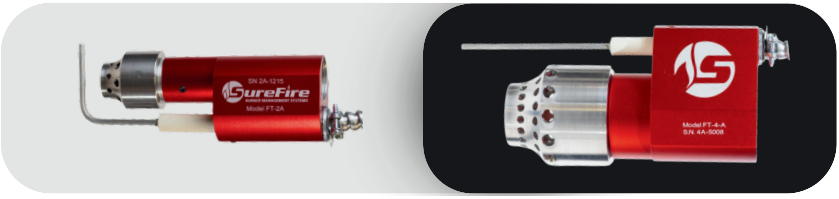
5.2 | Firetube Pilot

The FT-1 Ignition unit is designed for piloted applications, utilizes hot surface ignition, and a flame rod as the flame sensor. These units are utilized in piloted applications in conjunction with main burners rated up to 10MM BTU/hr.

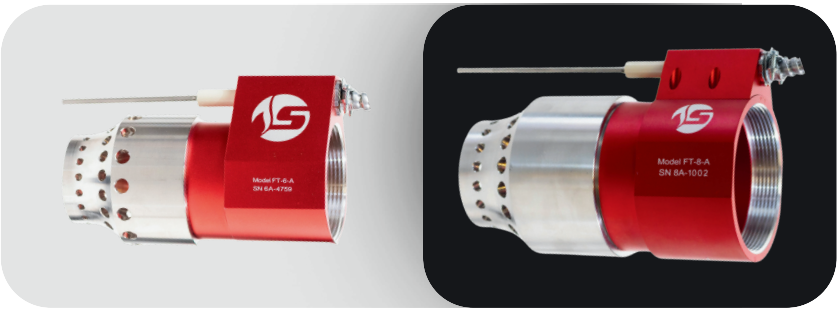
5.3 | Firetube Pilotless

The pilotless FT Ignition Unit is designed for pilotless firetube applications and utilizes hot surface ignition and a flame rod as a flame sensor. These ignition units are rated for burner applications from 125,000 BTU/hr - 1.5MM BTU/hr.

FT-2 **FT-4**



FT-6 **FT-8**



SureFire offers nozzle arrangements for horizontal and vertical firetube applications.

12 VOLT ACTUATOR VALVE
Part #51901065

Features:
- Controls the main fuel gas to the main burner
- Factory programmed and pre-wired – no adjustments necessary
- 3-wire termination for easy installation

1" SOLENOID VALVE
Part #51900605 K

Features:
- Fail-closed device
- No adjustment necessary
- Simple termination and installation

2" SOLENOID VALVE
Part #51900608 K

Features:
- Fail-closed device
- No adjustment necessary
- Simple termination and installation

1/4" ASCO SOLENOID VALVE

Features:
- Fail-closed device
- No adjustment necessary
- Simple termination and installation

Additional Accessories

RTDs
Thermocouple
Slow Flow Valve
Pressure Switch
Pressure Transducer
Coalescing Filter
Air/Gas Mixers
Pressure Regulators
Voltage Converters

Service Parts

Flame Rod Replacement Kits
Flame-Sensing Thermocouple Replacement Kits
Overlay Replacement Kits
CCA Replacement Kit

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MECHANICAL INSTALLATION

CONTROLLER INSTALLATION | IGNITION UNIT INSTALLATION VALVE INSTALLATION

7.1 | SureFire BMS-300 Enclosure

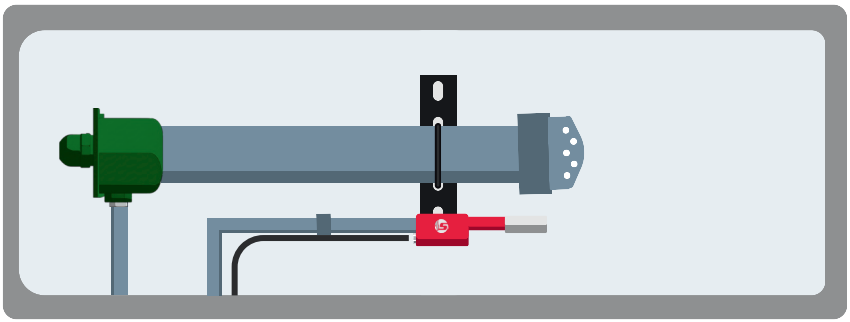
1. The enclosure must be mounted on a pole, stand, or building that can support at least 10 lbs.
2. The BMS-300 includes a mounting bracket kit ***(screw size is:#10-32)***
3. Using the bracket kit, mount the enclosure on to the apparatus, ensuring the enclosure is level.
4. Position the enclosure so that the LED display is clearly visible to the operator.
5. Install conduit seal-off fittings into the enclosure, ensure the position of the fittings are on the side or bottom of the enclosure, never on the top. Ensure that conduit fittings are water proof.
6. Instillation must comply with the National Electric Code.

WARNING ⚠:

- Before attempting any welding, disconnect all wires going to the circuit board. Any damage caused by welding to the SureFire BMS is NOT covered under warranty.
- Before terminating any wires, ensure that no power is supplied to the controller.
- Any damage caused by standing on or using the enclosure as a step is NOT covered under warranty.

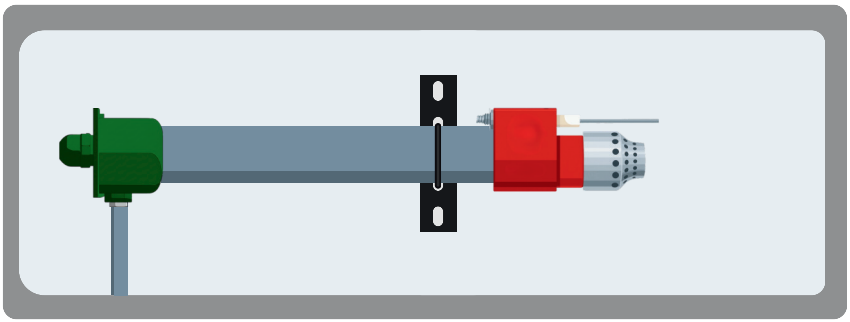
7.2 | SureFire FT-1 Ignition Unit On A Firetube

1. Ensure the supply gas is turned off and locked out/tagged out.
2. Remove the flame arrestor.
3. Remove the existing pilot nozzle.
4. Clean out the existing pilot mixer and pilot orifice.
    a. Ensure that the orifice diameter is a #72.
5. Install the SureFire FT-1 Ignition Unit on the pipe nipple that is screwed in to the mixer.
    a. Ensure the pilot nozzle is 1 inch shorter than the main burner nozzle.
6. Run the wiring harness into an external junction box.
    a. Do not cut the ignitor wires. This will void the warranty and reduce the life of the ignition unit.
7. Re-install the flame arrestor.



7.3 | SureFire FT Pilotless Ignition Unit On A Firetube

1. Ensure the supply gas is turned off and locked out/tagged out.
2. Remove the flame arrestor.
3. Remove the existing pilot burner assembly.
4. Remove the existing main burner nozzle.
5. Clean out the existing air fuel gas mixer and orifice.
6. Install the SureFire FT Pilotless Ignition Unit on the pipe nipple that is screwed into the mixer.
    a. Ensure the pipe nipple length from the end of the mixer to the beginning of the FT Unit is a minimum of 8' of pipe nipple length per 1' of burner diameter.
7. Run the wiring harness into an external junction box.
    a. Do not cut the ignitor wires. This will void the warranty and reduce the life of the ignition unit.
8. Re-install the flame arrestor.



7.4 | Piloted Valve Control (1st and 2nd stage)

1. Ensure all gas is turned off and locked out/tagged out.
2. Locate the pilot gas supply line.
3. Install the ¼“ ASCO in the appropriate location within the pilot fuel train (downstream of the 0-30lb regulator).
4. Locate the main burners diaphragm valve.
5. Install the ¼" ASCO in the instrument gas tubing that feeds the main burners diaphragm valves.
6. Install a ¼” Slow Flow Valve downstream of the ASCO valve referenced in point #5.

NOTES:

1. ASCO Solenoid Proper Flow Direction:
    - 2 = Inlet
    - 1 = Outlet

7.5 | Pilotless Valve Control (1st stage)

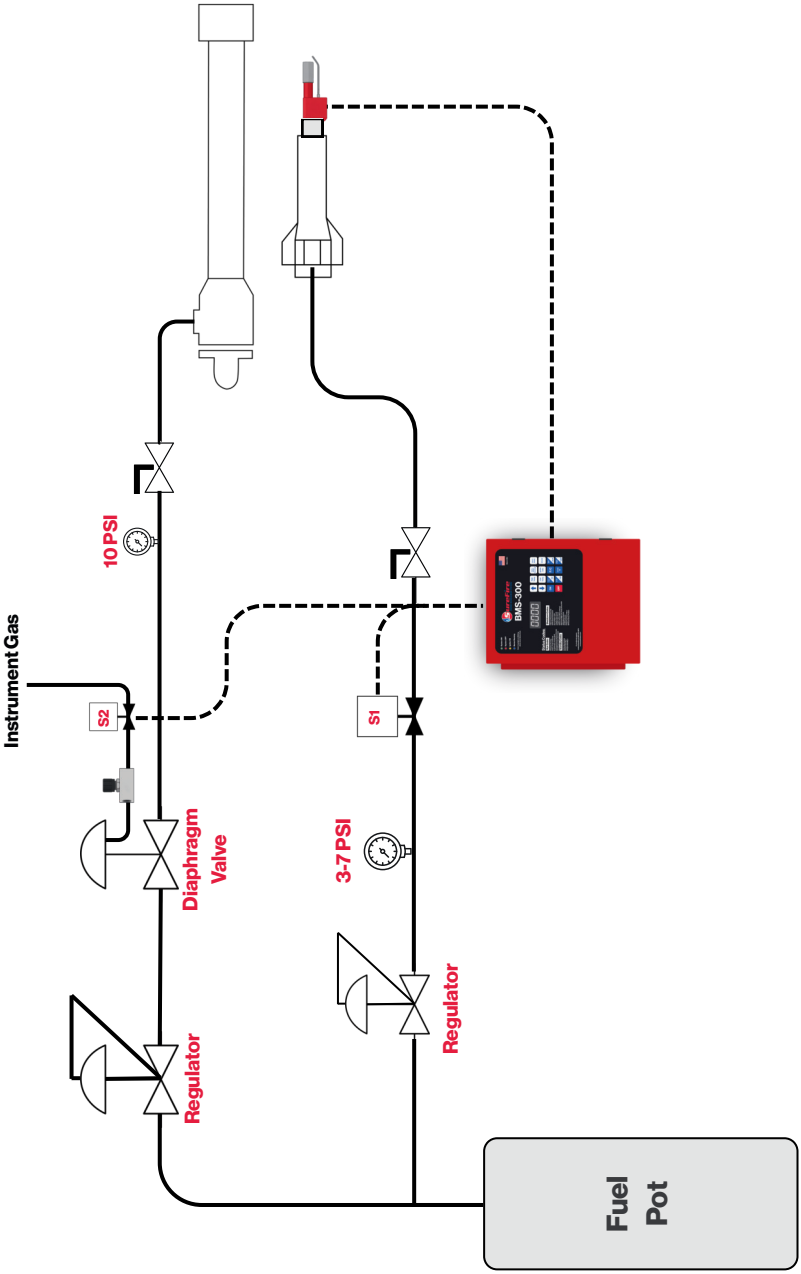
Pneumatically Driven:

1. Ensure the supply gas is turned off and locked out/tagged out.
2. Locate the main burners diaphragm valve.
3. Install the ¼" ASCO in the instrument gas tubing that feeds the main burners diaphragm valves.
4. Install a ¼" Slow Flow Valve downstream of the ASCO valve referenced in point #3.

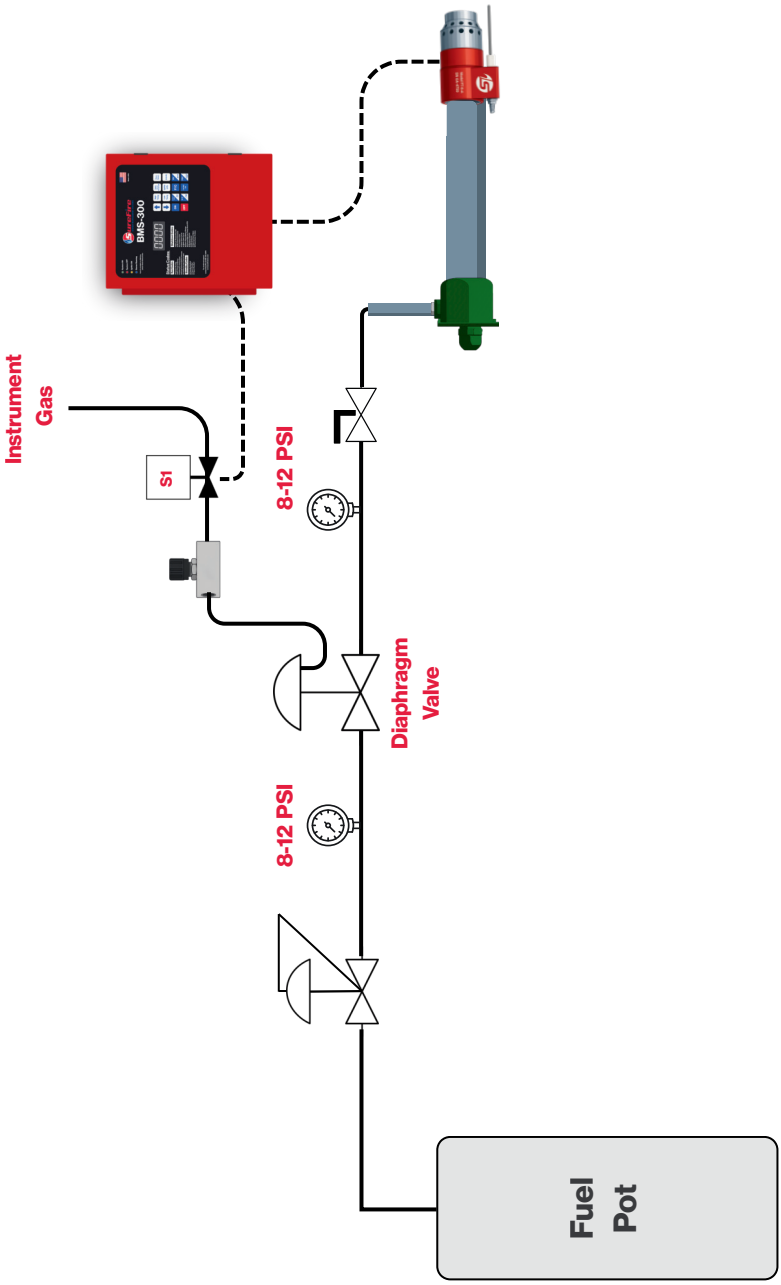
Ventless Fuel Train:

1. Ensure the supply gas is turned off and locked out/tagged out.
2. Locate the main burners diaphragm valve.
3. Remove the existing diaphragm valve.
4. Install the 1" actuator valve and the 1" solenoid valve.
    - The 1" solenoid valve will be upstream of the actuator valve and serves as a fail safe valve.
    - There needs to be a minimum of 3" of pipe nipple in between the actuator valve and the solenoid valve.

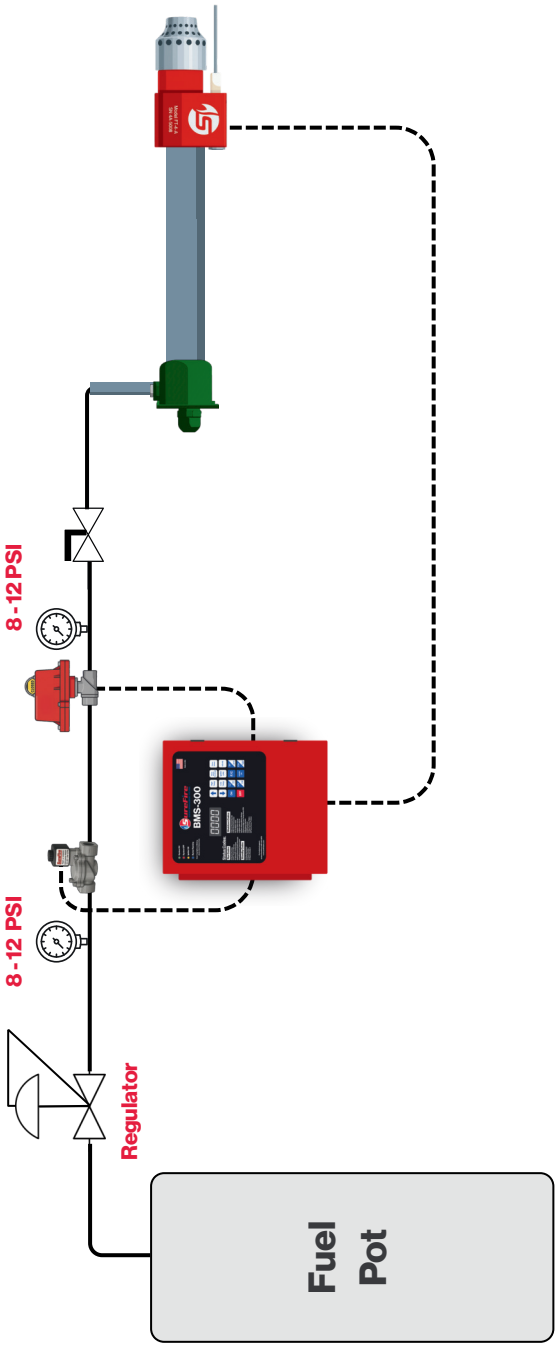
8.1 Standing Pilot Diagram

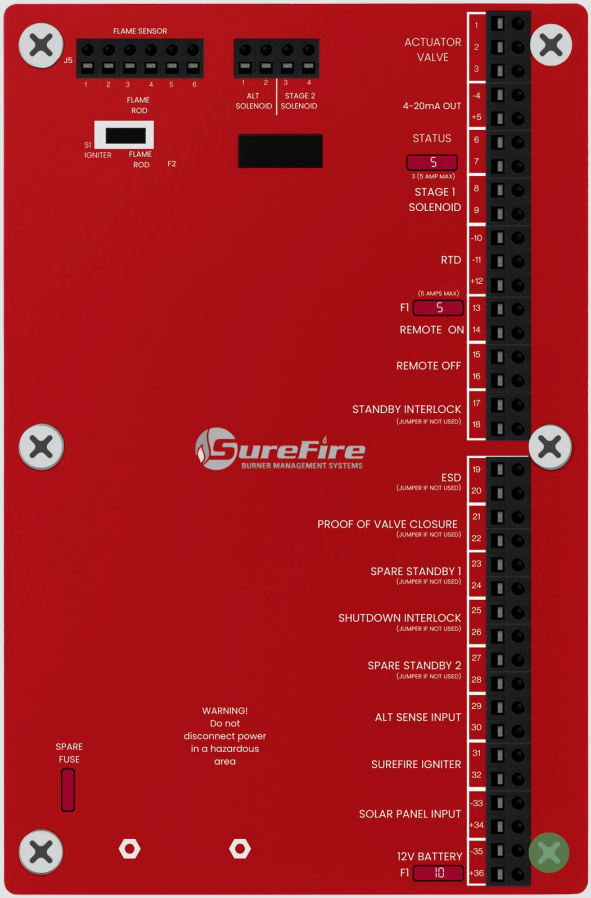


8.2 Pilotless (Pneumatic) Diagram



8.3 Pilotless (Ventless) Diagram





9-10

ELECTRICAL INSTALLATION

WIRING TERMINATION | ELECTRICAL DIAGRAMS SPECIFICATIONS

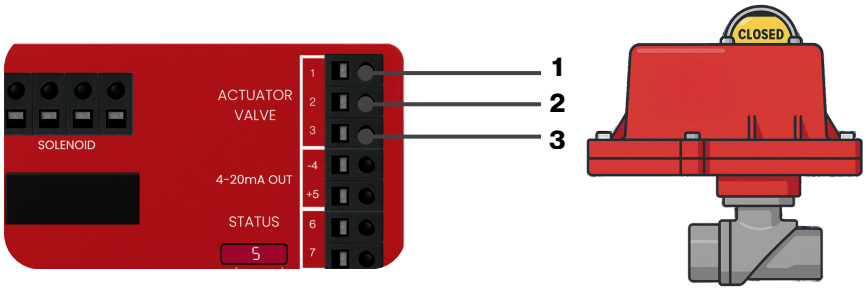
9.1 | Actuator Valve Port

Functions:

Controls the electrical actuation of the SureFire Actuator Valve.

Actuator *Installation:*

1. The Actuator Valve will require 3 wires (customer supplied).
2. Install a conduit box into the ½" threads on the Actuator Valve.
3. Use 18 gauge standard copper wire for this device.
4. When terminating wires, ensure proper electrical fittings are used to maintain proper operation and moisture resistance.
5. For future troubleshooting, label or color code all wiring for easy identification.
6. Terminate the 3 wires as shown in the diagram below.



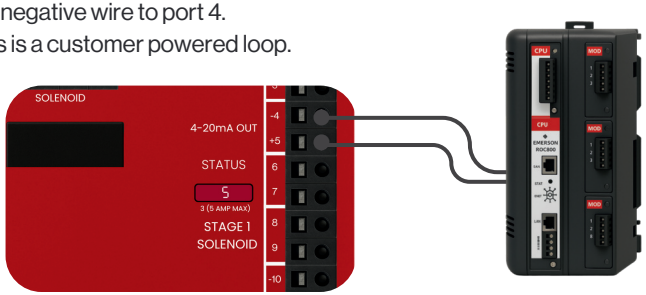
9.2 | 4-20mA Output

Functions:

The proper connection method for 4-20mA / 1-5 Volt remote circuit monitoring is as follows:

Installation:

1. Ensure there is no power to the BMS-300 or PLC before terminating any wires.
2. Connect the positive wire from the remote monitoring equipment to port 5 and the negative wire to port 4.
3. This is a customer powered loop.



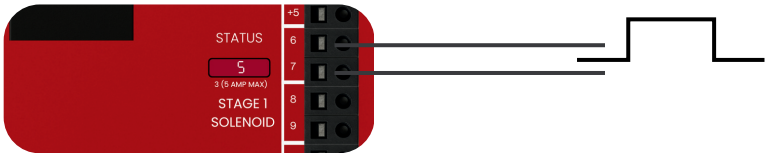
9.3 | Status

Functions:

To provide remote feedback of operational status.

Installation:

1. Terminate wires from the RTU/PLC to the Run Status terminals (Ports 6 & 7).



Unit Status	Status	Red LED	Green LED	Blue LED	Amber LED
Manual OFF	Open	ON	OFF	OFF	OFF
System On Igniter On	Open	OFF	ON	OFF	ON
Flame Sensed	Closed	OFF	ON	ON	OFF
Shutdown Igniter Error	Open	Blinking	OFF	OFF	Blinking
Standby	Open	OFF	Blinking	OFF	OFF
Shutdown	Open	Blinking	OFF	OFF	OFF

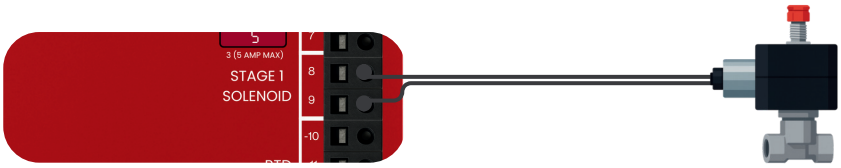
9.4 | Stage 1 Solenoid Valve

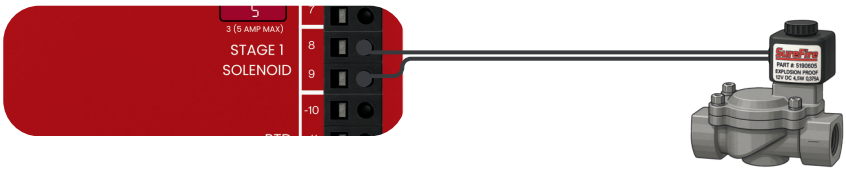
Functions:

Controls the electrical actuation of the solenoid valve for the pilot burner in a piloted arrangement or the main burner in a pilotless arrangement.

Installation:

1. The ASCO valve has three wires: two red and one green. For this application, the two red wires will be used (not polarity-sensitive), while the green wire will not be used.
2. Install a conduit box onto the electrical fitting on the ASCO valve.
3. Use 18-gauge, stranded copper wire for this device.
4. When terminating wires, ensure proper electrical fittings are used to maintain proper operation and moisture resistance.
5. For future troubleshooting, label or color-code all wiring for easy identification.
6. Terminate the 2 wires as shown in the diagram below.





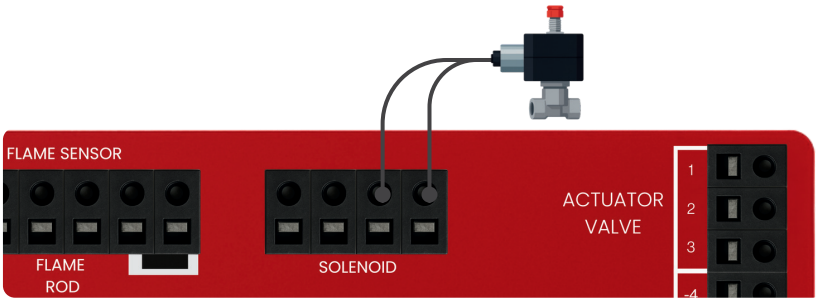
9.5 | Stage 2 Solenoid Valve

Functions:

Controls the electrical actuation of the solenoid valve for the main burner in a piloted arrangement.

Installation:

1. The ASCO valve has three wires: two red and one green. For this application, the two red wires will be used (not polarity-sensitive), while the green wire will not be used.
2. Install a conduit box onto the electrical fitting on the ASCO valve.
3. Use 18-gauge, stranded copper wire for this device.
4. When terminating wires, ensure proper electrical fittings are used to maintain proper operation and moisture resistance.
5. For future troubleshooting, label or color-code all wiring for easy identification.
6. Terminate the 2 wires as shown in the diagram below.



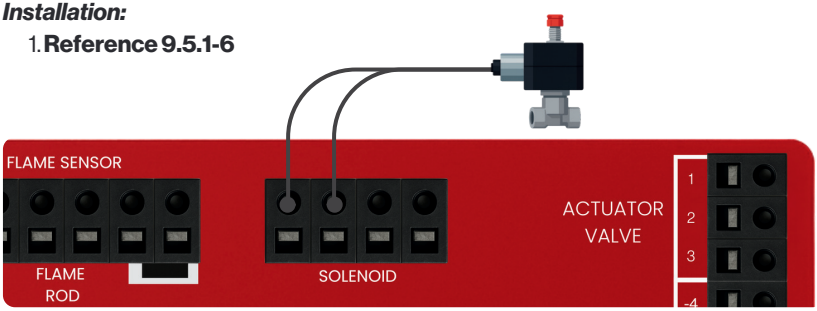
9.6 |Alt Solenoid Valve

Functions:

Controls the electrical actuation of the alternative solenoid valve for the main burner in a piloted arrangement.

Installation:

1. **Reference 9.5.1-6**



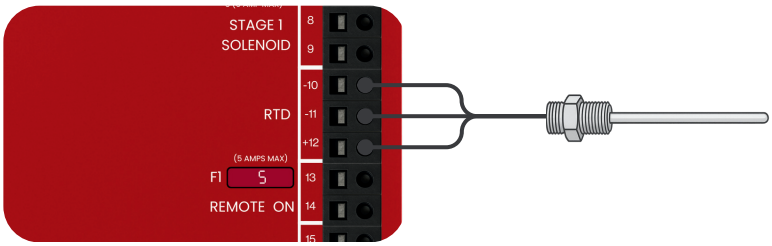
9.7 | RTD Installation

Functions:

Monitors the process temperature.

Installation:

1. Connect negative (-) wires to terminals 10 & 11.
2. Connect the positive (+) wire to terminal 12.
   - The two identically colored wires are the negative wires and the unique colored wire is the positive.
   - The BMS-300 requires a 3 wire RTD.
3. When the system recognizes a temperature of 4ºF or less, press the ON button to start a 30-minute timer.
4. If the temperature does not increase above 4ºF, the system will shut down with code 18.
5. Repeat the process until the temperature rises above 4ºF.



9.8 | Remote ON

Functions:

To allow remote activation of the BMS-300.

Installation:

1. Run a single pair of wires from the RTU/PLC back to the BMS-300.
2. This wire can be 18 gauge stranded copper wire.
3. Terminate the 2 wires as shown in the diagram below.
4. The remote on receives a signal/continuity from the RTU/PLC to activate the BMS-300.
5. This port will be left vacant if not used.

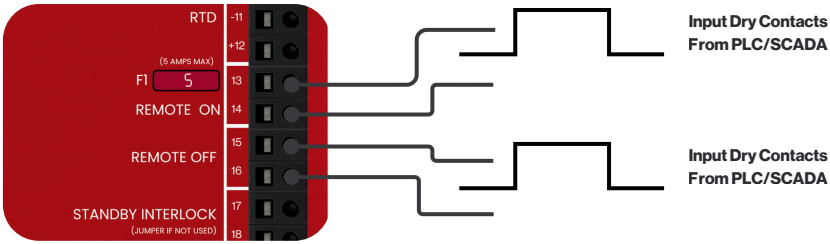
9.9 | Remote OFF

Functions:

To allow remote deactivation of the BMS-300.

Installation:

1. Run a single pair of wires from the RTU/PLC back to the BMS-300.
    - This wire can be 18 gauge stranded copper wire.
2. Terminate the 2 wires as shown in the diagram below.
3. The remote off receives a signal/continuity from the RTU/PLC to deactivate the BMS-300.
4. This port will be left vacant if not used.



9.10 | Standby Switches

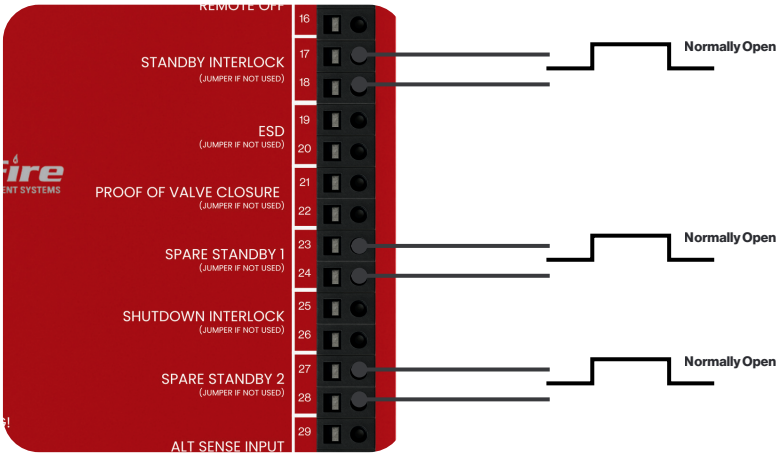
Functions:

To allow the BMS-300 to be placed into a standby state via an external signal.

Installation:

1. Run a single pair of wire from the external device back to the BMS-300.
   - The external device needs to be a normally closed dry contact device, such as a pressure switch or a low level switch.
   - This wire can be 18 gauge stranded copper wire.
2. Terminate the 2 wires as shown in the diagram below.
3. If the terminal port observes continuity, then the BMS-300 continues to operate normally.
4. If the terminal port observes no continuity then the BMS-300 will be placed into a standby state.
5. While in a standby state if that terminal port observes continuity the BMS-300 returns to an operational state.
6. If this port is unused, a jumper must be installed in the terminal.

NOTE: This applies to the standby interlock, spare standby 1 and spare standby 2.



9.11 | Shutdown Switches

Functions:

To allow the BMS-300 to be placed into a shutdown state via an external signal.

Installation:

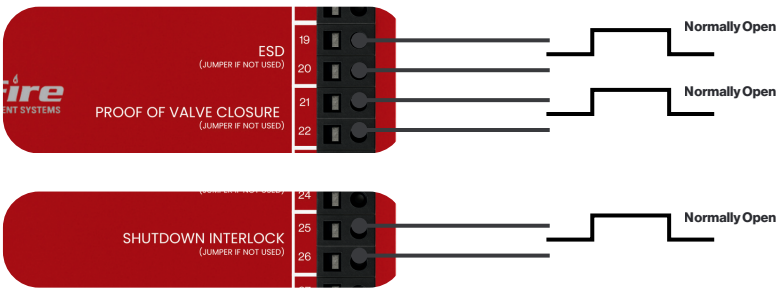
1. Run a single pair of wire from the external device back to the BMS-300.
    - The external device needs to be a normally closed dry contact device, such as a pressure switch or a low level switch.
    - This wire can be 18 gauge stranded copper wire.
2. Terminate the 2 wires as shown in the diagram below.
3. If the terminal port observes continuity, then the BMS-300 continues to operate normally.
4. If the terminal port observes no continuity then the BMS-300 will be placed into a shutdown state.
5. While in a shutdown state if that terminal port observes continuity the BMS-300 returns to an operational state.
6. If this port is unused, a jumper must be installed in the terminal.

NOTE:

- This applies to the ESD and Shutdown Interlock.

Proof of Valve Closure:

- The Proof of Valve Closure does not operate as a standard shutdown.
- This port looks for a close signal related to the actuator valve prior to start up ensuring that all valves are closed prior to the ignition sequence.



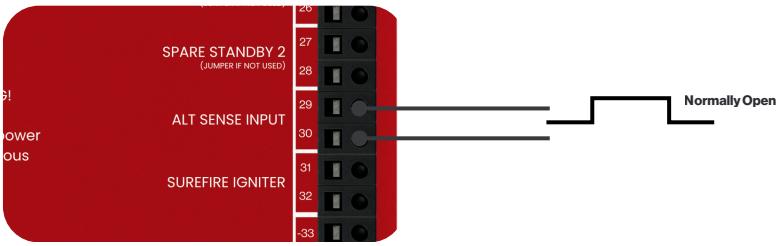
9.12 | Alt Sense Input

Functions:

To allow remote activation of the BMS-300.

Installation:

1. Run a single pair of wires from the RTU/PLC back to the BMS-300.
2. This wire can be 18 gauge stranded copper wire.
3. Terminate the 2 wires as shown in the diagram below.
4. The remote on receives a signal/continuity from the RTU/PLC to activate the BMS-300.
5. This port will be left vacant if not used.

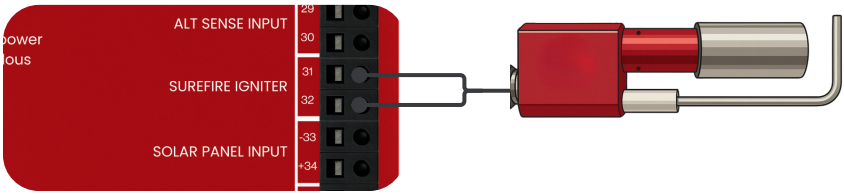


9.13 | Igniter

Functions:
Provides ignition for the FT Ignition Unit.

Installation:

1. The SureFire FT Ignition Unit has three total wires, two white wires (which are not polarity-sensitive) for the igniter and one black wire for the flame rod.
2. Install a conduit box on the flame arrestor (for firetube applications) for wire termination.
3. Referencing the table below, run the appropriate wire gauge from the junction box to the **BMS-300** enclosure.
    - It is recommended to run two pair of wire for the ignition unit: One pair for the igniter and one pair for the flame rod/ground.
4. When terminating wires, ensure proper electrical fittings are used to maintain proper operation and moisture resistance.
5. For future troubleshooting, label or color-code all wiring for easy identification.
6. Terminate the 2 wires as shown in the diagram below.



Ignition Unit Specifications	
Ignition Unit @ Inrush	6.5 Amps Inrush
Ignition Unit @ Steady State	2.0 Amps Nominal (during ignition only)
Igniter Wiring Requirements	
16 AWG	10 foot length - Copper Stranded
14 AWG	20 foot length - Copper Stranded
12 AWG	30 foot length - Copper Stranded

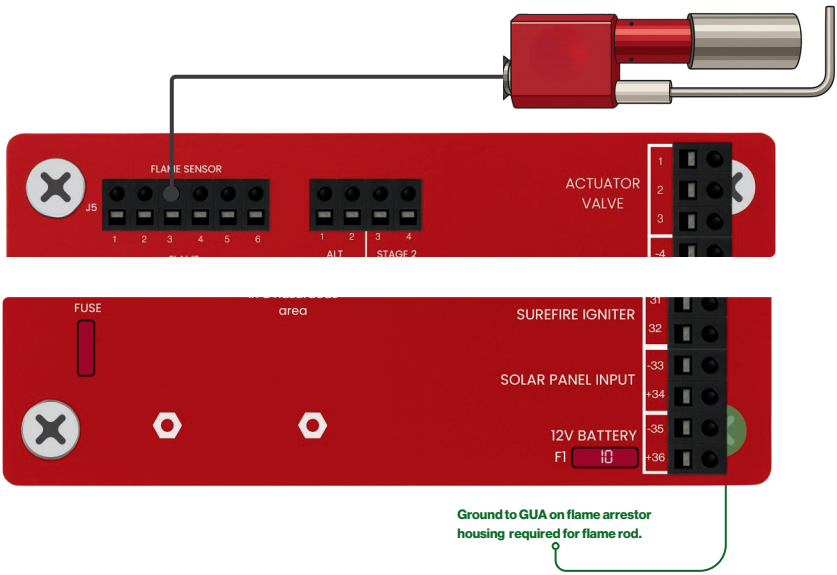
9.14 | Flame Rod

Functions:

Provides flame sensing for the FT Ignition Unit.

Installation:

1. The SureFire FT Ignition Unit has three total wires, two white wires (which are not polarity-sensitive) for the igniter and one black wire for the flame rod.
2. Install a conduit box on the flame arrestor (for firetube applications) for wire termination.
3. ***Reference 9.11.3 for the recommended wiring arrangement.***
4. When terminating wires, ensure proper electrical fittings are used to maintain proper operation and moisture resistance.
5. For flame sensing, an isolated ground is required. Terminate a ground wire to the circuit board labeled earth ground, and to the ground screw on the junction box mounted to the arrestor housing.
6. For future troubleshooting, label or color-code all wiring for easy identification.
7. Terminate the wire as shown in the diagram below.



Flame Rod	*No Flame Present*	*Flame Present*
Flame Strength Value	>500	<5

9.15 | Solar Panel

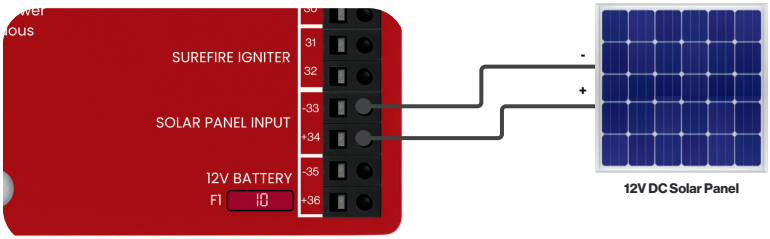
Functions:

The **BMS-300** has a built-in solar charge regulator that allows a solar panel to charge a battery without the need for an external charge controller.

Installation:

1. Run a pair of 18-gauge, stranded copper wires from the solar panel to the **BMS-300**.
2. Ensure the wiring arrangement is suitable for outdoor use.
3. Terminate the 2 wires as shown in the diagram below.

Notes: The maximum rating for the solar panel is 75 watts.



9.16 | 12 VDC ONLY

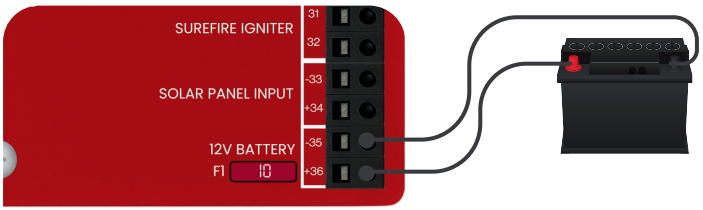
Functions:

This port allows 2 methods of voltage supply to power the **BMS-300**:

- 12 VDC power supply
- 12 VDC battery
-

Installation:

1. Referencing the table below, run the appropriate wire gauge from the power supply device to the **BMS-300** enclosure.
2. When terminating wires, ensure proper electrical fittings are used to maintain proper operation and moisture resistance.
3. For future troubleshooting, label or color-code all wiring for easy identification.
4. Terminate the 2 wires as shown in the diagram below.



Power Supply Specifications	
Battery Volts	12 - 13.4 VDC
12 VDC Power Supply	Set @ 13.4 VDC Rated at min 10 Amps
Max System Amperage	7.8 Amp / 0.4 Amp Avg.
Battery/Power Supply Wiring Requirements	
16 AWG	10 foot length - Copper Stranded
14 AWG	20 foot length - Copper Stranded
12 AWG	30 foot length - Copper Stranded

9.17 | BMS-300 Specifications

Power Supply Specifications	
Battery Volts	11-15 VDC
12 VDC Power Supply	SET @ 13.4 VDC, 10 Amps
Solar Panel	12 VDC / 75 Watt Solar Panel
Max System Amperage	7.8 Amps / 0.6 Amps Avg.
Ignition Unit Specifications	
Igniter Current Draw	7.5 Amps Inrush, 2.0 Amps NOM (during normal operation)
Sensor Specifications	
RTD Range	0°F — 529°F
ALT Sense Input	Dry Contact Switch (Open / Close loop)
Standby or Shutdown Inputs	Dry Contact Switch (Open / Close loop)
Remote ON/OFF Inputs	Dry Contact Switch (Open / Close loop)
Note: No voltage or current should be applied to the dry contact ports above.	
Output Specifications	
4-20mA	12-24 VDC for 4-20mA Output
Status	12-24 VDC @ 0.5 Amps
Relay Specifications	
Stage 1 Solenoid Valve 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	
Fuses: F1, F2, and F3	5 Amps
Fuses: F4 and F5	10 Amps

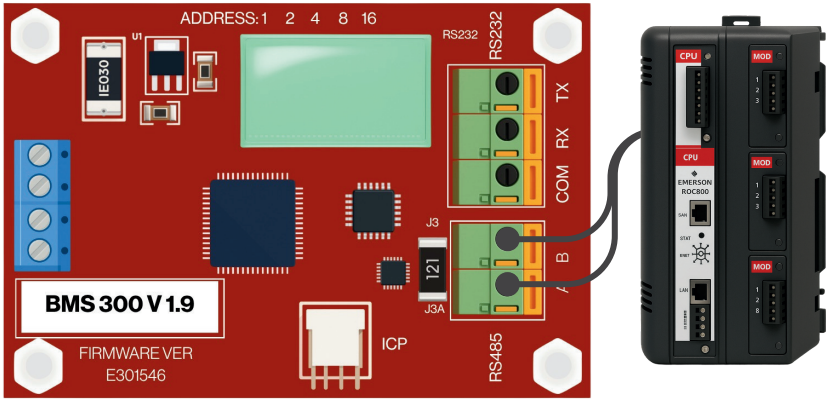
9.18 | Modbus Card (Optional)

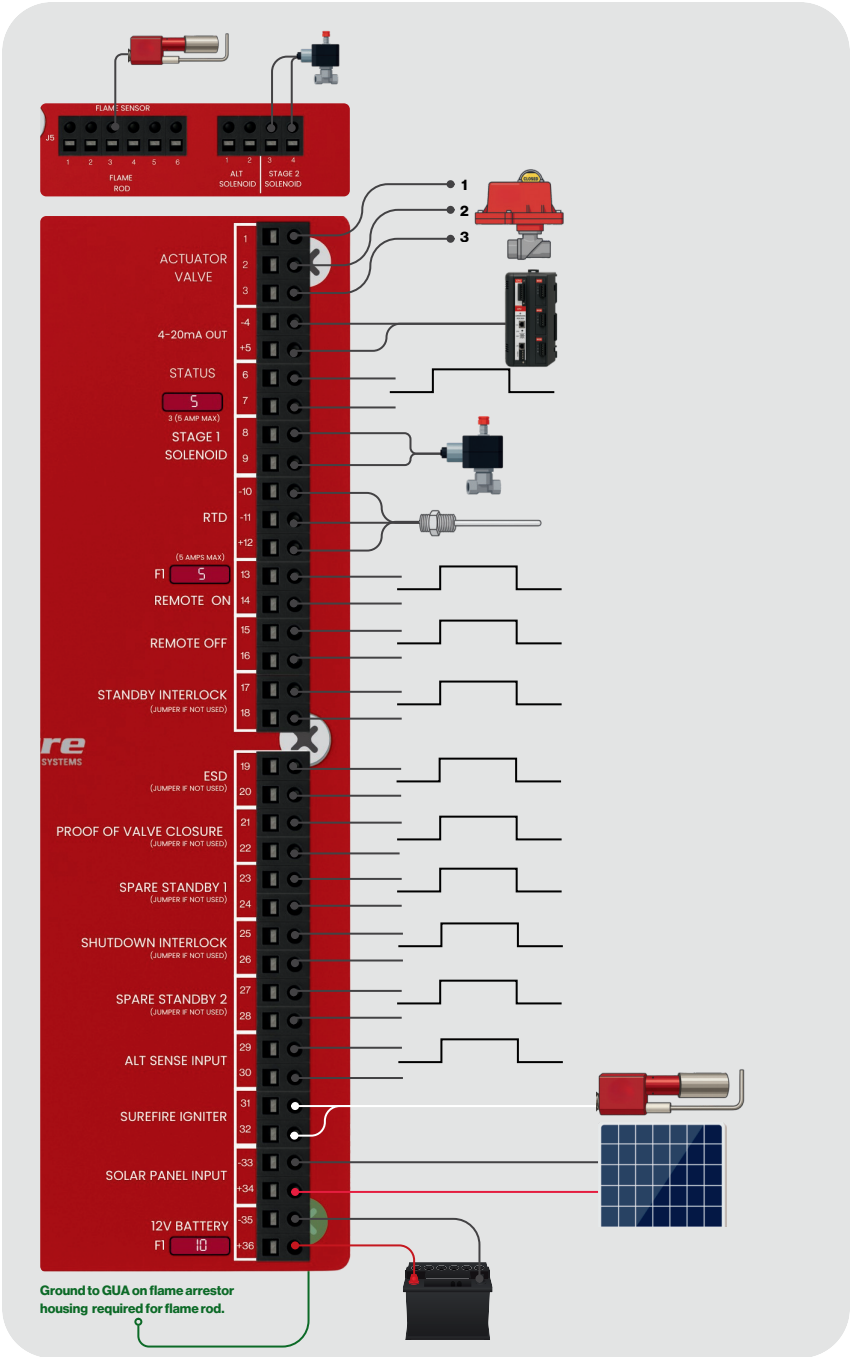
Functions:

To provide RS-485 modbus read only communications.

Installation:

1. Run a single pair of wire from the PLC/RTU to the BMS-300 "**MODBUS RS-485**" port.
2. When terminating wires, ensure proper electrical fittings are used to maintain proper operation and moisture resistance.
3. For future troubleshooting, label or color-code all wiring for easy identification.
4. Terminate the 2 wires as shown in the diagram below.




FLAME SENSOR
J5
1 2 3 4 5 6
FLAME ROD
1 2 3 4
ALT SOLENOID
STAGE 2 SOLENOID
ACTUATOR VALVE
1
2
3
4-20mA OUT
-4
+5
STATUS
6
7
5
3 (5 AMP MAX)
STAGE 1 SOLENOID
8
9
RTD
-10
-11
+12
(5 AMPS MAX)
F1
5
13
REMOTE ON
14
REMOTE OFF
15
16
STANDBY INTERLOCK
(JUMPER IF NOT USED)
17
18
re
SYSTEMS
ESD
(JUMPER IF NOT USED)
19
20
PROOF OF VALVE CLOSURE
(JUMPER IF NOT USED)
21
22
SPARE STANDBY 1
(JUMPER IF NOT USED)
23
24
SHUTDOWN INTERLOCK
(JUMPER IF NOT USED)
25
26
SPARE STANDBY 2
(JUMPER IF NOT USED)
27
28
ALT SENSE INPUT
29
30
SUREFIRE IGNITER
31
32
SOLAR PANEL INPUT
-33
+34
12V BATTERY
F1
10
-35
+36
Ground to GUA on flame arrestor housing required for flame rod.

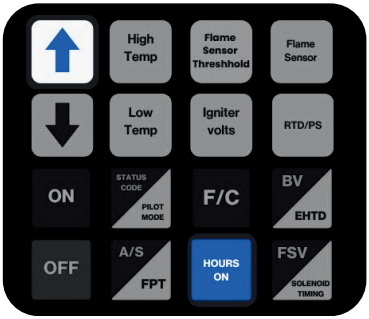
11-13

SYSTEM SETUP

SYSTEM SETUP | MENU | MODBUS

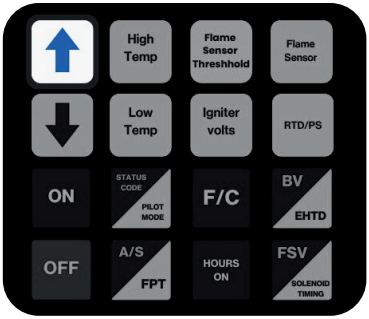
11.1 | Unlocking the System

1. Press and hold the UP ARROW and HOURS ON button together simultaneously for 5 seconds.
2. The display will flash 0000 to indicate the system is unlocked.
3. The system will automatically relock after 5-minutes of no button activity.



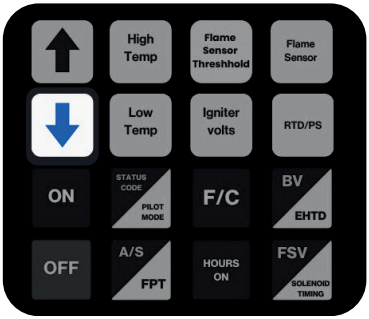
11.2 | Up Arrow

1. To increase the value of the displayed setting.



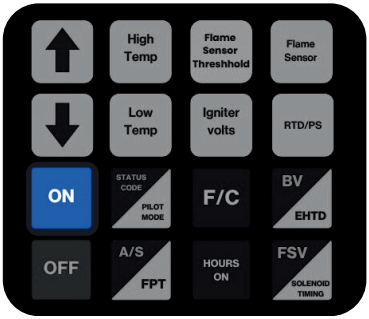
11.3 | Down Arrow

1. To decrease the value of the displayed sett



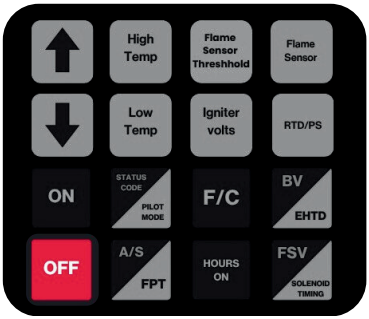
11.4 | On Button

1. Starts the ignition sequence



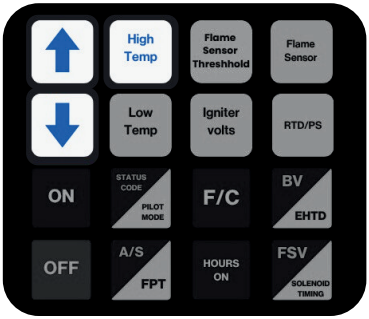
11.5 | Off Button

1. Turns off the system



11.6 | High Temp

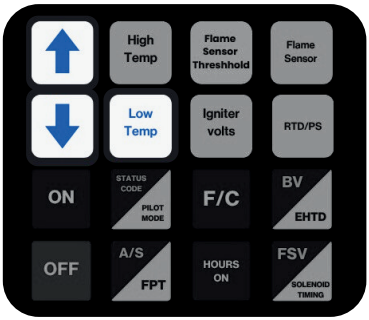
1. Press to display the current high temperature setpoint.
2. While unlocked, press in conjunction with the up or down arrow to adjust the high temperature setpoint.



Default Setting	*Minimum*	*Maximum*
150°F	14°F	490°F

11.7 | Low Temp

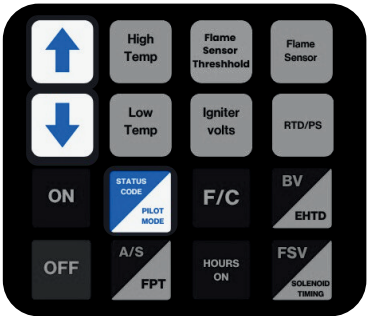
1. Press to display the current low temperature setpoint.
2. While unlocked, press in conjunction with the up or down arrow to adjust the low temperature setpoint.



Default Setting	Minimum	Maximum
60°F	10°F	486°F

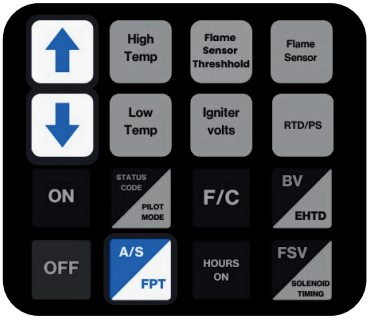
11.8 | Status Code / Pilot Mode

1. Press to display the current status code.
2. While unlocked, press and hold to display the current pilot mode.
3. Utilize the up or down arrow to adjust the setting.



Default Setting	Intermittent Pilot	Standing Pilot
1	1	2

11.9 | Attempts and Successes / Flame Proof Timing

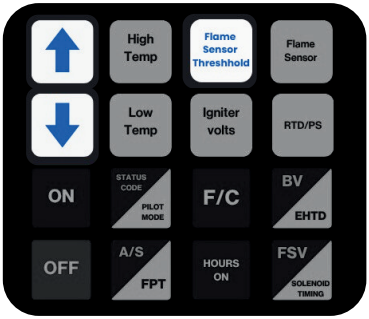


1. Press one time to display number of ignition attempts.
2. Press a second time to display the number of successful ignition attempts
3. Press and hold to display the flame proof timing setpoint (number of seconds allowed to sense the presence of a flame)
4. While unlocked, press and hold in conjunction with the up or down arrow to adjust the setpoint.

Default Setting	*Minimum*	*Maximum*
15	10	60
Seconds	Seconds	Seconds

11.10 | Flame Sensor Threshold

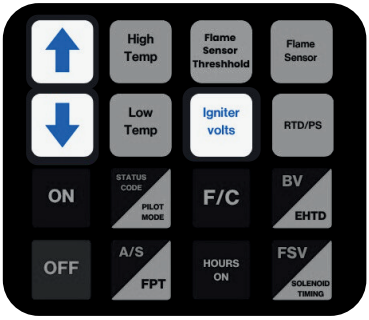
1. Displays the flame sensed threshold setpoint.
2. Press and hold in conjunction with the up or down arrow to adjust the setpoint.



Default Setting	*Minimum*	*Maximum*
250	65	350

11.11 | Igniter Volts

1. Displays the VDC being supplied to the igniter.
2. Press and hold in conjunction with the up or down arrow to adjust the setting.

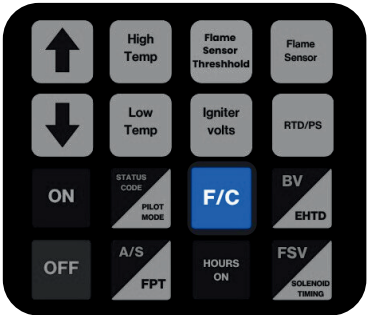


Note: This setting should only be modified after consulting SureFire technical support as energizing an new or lightly used igniter with 14 vdc may cause premature failure.

Default Setting	*Minimum*	*Maximum*
13 VDC	13 VDC	14 VDC

11.12 | Fahrenheit / Celsius

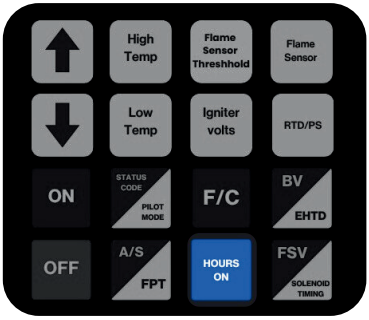
1. Displays the temperature scaling.
2. While unlocked, press to alternate between the two available temperature selections.



Default Setting	*Fahrenheit*	*Celsius*
F	F	C

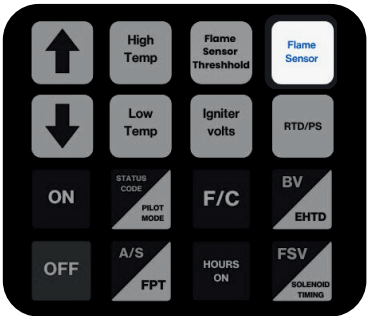
11.13 | Hours On

1. Displays the total hours the main burner solenoid / valve has been energized.



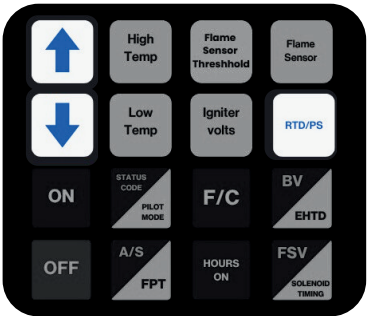
11.14 | Flame Sensor

1. Displays the selected flame sensing device.
2. The only available selection is a flame rod.
3. FL = Flame Rod



11.15 | RTD / PS

1. Displays the startup signal device.
2. While unlocked, press and hold in conjunction with the up or down arrow to adjust the setting.

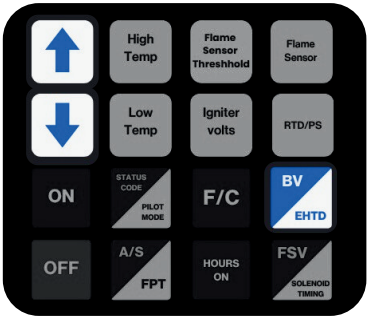


Default Setting	*RTD*	*Maximum*
0	0	P

NOTE:

1. **RTD** will utilize temperature settings and allow the BMS to control the sequencing.
2. **P** will allow an incoming signal to the Alt Sense Input to control the sequencing

11.16 | BV / EHTD



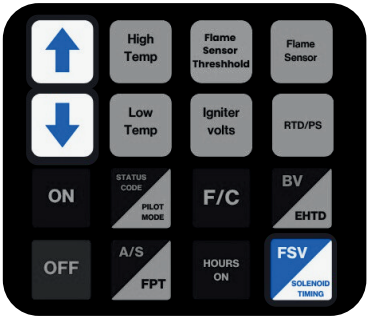
1. Displays the current supply voltage / battery voltage.
2. Press and hold to display the EHTD (extreme high temperature delta) setting.
3. While unlocked, press and hold in conjunction with the up or down arrow to adjust the setting.

NOTE: The EHTD setting is a delta in addition to the high temperature setpoint. For example, if the high temperature setpoint is set on 150F, and EHTD is set on 50, the system will shutdown on code 18 at 200F.

Default Setting	*Minimum*	*Maximum*
50°F	10°F	100°F

11.17 | Flame Strength Value / Solenoid Timing

1. Displays the flame strength value of the flame sensing device.
2. Press and hold to display the timing between stage 1 solenoid being energized and stage 2 solenoid being energized.
3. While unlocked, press and hold in conjunction with the up or down arrow to adjust the setpoint



Default Setting	Minimum	Maximum
60	2	60
Seconds	Seconds	Seconds

Flame Rod	No Flame Present	Flame Present
Flame Strength Value	>500°F	<5°F

12.1 | Introduction

The Modbus communication for the BMS-300 is facilitated through an intermediary circuit board, the BMS-300 Modbus Card.

This Modbus Card includes the following key functions:

- Acts as the Modbus PLC / RTU slave
- Relays command data to the BMS-300 board

The Modbus Card functions as a specialized mailbox, maintaining a setup of holding registers accessible by both the BMS-300 Controller and PLC / RTU Master.

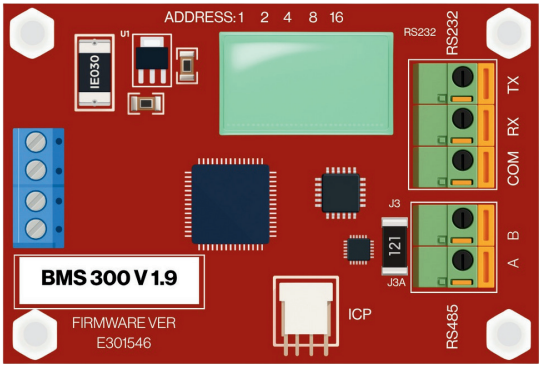
12.2 | Modbus Register Overview

The Modbus communications include a variety of holding registers that can be poled by the Modbus master:

- Status codes
- Temperature values
- Setpoints
- Safety data
- Other critical data

12.3 | Modbus Visual Indication

- The Modbus Card includes LED indication of the communication between the Modbus master (PLC/RTU) and the Modbus slave (Modbus Card) as well as the communication between the Modbus slave (Modbus Card) and the BMS-300.



An amber LED labeled “COM LED” will flash when the communication network between the master and slave has not only been established, but commands are being received and responded to.

An amber LED labeled “BMS COM LED” will flash when the communication between the BMS-300 and Modbus Card has been established.

12.4 Setup Information

Data Bit
8
Stop Bit
1
Parity Bit
None
Baud Rate
9600
Max Register - Singular Poling
10 Registers
Data Type
Unsigned Integers - 16 Bit
Register Range
40001 thru 40255
Poling Frequency
2 Seconds **or** Greater

12.5 Register Map

Modbus Register	Register Name	*Notes*
40001	Status Code (R)	See Status Code: On page 52 - 58
40002	Process Temperature / RTD Temperature	Bit 9 ... 0 = 0°F - 529°F
40003	High Temperature Setpoint	Bit 9 ... 0 = 14°F - 490°F
4004	Low Temperature Setpoint	Bit 9 ... 0 = 10°F - 586°F

Modbus Register	Register Name	*Notes*
40005	Configuration and Status	*Bit 0 = LED Status* 0: Red LED Solid 1: Green LED Solid *Bit 1 = Temperature Units* 0: Degrees Celsius 1: Degrees Fahrenheit *Bit 2 = Input Signal* 0: RTD 1: Alt Sense Input *Bit 3 = Igniter Volts* 0: 14 vdc 1: 13 vdc *Bit 4 = Pilot Mode* 0: Intermittent 1: Standing *Bit 5 = Flame Sensed* 0: Flame Not Sensed 1: Flame Sensed *Bit 6 = Factory Use Only* *Bit 7 = Factory Use Only* *Bit 8 = Spare Standby 1* 0: Not Activated 1: Activated *Bit 9 = Spare Standby 2* 0: Not Activated 1: Activated *Bit 10 = Shutdown Interlock* 0: Not Activated 1: Activated *Bit 11 = ESD* 0: Not Activated 1: Activated *Bit 12 = Standby Interlock* 0: Not Activated 1: Activated *Bit 13 = Factory Use Only* *Bit 14 = Factory Use Only* *Bit 15 = Factory Use Only*
40006	Battery Volts	Bit 9...0 = 0 - 145 (14.5)

Modbus Register	Register Name	*Notes*
40007	Hours On	Bit 9 ... 0 = 0 - 9999 hours
40008	Ignition Attempts	Bit 9 ... 0 = 0 - 9999
40009	Successful Ignition Attempts	Bit 9 ... 0 = 0 - 9999
40010	N/A	Not Used
40011 - 40019	N/A	Not Used
40020	Bit 0 - LED Status	0 = Red LED Solid 1 = Green LED Solid
40021	Bit 1 - Temperature Units	0 = Degrees Celsius 1 = Degrees Fahrenheit
40022	Bit 2 - Input Signal	0 = RTD 1 = Alt Sense Input
40023	Bit 3 - Igniter Volts	0 = 14 VDC 1 = 13 VDC
40024	Bit 4 - Pilot Mode	0 = Intermittent 1 = Standing
40025	Bit 5 - Flame Sensed	0 = Flame Not Sensed 1 = Flame Sensed

Modbus Register	Register Name	*Notes*
40026	Bit 6 - Factory Use Only	N/A
40027	Bit 7 - Factory Use Only	N/A
40028	Bit 8 - Spare Standby 1	0 = Not Activated 1 = Activated
40029	Bit 9 - Spare Standby 2	0 = Not Activated 1 = Activated
40030	Bit 10 - Shutdown Interlock	0 = Not Activated 1 = Activated
40031	Bit 11 - ESD	0 = Not Activated 1 = Activated
40032	Bit 12 - Standby Interlock	0 = Not Activated 1 = Activated
40033	Bit 13 - Factory Use Only	N/A
40034	Bit 14 - Factory Use Only	N/A
40035	Bit 15 - Factory Use Only	N/A
40036 - 40249	Unallocated	N/A
40250	BMS Diagnostic Register	Factory Use Only
40251	BMS Diagnostic Register # 2	Factory Use Only

Modbus Register	Register Name	*Notes*
40252	BMS Read Count	Number of packets sent by the BMS to Modbus via holding register
40253	Modbus Board Firmware	0x19 Ex: Version 1.9 = 0x19
40254	Modbus Read count	Number of functions requested from master
40255	BMS Write Count	Number of packets sent by BMS to Modbus via holding register

Switch	Selects	*Description*
Switch # 1	Modbus address bit 0	On = 1 | Off = 0
Switch # 2	Modbus address bit 1	On = 1 | Off = 0
Switch # 3	Modbus address bit 2	On = 1 | Off = 0
Switch # 4	Modbus address bit 3	On = 1 | Off = 0
Switch # 5	Modbus address bit 4	On = 1 | Off = 0
Switch # 6	Baud rate for communications	Off = 9600 9600 is the only selection
Switch # 7	N/A	N/A
Switch # 8	Interface for Modbus master	Off = RS485 485 is the only selection

Desired Modbus address	SW1-1	SW1-2	SW1-3	SW1-4	SW1-5
1	ON	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF
5	ON	OFF	ON	OFF	OFF
6	OFF	ON	ON	OFF	OFF
7	ON	ON	ON	OFF	OFF
8	OFF	OFF	OFF	ON	OFF
9	ON	OFF	OFF	ON	OFF
10	OFF	ON	OFF	ON	OFF
11	ON	ON	OFF	ON	OFF
12	OFF	OFF	ON	ON	OFF
13	ON	OFF	ON	ON	OFF
14	OFF	ON	ON	ON	OFF
15	ON	ON	ON	ON	OFF
16	OFF	OFF	OFF	OFF	ON
17	ON	OFF	OFF	OFF	ON
18	OFF	ON	OFF	OFF	ON
19	ON	ON	OFF	OFF	ON
20	OFF	OFF	ON	OFF	ON
21	ON	OFF	ON	OFF	ON
22	OFF	ON	ON	OFF	ON
23	ON	ON	ON	OFF	ON
24	OFF	OFF	OFF	ON	ON
25	ON	OFF	OFF	ON	ON
26	OFF	ON	OFF	ON	ON
27	ON	ON	OFF	ON	ON
28	OFF	OFF	ON	ON	ON
29	ON	OFF	ON	ON	ON
30	OFF	ON	ON	ON	ON
31	ON	ON	ON	ON	ON

13

SYSTEM OPERATION

SEQUENCE OF OPERATION | FLOW CHARTS
TROUBLESHOOTING GUIDE

13.1 | Sequence of Operation / Intermittent Pilot or Pilotless

1. Press the **ON** button.
2. The 120 second pre-purge countdown begins.

Display Value	Status Code	Flame Value	LED Indicator
120 Second Countdown	24 Purge Before Startup	504 - 506	

NOTE: Utilize the keypad overlay to display the status code and flame value.

3. Once the pre-purge countdown ends, if the input signal is present (temperature or Alt Sense) the 5 second audible alarm will begin.

Display Value	Status Code	Flame Value	LED Indicator
5 Second Countdown	24 5 Second Alarm	504 - 506	

4. The igniter is energized for 5 total seconds

Display Value	Status Code	Flame Value	LED Indicator
5 Second Countdown	5 Igniter ON	504 - 506	

5. The stage 1 solenoid valve and actuator valve are energized and the flame proof timing countdown begins.

Display Value	Status Code	Flame Value	LED Indicator
15 Second Countdown	08 Waiting for Main Valve	3 - 5	

6. Ignition is achieved and the pilot flame is sensed.

Note: If ignition is not achieved, the process will restart at step # 2 following the expiration of the flame proof timing countdown with a status code of 09.

Display Value	Status Code	Flame Value	LED Indicator
30 Second Countdown	08 Waiting for Main Valve	3 - 5	

7. The stage 2 solenoid valve is energized following the expiration of the flame proof timing countdown

Note: In pilotless mode, the countdown between stage 1 and stage 2 is arbitrary.

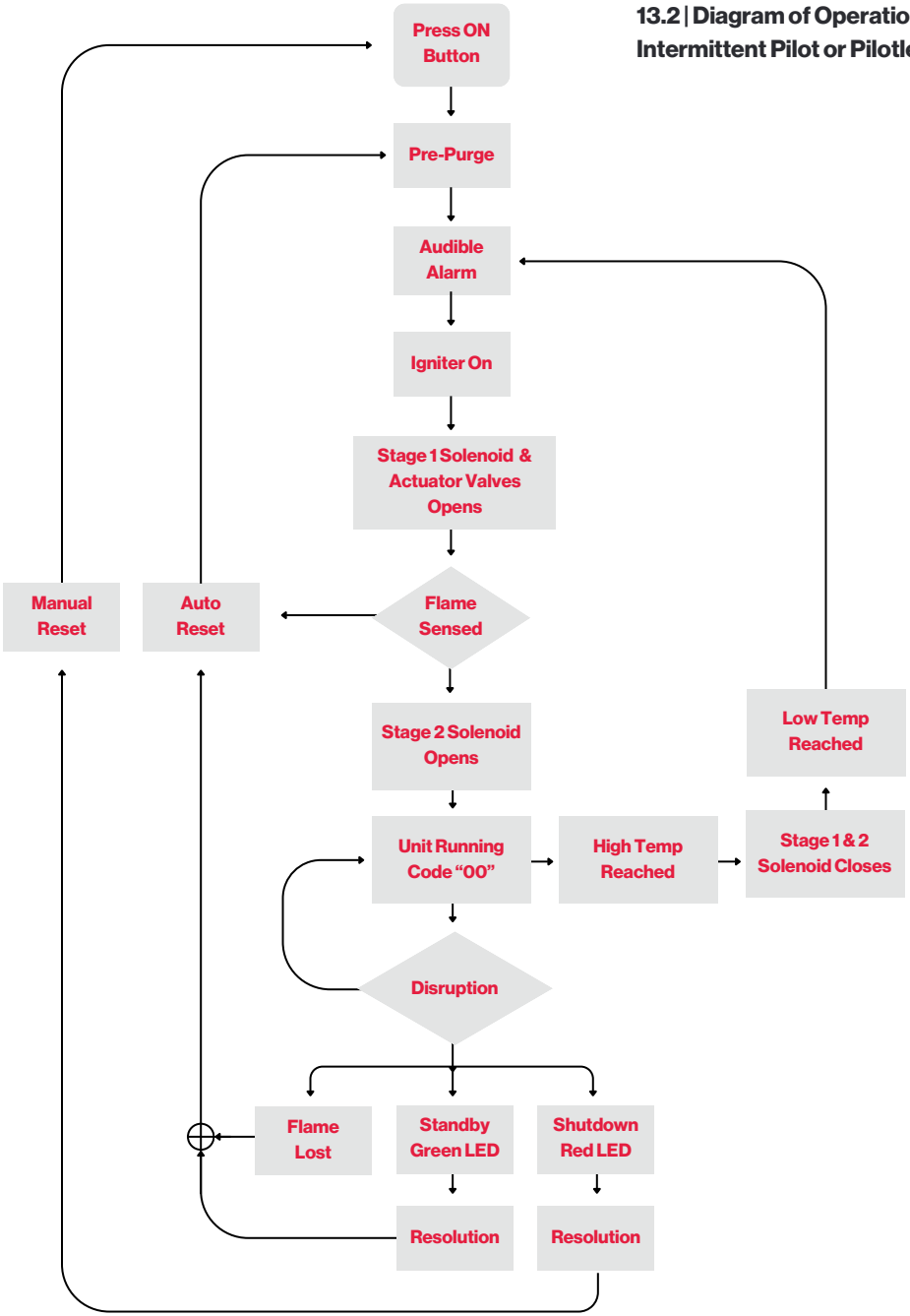
Display Value	Status Code	*Flame Value*	*LED Indicator*
F 85 RTD Temp	00 System Running	3 - 5	

8. The process temperature rises above the high temperature setpoint and all valves are de-energized.

Display Value	Status Code	*Flame Value*	*LED Indicator*
F 85 RTD Temp	00 System Running	3 - 5	

9. The process temperature drops below the low temperature setpoint, and the process resumes at step # 3.

13.2 | Diagram of Operation / Intermittent Pilot or Pilotless



13.3 | Sequence of Operation / Standing Pilot

1. Press the **ON** button.
2. The 120 second pre-purge countdown begins.

Display Value	Status Code	Flame Value	LED Indicator
120 Second Countdown	24 Purge Before Startup	504 - 506	

NOTE: Utilize the keypad overlay to display the status code and flame value.

3. Once the pre-purge countdown ends, if the input signal is present (temperature or Alt Sense) the 5 second audible alarm will begin.

Display Value	Status Code	Flame Value	LED Indicator
120 Second Countdown	24 Purge Before Startup	504 - 506	

4. The igniter is energized for 5 total seconds

Display Value	Status Code	Flame Value	LED Indicator
5 Second Countdown	5 Igniter ON	504 - 506	

5. The stage 1 solenoid valve and actuator valve are energized and the flame proof timing countdown begins.

Display Value	Status Code	Flame Value	LED Indicator
15 Second Countdown	08 Waiting for Main Valve	3 - 5	

6. Ignition is achieved and the pilot flame is sensed.

Note: If ignition is not achieved, the process will restart at step # 2 following the expiration of the flame proof timing countdown with a status code of 09.

Display Value	Status Code	Flame Value	LED Indicator
30 Second Countdown	08 Waiting for Main Valve	3 - 5	

7. The stage 2 solenoid valve is energized following the expiration of the flame proof timing countdown

Display Value	Status Code	*Flame Value*	*LED Indicator*
F 85 RTD Temp	00 System Running	3 - 5	

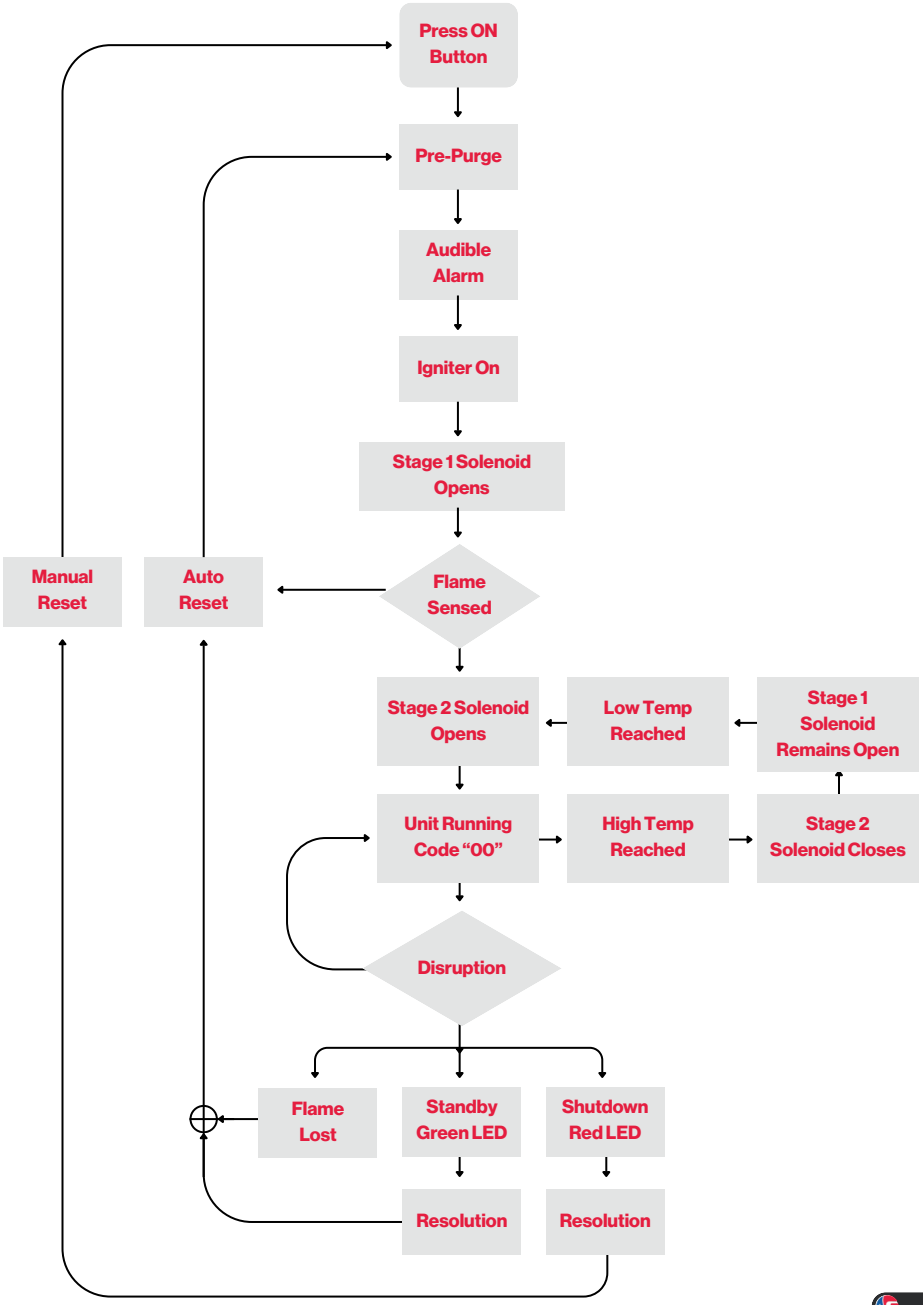
8. The process temperature rises above the high temperature setpoint, and the stage 2 solenoid valve is de-energized, while stage 1 remains energized (keeping the pilot lit).

Note: If the process temperature continues to rise 10 F over the high temperature setpoint, the stage 1 solenoid with then be de-energized.

Display Value	Status Code	*Flame Value*	*LED Indicator*
F 140 RTD Temp	01 Waiting for Startup Signal	3 - 5	

13.4 | Standing Pilot Sequence of Operation

Flow Chart:



14

TROUBLESHOOTING GUIDE

STATUS CODES | EVENT DESCRIPTIONS | SOLUTIONS
LED INDICATORS

14.1 | Run Codes:

Status Code	Event Description	Corrective Action	LED Indicator
00 System Running	• Flame is present • Solenoid valves are open • No errors	• Normal operation - no interaction required	
24 Purge Before Start-up	• Flame is not present • Solenoid valves are closed • No errors	• Normal operation - no interaction required • The display shows the pre-purge countdown	
01 Waiting for startup signal	• Flame is not present • Solenoid valves are closed • No errors	• Normal operation - no interaction required • Waiting for RTD temperature to decrease below low temperature setpoint or waiting for signal from Alt Sense Input	
08 Purge between Ignition Attempts	• Pilot/main burner is not on	• Normal operation - no interaction required • No ignition on previous attempts • 120 second countdown	
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 - no interaction required • 60 second countdown (unless adjusted on keypad)	

14.2 | Standby Codes:

Status Code	Event Description	Corrective Action	LED Indicator

02
Standby Interlock
	• Flame is not present
	• Solenoid valves are closed
	• No activity when attempting to start up the system
		• Ports #17 and #18 are experiencing an open circuit
		• If this port observes no continuity, this will cause the system to enter a standby state.
		• Verify if an external device is connected to these ports.
		  ◦ **If not**, ensure a jumper is fastened securely in ports #17 and #18.
		• Determine if the device is activated or faulty.
		  ◦ **If faulty**, replace the device.
		• If activated (open circuit), resolve the issue; the system will automatically restart the ignition process.
			Flashing

03
Spare Standby 1
	• Flame is not present
	• Solenoid valves are closed
	• No activity when attempting start up the system
		• Ports #23 and #24 are experiencing an open circuit
		• If this port observes no continuity, this will cause the system to enter a standby state.
		• Verify if an external device is connected to these ports.
		  ◦ **If not**, ensure a jumper is fastened securely in ports #23 and #24.
		• Determine if the device is activated or faulty.
		  ◦ **If faulty**, replace the device.
		• If activated (open circuit), resolve the issue; the system will automatically restart the ignition process.
			Flashing

14.2 | Standby Codes:

Status Code	Event Description	Corrective Action	LED Indicator

04
Spare Standby 2
	• Flame is not present
	• Solenoid valves are closed
	• No activity when attempting start up the system
		• Ports #237and #28 are experiencing an open circuit
		• If this port observes no continuity, this will cause the system to enter a standby state.
		• Verify if an external device is connected to these ports.
		  ◦ **If not**, ensure a jumper is fastened securely in ports #27 and #28.
		• Determine if the device is activated or faulty.
		  ◦ **If faulty**, replace the device.
		• If activated (open circuit), resolve the issue; the system will automatically restart the ignition process.
			Flashing

14.3 | Shutdown Codes:

Status Code	Event Description	Corrective Action	LED Indicator
11 Manual/Remote Shut Off	• Flame is not present • Solenoid valves are closed • The system is in a manual shutdown state • The system will restart if the ON button is pressed	• Normal operation • The OFF button was pressed, or the Remote OFF port was activated • To restart the system, press the ON button	

12
Max Retries Exceeded
	• Flame is not present
	• Solenoid valves are closed
	• The system has attempted the ignition process and failed in sequential attempts
	• The system will restart if the OFF and ON buttons are pressed, but the issue may continue
		• Use a DMM to verify ohms resistance on the igniter (normal 1.3–2.0)
		• Ensure input power is adequate
		  ◦ Verify battery voltage
		  ◦ Ensure the power supply is rated at 8A or greater with adequate wire gauge from the power supply to the BMS. Place a DMM in series and observe the VDC when the igniter is energized to see if the supply drops below 10.6 VDC
		• If a fired equipment piloted application:
		  ◦ If a pilot burner, ensure the pilot mixer is free of debris and pilot fuel is being supplied (3–7#)
		  ◦ Ensure the pilot orifice is sized at #72
		  ◦ If a pilotless burner, ensure the air/fuel mixer is free of debris, air and gas settings are correct, and fuel is being supplied (8–12#)
		  ◦ If ignition is not occurring, verify the igniter, fuel supply, or power conditions
		  ◦ If the flame is being established but the flame strength value is not being sensed, it may be due to a flame rod failure, grounding issue, or the flame lifting off the nozzle
			
			Flashing

14.3 | Shutdown Codes:

Status Code	Event Description	Corrective Action	LED Indicator
13 Low Battery Voltage	• Flame is not present • Solenoid valves are closed • The system may restart if the OFF and ON buttons are pressed, depending on the input voltage	• The input voltage decreased to below 10.6 VDC during the ignition process • Check battery voltage and verify it under load • If the battery is below 10.6 VDC, check the charging mechanism (solar panel, battery charger, site power, etc.) to ensure the battery is being charged • Ensure the power supply is rated at 8A or greater with adequate wire gauge from the power supply to the BMS. Place a DMM in series and observe the VDC when the igniter is energized to see if the supply drops below 10.6 VDC • Ensure the wire gauge is adequate for the igniter, as insufficient gauge size will result in a code 13 shutdown even with sufficient input power	 Flashing

14
Igniter Short
	• Flame is not present
	• Solenoid valves are closed
	• The system will not restart if OFF and ON button is pressed
		• Use a DMM a verify the ohm value of the igniter (normal 1.3 – 2.0). If the igniter is damaged or shorted, the ohms' resistance will read an elevated value, requiring a replacement igniter / FT ignition unit
		• If the igniter is in good shape, verify the wire connections, ensuring there are no breaks or shorted wires.
		• If the igniter and wiring are in good shape, verify the gauge size between the FT ignition unit and the BMS, ensuring adequate wire gauge size is being utilized
		• If everything associated with the igniter is verified, review the input power:
		  ◦ Check battery voltage – ensure the voltage is verified with a load applied.
		  ◦ Ensure power supply is rated at 8A or greater with adequate wire gauge size from power supply to the BMS. Place a DMM in series and observe the VDC when the igniter is energized to observe if the supply decreases below 10.6 VDC
			
			Flashing

14.3 | Shutdown Codes:

Status Code	Event Description	Corrective Action	LED Indicator

15
Igniter Disconnected
	• Flame is not present
	• Solenoid valves are closed
	• The system will not restart if the OFF and ON buttons are pressed
		• Use a DMM to verify the ohm value of the igniter (normal 1.3–2.0). If the igniter is broken or damaged, the resistance will read 0 or open, requiring a replacement igniter or FT ignition unit
		• If the igniter is in good condition, verify the wire connections to ensure there are no breaks or disconnected wires
		• If the igniter and wiring are in good condition, verify the gauge size between the FT ignition unit and the BMS to ensure proper wire sizing
		• If all components related to the igniter are verified, review the input power:
		  ◦ Check battery voltage and verify it under load
		  ◦ Ensure the power supply is rated at 8A or greater with adequate wire gauge from the power supply to the BMS. Place a DMM in series and observe the VDC when the igniter is energized to see if the supply drops below 10.6 VDC
			
			Flashing

16 Flame Sensed Before Startup	• Flame is not present • Solenoid valves are closed • The system will not restart if the OFF and ON buttons are pressed	• The flame sensing loop is detected a flame / short prior to the startup sequencing. • Verify there are no wiring shorts. • Unplug the flame rod termination and test flame strength value (should be >500). • If the flame strength value with the flame rod unplugged = 3-5, indicates an electrical issue (grounding, noise, circuit board, etc.) - contact SureFire technical support. • If the flame strength value with the flame rod unplugged = >500, the issue is associated with wiring or the flame rod - contact SureFire technical support	 Flashing

14.3 | Shutdown Codes:

Status Code	Event Description	Corrective Action	LED Indicator
18 Extreme High / Low Temperature	• Flame is not present • Solenoid valves are closed • The system will not restart if the OFF and ON buttons are pressed	• The process temperature elevated beyond the EHTD setpoint over the high temperature setpoint. • The process remained below 4F for 30 consecutive minutes. • Verify the RTD wiring (same color = negative / unique color = positive)	Flashing

19
Shutdown Interlock
	• Flame is not present
	• Solenoid valves are closed
	• No activity when attempting to start up the system
		• Ports #25 and #26 are experiencing an open circuit
		• If this port observes no continuity, this will cause the system to enter a shutdown state
		• Verify if an external device is connected to these ports
		  ◦ **If Not,** ensure a jumper is fastened securely in ports #25 and #26
		• Determine if the device is activated or faulty
		  ◦ **If faulty,** replace the device
		• If activated (open circuit), resolve the issue; the system will require a local reset to restart the ignition process
			Flashing

20
ESD Activated
	• Flame is not present
	• Solenoid valves are closed
	• No activity when attempting to start up the system
		• Ports #19 and #20 are experiencing an open circuit
		• If this port observes no continuity, this will cause the system to enter a shutdown state
		• Verify if an external device is connected to these ports
		  ◦ **If Not,** ensure a jumper is fastened securely in ports #19 and #20
		• Determine if the device is activated or faulty
		  ◦ **If faulty,** replace the device
		• If activated (open circuit), resolve the issue; the system will require a local reset to restart the ignition process
			Flashing

14.3 | Shutdown Codes:

Status Code	Event Description	Corrective Action	LED Indicator
21 Main Fuel Valve Failure	• Flame is not present • Solenoid valves are closed • No activity when attempting to start up the system	• System detecting an open circuit. • No jumper at 21 & 22. • Switch on main fuel valve is activated. • Check wire connections. • Check main fuel valve. **Note: Not a shutdown, works as a:** ◦ permissive. Ignores open circuit ◦ after audible alarm.	 Flashing
22 Flame Sensor Problem	• Flame is not present • Solenoid valves are closed • No activity when attempting to start up the system	• No longer applicable	N/A

14.4 | Modbus Troubleshooting Guide

Sequence	Troubleshooting

Step 1	**Verify Communication Parameters (Reference Section 12.4 of Operations Manual)**
	• Confirm that both the master and slave devices are configured with identical communication parameters:
	  ◦ Baud Rate (e.g., 9600)
	  ◦ Data Bits (8)
	  ◦ Parity (None)
	  ◦ Stop Bits (1)
	  ◦ Device ID / Slave Address (unique for each slave on the network – reference 11.14)
	• Check that termination resistors and biasing resistors (if required) are applied consistently.
	• Ensure all devices use the same protocol type: Modbus RS-485

Step 2	**Verify Register Mapping and Addressing**
	• Confirm the correct method of register addressing for the specific PLC or SCADA platform in use:
	  ◦ Some systems require 40001 as the first holding register.
	  ◦ Others may require 1 or 0 as the first register reference.
	• Validate that the function codes (e.g., 03: Read Holding Registers, 04: Input Registers, 06: Write Single Register) match the intended operation.
	• Confirm endianness (byte and word order) if numerical values appear scrambled or incorrect.

Step 3	**Utilize a PLC Communication Simulator**
	• Connect a Modbus simulator application directly to the BMS-100 to bypass external PLC hardware and field wiring.
	• If the simulator shows no connectivity:
	  ◦ Suspect internal hardware on SureFire's BMS-100.
	  ◦ Escalate for hardware diagnostics or replacement.
	• If the simulator shows connectivity:
	  ◦ The issue is likely related to external wiring, third-party PLC hardware, or configuration outside of the BMS-100.

Step 5	***Physical Layer and Wiring Checks***
	• *Verify correct RS-485 wiring topology:*
	  ◦ *Use twisted pair shielded cable rated for RS-485.*
	  ◦ *Ensure daisy-chain topology (no stubs or stars).*
	  ◦ *Maximum cable length typically 1200 meters (4000 feet) for standard baud rates.*
	• *Confirm polarity: A(+) and B(–) terminals must be consistent across all devices.*
	• *Inspect for broken wires, loose terminations, or reversed polarity.*
	• *Check shield grounding practices—generally grounded at one point only.*
	• *Ensure termination resistors (120 Ω) are installed at both ends of the line (if applicable)*
	• *Check for excessive noise, voltage drops, or reflections on the line.*
	• *Verify that only one device is configured as the master*

14.4 | Modbus Troubleshooting Guide

Sequence	Troubleshooting
Step 5	**Firmware / Software Considerations** • Confirm that all devices have up-to-date firmware revisions that support Modbus. • Verify the correct Modbus table or register map is being referenced. • Review system logs (if available) for error codes or communication timeout messages.

Step 6	**Escalation and Documentation**
	• If all above steps fail:
	  ◦ Replace cables or swap ports to isolate hardware vs. software issues.
	  ◦ Test with a known-good master or slave device.
	• Document all troubleshooting steps, findings, and corrective actions in the system log for future reference
	• Contact SureFire Technical Support at 505-333-2876.

24/7 CARE FOR OUR CLIENTS.

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