SureFire
BURNER MANAGEMENT SYSTEMS

| BMS 100 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

System Introduction Page 1

Certification and Warnings Page 2

Warranty & Return Policy Page 3-4

Product Descriptions Page 5-12

Mechanical Installation Page 13-19

Electrical Installation Page 20-35

System Setup Page 36-44

System Operation Page 45-49

Troubleshoting Guide Page 50-60

Customer Service Page 61

1.1 | System Introduction

The BMS-100 is designed as a pilot maintainer for flare, combustor, or fire tube applications within the oil and gas industry. It operates with FT Ignition Units to provide optimal ignition.

The controller's display functions in ambient temperatures ranging 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 to assist with troubleshooting. 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-100 monitors a pilot flame using a Type K thermocouple. The SureFire controller manages and monitors both the pilot and main burner valves as needed. 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-100 and Ignition Unit packages provide solutions for environmental and regulatory compliance. Additional optional adder cards are available, offering:

- Modbus communication
- Data logging
- 4-20mA input control
- High-temperature safety shutdown

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

2.1 | WARNINGS ⚠

Explosion hazard – Substitution of components may impair suitability for Class I, Division 2, Groups C and D applications.

Explosion hazard – 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: Hamlin Electronics relay, model HE721A0500, Allied Electronics relay, model JW2SN-DC12V, and Panasonic relay, model DS2E-SL2-DC5V.

Substitution of the following components may impair suitability for Division 2.

MISE EN GARDE ⚠

Risque d'explosion – La substitution de composants peut altérer l'aptitude pour la Classe I, Division 2, Groupes C et D, ou des applications non classifiées.

Risque d'explosion – Ne débranchez pas l'équipement à moins que l'alimentation ait été coupée ou que l'environnement soit classé non dangereux.

L'exposition à certains produits chimiques peut dégrader les propriétés d'étanchéité des matériaux utilisés dans les appareils suivants : relais électronique Hamlin, modèle HE721A0500, relais Allied Electronics, modèle JW2SN-DC12V, et relais Panasonic, modèle DS2E-SL2-DC5V.

La substitution des éléments suivants peut altérer les qualités de Division 2.

2.2 | Certifications

Reference Designation	Description	Type of Protection
K1, K2, or K3	Relay	Sealed Contacts

Intertek

Certified to:
UL STD 61010-1 & UL STD 61010-2-030
UL STD 121201:2017 Ed.9
Model Number: BMS - 100
Rated Input Voltage: 12VDC - 13.4VDC
Amperage: 5A Max

Wattage: 67W Max
Ingress Protection (EN 60529): IP66/1P67
Class 1, Division 2, Groups C and D, or Unclassified Applications, T4
Ambient Temperature Range:
-40°F STAMB ≤ +131°F (-40°C STAMB ≤ +55°C)

Certified to:
CAN/CSA-C22.2 No. 213-17
UL 121201 (Ed 9) & ANSI 221.20-
20k4/CAN/CSA-C22.2 No. 60730-2-5-14

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 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.**

4-6

PRODUCT DESCRIPTIONS

BMS-100 | FT IGNITION UNITS | AUXILIARY COMPONENTS

4.1 | Enclosure

The SureFire BMS-100 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:

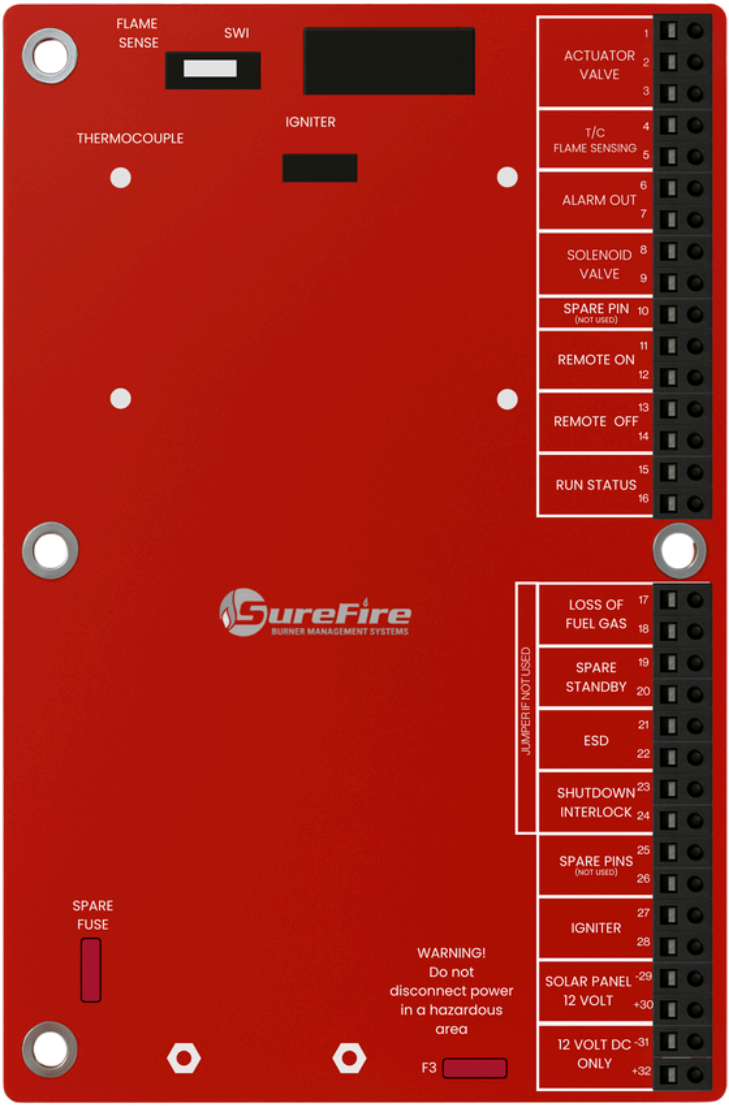
- Dust-tight: No ingress of dust; complete protection against contact.
- Water resistance: Water projected in powerful water jets (12.5mm nozzle) against the enclosure from any direction shall have no harmful effects.

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.

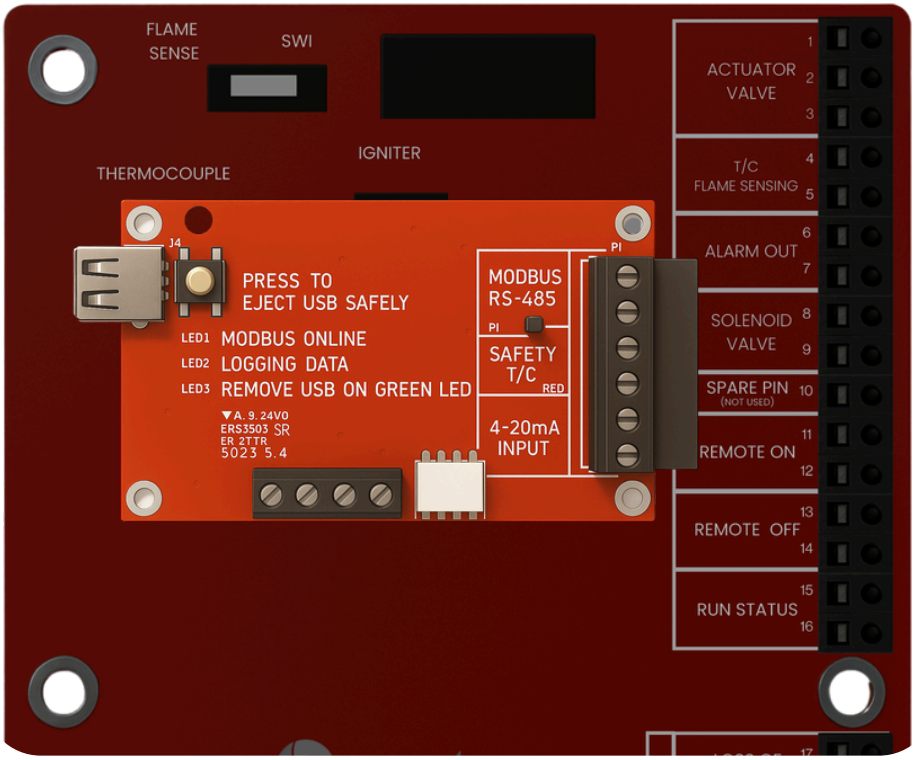
4.3 | BMS-100 Circuit Board

The SureFire BMS-100 system is controlled by state-of-the-art, non-arcing electronics that monitor and control all burner functions. It features two 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-100 Combo Card

The SureFire Combination Adder Card expands the functionality of the BMS with four key capabilities: Modbus communication, high-temperature safety monitoring, 4-20mA input compatibility, and onboard data logging. Designed for flexibility and safety, this card integrates seamlessly into existing systems while providing clear indicators for communication and data integrity.



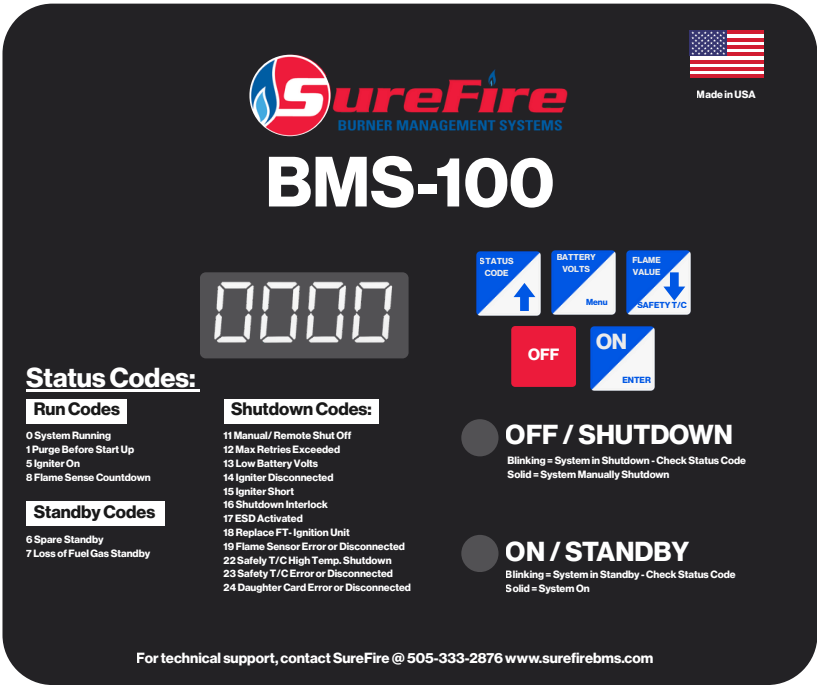
4.5 | LED Indicators

The circuit board's 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 switch has been activated
RED	**LED ON** - Indicates that the system is off **Blinking** - Indicates a shutdown switch has been activated

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 | 5-Button Keypad

The SureFire BMS-100 system features a 5-button keypad for controlling and monitoring the system. The buttons perform the following functions:

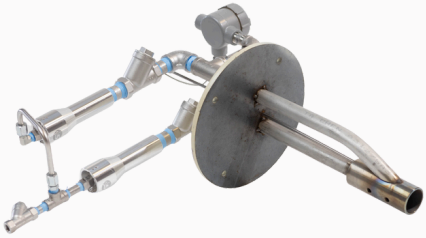
Button	Displayed Value / Functional Operation
	• **Press once (while in locked mode)** - Turns the system On • **Press once (while in unlocked mode)** - Accepts new setpoint or setting selection within the menu system
	• **Press once (while in locked mode)** - Turns the system Off • **Press and hold (while in locked mode)** - Unlocks the system • **Press and hold (while in unlocked mode)** - Lock the system
	• **Press once (while in locked mode)** - Displays the current system status code • **Press once (while in unlocked mode)** - Increases the selected value
	• **Press once (while in locked mode)** - Displays the current supply voltage to the BMS • **Press once (while in unlocked mode)** - Enters the selected mode or selection to allow setting or setpoint adjustment
	• **Press once (while in locked mode)** - Displays current flame strength value of the ignition unit's flame sensing device • **Press and hold (while in locked mode)** - Displays the current temperature value of the high temperature safety thermocouple • **Press once (while in unlocked mode)** - Decreases the selected value

5.1 | SureFire FT-Series Ignition Units

The **SureFire BMS-100** is compatible with the listed **FT series ignition units**. Each unit is specifically designed for **Flare**, **Combustor**, or **Firetube** applications. The FT-series ignition units are suitable for ***piloted*** applications.

5.2 |Combustor Pilot

The FTL-F Series ignition unit for combustor applications utilizes hot surface ignition, flame front generation, and a thermocouple as a flame sensor. The FTL-F Mini series is custom engineered to specifically fit the combustor application.



5.3 | Flare Pilot

The FTL-F series ignition unit for flare applications utilizes hot surface ignition, flame front generation, and a thermocouple as the flame sensor. These pilots are designed in various lengths (5', 7', and 17' in length.) for various flare applications.

5.4 | Firetube Pilot

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

For proper pilot placement and flame sensing selection, please contact **SureFire Tech Support at 505-333-2876** or your local SureFire representative.

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

7

MECHANICAL INSTALLATION

CONTROLLER INSTALLATION | IGNITION UNIT INSTALLATION
VALVE INSTALLATION

7.1 | SureFire BMS-100 Enclosure

1. The enclosure must be mounted on a pole, stand, or building that can support at least 10 lbs.
2. The BMS-100 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-Series Ignition Unit On A Combustor

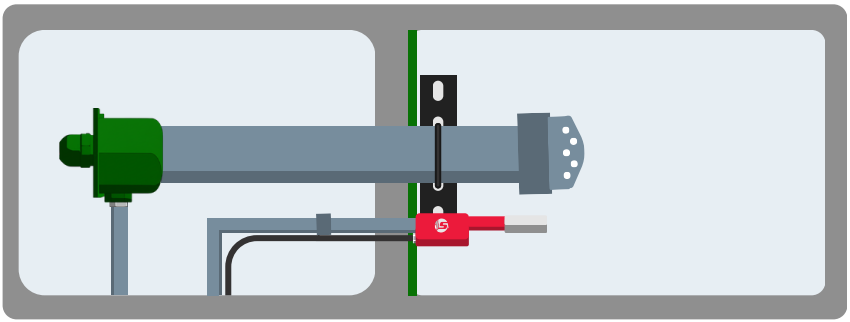
1. Ensure all gas is turned off and locked out/tagged out.
2. Install the FTL-F Mini ignition unit.
3. Ensure the gasket is mounted to the flange and all bolts are securely fastened.

7.3 | SureFire FT-Series Ignition Unit On A Flare

1. Ensure all gas is turned off and locked out/tagged out.
2. Install the FTL-F ignition unit.
    a. The FTL-F ignition unit produces a flame pattern that extends past the nozzle- 9"-12".
3. Secure the supply gas tubing and wiring harness back to the flare body, ensuring their stability in windy conditions.

7.4 | SureFire FT-Series 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.



7.5 | 1st Stage Valve Control

1. Ensure all gas is turned off and locked out/tagged out.
2. Locate the pilot gas supply line.
3. Install the ¼“ ASCO or 1" SureFire Solenoid Valve in the appropriate location within the pilot fuel train (downstream of the 0-30lb regulator).

NOTES:

1. ASCO Solenoid Proper Flow Direction:
    - 2 = Inlet
    - 1 = Outlet
2. The 1" Solenoid Valves pressure range is 5-125 lbs

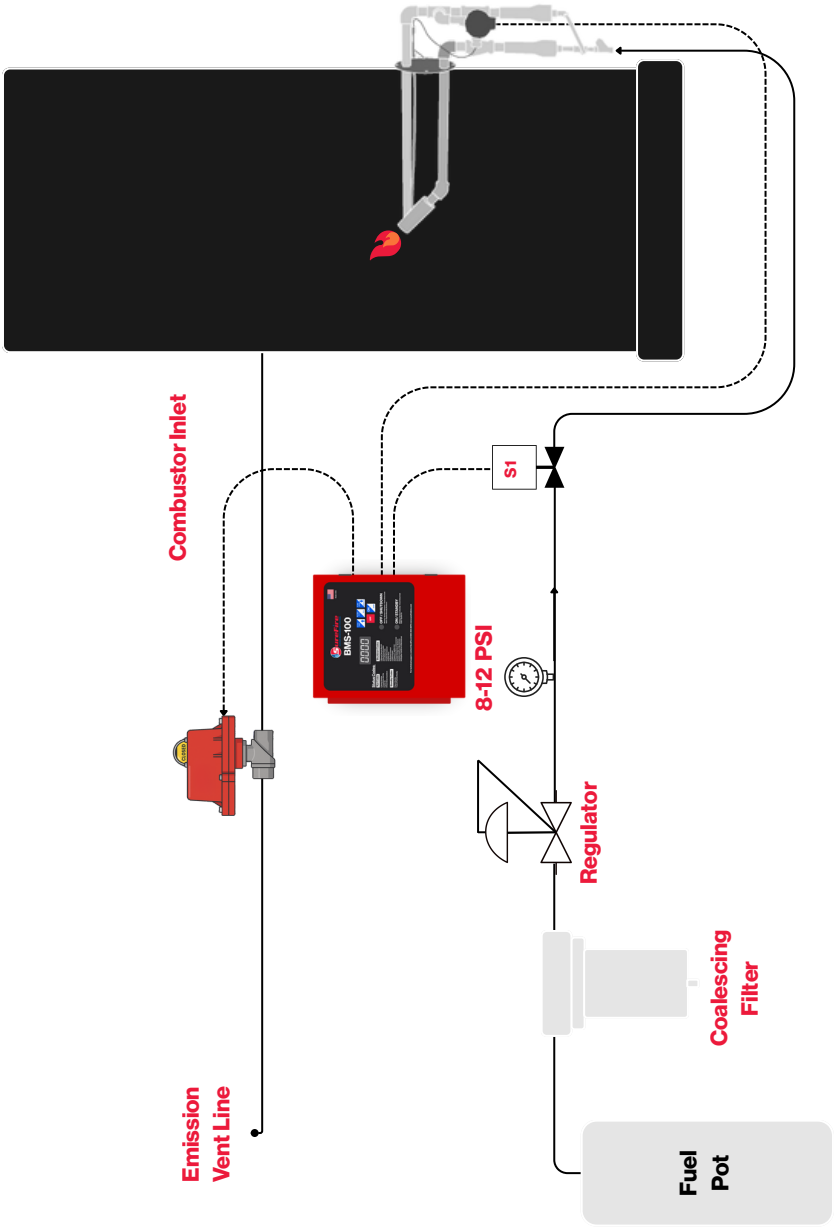
7.6 | Vent Line Control

1. Ensure the supply gas is turned off and locked out/tagged out.
2. Install the SureFire Actuator Valve in the fuel train on the main vent line to the flare (if applicable) or combustor applications.

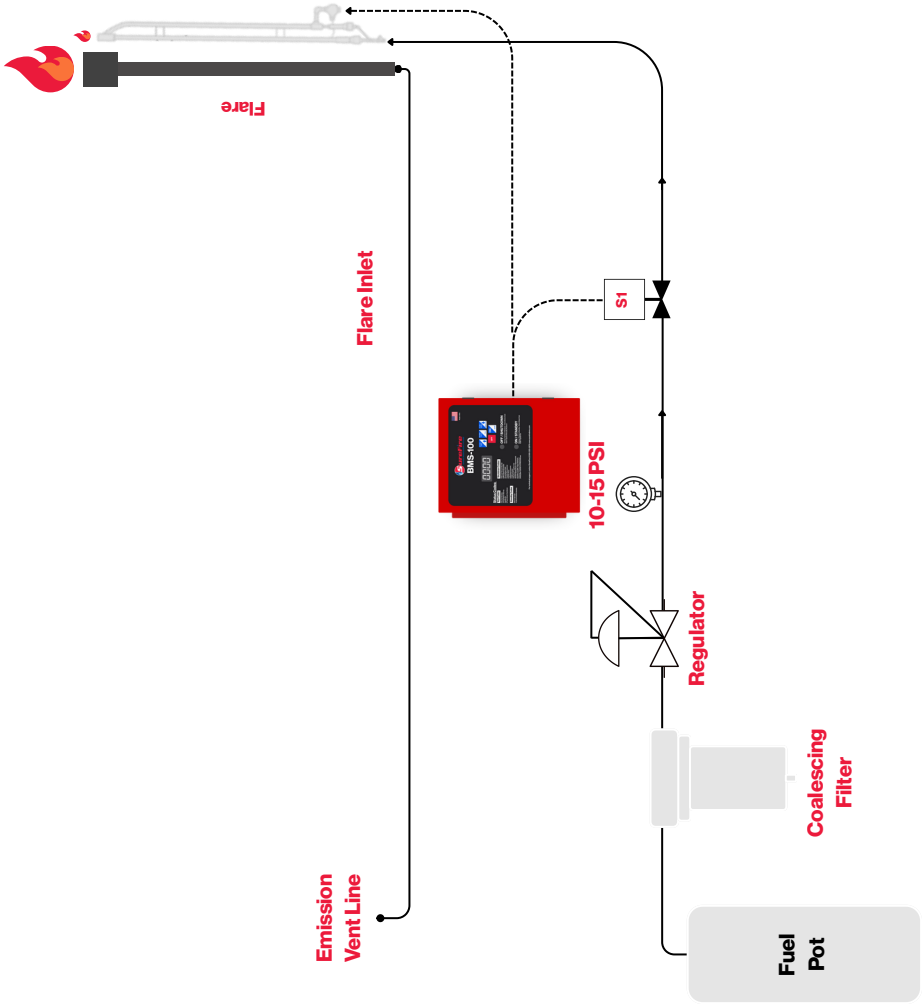
7.7 | 2nd Stage Valve Control

1. Ensure the supply gas is turned off and locked out/tagged out.
2. Install a 1/4" ASCO Valve, SureFire Actuator Valve, SureFire 1" Solenoid Valve, or SureFire 2" Solenoid Valve in the appropriate position based on the application's demands.

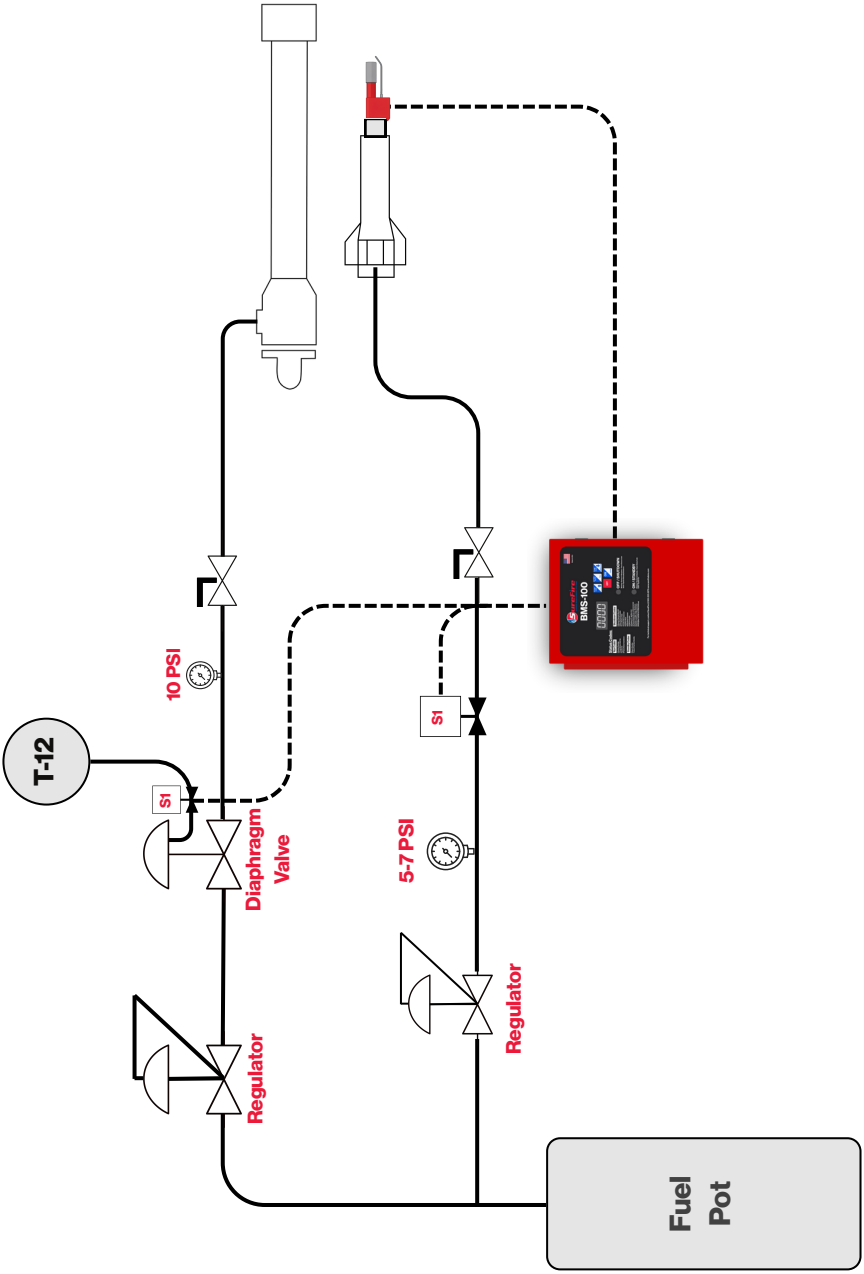
8.1 Combustor Pilot Diagram



8.2 Flare Pilot Diagram



8.3Standing Pilot Diagram



9-10

ELECTRICAL INSTALLATION

WIRING TERMINATION | ELECTRICAL DIAGRAMS SPECIFICATIONS

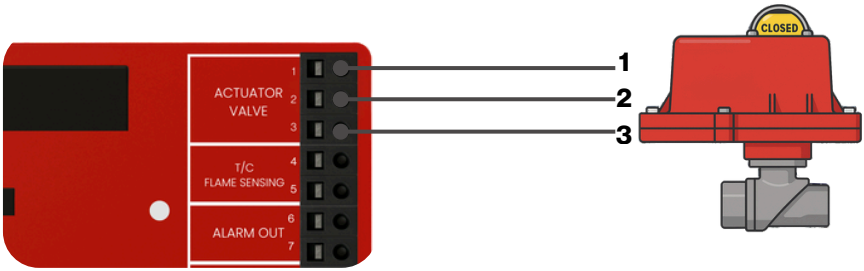
9.1 | Actuator Valve Port

Functions:

Controls the electrical actuation of the SureFire Actuator Valve or a 2nd stage Solenoid Valve.

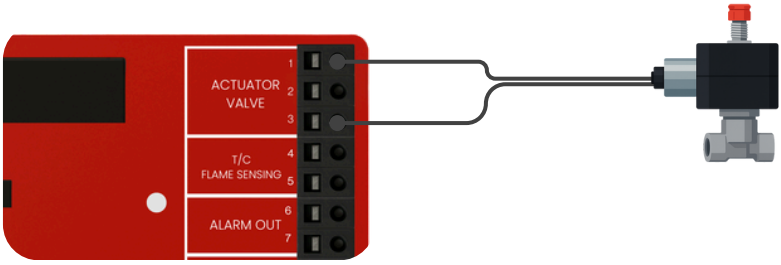
Actuator *Installation:*

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.



Solenoid *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 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 2 wires as shown in the diagram below.



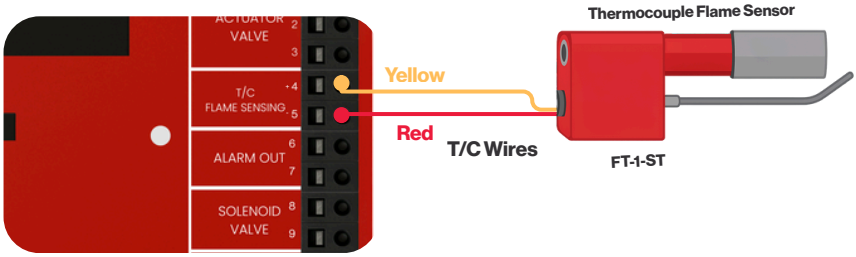
9.2 | Thermocouple Flame Sensing

Functions:

Senses the temperature value of the flame sensing thermocouple on the FT Ignition Unit.

Installation:

1. The thermocouple has 2 wires, a yellow and a red.
   - Yellow = Positive
   - Red = Negative
2. Install a conduit box on the flame arrestor (for firetube applications) for wire termination. For flare applications the FTL-F Ignition Unit includes a conduit box.
3. Run a single pair of wire from the junction box to the BMS-100 enclosure.
   - This wire can be either a type K thermocouple wire or an 18 gauge stranded copper wire.
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.



Flame Sensing Software	*No Flame Present*	*Flame Present*
Delta Based	< 300°F	> 350°F
Percentage Based	20% Decrease (If value < 800°F) or 40% Decrease (If Value > 800°F)	Increase of 20°F

Note: Run the wire from the thermocouple (T/C) directly to the circuit board, ensuring there is only one junction at the T/C. If multiple junctions exist, signal accuracy may be affected.

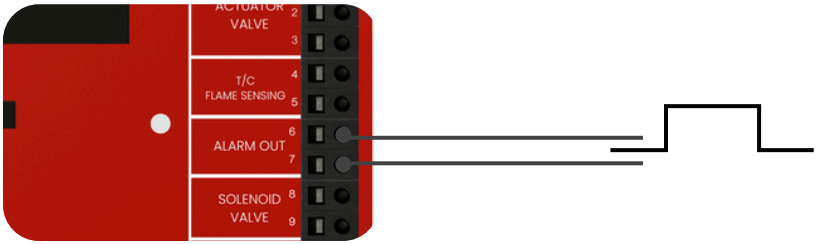
9.3 | Alarm Out

Functions:

Provides remote monitoring of the alarm status via a dry contact.

Installation:

1. Run a single pair of wires from the RTU/PLC back to the BMS-100.
   - This wire can be 18 gauge stranded copper wire.
2. Terminate the 2 wires as shown in the diagram below.



3. This port will be left vacant if not used.
4. Reference the following chart for operational states:

Unit Status	*Alarm Out*	*Green LED*	*Red LED*
Manual OFF	Open	OFF	ON
Shutdown	Open	OFF	Blinking
Standby	Closed	Blinking	OFF
Unit ON (Status Code 00)	Closed	ON	OFF

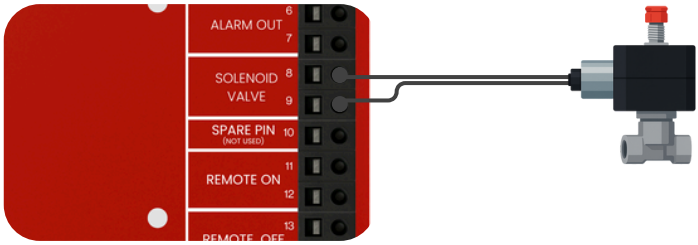
9.4 | Solenoid Valve

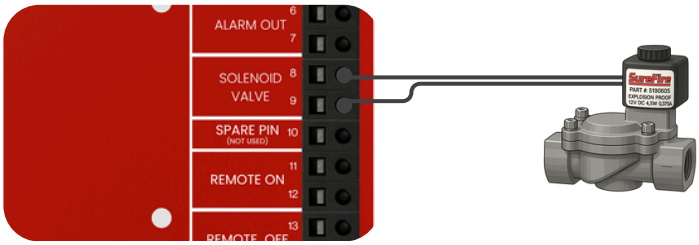
Functions:

Controls the electrical actuation of the solenoid valve for the pilot burner.

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





9.5 | Remote ON

Functions:

To allow remote activation of the BMS-100.

Installation:

1. Run a single pair of wires from the RTU/PLC back to the BMS-100.
   - This wire can be 18 gauge stranded copper wire.
2. Terminate the 2 wires as shown in the diagram below.
3. The remote on receives a signal/continuity from the RTU/PLC to activate the BMS-100.
4. This port will be left vacant if not used.

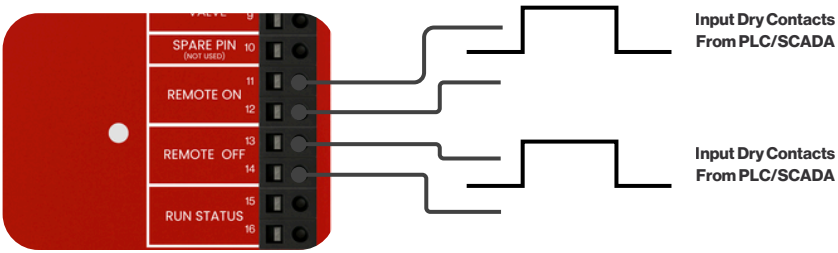
9.6| Remote OFF

Functions:

To allow remote deactivation of the BMS-100.

Installation:

1. Run a single pair of wires from the RTU/PLC back to the BMS-100.
   - 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-100.
4. This port will be left vacant if not used.



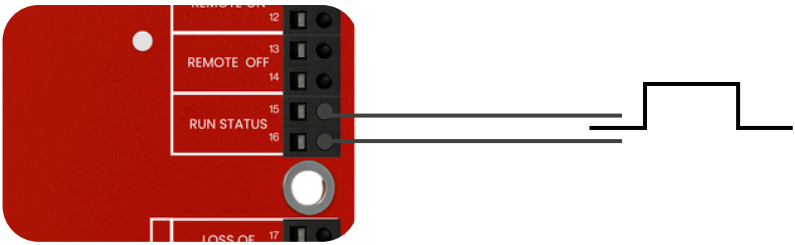
9.7 | Run Status

Functions:

Provides remote monitoring of the run status via a dry contact.

Installation:

1. Run a single pair of wires from the RTU/PLC back to the BMS-100.
   - This wire can be 18 gauge stranded copper wire.
2. Terminate the 2 wires as shown in the diagram below.



3. This port will be left vacant if not used.
4. Reference the following chart for operational states:

Unit Status	Run Status	Green LED	Red LED
Manual OFF	Open	OFF	ON
Shutdown	Open	OFF	Blinking
Standby	Open	Blinking	OFF
Unit ON (Status Code 00)	Closed	ON	OFF

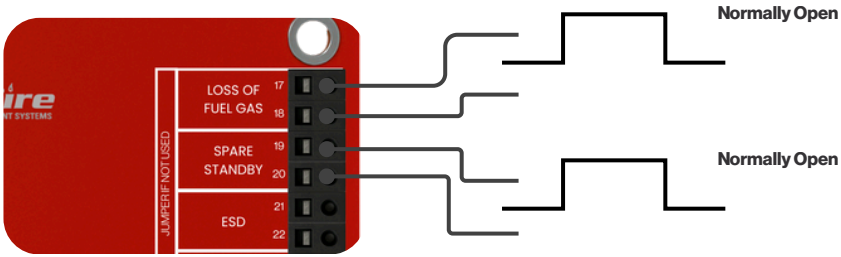
9.8 | Loss Of Fuel Gas And Spare Standby

Functions:

To allow the BMS-100 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-100.
   - 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-100 continues to operate normally.
4. If the terminal port observes no continuity then the BMS-100 will be placed into a standby state.
5. While in a standby state if that terminal port observes continuity the BMS-100 returns to an operational state.
6. If this port is unused, a jumper must be installed in the terminal.



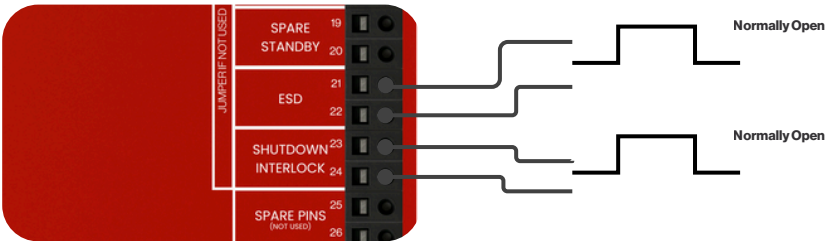
9.9 | ESD And Shutdown Interlock

Functions:

To allow the BMS-100 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-100.
   - 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-100 continues to operate normally.
4. If the terminal port observes no continuity then the BMS-100 will be placed into a shutdown state.
5. In order to return to an operational state, the BMS-100 will require a local restart.
6. If this port is unused, a jumper must be installed in the terminal.

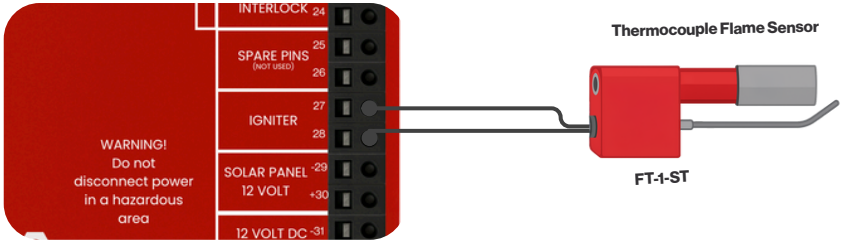


9.10 | Igniter

Functions:
Provides ignition for the FT Ignition Unit.

Installation:

1. The SureFire igniter has two white wires, which are not polarity-sensitive.
2. Install a conduit box on the flame arrestor (for firetube applications) for wire termination. For flare applications the FTL-F Ignition Unit includes a conduit box.
3. Referencing the table below, run the appropriate wire gauge from the junction box to the **BMS-100** enclosure.
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

9.11 | Solar Panel

Functions:

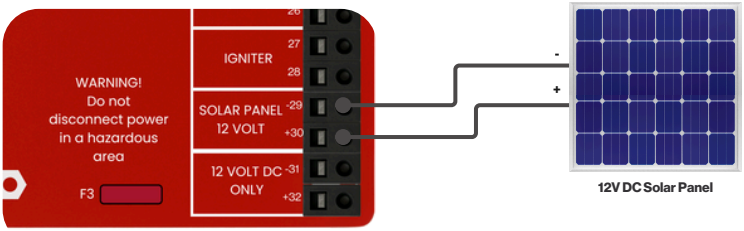
The **BMS-100** has a built-in solar charge regulator that allows a solar panel to charge a battery without the need for an external charge controller.

Installation:

1. Run a pair of 18-gauge, stranded copper wires from the solar panel to the **BMS-100**.
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.



9.12 | 12 VDC ONLY

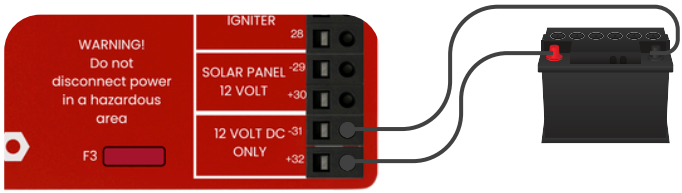
Functions:

This port allows 2 methods of voltage supply to power the **BMS-100**:

- 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-100** 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

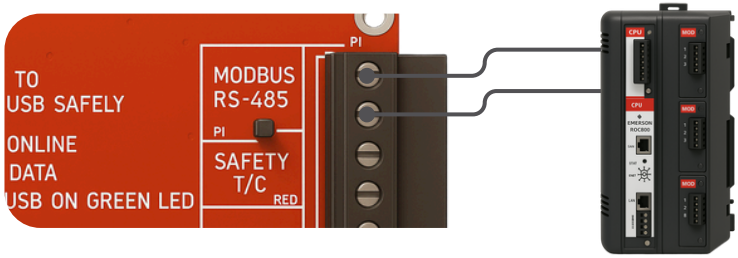
9.13 |Combo Card - Modbus (Optional)

Functions:

To provide RS-485 modbus read only communications.

Installation:

1. Run a single pair of wire from the PLC/RTU to the BMS-100 "**MODBUS RS-485**" port.



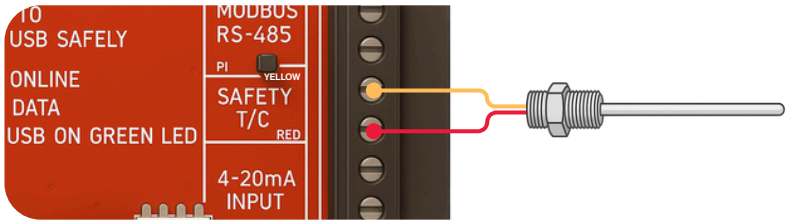
9.14 |Combo Card - Safety T/C (Optional)

Functions:

Senses the temperature value of the Safety Thermocouple.

Installation:

1. The thermocouple has 2 wires, a yellow and a red.
   - Yellow = Positive
   - Red = Negative
2. Run a single pair of wire from the junction box to the BMS-100 enclosure.
   - This wire can be either a type K thermocouple wire or an 18 gauge stranded copper wire.
3. When terminating wires, ensure proper electrical fittings are used to maintain proper operation and moisture resistance.
4. For future troubleshooting, label or color-code all wiring for easy identification.
5. Terminate the 2 wires as shown in the diagram below.
6. If this port is unused, a jumper must be installed in the terminal.



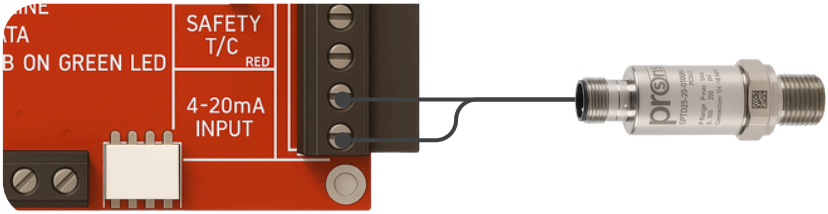
9.15 |Combo Card - 4-20mA Input (Optional)

Functions:

To sense a 4-20mA input signal for a vent valve.

Installation:

1. Run a single pair of wire from the pressure transducer/transmitter to the "4-20mA INPUT".



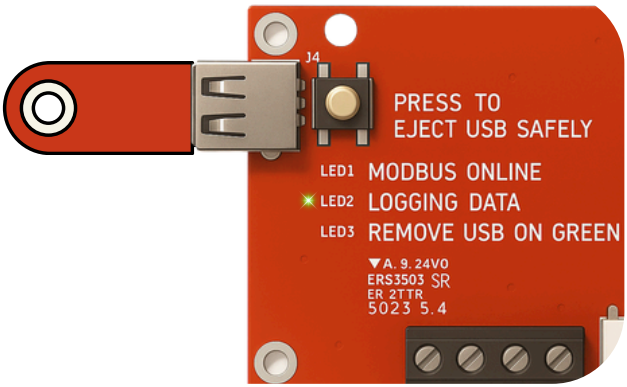
9.16 |Combo Card - Data Logging (Optional)

Functions:

To data log the flame sensing thermocouple's value.

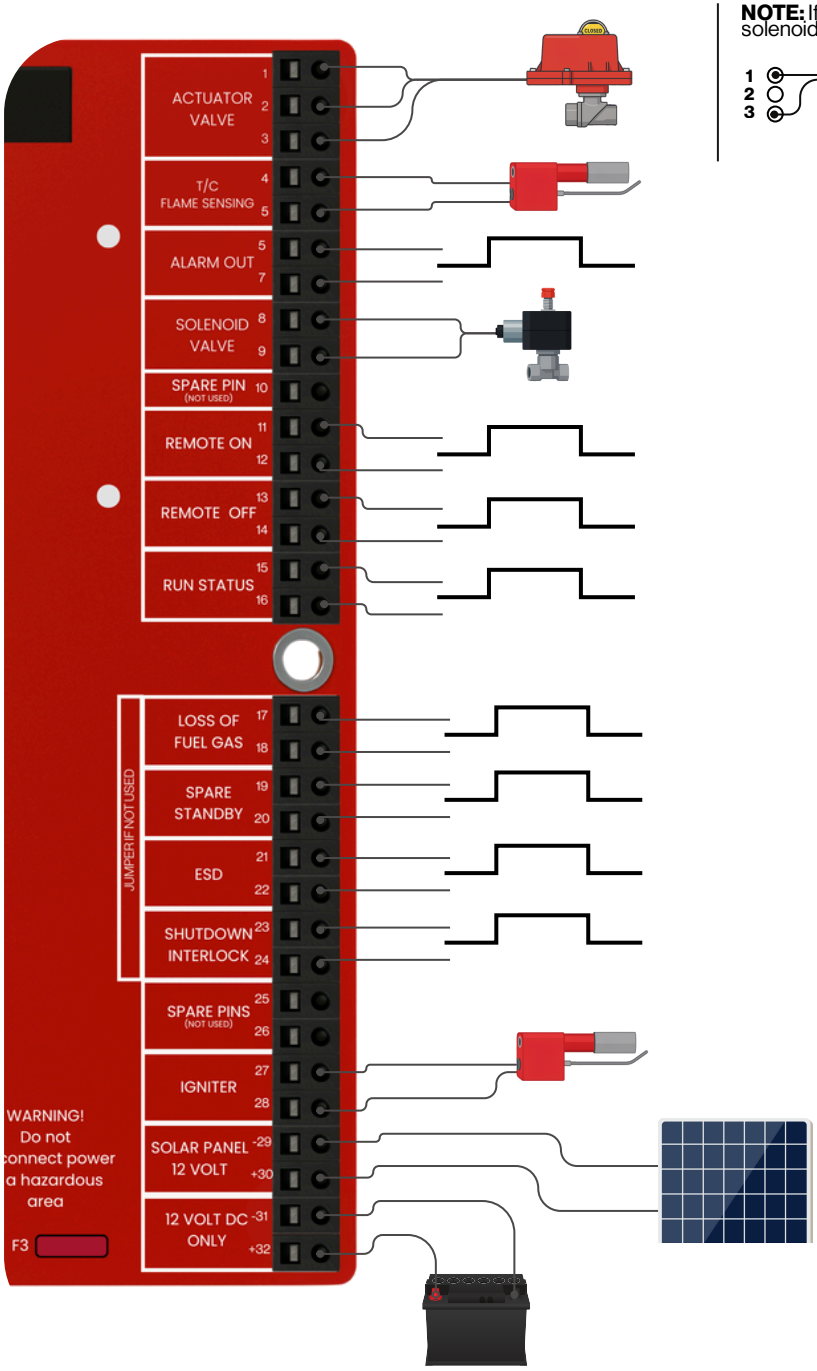
Installation:

1. Install a USB into the USB terminal.
2. Ensure the green LED labeled **LOGGING DATA** is flashing.

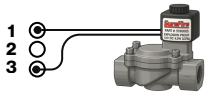


9.17 | BMS-100 Specifications

Power Supply Specifications	
Battery Volts	12 - 13.4 VDC
12 VDC Power Supply	Set @ 13.4 VDC
Solar Panel	12 VDC / 75 W
Max System Amperage	7.8 Amp / 0.6 Amp Avg.
Ignition Unit Specifications	
Ignition Unit @ Inrush	7.5 Amps Inrush
Ignition Unit @ Steady State	2.0 Amps Nominal (during ignition only)
Sensor Specifications	
Standby and Shutdown Switches	Dry Contact Switch (Open / Close Loop)
Remote ON and Remote OFF	Dry Contact Switch (Open / Close Loop)
Battery / Igniter Wiring Requirements	
16 AWG	10 foot length - Copper Stranded
14 AWG	20 foot length - Copper Stranded
12 AWG	30 foot length - Copper Stranded
Relay Specifications	
Stage 1 Solenoid Valve Load	12 VDC, 60 Watt MAX
Actuator Valve Load	12 VDC, 60 Watt MAX
Other	
Fuses: F3 and F5	10 Amps



NOTE: If using a solenoid use ports 1 & 3.



11-13

SYSTEM SETUP

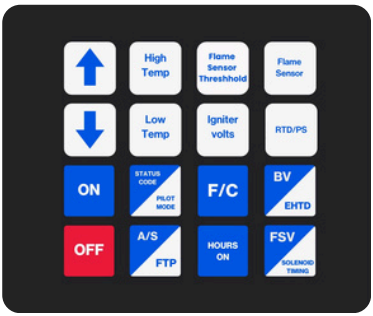
SYSTEM SETUP | MENU | MODBUS

11.1 | Unlocking the System

- Press and hold the **OFF** button to unlock the system.
- The system will display **0000** to indicate the system is unlocked.
- Then the display will flash **OFF**.

11.2 | Navigating the Menu

- **Press the Battery Volts button** to open or enter the menu.
- **Press the Status Code / Up Arrow button** to increase the displayed selection.
- **Press the Flame Value / TC HTS button** to decrease the displayed selection.
- **Press the ON button** to accept the newly selected value and return to the menu.



11.3 | Locking the System

- Press and hold the **OFF** button to lock the system.
- The system will display **1111** to indicate the system is locked.
- The system must be locked in order to turn it on and run through a sequence.

11.4 | Mode S-01 (Flame Sensing)

Functions:

- To select the sensing and loss of flame operation on the flame sensing thermocouple.

Flame Sensing Software	*No Flame Present*	*Flame Present*
0 Delta Based	< 300°F	> 350°F
***1** Percentage Based	20% Decrease (If value < 800°F) ***or*** 40% Decrease (If Value > 800°F)	Increase of 20°F

***Default setting**

11.5 | Mode S-02 (Maximum Retry)

Functions:

- To select the maximum number of consecutive unsuccessful ignition attempts.

Default Setting	*Minimum*	*Maximum*
3 Attempt	1 Attempt	9999 Attempts

11.6 | Mode S-03 (Pre-Purge Timing)

Functions:

- To select the timing allotted prior to an ignition attempt allowing raw combustible gas to purge for safety purposes.

Default Setting	*Minimum*	*Maximum*
3 Minutes	1 Second	10 Minutes

11.7 | Mode S-04 (Safety Thermocouple Threshold)

Functions:

- To select the temperature threshold in which the safety thermocouple's value must exceed in order to detect an extreme high temperature scenario.

Default Setting	*Minimum*	*Maximum*
1900°F	100°F	2450°F

11.8 | Mode S-05 (Low Pressure Setpoint)

Functions:

- To select the ounce setpoint that will determine at what input pressure the actuator valve/vent valve will close.

Default Setting	*Minimum*	*Maximum*
1.0oz	**0.5oz**	**10.0oz**

11.9 | Mode S-06 (High Pressure Setpoint)

Functions:

- To select the ounce setpoint that will determine at what input pressure the actuator valve/vent valve will open.

Default Setting	*Minimum*	*Maximum*
2.0oz	**2.0oz**	**20.0oz**

11.10 | Mode S-07 (Pressure Transmitter Scaling)

Functions:

- To select the input 4-20mA scaling based on the utilized pressure transmitter.

inH2O Transmitter Type	
*0	0-50 inH2O
1	0-100 inH2O

***Default setting**

11.11 | Mode S-08 (Actuator Valve Port Operation)

Functions:

- To select the functionality or signal in which the actuator valve port is energized or de-energized.

Actuator Settings	
0	Energizes and de-energizes according to the 4-20mA signal and the pressure setpoints established in mode S-05 and S-06.
*1	Energizes 30 seconds after the stage 1 solenoid is energized.

***Default setting**

11.12 | Mode S-09 (Combination Card Status)

Functions:

- To select whether or not the combination card is being utilized.

Combination Card Status	
*0	The Combination Card is not in use.
1	The Combination Card is in use.

***Default setting**

11.13 | Mode S-10 (Modbus Address)

Functions:

- To select the specific Modbus address designated to the system.

Default Setting	*Minimum*	*Maximum*
0	0	100

11.14| Mode S-11-15 (Data Logging Setup)

Functions:

- To select the date and time for the data logging function.
- The BMS-100 records a data point every 15 minutes.

Mode	*Description*
S-11	Sets the **minute** value
S-12	Sets the **hour** value
S-13	Sets the **day** value
S-14	Sets the **month** value
S-15	Sets the **year** value

12.1 | Introduction

Introduction

The Modbus communication for the BMS-100 is facilitated through an intermediary circuit board, the BMS-100 Combination Card.

This Combination Card includes the following key functions:

- Acts as the Modbus PLC / RTU slave
- Relays command data to the BMS-100 board

The Combination Card functions as a specialized mailbox, maintaining a setup of holding registers accessible by both the BMS-100 Controller and PLC / RTU Master.

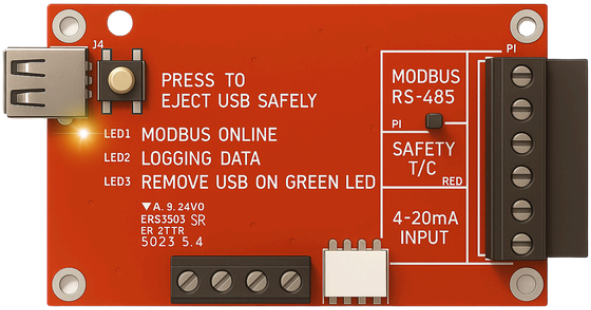
12.3 | Modbus Register Overview

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

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

12.4 | Modbus Visual Indication

- The Combination Card includes LED indication of the communication between the Modbus master (PLC/RTU) and the Modbus slave (Combination Card)



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

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 40027
Modbus Address
Reference 11.13
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	Flame Sense Thermocouple Value	Bit 9 ... 0 = 0°F - 2400°F
40003	Igniter Ohm Value	Bit 9 ... 0 = 0Ω - 40Ω
40004	Combination of all Digital Switches	Single Bit Information

Modbus Register	Register Name	*Notes*
40005	Battery Volts	Bit 9 ... 0 = Voltage value i.e. 144 = 14.4 VDC
40006	Flame Sense Type ***Mode S-01***	0 = Delta Type 1 = Percentage Type
40007	Max Retry Setpoint ***Mode S-02***	Bit 9 ... 0 = 1 – 9999 Attempts
40008	Pre-Purge Timing Setpoint ***Mode S-03***	Bit 9 ... 0 = 1 – 600 Seconds
40009	Safety Thermocouple Setpoint ***Mode S-04***	Bit 9 ... 0 = 100°F - 2400°F
40010	Low Pressure Setpoint ***Mode S-05***	Bit 9 ... 0 = .5 oz – 10 oz
40011	High Pressure Setpoint ***Mode S-06***	Bit 9 ... 0 = 2oz – 20 oz
40012	Pressure Scaling Type ***Mode S-07***	0 = 0-50inH20 1 = 0-100 inH20
40013	Actuator Operation Setpoint ***Mode S-08***	0 = 4-20mA Input 1 = Timing
40014	4-20mA Input Signal in Ounces – Live	Bit 9 ... 0 = 0oz – 57.8 oz
40015	Safety Thermocouple Value – Live	Bit 9 ... 0 = 0°F - 2400°F
40016	Loss of Fuel Gas – Status	0 = Not Active – No Errors 1 = Active

Modbus Register	Register Name	*Notes*
40017	Spare Standby – Status	0 = Not Active – No Errors 1 = Active
40018	ESD	0 = Not Active – No Errors 1 = Active
40019	Shutdown Interlock	0 = Not Active – No Errors 1 = Active
40020	Run Status	0 = Active 1 = Not Active
40021	Alarm Out	0 = Active 1 = Not Active
40022	Not Used	Not Used
40023	Data Logging Minute Value	Bit 9 ... 0 = Active Data
40024	Data Logging Hour Value	Bit 9 ... 0 = Active Data
40025	Data Logging Day Value	Bit 9 ... 0 = Active Data
40026	Data Logging Month Value	Bit 9 ... 0 = Active Data
40027	Data Logging Year Value	Bit 9 ... 0 = Active Data

13

SYSTEM OPERATION

SEQUENCE OF OPERATION | FLOW CHARTS
TROUBLESHOOTING GUIDE

13.1 | Sequence of Operation

1. Press the **ON** button.
2. The 180 second pre-purge countdown begins.

NOTE: Pre-purge is adjustable in mode S-03.

Display Value	Status Code	*Flame Value*	*LED Indicator*
180 Second Countdown	1 Purge Before Startup	Ambient Temperature	

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

3. Once the pre-purge countdown ends, the 5 second audible alarm will begin.

Display Value	Status Code	*Flame Value*	*LED Indicator*
5 Second Countdown	4 5 Second Alarm	Ambient Temperature	

4. Once the audible alarm ends, the SureFire Igniter will be energized for 8 seconds.

Display Value	Status Code	*Flame Value*	*LED Indicator*
8 Second Countdown	5 Igniter ON	Ambient Temperature	

5. The Solenoid Valve is energized and the igniter remains on for an additional 5 seconds.

Display Value	Status Code	*Flame Value*	*LED Indicator*
5 Second Countdown	5 Igniter ON	300-1500 Flame Value Increases Pending Ignition	

6.The SureFire Igniter is de-energized and a 30 second flame proof countdown begins.

Display Value	Status Code	*Flame Value*	*LED Indicator*
30 Second Countdown	8 Flame Sense Countdown	300-1500 Flame Value Increases Pending Ignition	

7. Pilot burner ignition is achieved, the pilot flame is sensed, the flame proof countdown ends, and the actuator valve will now be energized based on mode S-08.

NOTE:

- The flame sensing process is determined in mode S-01.
- The display value is determined in mode S-08.

Mode S-08	*Display Value*	Status Code	*Flame Value*	*LED Indicator*
0	0-20 Ounces	00 System Running	350-1500	●
1	ON	00 System Running	350-1500	●

13.2 | Sequence of Operation - Flame Out/Re-Ignition Process

1. The system is in a run state, the pilot burner is running, and the status code is 00.
2. The pilot flame is extinguished.

Display Value	Status Code	*Flame Value*	*LED Indicator*
ON	00 System Running	350-1500 Flame Value Decreasing	●

3. The flame sense thermocouple's value decreases below the threshold/delta setting.

NOTE: The flame loss process is determined in mode S-01.

4.The Solenoid Valve and Actuator Valve are de-energized initiating the pre-purge countdown and ignition processes. ***Reference 13.1.2***

13.3 | Sequence of Operation - Standby/Re-Ignition Process

1. The system is in a run state, the pilot burner is running, and the status code is 00.
2. An external device has placed the BMS in a standby state.

NOTE: The loss of fuel gas/spare standby terminal ports are observing no continuity. ***Reference 8.7***

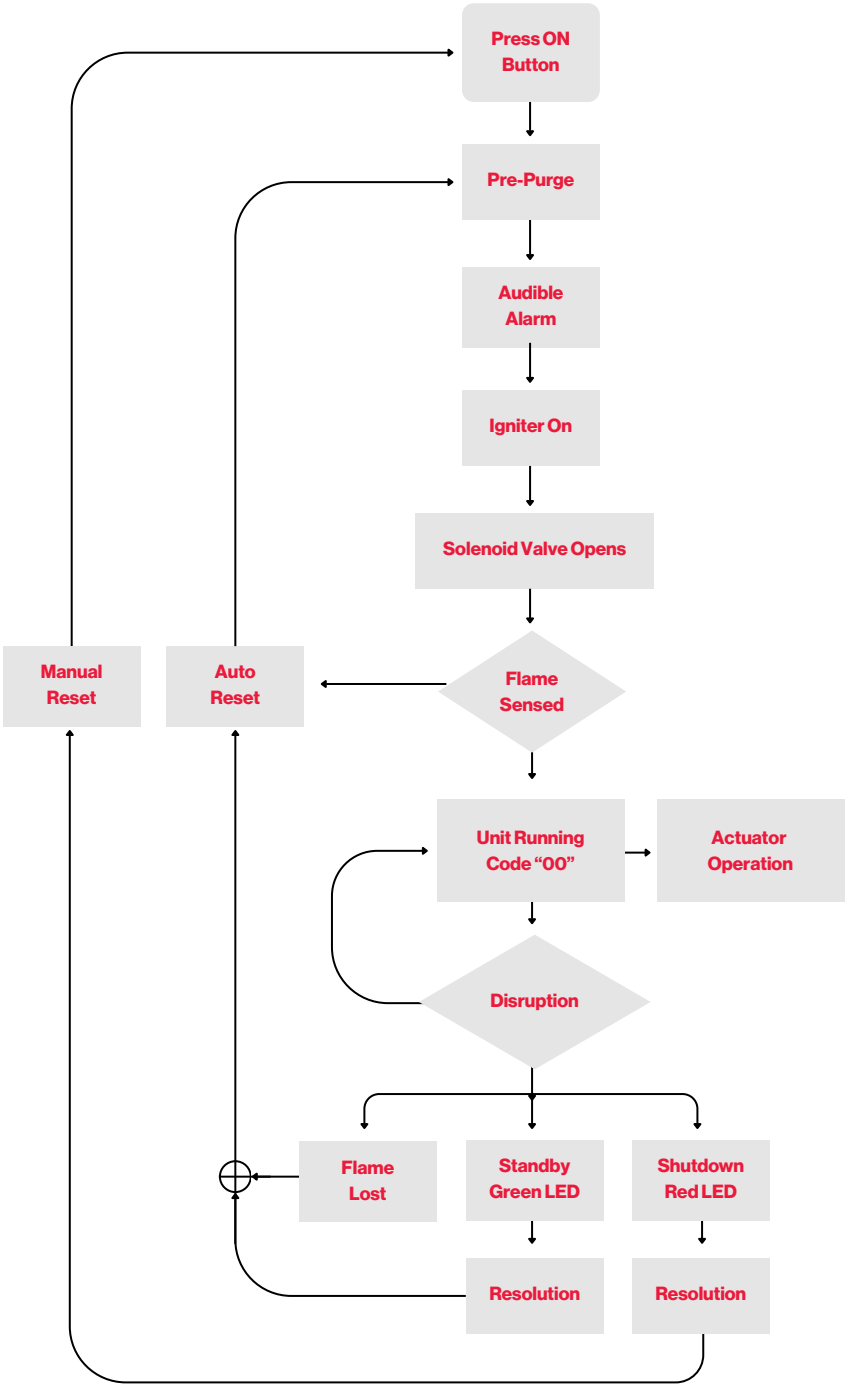
Display Value	Status Code	*LED Indicator*
OFF	or 6 7	● Flashing

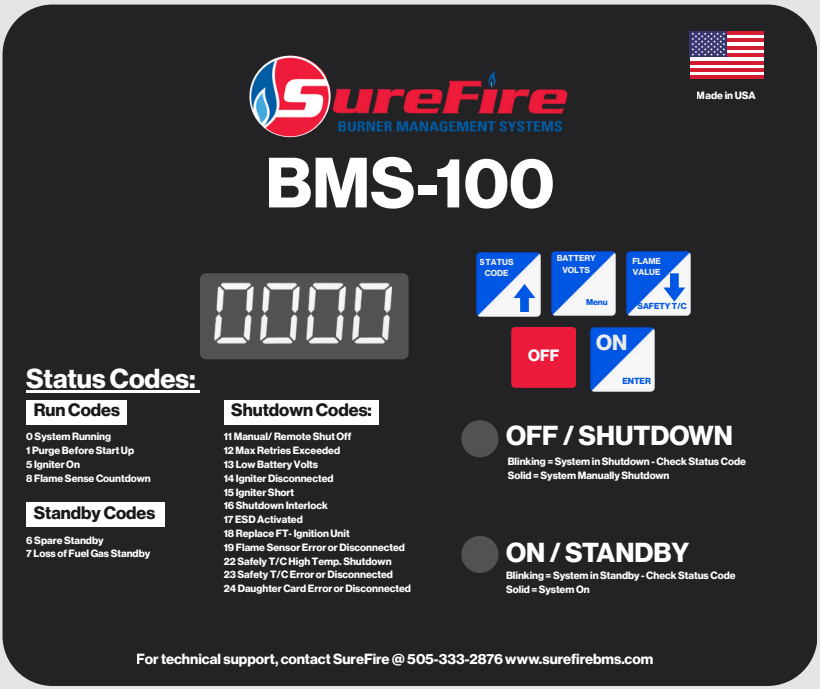
13.4 | Sequence of Operation - Shutdown/Re-Ignition Process

1. The system is in a run state, the pilot burner is running, and the status code is 00.
2. The system is placed into a shutdown state.

Display Value	Status Code	*LED Indicator*
OFF	12 to 24	Flashing

3. The shutdown state needs to be resolved. **Reference 15.3 for troubleshooting.**
4. Once the shutdown state has been resolved press the **OFF** button, then the **ON** button to restart the ignition sequencing. **Reference 13.1**


Press ON Button
Pre-Purge
Audible Alarm
Igniter On
Solenoid Valve Opens
Flame Sensed
Manual Reset
Auto Reset
Unit Running Code "00"
Actuator Operation
Disruption
Flame Lost
Standby Green LED
Shutdown Red LED
Resolution
Resolution



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	• Pilot flame is present • Solenoid valves are open • No errors	• Normal operation — no interaction required • The display reads ON or shows the input 4–20 mA value in oz	
01 Purge Before Start-up	• Pilot flame is not present • Solenoid valves are closed • No errors	• Normal operation — no interaction required • The display shows the pre-purge countdown	
04 5 Second Alarm	• Pilot flame is not present • Solenoid valves are closed • No errors	• Normal operation — no interaction required • The display shows a 5-second countdown • Ignition warning buzzer is activated (120 dB) • This warns that the ignition process is about to begin	
05 Igniter On	• The igniter is energized • Pilot flame is not present • Solenoid valves are closed • No errors	• Normal operation — no interaction required • The display shows an 8-second countdown • If a pilot solenoid valve is not being used, the pilot burner will ignite at this point	

14.2 | Standby Codes:

Status Code	Event Description	Corrective Action	LED Indicator

06
Spare Standby
	• Pilot 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, the system will enter a standby 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 and the system will automatically restart the ignition process
			Flashing

07
Loss of Fuel Gas Standby
	• Pilot 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, the system will enter a standby 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 and the system will automatically restart the ignition process
			Flashing

14.2 | Standby Codes:

Status Code	Event Description	Corrective Action	LED Indicator

08
Flame Sense Countdown
	• The system is monitoring the flame sense thermocouple for the presence of the pilot flame
	• The pilot solenoid valve is open
		• Normal operation
		• If combustion has occurred:
		• (If the FTL-F Pilot series is being utilized) multiple loud pops will be heard — this is the flame front generation process occurring
		• Consistently press the flame value button to observe the flame sense thermocouple's temperature value
		• The temperature value should be increasing
		• Once the temperature value has increased beyond the required level (reference 11.4), the flame sense countdown will be bypassed and the system will enter a run state
		• If combustion has not occurred:
		  ◦ Consistently press the flame value button to observe the flame sense thermocouple's temperature value
		  ◦ The temperature value will not increase
		• Once the flame sense countdown (30 seconds) ends, the system will either return to the pre-purge countdown or shut down on maximum retries
			Flashing

14.3 | Shutdown Codes:

Status Code	Event Description	Corrective Action	LED Indicator
II Manual/Remote	• Pilot 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	

Status Code	Event Description	Corrective Action	LED Indicator

12
Max Retries Exceeded
	• Pilot flame is not present
	• Solenoid valves are closed
	• The system has attempted the ignition process and failed in sequential attempts (reference 11.5)
	• 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 flare/ECD piloted application:
		  ◦ Ensure all orifices, Y strainers, and FTL-F pipe (¾") are free of debris or blockage and that pilot fuel is being supplied (8–12#)
		  ◦ If ignition "popping" is occurring but a pilot isn't being established, review the pilot side of the system
		  ◦ If ignition "popping" is not occurring, review the flame front/ignition side of the pilot
		  ◦ If the pilot is being established but the flame strength value is not increasing, there may be a positioning issue or damage to the flame sense thermocouple
		• If a fired equipment piloted application:
		  ◦ Ensure the pilot mixer is free of debris and that pilot fuel is being supplied (3–7#)
		  ◦ Ensure the pilot orifice is sized at #72
		  ◦ If ignition is not occurring, verify the igniter, fuel supply, or power conditions
		  ◦ If the pilot is being established but the flame strength value is not increasing, there may be a positioning issue or damage to the flame sense thermocouple
			
			Flashing

14.3 | Shutdown Codes:

Status Code	Event Description	Corrective Action	LED Indicator
13 Low Battery Voltage	• Pilot flame is not present • Solenoid valves are closed • The system will not restart if the OFF and ON buttons are pressed	• 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 Disconnected
	• Pilot 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

14.3 | Shutdown Codes:

Status Code	Event Description	Corrective Action	LED Indicator

15
Igniter Short
	• Pilot 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 damaged or shorted, the resistance will read an elevated value, 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 shorted 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
Shutdown Interlock
	• Pilot flame is not present
	• Solenoid valves are closed
	• No activity when attempting to start up the system
		• Ports #23 and #24 are experiencing an open circuit
		• If this port observes no continuity, the system will enter a shutdown 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 require a local reset to restart the ignition process
			Flashing

17
ESD Activated
	• Pilot flame is not present
	• Solenoid valves are closed
	• No activity when attempting to start up the systema
		• Ports #21 and #22 are experiencing an open circuit
		• If this port observes no continuity, the system will enter a shutdown state
		• Verify if an external device is connected to these ports
		  ◦ If not, ensure a jumper is fastened securely in ports #21 and #22
		• 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
18 Replace FT-Ignition Unit	• Pilot 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 worn, the resistance will read greater than 10 ohms, requiring a replacement igniter or FT ignition unit	Flashing
19 T/C Flame Sensor Error or Disconnected	• Pilot flame is not present • Solenoid valves are closed • The system will not restart if the OFF and ON buttons are pressed	• The flame sensing thermocouple is either disconnected or faulty • Verify the wiring connections to ensure there are no breaks or disconnected wires • If the thermocouple is wired correctly, press the flame value button. If 2450 is shown, this indicates the thermocouple is faulty and needs replacement	Flashing
20 Solenoid Disconnected	N/A	• Shutdown code is inactive. If the shutdown code is needed, please contact SureFire Tech Support.	N/A
21 Solenoid Short	N/A	• Shutdown code is inactive. If the shutdown code is needed, please contact SureFire Tech Support.	N/A
22 Safety T/C High Temp. Shutdown	• Pilot flame is not present • Solenoid valves are closed • The system will not restart if the OFF and ON buttons are pressed	• The safety thermocouple's high temperature setpoint has been exceeded (reference 11.4) • Determine the cause of the elevated temperature condition, resolve it, and restart the system	Flashing
23 Safety T/C Error or Disconnected	• Pilot flame is not present • Solenoid valves are closed • The system will not restart if the OFF and ON buttons are pressed	• The safety thermocouple is either disconnected or faulty • Verify the wiring connections to ensure there are no breaks or disconnected wires • If the thermocouple is wired correctly, press and hold the flame value button. If 2450 is shown, this indicates the thermocouple is faulty and needs replacement	Flashing

14.3 | Shutdown Codes:

Status Code	Event Description	Corrective Action	LED Indicator
24 Combination Card Disconnected	• Pilot flame is not present • Solenoid valves are closed • The system will not restart if the OFF and ON buttons are pressed	• Verify S-09 is set accordingly (reference 11.12) • If the combo card is present, remove all input voltages • Wait for 15 seconds, then reapply the input voltage • Restart the start-up sequence	 Flashing

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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