SureFire
iBURNER MANAGEMENT SYSTEMS

INSTALLATION & OPERATIONS MANUAL

SureFire
BMS-300

Made in USA

- System ON
- System OFF
- Igniter On
- Burner Running

Note: If any lights are Blinking, please check Status Code.
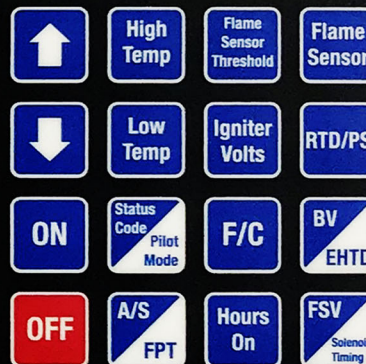
Status Codes:

Run Codes:
- 00 System Running
- 24 Pre-Purge on Startup
- 01 Waiting for startup signal
- 08 Purge between Ignition Attempts
- 09 Waiting for main valve to open.

Standby Codes:
- 02 Standby Interlock
- 03 Spare Standby 1
- 04 Spare Standby 2

Shutdown Codes:
- 11 Manual / Remote Shut Off
- 12 Max Retries Exceeded
- 13 Low Battery Volts
- 14 Igniter Short Circuit
- 15 Igniter Open Circuit
- 16 Flame Sensed Before Startup
- 18 Extreme High/Low Temp, Check RTD
- 19 Shutdown Interlock
- 20 ESD Activated
- 21 Main Fuel Valve Failure
- 22 Flame Sensor Problem

Keypad buttons:
↑ | High Temp | Flame Sensor Threshold | Flame Sensor
↓ | Low Temp | Igniter Volts | RTD/PS
ON | Status Code / Pilot Mode | F/C | BV / EHTD
OFF | A/S / FPT | Hours On | FSV / Solenoid Timing

Flame Sensor = Switches between F-Flame Rod or I=Igniter
RTD/PS = Switches between O=RTD or P=Pressure Switch
A/S = Ignition Attempts and Successful Ignitions
FSV = Flame Strength Value
FPT = Flame Proof Timing

For technical support,
contact SureFire @ 505-333-2876
www.SureFire-Controls.com

PROUDLY MADE IN THE USA

Table of Contents

BMS-300 System Introduction

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

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

This burner management system is suitable for use in **Class 1, Division 2, Groups C and D, T6 Hazardous (Classified) and Ordinary Location.**

The system monitors target temperature with an enhanced RTD circuit and detects temperatures from 0°F to 490°F. The system controls both the pilot and main burner gas valves as necessary and is designed as a fail safe system. High temperature and flame failure shutdowns are available along with an audible startup warning. The system's fail safe run status alarm function allows for remote monitoring for environmental and regulatory compliance. Standard remote features include temperature indication, remote ON and OFF utilizing an RTU or PLC, and Modbus read only communication through RS-485 or RS-232.

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

Every SureFire system must pass complete factory QA/QC inspections before shipment.

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.

Certifications and Warnings

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

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

CERTIFIED TO:

CSA STD C22.2 NO. 61010-1

CSA STD C22.2 NO. 213:2017 Ed.3

Intertek

CONFORMS TO:

UL STD 61010-1

UL STD 121201:2017 Ed.9

WARNING
EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2;
AVERTISSEMENT
RISQUE D'EXPLOSION – LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATE-RIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE I, DIVISION 2

WARNING
EXPLOSION HAZARD - DO NOT REPLACE FUSES UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS;
AVERTISSEMENT
RISQUE D'EXPLOSION - COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX AVANT DE REPLACER LE FUSE.

WARNING
EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS;
AVERTISSEMENT
RISQUE D'EXPLOSION - AVANT DE DECONNECTER L'EQUIPEMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DESIGNE NON DANGEREUX.

WARNING
EXPOSURE TO SOME CHEMICALS MAY DEGRADE THE SEALING PROPERTIES OF MATE-RIALS USED IN THE FOLLOWING DEVICES: Panasonic Relay, Model JW2SN-DC12V, and Hamlin Relay, Model HE721A0500
AVERTISSEMENT
L'exposition à certains produits chimiques peuvent dégrader les FERMETURE PROPRIETES des maté-riaux utilisés dans les appareils suivants: Panasonic Relais, modèle JW2SN-DC12V, et Hamlin Relais, modèle HE721A0500

Warranty and Return Policy

SureFire Warranty Statement:

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

Product Description	Warranty Policy Defective Products	Return Policy Customer Return New Product
SureFire Controllers: BMS-300, BMS-100, Flare-100 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.

Shipping Cost:

For Warranty Claims, the shipping cost incurred by shipping the product from the customer to SureFire will be at the expense of the customer. If the product is deemed under warranty by SureFire, then the shipping cost incurred by shipping the product from SureFire to the customer will be at the expense of SureFire. If the product is deemed non-warranty by SureFire, then the shipping cost incurred by shipping the product from SureFire to the customer will be at the expense of the customer.

Enclosure:

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

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

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

The Enclosure is IP66 certified and has been tested to the following to meet certification:

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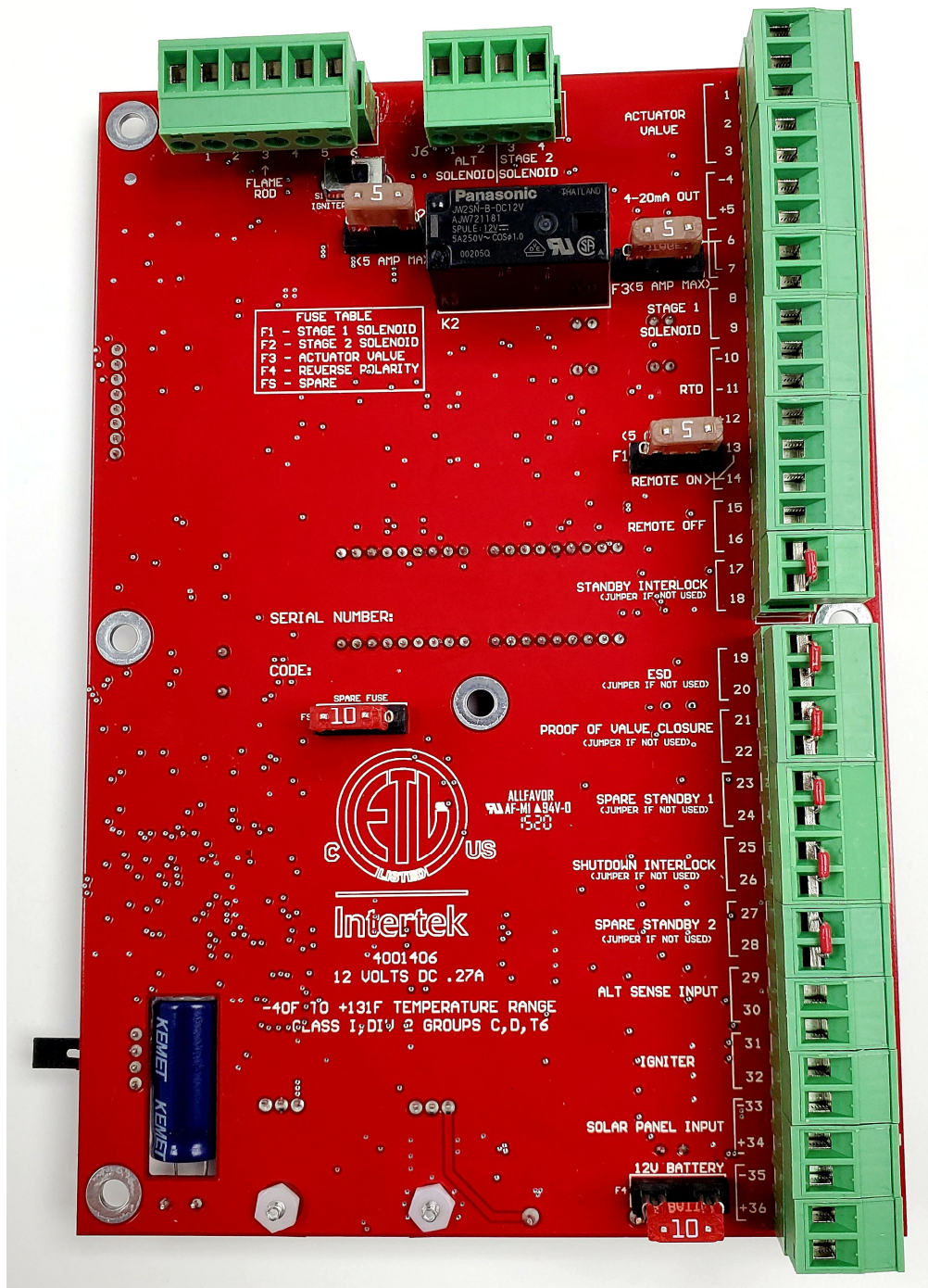
WARNING:

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

BMS-300 Circuit Board:

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

LED Indicators:

The circuit boards LEDs illuminate through the lid of the enclosure. The LED's 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 igniter is on.
	Blinking - Indicates an igniter failure.
BLUE	LED ON - Indicates stage 1 solenoid and/or actuator has opened

Graphic Overlay:

The overlay is used for interfacing with the system to acquire system data. The overlay also provides a list of status codes and a display window that shows data, settings and information.

BMS-300 Description

16 Button Keypad:

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

Button	Displayed Value / Functional Operation
Up Arrow	♦ Increases the current value. Press & hold with the Hours On button for 5 seconds to unlock the system.
Down Arrow	♦ Decreases the current value
High Temp	♦ Displays High Temperature setpoint
Low Temp	♦ Displays Low Temperature setpoint
Flame Sensor Threshold	♦ 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 I = Igniter
RTD/PS	♦ Displays current controlling device 0 = RTD P = Alternative Sensor
ON	♦ Turns system ON
OFF	♦ Turns system OFF
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 unit
Battery Volts	♦ 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.

SureFire FT-Series Ignition Units:

The SureFire BMS-300 is compatible with the listed FT series igniters. Each unit is designed for specific fire tube applications and comes with an armored wiring harness suitable for high temperature application. The SureFire FT series ignition units have been designed for both piloted and pilotless applications.

Piloted System:

The FT-1 Ignition units are designed for piloted application with igniter or flame rod flame sensing devices. The FT-1 Ignition units are used in a piloted application with burners ranging from **125,000BTU/HR to 10MM BTU/HR.**

Optional Flame Sensors:

Flame Rod:

♦ Kanthal flame rod rated 2600°F
♦ Armored wiring harness to 500°F duty / 800°F flash
♦ Direct termination to BMS-300 controller

For proper pilot placement and flame sensing selection, contact SureFire Tech Support @ 505-333-2876 or the local SureFire representative

SureFire Ignition Units

Pilotless System:

The FT-2, FT-4 and FT-6 Ignition units are designed for pilotless applications with a flame rod flame sensing device. These three ignition units are used in pilotless fire tube applications for horizontal treaters with the following BTU/HR burner ratings.

♦ FT-2 Systems (1") are rated for **125,000BTU/HR**
♦ FT-4 Systems (2") are rated for **500,000BTU/HR**
♦ FT-6 Systems (3") are rated for **1,000,000BTU/HR**

The FT-4-VT and FT-6-VT ignition units are designed for pilotless applications for vertical treaters and have the same BTU/HR burner ratings as above.

Flame Rod:

♦ Kanthal flame rod rated 2600°F
♦ Armored wiring harness to 500°F duty / 800°F flash
♦ Direct termination to BMS-300 controller

For proper pilotless ignition unit and orifice sizing, contact tech support @ 505-333-2876 or the local SureFire representative

1" SureFire Actuator:

♦ Control the main fuel gas to the main burner.
♦ Factory programmed and pre-wired so no adjustment is necessary.
♦ 3 wire termination.
♦ Proof of valve closure switch kit available
♦ Applications include– non-venting pilotless fuel trains, double block fuel trains, fuel trains for combustors and flare systems.

1" & 2" SureFire Solenoid Valve:

♦ Fail-closed device.
♦ No adjustment necessary.
♦ Simple termination and installation.
♦ Kalrez elastomer plunger.
♦ Plunger replacement kits available.
♦ Applications include– non-venting pilotless fuel trains, double block fuel trains, fuel trains for combustors and flares systems.
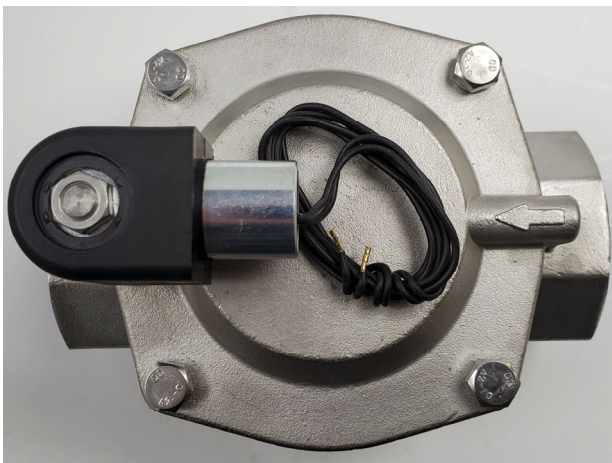
SureFire Additional Components

1/4" ASCO Solenoid Valve:

♦ Fail closed device.
♦ No adjustment necessary.
♦ Simple termination and installation.
♦ Applications include– direct pilot (#72 orifice) and pneumatic valve operation.

1/2" Pressure Switch:

♦ Used on a variety of standbys and shutdowns
♦ Can be set as normally open or normally closed.
♦ Adjustable from 1 psi — 15 psi.
♦ 316 SS construction, wetted parts are NACE

1/2" Resistance Temperature Detector:

♦ Detects the process temperature.
♦ Simple three wire termination.
♦ Available in: 5", 6", 9"and 12"

1/4" Slow Flow Valve:

♦ Reduces the inrush of fuel gas into the diaphragm valve for smooth and reliable ignition.
♦ Required on all pilotless installations when not using an actuator valve.
♦ Recommended for piloted installations

SureFire BMS-300 Enclosure:

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

WARNING:

♦ Before any welding is attempted, 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 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.

SureFire FT-Series Ignition Unit:

1. Ensure supply gas is turned off and locked out/ tagged out.
2. Install the FT unit in fire tube.
3. The igniter has two white wires that are not polarity sensitive. Terminate wires to ports 31 & 32. See illustration below.

Flame Rod Flame Sensing:

Piloted and Pilotless ignition units are wired the same as below.

1. Terminate flame rod wire at designated port on upper left hand corner of the circuit board. Terminate to port 3 on the J5 block.
2. Isolated grounding is required. Terminate ground wire to circuit board labeled Earth Ground and ground screw on GUA on arrestor housing.
3. Flame sensing switch needs to be on Flame Rod.

NOTES:
♦ Please do not bond the flame sensing ground to facility ground to avoid flame sensing disruption.
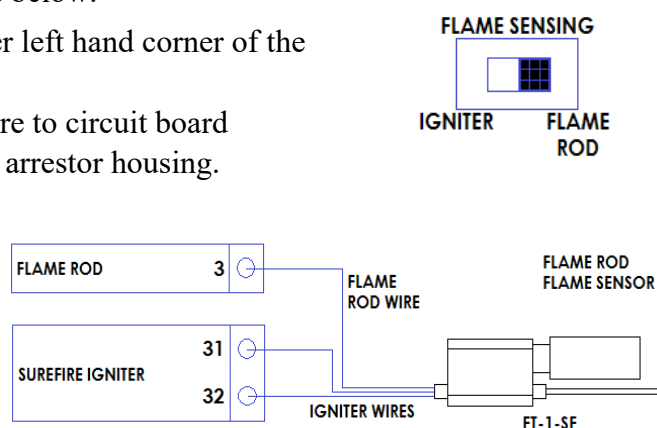
For proper FT unit positioning, contact tech support @ 505-333-2876 or the local SureFire representative

Piloted System:
1st and 2nd Stage Solenoid Valve

1. Ensure main supply gas is shut off.
2. Locate the pilot gas supply line and instrument gas supply line controlling the main burner control valve.
3. Install 1st stage solenoid down stream of the pilot regulator.
4. Install 2nd stage solenoid in the appropriate location to actuate the main burner control valve.
5. Cut and bend custom 3/8" tubing and connect to tubing fittings on solenoids.
6. Terminate 1st and 2nd stage solenoid wires.

NOTES:
♦ ASCO Solenoid proper flow direction: 2 = Inlet and 1 = Outlet
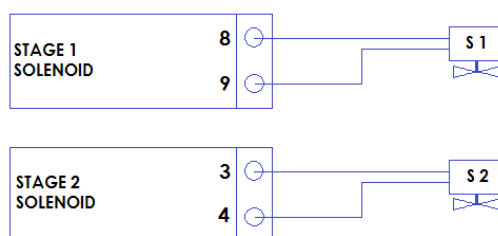
```
STAGE 1        8  ⊖────────────┐   S 1
SOLENOID                       │
               9  ⊖────────┐   │
                           │   │

STAGE 2        3  ⊖────────────┐   S 2
SOLENOID                       │
               4  ⊖────────┐   │
```

Pilotless System:
SureFire Actuator Valve & 1st Stage Solenoid Valve

1. Ensure main supply gas is shut off.
2. Locate the pilot gas supply line and eliminate the pilot fuel train completely.
3. Install the SureFire Actuator Valve in the fuel train on the main burner line down steam of the main burner control valve.
4. Locate the instrument gas supply line controlling the main burner control valve and install 1st stage solenoid in the appropriate location to actuate the main burner control valve.
5. Cut and bend custom 3/8" tubing and connect to tubing fittings on the solenoid valve.
6. Terminate 1st stage solenoid wires to ports 8 & 9. See notes and termination location on page 17.
7. Terminate Actuator wires at terminal block labeled Actuator Valve (1, 2 & 3) from the Actuator Valve terminals (1, 2 & 3).

Pilotless System:
SureFire Actuator Valve & 1st Stage Solenoid Valve

NOTES:
- Terminal block 1 @ SureFire Actuator port 1
- Terminal block 2 @ SureFire Actuator port 2
- Terminal block 3 @ SureFire Actuator port 3
- Must use a SureFire Actuator valve or an actuator approved by SureFire.
- ASCO Solenoid proper flow direction: 2 = Inlet and 1 = Outlet
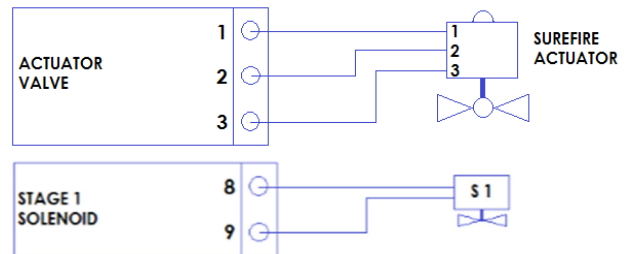
RTD:

1. Install the RTD into the provided thermowell on the vessel for process temperature.
2. Connect negative (-) wires to terminals 10 & 11.
3. Connect positive (+) wire to terminal 12.
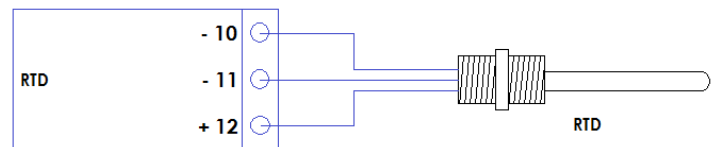
NOTES:
- Software version 3.3 and above. When system recognizes temperature at 4ºF or less, press ON button and a 30 minute timer starts. If system does no recognize a temperature increase above 4ºF, the system will shutdown on code 18. Repeat until temperature gets above 4ºF.

Standby Switches:

1. If no device is used, a jumper is required on ports 17 & 18, 23 & 24, and 27 & 28
2. When using a device, install a normally open or normally close dry contact device and terminate wires from the device in one of the assigned terminal (Ports 17 & 18, 23 & 24, and 27 & 28)
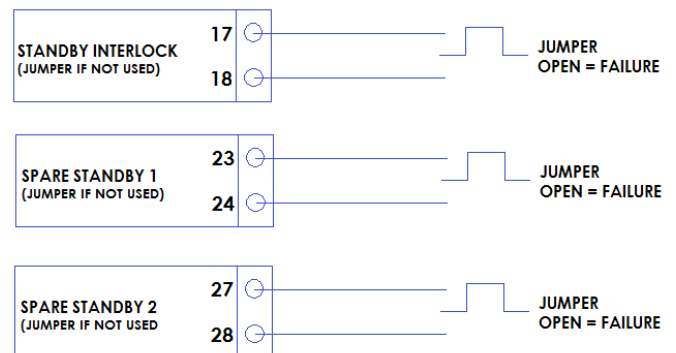
NOTES:
- Closed Contact = Normal Operation
- Open Contact = Failed Operation
- Standby does not require a local reset to re-start system.

Shutdown Switches:

1. If no device is used, a jumper is requires on ports 19 & 20 and 25 & 26.

NOTES:
- Closed Contact = Normal Operation
- Open Contact = Failed Operation
- Shutdown requires a local reset to re-start system.
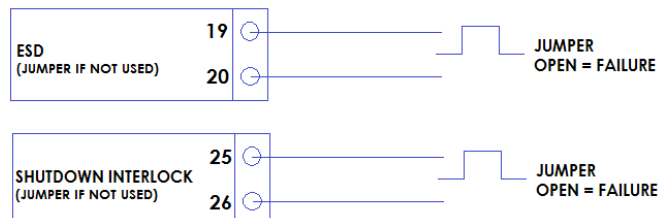
Proof of Valve Closure:

1. If no device is used, a jumper is required on ports 21 & 22.
2. Terminate wires at ports 21 & 22 from the set of contacts on the main burner control valve.
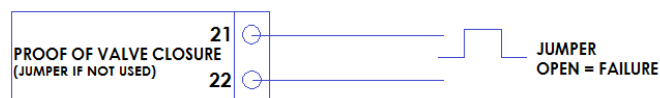
NOTE:
- Do not use ports as a standard Shutdown

4-20mA Output:

The proper connection method for the 4-20mA / 1-5 Volt remote circuit monitoring is as follow.

4-20mA:
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.
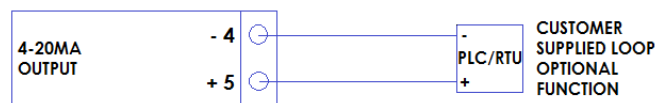
1-5 Volt:
1. If a 1-5 volt signal is desired instead of the 4-20mA.
2. Ensure there is no power to the BMS-300 or PLC before terminating any wires.
3. Connect the positive wire from the remote monitoring equipment to port 5.
4. Install a 250 Ω resistor in series with the negative wire and ground. Monitor the DC voltage signal at port 4.
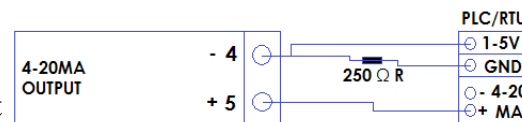
NOTES:
- 4-20mA Scale: 4mA = 0°F/-17°C — 20mA = 529°F/ 276°C
- 1-5V Scale: 1 Volt = 0°F/-17°C — 5 Volt = 529°F/ 276°C

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

Installation Guide

Run Status:

The proper connection method for the Run Status is as follow.
1. Terminate wires from the RTU/PLC to the Run Status terminals (Port 6 & 7).

RUN STATUS	6	DRY CONTACTS OUTPUT TO PLC/SCADA - OPTIONAL FUNCTION
	7	
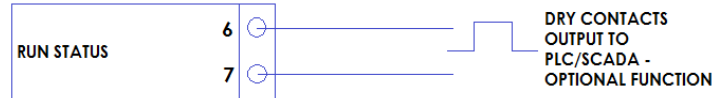
Remote ON / Remote OFF:

The proper connection method for the Remote ON / OFF is as follow:
1. Terminate wires from the RTU/PLC to the Remote ON terminals (Ports 13 & 14)
2. Terminate wires from the RTU/PLC to the Remote OFF terminals (Ports 15 & 16)

NOTES:
♦ The remote ON / OFF receives a signal from a momentary switch from the PLC/SCADA to turn unit ON / OFF remotely.
♦ During a Shutdown error, unit cannot be reset remotely.

REMOTE ON	13	DRY CONTACTS INPUT OPTIONAL FUNCTION
	14	

REMOTE OFF	15	DRY CONTACTS INPUT OPTIONAL FUNCTION
	16	
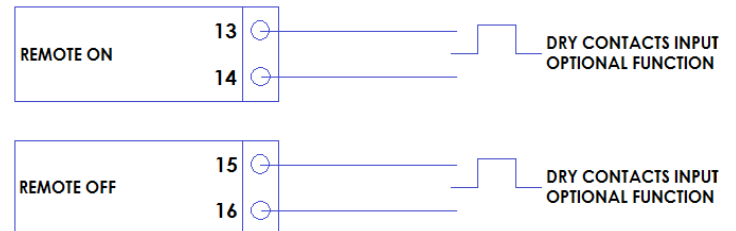
Solar Panel Input:

1. Install 12 VDC Solar Panel on a pole or build and face it south.
2. Connect negative (-) terminal to port 33
3. Connect positive (+) terminal to port 34

NOTES:
♦ Maximum rating for solar panel is 75 watts
♦ Circuit board has internal charge controller to charge 12 VDC battery, if a battery is connected to port 35 & 36.

SOLAR PANEL INPUT	- 33	
	+ 34	

12V DC SOLAR PANEL
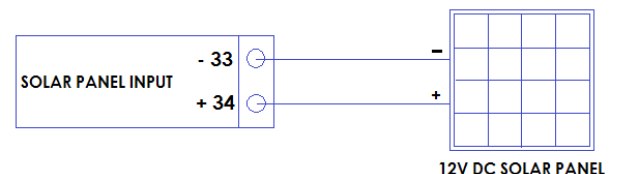
12 VDC Battery Input:

1. Install a 12VDC SLA battery within an enclosure that is separate from the BMS-300 enclosure.
2. Connect negative (-) terminal to port 35
3. Connect positive (+) terminal to port 36
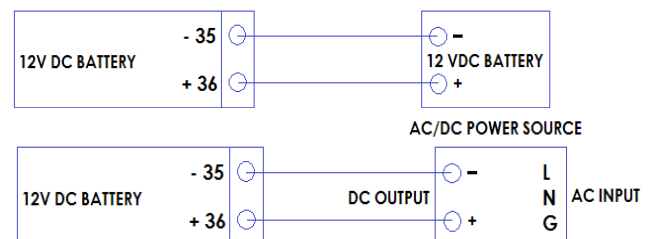
NOTES:
♦ If battery is more than 10 feet away from SureFire controller, use larger wire as needed.
♦ If utilizing 12 VDC power supply, set voltage @ 13.4 VDC. Power supply should be rated for 90 + watts.

12V DC BATTERY	- 35	12 VDC BATTERY
	+ 36	

AC/DC POWER SOURCE

12V DC BATTERY	- 35	DC OUTPUT	L N G	AC INPUT
	+ 36			

Specifications

Power Supply Specifications	
Battery Volts	11-15 VDC
12 VDC Power Supply	SET @ 13.4 VDC, 10 Amps
Solar Panel	12 VDC Type 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
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
	Max Volts: 26 VDC, Max Current: 0.5 Amps
Relay Specifications	
Stage 1 Solenoid Load	12 VDC, 60 Watt MAX
Stage 2 and ALT Solenoid Load	12 VDC, 60 Watt MAX
Actuator Valve Load	12 VDC, 60 Watt MAX
Other	
Fuses: F1, F2, and F3	5 Amps
Fuses: F4 and F5	10 Amps

Run Status and Flame Strength Information

Run Status Operational States:

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

Flame Strength Value Information:

Flame Rod	No Flame Present	Flame Present
Flame Strength Value	Above 500	Below 6

Igniter	No Flame Present	Flame Present
Flame Strength Value	Between 7-12	Between 12-40

S₂

J5
1 2 3 4 5 6
FLAME ROD

J6
1 2 3 4
ALT SOLENOID | STAGE 2 SOLENOID

S1 IGNITER   FLAME ROD   F2

FUSE TABLE
F1- STAGE 1 SOLENOID
F2- STAGE 2 SOLENOID
F3- ACTUATOR VALVE
F4- REVERSE POLARITY
F5- SPARE

SUREFIRE BMS-300
BURNER MANAGEMENT SYSTEM

SERIAL NUMBER:

F5

F4

ACTUATOR VALVE — 1, 2, 3

4-20mA OUT — 4, 5

STATUS — 6, 7
F3

STAGE 1 SOLENOID — 8, 9

RTD — 10, 11, 12

REMOTE ON — 13, 14
F1

REMOTE OFF — 15, 16

STANDBY INTERLOCK
(JUMPER IF NOT USED) — 18, 17

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

12 VOLT BATTERY — 35, 36
F4

1 2 3
SUREFIRE ACTUATOR

PLC/RTU

CUSTOMER SUPPLIED LOOP - OPTIONAL FUNCTION

DRY CONTACTS OUTPUT TO
PLC/RTU - OPTIONAL FUNCTION

S1

RTD

DRY CONTACTS INPUT
OPTIONAL FUNCTION

DRY CONTACTS INPUT
OPTIONAL FUNCTION

PRESSURE SWITCH

JUMPER
OPEN=FAILURE

JUMPER
OPEN=FAILURE

JUMPER
OPEN=FAILURE

JUMPER
OPEN=FAILURE

JUMPER
OPEN=FAILURE

DRY CONTACT
CLOSED=RUN / OPEN=STOP

WHITE
WHITE
BLACK
RED
BLACK
RED

BLACK

SOLAR PANEL

GREEN

GROUND TO GUA ON
FLAME ARRESTOR HOUSING
REQUIRED FOR FLAME ROD

12 VDC BATTERY

NOTE: FOR ALTERNATE POWER SUPPLY WIRING
AND TERMINATIONS, PORTS 33 - 34 AND 35 - 36,
SEE PAGE 19.

Fuel Train Diagrams

Pilotless Fuel Train:

PS-PRESSURE SWITCH
PRV-PRESSURE REGULATING VALVE
MV-MOTOR VALVE
ACV-ACTUATOR VALVE
HV-HAND VALVE
SV-SOLENOID VALVE
SFV-SLOW FLOW VALVE
PI-PRESSURE INDICATOR

PI 25 PSI
S₁
SV-2002
PRV-2001
SFV-2003
SFV-2003 NOT USED WITH ACV-1004
PS-1001
PI 10 PSI
PRV-1002
MV-1003
ACV-1004 OPTIONAL CONTROL VALVE
HV-1005
PI
FUEL POT
COALESCING FILTER
AIR/FUEL MIXER
PILOTLESS FT-SERIES

Piloted Fuel Train:

PS-PRESSURE SWITCH
PRV-PRESSURE REGULATING VALVE
MV-MOTOR VALVE
HV-HAND VALVE
SV-SOLENOID VALVE
SFV-SLOW FLOW VALVE
PI-PRESSURE INDICATOR

PI 25 PSI
S₂
SV-3002
PRV-3001
SV-3004
S₂
SFV-3003
PI 10 PSI
PRV-2001
MV-2002 OPTIONAL DOUBLE BLOCK
MV-2003
HV-2004
PI
MAIN BURNER ASSY
PS-1001
PI 3-5 PSI
PRV-1002
S₁
SV-1003
HV-1004
PILOT VENTURI
FT-1-SF
FUEL POT
COALESCING FILTER

High Temperature:

1. The **High Temp** button displays the current high temperature setpoint.
2. To adjust the High Temperature setpoint:
   - Unlock the system by pressing and holding the **Hours On** and **Up Arrow** buttons for 5 seconds until a series of zeros appear.
   - Press and hold the **High Temp** button and use the **Up Arrow** or **Down Arrow** buttons to adjust the temperature setpoint. (Press and hold the up or down arrows for 3 seconds to scroll.)

NOTES:
- High temp factory setting is 150°F / 65°C
- High Temperature setpoint range:14°F — 490°F / -16°C — 254°C

Low Temperature:

1. The **Low Temp** button displays the current low temperature setpoint.
2. To adjust the Low Temperature setpoint:
   - Unlock the system by pressing and holding the **Hours On** and **Up Arrow** buttons for 5 seconds until a series of zeros appear.
   - Press and hold the **Low Temp** button and use the **Up Arrow** or **Down Arrow** buttons to adjust the temperature setting. (Press and hold the up or down arrows for 3 seconds to scroll.)

NOTES:
- Low temperature factory setting is 60°F / 15°C
- Low temperature setpoint range: 10°F — 486°F / -12°C — 250°C

Flame Sensor:

1. The **Flame Sensor** button displays the current flame sensing device.
2. To adjust the flame sensor type:
   - Position the flame sensing switch to desired setting: Flame Rod or Igniter.
   - Press the **Flame Sensor** button and display will show desired setting. See below:
     - ◊ FL = Flame Rod / I = Igniter.

NOTES:
- Flame Sensor factory setting is (FL) Flame Rod

Igniter Volts:

1. The **Igniter Volts** button displays the current volts being delivered to the igniter element.
2. To adjust the voltage setting:
   - Unlock the system by pressing and holding the **Hours On** and **Up Arrow** buttons for 5 seconds until a series of zeros appear.
   - Press and hold the **Igniter Volts** button and use the **Up Arrow** or **Down Arrow** buttons to increase or decrease the voltage.

NOTES:
- Igniter Volts factory setting is 13.
- Igniter Volts set points are 13 and 14 Volts
- Do not increase voltage to the igniter unless necessary, undue high voltage can adversely effect the igniter. For assistance please call tech support @ (505) 333-2876.
- Any time ignition unit is replaced, Igniter Volts need to be decreased back to 13 volts before start-up. Igniter element can be damaged if Igniter Volts is left on 14.

FSV / Solenoid Timing:

Primary Function:
1. The **FSV** button displays the current flame strength valve for the Flame Rod and Igniter.
2. To check flame strength when using a Flame Rod:
   - Press the **FSV** button.
     ◊ When no flame is present, the value will be above 500.
     ◊ When flame is present the value will be below 6.
3. To check flame strength when using an Igniter:
   - Press the **FSV** button.
     ◊ When no flame is present, the value will be between 7-12.
     ◊ When flame is present, the value will be between 12-40

NOTES:
- The flame strength value in igniter mode is dependent on the Ohms value of the igniter. Values will vary between different igniters.

Secondary Function:
1. The **Solenoid Timing** button displays the current solenoid timing between stage 1 and stage 2 opening when pressed down for 5 seconds.
2. To adjust the solenoid timing:
   - Unlock the system by pressing and holding the **Hours On** and **Up Arrow** buttons for 5 seconds until a series of zeros appear.
   - Press and hold the **Solenoid Timing** button down for 5 seconds to display current solenoid timing and use the **Up Arrow** or **Down Arrow** buttons to adjust the setting.

NOTES:
- The Solenoid timing factory setting is 60 seconds.
- Solenoid timing is settable between 2 — 60 seconds

Flame Sensor Threshold

Utilizing Flame Rod as Flame Sensor

1. The **Flame Sensor Threshold** button displays the current threshold value.
2. To adjust the threshold value:
   - Unlock the system by pressing and holding the **Hours On** and **Up Arrow** buttons for 5 seconds until a series of zeros appear.
   - Press and hold the **Flame Sensor Threshold** button and use the **Up Arrow** and **Down Arrow** buttons to select the desired value.

NOTES:
- The Flame Sensor Threshold factory setting is 250.
- Flame Sensor Threshold range: 65 - 350.

Utilizing the Igniter as Flame Sensor:

1. The **Flame Sensor Threshold** button displays the current flame sensor threshold value.
2. The threshold is pre-set at 3 and does not require any change.

NOTE:
- When using the igniter as a flame sensor, the threshold is positive delta. As the igniter deteriorates the flame strength value and delta threshold increases.

Example:
- Check igniter flame strength before starting up system:

New Igniter:	Deteriorating Igniter:
Flame strength = 10	Flame strength = 15
Threshold setting = 3	Threshold setting = 3
Threshold = 13	Threshold = 18

RTD/PS:

1. The **RTD/PS** button displays the current input control device.
2. The system can be controlled by two different input devices: RTD or ALT SENSE INPUT.
3. To adjust the input device:
   - Unlock the system by pressing and holding the **Hours On** and the **Up Arrow** buttons for 5 seconds until a series of zeros appear.
   - Press and hold the **RTD/PS** button and use the **Up Arrow** or **Down Arrow** buttons to select desired setting.
     - ◊　　0 = RTD　/　P = ALT SENSE

NOTES:
- The RTD/PS factory setting = 0 (RTD).
- An ALT SENSE INPUT device can be a pressure switch or a dry contact switch from the PLC/RTU.

BMS-300 Setup

F/C (Fahrenheit or Celsius):

1. The **F/C** button displays the current temperature scale being used.
2. To set or change the temperature scale, follow these steps:
   - Unlock the system by pressing and holding the **Hours On** and the **Up Arrow** buttons for 5 seconds until a series of zeros appear.
   - Press and hold the **F/C** button and use the **Up Arrow** or **Down Arrow** buttons to select desired setting.
     - ◊ F = Fahrenheit   C = Celsius

NOTE:
- The F/C factory setting = F (Fahrenheit).

A/S (Attempts and Successes) / FPT (Flame Proof Timing):

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

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

Secondary Function:
1. The **FPT** button displays the current flame proof timing when held down for 5 seconds.
2. To adjust the flame proof timing:
   - Unlock the system by pressing and holding the **Hours On** and **Up Arrow** buttons for 5 seconds until a series of zeros appear.
   - Press and hold the **FPT** button down for 5 seconds to display current Flame Proof Timing and use the **Up Arrow** or **Down Arrow** buttons to select the desired setting.

NOTES:
- The FPT factory setting = 15 seconds.
- The FPT setting range: 10 - 60 seconds

Hours On:
- The **Hours On** button displays the total hours the main burner flame has been present.
- The unit has a built in counter to record the total hours the main burner flame has been present. The number displayed when the button is pressed are the total hours.
- Functions with the **Up Arrow** button to unlock system for setting adjustments.

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

Status Code / Pilot Mode:

Primary Function:
1. The Status Code button displays the current code that corresponds with current unit status.
2. To observe the status of the system, press the status code button to view the current code. Reference the code to the status codes printed on the overlay of the controller.

NOTES:
♦ For status code and descriptions see page 36-38.

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

NOTES:
♦ The Pilot Mode factory setting = 1 (Intermittent Pilot).
♦ For Intermittent and Standing pilot mode function see pages 30-33.

Intermittent Pilot Mode:
1. When high temperature setting is reached stage one and stage two solenoids shut off together .
2. If the process temperature continues to increase 50 degrees above the high temperature setpoint, the system will shutdown on a code 18

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

Standing Pilot Mode:
1. When high temperature setting is reached stage one remains open and stage two solenoid closes.
2. When low temperature is reached stage two solenoid re-opens .
3. If the process temperature continues to increase 10 degrees above the high temperature setpoint both stage one and stage two solenoids closes and waits for the low temperature to be reached before re-starting
4. If the process temperature continues to increase 50 degrees above the high temperature setpoint, the system will shutdown on a code 18.

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

BV / EHTD:

Primary Function:
1. The BV (Battery Volts) button displays the current voltage being delivered to the controller by the power supply or battery.
2. To view the current voltage of the power supply or battery, press the BV/EHTD button.

Secondary Function
1. The EHTD button displays the current Extreme High Temperature Delta setting.
2. To view the current EHTD setting, press the BV/EHTD button for 5 seconds to view setting.
3. To set or change the EHTD setting:
   ♦ Unlock the system by pressing and holding the hours on and the up arrow buttons for 5 seconds until a series of zeros appear.
   ♦ Press and hold the BV/EHTD button for 5 seconds to display the current Extreme High Temperature Delta and use the up or down arrow buttons to select desired setting.

NOTES:
♦ EHTD factory setting = 50°F
♦ The EHTD setting range: 10°F — 100°F

Power Supply

♦ The SureFire controller accepts rated voltages as described in the specifications information on page 20. No setup is required. However, the system does have a built-in volt meter to measure battery voltage at all times. To check the battery volts, press the battery volts button. This can be helpful in troubleshooting, but will not replace a battery load tester.

Intermittent Pilot Sequence of Operation

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

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

NOTE: If system fails to prove flame on the third attempt, the system shuts down on code 12. **Blinking** **Red** **LED.**
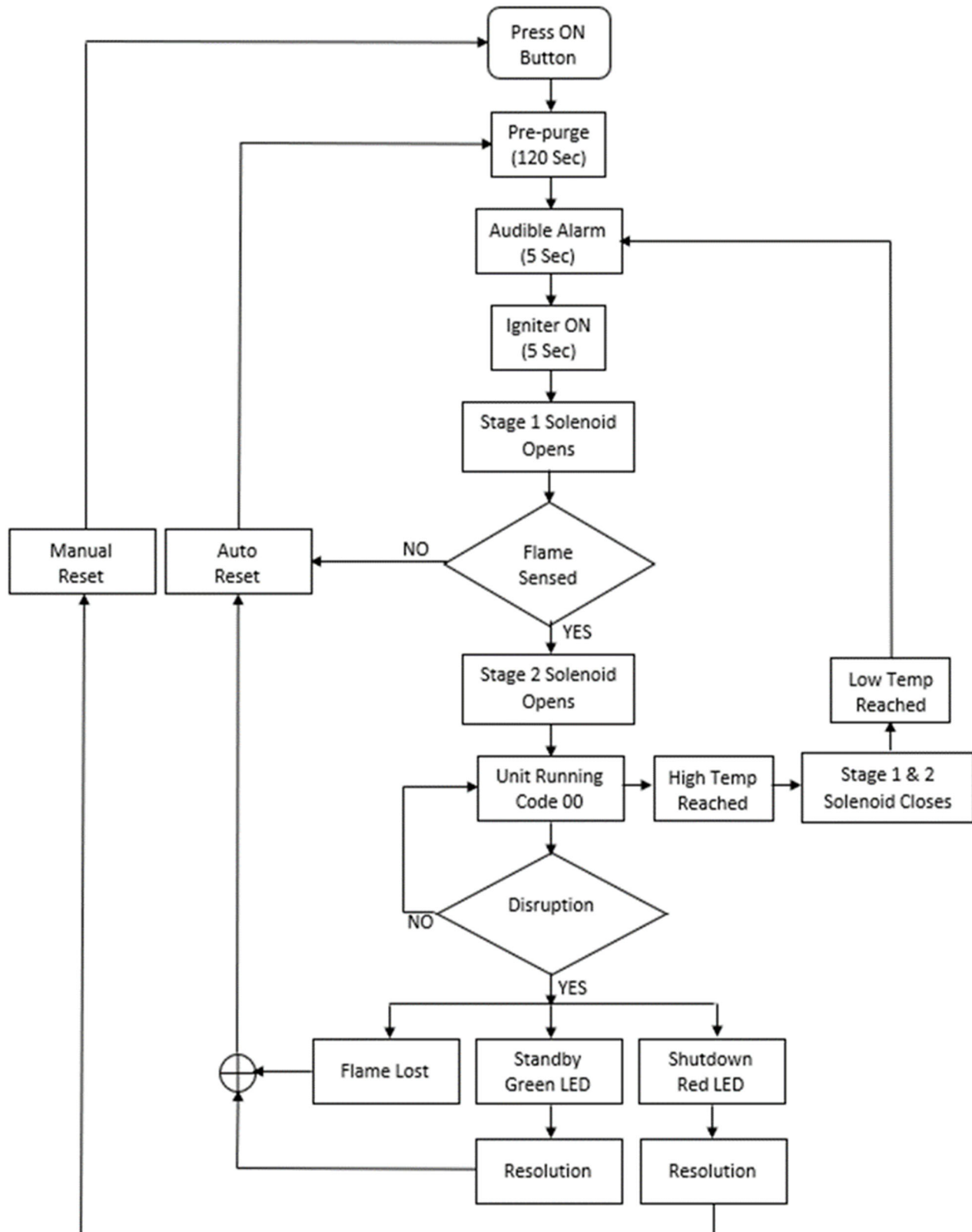
Re-Ignition Process - Standby:
1. System in Standby - **Blinking** **Green** **LED.**
2. Once the Standby issue is resolved, the system will automatically begin the re-ignition process.
3. Pre-purge - 120 second countdown - **Blinking** **Green** **LED.**
4. Reference step 5 - 10 in the "Ignition Process Section".

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

Flow Chart:

Standing Pilot Sequence of Operation

Ignition Process:

1. Press the ON button
2. Pre-Purge - 120 second countdown displayed– **Red** LED ON
5. Audible Alarm - 5 second countdown - **Green** LED ON
6. Igniter on - 5 second countdown- **Green** and **Amber** LED ON
7. Stage 1 Solenoid valve opens - igniter remains on - **Green, Blue** and **Amber** LED ON
8. Ignition is achieved, flame is sensed - **Green** and **Blue** LED ON
9. Stage 2 solenoid valve opens - once the timing between solenoids expires - **Green** and **Blue** LED ON
10. System is running - Status code 00 - **Green** and **Blue** LED ON
11. Process Temperature exceeds High Temp Set point - Stage 2 solenoid valve closes and Stage 1 solenoid remains open - **Green** and **Blue** LED ON
    - If the process temperature exceeds the high temp set point by 10 $^\circ$F, stage 1 solenoid valve will close - **Green** LED ON
    - If the above occurs, the system will restart at step 5 once process temperature is reduced to low temp set point
12. Process Temperature reduced to Low Temp Set point - Restart at step 9

Re-Ignition Process - No Flame Sensed:

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

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

Re-Ignition Process - Standby:

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

Re-Ignition Process - Shutdown:

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

Flow Chart:

Pilotless Sequence of Operation

Ignition Process:

1. Press the ON button
2. Pre-Purge - 120 second countdown displayed– **Red** LED ON
3. Audible Alarm - 5 second countdown - **Green** LED ON
4. Igniter on - 5 second countdown- **Green** and Amber LED ON
5. Stage 1 Solenoid/Actuator valve opens - igniter remains on - **Green** and Amber LED ON
6. Ignition is achieved, flame is sensed - **Green** and Blue LED ON
7. System is running - Status code 00 - **Green** and Blue LED ON
8. Process Temperature exceeds High Temp Set point - Stage 1 solenoid valve close - **Green** LED ON
9. Process Temperature reduced to Low Temp Set point - Restart at step 5

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

Re-Ignition Process - No Flame Sensed

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

NOTE: If system fails to prove flame on the third attempt, the system shuts down on code 12. **Blinking Red LED.**
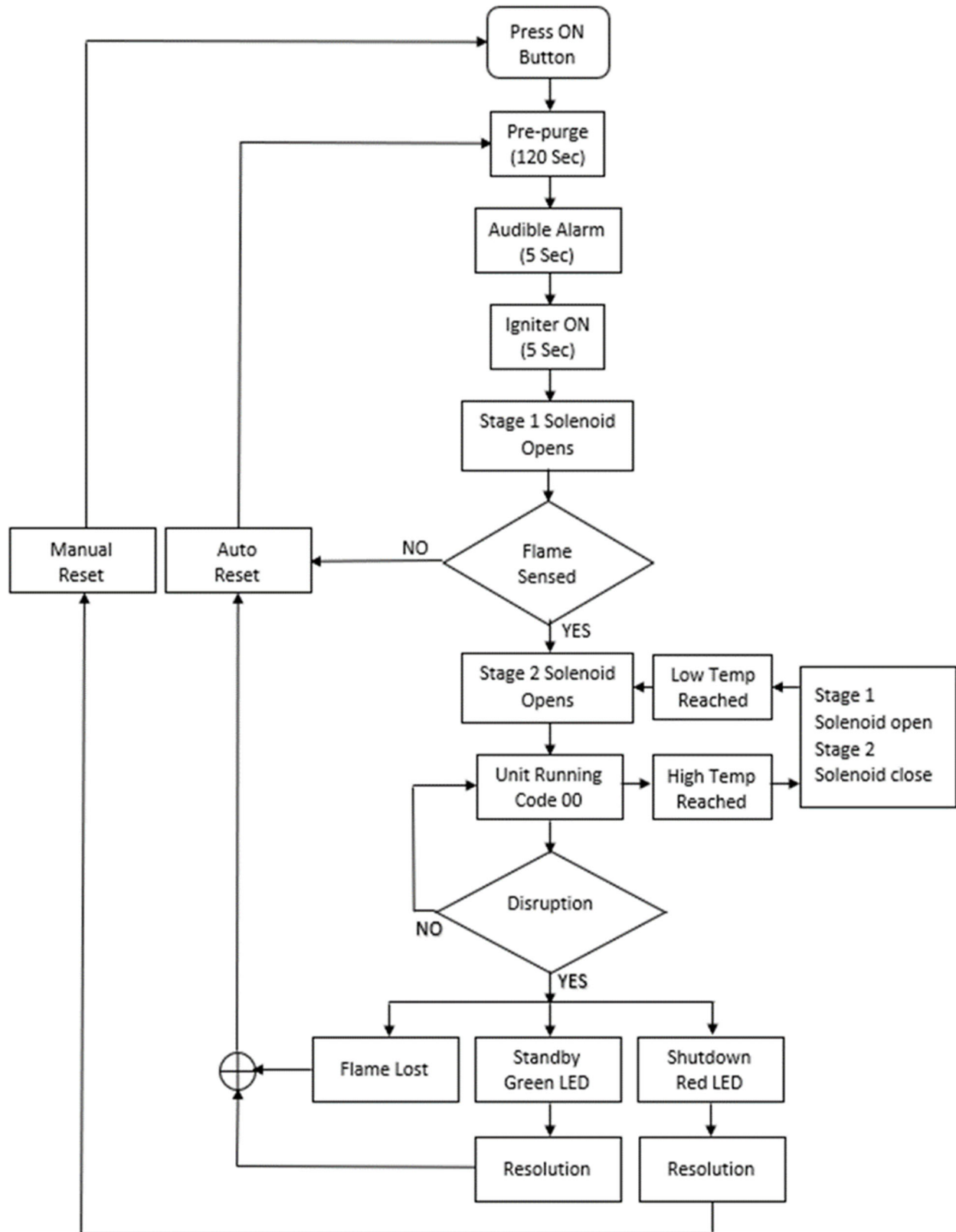
Re-Ignition Process - Standby

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

Re-Ignition Process - Shutdown

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

Flow Chart:

Troubleshooting Guide

Run Codes:

Code	Symptom	Action	LED
00 System Running	♦ Pilot/main burner is on.	♦ Normal operation. ♦ Successful ignition recorded ♦ Process temperature increasing.	Blue and Green LEDs ON
24 Pre-Purge on Startup	♦ Pilot/main burner is not on.	♦ Normal operation. ♦ 120 second countdown.	Red LED ON
01 Waiting for startup signal	♦ Pilot/main burner is not on.	♦ Normal operation. ♦ Process temperature reached high temp setting. ♦ Waiting for process temperature to decrease below low temp setting.	Green LED ON
08 Purge between Ignition Attempts	♦ Pilot/main burner is not on.	♦ Normal operation. ♦ No ignition on previous attempts. ♦ 120 second countdown.	Green LED ON
09 Waiting for main valve to open	♦ Main burner is on. (Single stage) ♦ Pilot is on but main burner is not. (Dual stage)	♦ Normal operation. ♦ System is on and flame is proven. ♦ Waiting for 2nd stage solenoid to open.	Green and Blue LEDs ON

Standby Codes:

Code	Symptom	Action	LED
02 Standby Interlock	♦ Pilot/main burner is not on. ♦ No activity when system is attempting startup. ♦ Ports 17 & 18 are activated.	♦ System detecting an open circuit. ♦ No jumper at ports 17 & 18. ♦ Customer supplied switch is activated. ♦ Check wire connections.	Blinking Green LED.
03 Spare Standby 1	♦ Pilot/main burner is not on. ♦ Igniter is not lighting gas. ♦ No activity when system is attempting startup. ♦ Ports 23 & 24 are activated.	♦ System detecting an open circuit. ♦ No jumper at ports 23 & 24. ♦ Customer supplied switch is activated. ♦ Check wire connections.	Blinking Green LED
04 Spare Standby 2	♦ Pilot/main burner is not on. ♦ Igniter is not lighting gas. ♦ No activity when system is attempting startup. ♦ Ports 27 & 28 are activated.	♦ System detecting an open circuit. ♦ No jumper at ports 27 & 28. ♦ Customer supplied switch is activated. ♦ Check wire connections.	Blinking green LED

Troubleshooting Guide

Shutdown Codes:

Code	Symptom	Action	LED
11 Manual / Remote Shut Off	♦ Pilot/main burner is not on.	♦ System was manually or remotely turned OFF. ♦ To startup system press the ON button.	Red LED ON
12 Max Retries Exceeded	♦ Pilot/main burner is not on. ♦ Ignition failed three consecutive attempts.	♦ Check fuel supply. ♦ Check power supply. ♦ Check air/fuel mixer. ♦ Ensure burner pressures are within appropriate range. (3-5lbs for pilot, 8-18 lbs. for main). ♦ Check pilot ignition unit positioning for piloted system. ♦ Check for plugged or frozen orifice. ♦ Check igniter wires and fuses. ♦ Check wiring for flame sensing ground. ♦ Check temperature settings on pneumatic temperature controller (T12) ♦ Ensure that all valves and external components are functioning properly. ♦ Check igniter voltage and Ohms.	Blinking Red LED
13 Low Battery Volts	♦ Pilot/main burner is not on. ♦ Igniter is not lighting gas. ♦ No activity when system is attempting startup.	♦ Check battery voltage. ♦ Check re-charging device. ♦ Check wiring for power package. ♦ A power outage occurred. ♦ Replace battery.	Blinking Red LED
14 Igniter Short Circuit	♦ Pilot/main burner is not on. ♦ System will proceed through startup but will shutdown when igniter receives voltage.	♦ Ensure igniter wires are not touching each other, or grounding to conduit. ♦ Ensure there is no moisture in the conduit. ♦ Check power supply. When power supply is inefficient, system detects a short circuit.	Blinking Amber and Red LEDs
15 Igniter Open Circuit	♦ Pilot/main burner is not on. ♦ System will proceed through startup but will shutdown when igniter receives voltage.	♦ Ensure igniter wires are terminated properly. ♦ Check for disconnected wires ♦ Igniter element could have wore out or is broken. ♦ Check power supply. When power supply is inefficient, system detects an open circuit.	Blinking Amber and Red LEDs

Shutdown Codes:

Code	Symptom	Action	LED
16 Flame Sensed Before Startup	♦ Pilot/main burner is not on. ♦ No activity when system is attempting startup.	♦ Ensure proper flame sensing mode is selected. ♦ Flame rod wire shorting against ground. ♦ Flame Rod shorting against ground. ♦ Ensure ignition unit did not received heat damage.	Blinking Red LED
18 Extreme High/ Low Temp, Check RTD	♦ Pilot/main burner is not on. ♦ No activity when system is attempting startup.	♦ Process may have exceed 50°F above the high temp setting. ♦ Process below 4ºF. ♦ Check wire connections on RTD. ♦ Check the functionality of the RTD.	Blinking Red LED
19 Shutdown Interlock	♦ Pilot/main burner is not on. ♦ No activity when system is attempting startup. ♦ Ports 25 & 26 are activated.	♦ System detecting an open circuit. ♦ No jumper at ports 25 & 26. ♦ Customer supplied device is activated. ♦ Check wire connections.	Blinking red LED
20 ESD Activated	♦ Pilot/main burner is not on. ♦ No activity when system is attempting startup. ♦ Ports 19 & 20 are activated.	♦ System detecting an open circuit. ♦ No jumper at ports 19 & 20. ♦ Customer supplied device is activated. ♦ Check wire connections.	Blinking Red LED
21 Main Fuel Valve Failure	♦ Pilot/main burner is not on. ♦ No activity when system is attempting startup. ♦ Ports 21 & 22 are activated.	♦ 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.**	Blinking Red LED
22 Flame Sensor Problem	♦ Pilot/main burner is not on. ♦ No activity when system is attempting startup. ♦ Improper Flame Detection– Igniter	♦ Ensure proper flame sensing mode has been selected. ♦ Check igniter ohms. ♦ Ensure igniter resistance decreases before pressing the ON button.	Blinking Red LED

Modbus Information

Programming Information for
SureFire BMS300 with Modbus Interface
(Firmware 1.8)

Modbus registers, their contents, command sequencing and examples of command execution over Modbus are described.

This document applies to Modbus firmware version 1.8. In order to use Modbus with the BMS-300, the BMS-300 firmware needs to be version 3.5.

Introduction:

The Modbus interface to the BMS-300 is accomplished via an intermediary processor board, the BMS Modbus board. **The function of this board is to serve as a Modbus RTU slave**, handling requests from the Modbus master to read information and relay command data to the BMS-300 board.

The Modbus board behaves as a specialized "mailbox"; a set of Modbus holding registers is available in the Modbus board, any of which can be read by either the BMS board or the Modbus master. This arrangement relieves the BMS board of the job of hosting the Modbus and relaxes many of the timing constraints that would overtax the limited hardware resources on the BMS board Micro Controller Unit (MCU).

A number of the registers are constantly updated by the BMS board with information such as temperatures, modes, output states, ignition attempts, and other important data. These should be treated as read-only by the Modbus master.

Both RS-485 and RS-232 interfaces are available for use by the Modbus master. Only one of these interfaces can be selected for use at any given time via the configuration DIP switch. The configuration DIP switch also sets the Modbus slave address or slave ID and the baud rate.

LEDs are present on the Modbus board to indicate processing of Modbus packets (from the Modbus side) and BMS300 packets (from the BMS-300 side). The **LEDs illuminate when intact packets are received and are being processed**. Under normal operation the LED on the BMS side should show regular activity as it updates the holding registers on the Modbus board and queries for command data. The LED on the Modbus side will only show activity if the Modbus master is reading from the Modbus board.

Amber LED Indication:

There are two LEDs in the Modbus circuit board that indicates different operations.

COM LED:
This LED indicates that the Modbus circuit board is communicating and sending data packages to the BMS-300 circuit board. This LED is labeled **COM.**

BMS COM LED:
This LED indicates that the BMS-300 is communicating and sending data packages to the Modbus circuit board. This LED is labeled **BMS COM.**

Basic Read Operation:

Basic operation of the BMS-300 with Modbus is as follows:

For reading a register (or registers) the Modbus master sends a holding register read request to the BMS Modbus board using **Modbus Function 03** (see "MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b", www.modbus.org for more detailed information about the Modbus protocol and functions). The Modbus board will respond with the contents of the requested registers. There are currently 256 registers defined (Modbus addresses 40001 thru 40256), but not all are used. Attempts to read registers outside that address space will return an error according to the Modbus protocol.

While the Modbus board is servicing a read request from the master, it is unable to service simultaneous read requests from the BMS board for command data. This may result in the BMS board waiting for access and may result in a blinking LED display on the BMS board. For this reason it is best for the master to refrain from reading a large number of registers in a single request, and also to avoid issuing rapid read requests. It is suggested that read requests be limited to about 10 registers or less at a time.

Note:

Address 40001 maps to Register 1
Address 40002 maps to Register 2
↓   ↓   ↓

The following table is the register map for the BMS-300. Bits are in MSB first order.

Modbus Address	Register Name Modbus Master	Data Type	Notes
40001	Status Code (R)	unsigned int 16	See Status Code on page 31 or reference BMS-300 overlay
40002	Average temperature (R)	unsigned int 16	Bit 9..0 is 0-529 degrees
40003	High temperature limit R)	unsigned int 16	Bit 9..0 is 14-490 degrees
40004	Low temperature limit (R)	unsigned int 16	Bit 9..0 is 10-486 degrees

Address 40255 maps to Register 255

Modbus Information

Modbus Address	Register Name Modbus Master	Data Type	Notes

40005	Configuration and status (R)	unsigned int 16	Bit 0 – Light status
			    0 : RED light is on solid
			    1 : GREEN light is on solid
			Bit 1 – Temperature units
			    0 : Degrees C
			    1 : Degrees F
			Bit 2 – Input sense
			    0 : RTD
			    1 : ALT (pressure switch)
			Bit 3 - Igniter volts
			    0 : 14V
			    1 : 13V
			Bit 4 – Pilot mode
			    0 : Intermittent pilot
			    1 : Standing pilot
			Bit 5 – Flame sensed
			    0 : No flame sensed
			    1 : Flame sensed
			Bit 6 – Factory use only
			Bit 7 – Factory use only
			Bit 8 – Spare standby #1
			    0 : Clear
			    1 : Activated (GREEN light blinking)
			Bit 9 – 2pare standby #2
			    0 : Clear
			    1 : Activated (GREEN light blinking)
			Bit 10 – Shutdown interlock
			    0 : Clear
			    1 : Activated (RED light blinking)
			Bit 11 – ESD status
			    0 : Clear
			    1 : Activated (RED light blinking)
			Bit 12 – Standby interlock
			    0 : Clear
			    1 : Activated (GREEN light blinking)
			Bit 13 – Factory use only
			Bit 14 – Factory use only
			Bit 15 – Factory use only

40006	Average battery voltage (R)	unsigned int 16	Bit 7..0 is 0 to 145 volts (14.5) Modbus does not show decimals
40007	Burn time R)	unsigned int 16	Hours burner on, rolls over to 0 after 9999
40008	Number of Ignition Attempts (R)	unsigned int 16	Number of ignition attempts, rolls over to 0 after 9999
40009	Number of successful ignition (R)	unsigned int 16	Number of successful ignition, rolls over to 0 after 9999

Modbus Information

Modbus Address	Register Name Modbus Master	Data Type	Notes
40010	Command status (R)	unsigned int 16	0x55 IDLE - Ready for new command 0x01 Command executed OK 0x02 Bad command, nothing done 0x03 BMS read of exec reg from Modbus board timed out 0x04 BMS read of exec packet from Modbus board had bad check sum 0x05 BMS read of cmd reg from Modbus board timed out 0x06 BMS read of cmd packet had bad checksum 0x07 Command number not recognized (Ready for new command) 0x08 BMS read of param reg from Modbus board timed out 0x09 BMS read of param packet had bad checksum 0x0A Parameter out of limits for command 0x0B BMS 300 Controller is locked 0x0C Unknown status code returned from Modbus board read attempt
40011 thru 40013	N/A	unsigned int 16	Factory use only
40014 thru 40019	Unallocated	unsigned int 16	Read as zero, can be written but will be ignored
40020	Bit 0 – Light status 0 : RED light is on solid 1 : GREEN light is on solid	unsigned int 16	Bit #0 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40021	Bit 1 – Temperature units 0 : Degrees 1 : Degrees F	unsigned int 16	Bit #1 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40022	Bit 2 – Input sense 0 : RTD 1 : ALT (pressure switch)	unsigned int 16	Bit #2 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40023	Bit 3 - Igniter volts 0 : 14V 1 : 13V	unsigned int 16	Bit #3 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40024	Bit 4 – Pilot mode 0 : Intermittent pilot 1 : Standing pilot	unsigned int 16	Bit #4 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.

Modbus Information

Modbus Address	Register Name Modbus Master	Data Type	Notes
40025	Bit 5 – Flame sensed 0 : No flame sensed 1 : Flame sensed	unsigned int 16	Bit #5 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40026	Bit 6 – Factory use only	unsigned int 16	Bit #6 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40027	Bit 7 – Factory use only	unsigned int 16	Bit #7 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40028	Bit 8 – Spare standby #1 0 : Clear 1 : Activated (GREEN light blinking)	unsigned int 16	Bit #8 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40029	Bit 9 – 2pare standby #2 0 : Clear 1 : Activated (GREEN light blinking)	unsigned int 16	Bit #9 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40030	Bit 10 – Shutdown interlock 0 : Clear 1 : Activated (RED light blinking)	unsigned int 16	Bit #10 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40031	Bit 11 – ESD status 0 : Clear 1 : Activated (RED light blinking)	unsigned int 16	Bit #11 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40032	Bit 12 – Standby interlock 0 : Clear 1 : Activated (GREEN light blinking)	unsigned int 16	Bit #12 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40033	Bit 13 – Factory use only	unsigned int 16	Bit #13 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40034	Bit 14 – Factory use only	unsigned int 16	Bit #14 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.
40035	Bit 15 – Factory use only	unsigned int 16	Bit #15 of register 40005 unpacked into a single register for use by controllers with primitive bit manipulation capabilities.

Modbus Information

Modbus Address	Register Name Modbus Master	Data Type	Notes
40036 thru 40249	Unallocated	unsigned int 16	Read as zero, can be written but will be ignored
40250	BMS diagnostics register #1 (R)	unsigned int 16	Factory use only
40251	BMS diagnostics register #1(R)	unsigned int 16	Factory use only
40252	BMS read count (R)	unsigned int16	Number of packets sent by the BMS board to the Modbus board to read the contents of a holding register
40253	Modbus board firmware revision (R)	unsigned int16	High byte: uint8 – major release number Low byte: uint8 – minor release number Ex: Version 1.7 will exhibit 0x17
40254	Modbus read count (R)	unsigned int16	Number of function 03 requests from the Modbus master
40255	BMS write count (R)	unsigned int16	Number of packets sent by the BMS board to the Modbus board to update the contents of a holding register

DIP Switch Configuration and Settings

Switch SW1 on the Modbus board configures the Modbus address, baud rate, and selects the serial interface to be used. The notation "ON" and "OFF" follows from the direction of the arrow and the word "ON" located on the left side of the switch body near SW1-1. The switches are as follows:

Switch	Selects	Description
SW1-1	Modbus address bit 0	"ON" position is "1", "OFF" is 0
SW1-2	Modbus address bit 1	"ON" position is "1", "OFF" is 0
SW1-3	Modbus address bit 2	"ON" position is "1", "OFF" is 0
SW1-4	Modbus address bit 3	"ON" position is "1", "OFF" is 0
SW1-5	Modbus address bit 4	"ON" position is "1", "OFF" is 0
SW1-6	Baud rate for communication with Modbus master	"ON" is 19200, "OFF" is 9600
SW1-7	Unused	Unused
SW1-8	Interface for communication with Modbus master	"ON" is RS232, "OFF" is RS485

Make sure at the receiving end, the following bits are set as:
Data Bit: 8
Parity Bit: None
Stop Bit: 1

Modbus Information

The following table shows the switch settings for SW1-1 through SW1-5 required to obtain the desired Modbus address:

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

Modbus Troubleshooting Information

Symptom:
The LEDs on the Modbus board are not flashing.

Discussion:
The LEDs only flash when intact (complete and correct) packets are received from their respective interfaces. If the data arrives garbled, or if no data is sent, then the corresponding LED will not flash. The COM LED is between the MCU and the large terminal blocks, and is associated with activity on the Modbus. The BMS COM LED is between the MCU and the small terminal blocks, and is associated with activity on the BMS board.

Possible Solutions:
1. Verify that the cables or wires to the BMS Modbus board are connected.
2. Verify that the wires are connected to the correct pins.
3. Verify that the baud rate for data transmission is in agreement on both sides (for example, if the BMS Modbus board is set for 9600 baud, then the Modbus master must also be set for 9600 baud).
4. Verify that power is present at the BMS Modbus board.
5. If the Modbus COM LED doesn't flash, verify that the Modbus master is sending read requests.
6. If the BMS COM LED doesn't flash, verify that the BMS board has power. Under normal operation this LED should always be flashing if both boards are powered.

Symptom:
The BMS-300 display flickers during Modbus operation

Discussion:
Due to the hardware constraints on the BMS-300, the LED display will flicker slightly during normal operation when the Modbus is in use. If the Modbus master polls the BMS300 for data at a rapid rate, or transfers many registers during each poll, the flickering becomes worse. If the Modbus is being queried on a continuous basis, the display and keypad may become difficult to operate.

Possible Solutions:
1. Limit the number of registers being read from the BMS-300 during each transfer to about 10 or less.
2. Limit the polling interval to about twice per second.

Software Versions

BMS-300

Software Version	Release Date	Description
V 3.5	4/2/2019	Standard base software

MODBUS

Software Version	Release Date	Description
V 1.8	5/6/2013	Standard base software (Read only)

Serial Number: _____

Software Version: _____

Installation Notes

BMS-300 Installation and Operations Manual:

Last Update: **08/04/2020**

Version: **8.0**

SureFire Farmington, NM Office:

Mailing Address: **1910 Rustic Place, Farmington, NM 87401**
Phone: **(505) 333 - 2878**
Fax: **(505) 333 - 2879**

SureFire Houston, TX Office:

Mailing Address: **12510 Cutten Road, Houston, TX 77066**

Phone: **(281) 377 - 9756**

Fax: **(281) 379 - 1081**

SureFire 24-Hour Technical Support:

Phone: **(505) 333 - 2876**

For SureFire Product Updates Please Visit:
www.surefire-controls.com

Follow Us: