OPERATION | CONFIGURATION | CALIBRATION | INSTALLATION

COMBUSTEX

BURNER IGNITION & CONTROL SYSTEMS

OPERATIONS MANUAL

The Combustex BMS-2500

B149.3 Compliant Burner Management System

BMS Software Version 5.03

CANALTA CONTROLS GROUP

QUALITY, RELIABILITY, PERFORMANCE

With Control Comes Safety

The BMS-2500 Burner Management System gives you the automated control to safely start, monitor and manage a single or dual burner gas-fired industrial heater.

- Calibrate, tune and configure more than 60 parameters and variables via the front keypad.
- Maintain system security through password protection.
- Access a wide selection of sequencing, monitoring and control information through easy page scrolling on the heated, back-lit display.
- Gain flexibility with remote and local start / shutdown / set point capabilities.
- Take control of shutdowns with first out annunciation and a direct readout of shutdown conditions.

With the BMS-2500, You Have Exceptional Control

Standards & Certifications

ANSI Z21.20 - 2007
CSA C22.2 No. 199 - B149.3 Compliant
CSA 22.2 No. 213 - M1987
UL 1998
UL 372
Class 1, Div. 2 Groups B, C and D Haz. Loc.
Temp. Code T4
NEMA Type 4x

C ETL LISTED US
Intertek
4003497

COMBUSTEX
BURNER IGNITION & CONTROL SYSTEMS
A Canalta Controls Company

For operational, technical or installation assistance, please contact us.

Phone: 403.342.4494 | **Web:** www.combustex.com

Call Us Toll Free: *1-855-226-2582*

The Combustex BMS-2500

Burner Management System

OPERATIONS MANUAL

Controller Version 5.03

WARNINGS

Combustex recommends that this manual be read thoroughly before **attempting installation or operation of the BMS-2500. SAFETY FIRST.**

-- WARNING --

THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS 1, DIVISION 2 GROUPS B, C, D OR NON-HAZARDOUS LOCATIONS ONLY.

-- WARNING --

EXPLOSION HAZARD - DO NOT DISCONECT EQUIPMENT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS

-- WARNING --

EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2 LOCATIONS.

-- AVERTISSEMENT --

RISQUE D'EXPLOSION - LA SUBSTITUTION DE COMPOSANTS PEUT RENDRE CE MATERIEL INACCEPTABLE POUR LES EMPLACEMENTS DE CLASSE 1, DIVISION 2.

-- ADVERTENCIA --

PELIGRO DE EXPLOSION - LA SUSTITUCION DE LOS COMPONENTES PUEDE AFECTAR LA COMPATIBILIDAD PARA CLASE 1, LOCALIZACION DE DIVISION 2

COMBUSTEX
BURNER IGNITION & CONTROL SYSTEMS
A Canalta Controls Company

For operational, technical or installation assistance, please contact us.

Phone: 403.342.4494 | **Web:** www.combustex.com

Call Us Toll Free: *1-855-226-2582*

CONTENTS

1. INTRODUCTION
1.1 Overview . . . 3
1.2 Burner Sequencing . . . 4
1.3 ESD (Emergency Shutdown) Capabilities . . . 4
1.4 Temperature Control . . . 5
1.5 Features . . . 5
1.6 Communications . . . 6
1.7 Definitions of Common Terms and Abbreviations . . . 6
1.8 Technical Specifications . . . 6

2. OPERATION
2.1 Overview . . . 7
2.2 Passwords - Gaining Entry . . . 9
2.3 Sequence Status & Shutdown Annunciation . . . 10
2.4 Temperature Control . . . 12
2.5 Output Status . . . 13
2.6 Auxiliary Analog Inputs and Shutdowns . . . 13
2.7 PID & Control Parameters . . . 14

3. CONFIGURATION OF THE BMS-2500
3.1 Overview . . . 15
3.2 Configuration Menu Options . . . 16

4. CALIBRATION OF THE BMS-2500
4.1 Overview . . . 25
4.2 Calibration Menu Items . . . 26
4.3 Thermocouple / mV Reference Chart . . . 27

5. INSTALLATION
5.1 Overview . . . 28
5.2 Analog Input Connections . . . 29
5.3 Digital Input Connections . . . 29
5.4 Analog Output Connections . . . 30
5.5 Digital Output Connections . . . 30
5.6 Modbus Connections . . . 30
5.7 Sample P&ID Drawings & Wiring Diagrams . . . 31

6. TROUBLESHOOTING SHUTDOWN CONDITIONS
6.1 Error Messages and Shutdown Conditions . . . 37

INTRODUCTION

1.1 OVERVIEW

The Combustex BMS-2500 Burner Management System has been designed to be compatible with a wide variety of industrial and oilfield burner vessels. A common vessel will have a main burner firing into a fire tube which, in turn, heats a fluid (often glycol). This fluid is referred to as the "Bath". Another fluid (oil or gas) is routed through the bath to be heated. This is referred to as the "Process".

The BMS will control up to two pilots and two main burners, handle temperature control of the bath, and provide flame status outputs and a variety of ESD (emergency shutdown) inputs.

The BMS-2500 is typically installed together with a Canlite Ignition Assembly. These igniters are designed and built around the features of the BMS, allowing the BMS to light and maintain a pilot flame with the sensor that is incorporated into the pilot ignition module, providing flame verification. The Combustex BMS-2500 is suitable for both new installations and retrofitting older vessels, and is not limited to Pilot Pro™ igniters.

1.2 BURNER SEQUENCING

When initiating a start sequence, the BMS will open the pilot and energize the igniter for the trial for ignition period and wait for the flame sensor to confirm a flame. Upon flame verification, the unit will then go into "Normal Operation". At this point, the BMS will energize the main burner and the flame status output(s). The temperature control option will also become enabled (if configured).

Set points and the associated password protected timers are configurable in the BMS menu. Other configurable options:

- Purge and Pre-purge
- Auto Relight on Flame Fail
- Auto Relight on Power Fail (unit will relight when power is restored)

1.3 EMERGENCY SHUTDOWN CAPABILITIES

The BMS-2500 can be configured to shut down when an unsafe or out-of-control condition exists.

1. Programmable HTSD limits on:
   - Bath Thermocouple Input
   - Process Thermocouple Input
   - Stack Thermocouple Input
2. Standard dedicated discrete field device inputs preset at the factory:
   - Remote Stop
   - Remote Start
   - Low Voltage
   - Burner #1 Flame Sensor Failure
   - Burner #1 Flame Failure to Relight
   - Burner #1 Fuel Gas Low Pressure
   - Burner #1 Fuel Gas High Pressure
   - Aux. High Bath Temp. (Contact)
   - Low Bath Level
   - Burner #1 Main Valve Proof of Closure
3. Additional inputs for Dual Burner Systems:
   - Burner #2 Flame Sensor Failure
   - Burner #2 Flame Failure to Relight
   - Burner #2 Fuel Gas Low Pressure
   - Burner #2 Fuel Gas High Pressure
   - Burner #2 Main Valve Proof of Closure

1.4 TEMPERATURE CONTROL

The BMS-2500 can be configured to perform bath temperature control by a Proportional or ON/OFF Control output.

Proportional Control:

One 4-20mA output will be used. Set point and PID parameters are configurable via the BMS-2500 keypad.

ON/OFF Control:

The main #1 (and main #2, if applicable) burner will be cycled on and off to maintain set point. The ON/OFF dead band and set point is adjustable via the BMS-2500 keypad.

1.5 FEATURES

- The larger case size of the BMS-2500 allows for easier installation, wiring and maintenance.

Automatic Sequencing Features

- LCD backlight, which can be set to ON, OFF, AUTO (with photocell) or TIMED.
- LCD heater, which automatically turns on at -10°C (14°F) to maintain display stability.
- Available computer interface via RS232 or RS485 Modbus protocol.
- Input filtering to help alleviate noisy signals and signal spikes.
- Capable of driving latching solenoids (separate latch and unlatch outputs).
- Single or dual burner control (selectable in series or parallel).
- Auto relight sequence can be de-selected or selected with up to three relight attempts after loss of flame.
- Configurable pre- and post-purge times and auxiliary blower with confirmation.
- Configurable flame sensor options.
- Ignition output signal can be configured as steady or pulsed.
- Wide variety of configurable safety interlock devices (factory set to standard settings).
- Remote start / stop is configurable.
- Auto startup after power failure is configurable.
- Intermittent pilot or standing pilot is configurable.
- Remote indication of temperatures via 4-20 mA output.
- Remote set point of bath available via 4-20 mA input.
- **Configuration is password protected and stored in non-volatile memory.**

Shutdown Annunciation Features

- A first out annunciation is built in with direct readout of the shutdown conditions. Each shutdown condition is marked with its chronological incoming position. The operator must acknowledge each shutdown condition and the condition must be cleared before startup can be initiated.

1.6 COMMUNICATIONS

The Combustex BMS-2500 includes both analog (9 total) and digital (28 total) connections for communication between the BMS controller and various combustion system monitoring and control devices. In addition, the BMS offers Modbus connectivity for fast, robust communication between the BMS unit and remote controllers and readout devices. Modbus protocols RS232 and RS485 can be used to remotely monitor and configure a select list of settings and readouts. This functionality is available in both single and dual-burner versions of the Combustex BMS-2500.

1.7 DEFINITIONS AND ABBREVIATIONS

Dead Band	The allowed deviation from set point (while in ON/OFF Control)
DI	Discrete Input
ESD	Emergency Shutdown
HTSD	High Temperature Shutdown
LCD	Liquid Crystal Display
PID	Proportional, Integral (Reset), Derivative (Rate)
PV	Process Variable (Actual Temperature)
SD or S/D	Shutdown
SP	Set Point (Desired Temperature)

1.8 TECHNICAL SPECIFICATIONS

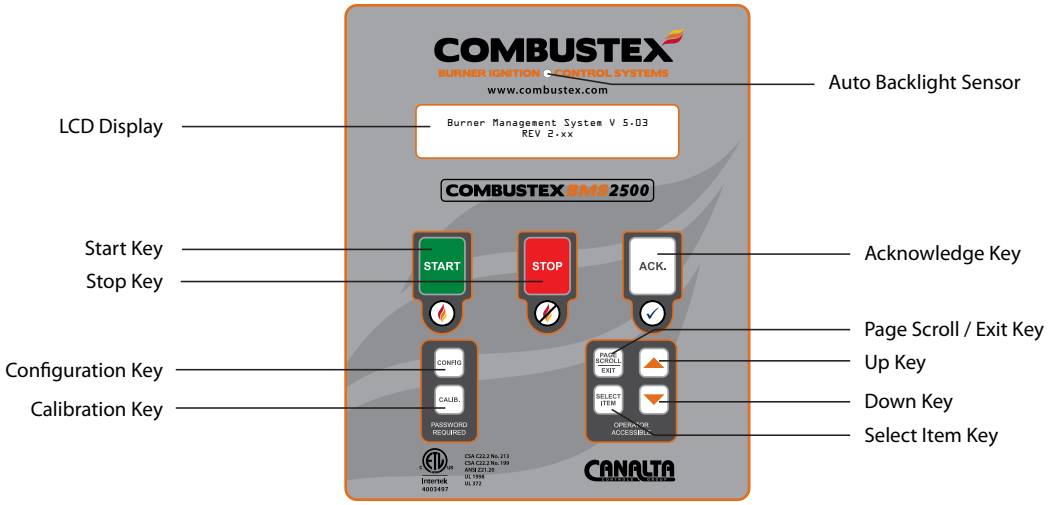
Rating	Class 1, Div. 2; Class 1, Div. 1 (pending); Intrinsically Safe; Nema 4x; B149.3 Compliant
Enclosure Dimensions	12.5" H, 10.75" W, 6.125" D
Enclosure Construction	Molded Fiberglass Polyester with Quick Release Latches
Operating Temperature	- 40°C to + 40°C (-40°F to +104°F)
Inputs	(12) Digital Solid State; (2) Analog 4-20mA; (5) Thermocouple Type K Underground Cold Junction Compensated
Outputs	(16) 12-30 VDC Digital Solid State Optical Isolated (1.5A each) (2) Analog 4-20mA 500 Ohm (max.)
Power Supply	12 to 30 VDC Clean Filtered
Current Draw	80 mA (min), 160 mA (typical), 300 mA (max) for Electronics + LCD Backlight + Display Heater. Current draw of solenoids and other devices driven by BMS will have to be added to above to calculate total. Total current draw not to exceed 3A.
Display	Low Temp. Heated LCD
Mounting	Wall Mount Bracket Standard; 2" Pipe Mount Optional
Communication	Digital, Analog and Modbus

OPERATION

2.1 OVERVIEW

The operator interface of the BMS-2500 consists of two components:

- Heated, Back-lit LCD Alphanumeric Display
- 9-Key Membrane Keypad



Keypad functions:

- START initiates the automatic ignition sequence of the pilot and BMS. Once the pilot flame is proven, the BMS will continue into NORMAL OPERATION.
  Note: the BMS display must read "CLEAR TO START" in order to initiate startup sequence.

- STOP cancels the ignition sequence and / or shutdown the operation of the BMS and pilot by closing all fuel train valves and extinguishing the pilot flame. A shutdown reading of "LOCAL MANUAL S/D" will be displayed on BMS display page 1, indicating the STOP button has been pressed.

- ACK. ACK clears any active shutdowns displayed on BMS display page 1. This key also acknowledges passwords and selects items in the calibration and configuration menus for adjustment.
  Note: active shutdowns will only be cleared from the display *if they have been cleared in the field and a safe condition exists*. If the ACK button is pressed and a shutdown has not been field-cleared, a * symbol will appear beside the shutdown, indicating that it has been acknowledged by the operator, but the error still exists in the field.

- CONFIG allows the user access to the Configuration Menu.
  Note: BMS must be shut down (*not in NORMAL OPERATION*) in order to access the Configuration Menu.
  Note: Configuration Menu is password protected.

- CALIB. allows the user access to the Calibration Menu.
  Note: BMS must be shut down (*not in NORMAL OPERATION*) in order to access the Calibration Menu.
  Note: Calibration Menu is password protected.

- PAGE SCROLL / EXIT displays a > symbol beside the page number in the top left corner of the BMS display, indicating that the user may scroll through the pages by pressing the arrow keys. This button is also used to exit the Configuration and Calibration Menus.

- SELECT ITEM allows the user to scroll through any active shutdowns on BMS display page 1, change the control parameters on page 2, and adjust settings on pages 4 and 5 (using the arrow keys). SELECT ITEM also moves the cursor from right to left when inputting any password or numerical value.

- The arrows are used to scroll through pages, scroll through the Configuration and Calibration Menus, and adjust settings and numerical values.

Upon power-up, the introduction message and controller version will be displayed:

Burner Management System V 5.03 REV 2.xx

From the main display, the user can scroll through five different pages.

To enable the scroll function:

1. Press the 'PAGE SCROLL' button. Notice that the > symbol appears beside the page number in the top left-hand corner of the display.
2. Press the ▲ and ▼ buttons to go to the desired page.

1>	
Low Input Voltage	1 of 3

Pages are displayed in the following order:

Page 1 - Sequence Status & Shutdown
Page 2 - Temperature Control / Set Point
Page 3 - Output Status
Page 4 - Auxiliary Analog Input
Page 5 - PID & Temperature Control Parameter

2.2 PASSWORDS - GAINING ENTRY

The controller will be preconfigured at time of order, making changes to the unit's configuration and calibration unnecessary.

The BMS-2500 has a configurable 4-digit password which can be used to prevent unauthorized personnel from altering configuration, calibration or temperature control parameters. Once in the configuration menu, the 'USER' password can be changed to a defined value.

Whenever the BMS asks for the password, use the 'SELECT ITEM' and ▲ and ▼ buttons to change the password, then press the 'ACK' key.

If the 'USER' password has been configured, use that value. If the 'USER' password has not been configured, use the 'MASTER' password.

Factory presets are as follows:

MASTER - Password is 1313 and can be used if 'USER' password is forgotten.
USER - Same entry level as 'MASTER' but user-defined (see section 3.2 item 39).
CONFIG - Manufacturer and authorized personnel (password = 0065).
CALIB - Manufacturer and authorized personnel (password = 0067).

Feature access is as follows:

ACCESS TYPE	MASTER	USER	CONFIG	CALIB
View CONFIG Menu Items	YES	YES	YES	YES
Change Enabled CONFIG Menu Items	YES	YES	YES	YES
Change Locked CONFIG Items	NO	NO	YES	NO
View CALIB Menu Items	YES	YES	YES	YES
Change CALIB Menu Items	NO	NO	NO	YES
View PAGE 5 (PID, ON/OFF Parameters)	YES	YES	YES	YES
Change PID / ON/OFF Control Parameters	YES	YES	YES	YES

2.3 SEQUENCE STATUS & SHUTDOWN ANNUNCIATION

Page one on the controller display is the Sequence / Status page which displays:

- The current status of the controller
- Shutdown conditions

All shutdowns are recorded in chronological order and can be scrolled through.

1. Press the 'SELECT ITEM' key
2. Press the ▲ and ▼ buttons

In the example below, three shutdowns are active, the first of which is due to low voltage.

1. Low Input Voltage 1 of 3

All shutdowns must be cleared before being permitted to proceed. To clear them:

1. Satisfy the shutdown condition(s)
2. Depress the 'ACK' key for each condition (shutdown message will scroll in sequence)

1. *Remote Shutdown 2 of 3

Note:

- Any shutdown which has been acknowledged will have an asterisk (*) preceding the text.
- Any condition that has been satisfied will be cleared from the screen, providing it has been acknowledged. Note: *See section 6 for troubleshooting shutdown conditions (pp. 37 - 41).*

After all shutdowns have been cleared and acknowledged, the following will be displayed:

1. Clear to Start

The BMS-2500 is now ready to relight the burner. The following message appears after depressing the 'START' button (ignitor is on Preset Trial for Ignition Period):

1. Ignition ON

The following message is displayed once the system has verified the pilot flame:

1. #1 Burner Normal Mode

If, after reaching "Normal Mode", the pilot flame goes out, the following message will be displayed (provided relight attempts have been enabled):

1. Relight Attempt #1 Purge On

After the preset purge time, the relight ignition sequence is initiated.

1. Relight Attempt #1 Ignition On

2.4 TEMPERATURE CONTROL

Temperature control is accessed on page two of the BMS-2500 controller display. This page displays:

- Bath and/or Process Temperature
- Bath and/or Process Set Point
- Temperature Control Output Status
- HTSD Set Point (as set in the configuration menu)

2.	Bath: +21C SP : +70C Loc. OUT.: 90% Auto HTSD: +95C

** Note: Displayed temperature units are specified at time of order.*

While viewing this page, the operator can:

- Adjust the Local Set Point
- Switch between Local, Remote or Serial Set Point Control
- Adjust 'Manual' Control's Output Value

To make these changes:

1. Depress the 'SELECT ITEM' key repeatedly until the flashing cursor is in front of the parameter to be changed.
2. Use the ▲ and ▼ buttons to scroll through the options or to change the value.

NOTES:

- When configured for proportional control, the output will be displayed in '%'.
- When configured for ON/OFF control, the output will be displayed as 'ON' or 'OFF'.
- Set point input offers three options:
  - Loc. = Local (from BMS keypad)
  - Rem. = Remote (via 4-20mA signal) - 'REMOTE SP I/P' must be enabled in configuration
  - Ser. = Serial (computer interface, RS 232/485)

2.5 OUTPUT STATUS PAGE

Page three of the BMS-2500 controller displays the status of the following:

- Pilot Solenoid Valve
- Main Solenoid Valve
- Ignition Output
- Purge Blower Output

3.	#1 Pilot	: Open
	#1 Main	: Open
	#1 Ign. : Off	
	Purge Blower: Off	

NOTE: This page is non-adjustable and is for indication only.

2.6 AUX. ANALOG INPUTS AND SHUTDOWNS

Page four of the BMS-2500 controller displays two monitored values:

- Spare Thermocouple Input #1 (if selected)
  - This value can be labeled as ' #1 Stack', 'Bath' or 'Process'
  - Input can be used for indication only, or as a HTSD
  - When used as a HTSD, this value appears in brackets beside the actual temperature
- Supply Voltage

4.	#1 Stack	:		+315C [+700]
	Supply Voltage	:	+24V	[+20]

** Note: Displayed temperature units are specified at time of order.*

NOTE: This page is non-adjustable and is for indication only. Shutdown limits, which appear in brackets, are definable in the configuration menu.

2.7 PID & CONTROL PARAMETER PAGE

NOTE: This page is password protected. See section 2.2.

Page five of the BMS-2500 controller display allows the adjustment of four parameters relating to temperature control:

- Proportional, for PID control only
- Integral (Reset), for PID control only
- Derivative (Rate), for PID control only
- Dead Band, for ON/OFF control only

To make these adjustments:

1. Depress the 'SELECT ITEM' key repeatedly until the flashing cursor is in front of the parameter to be changed.
2. Use the ▲ and ▼ buttons to change the value.

5.	Prop. Band (%)	Bath: 50
	Reset (Min/Rpt)	Bath: 0.00
	Rate (Min)	Bath: 0.00
	D.Band (Deg C)	Bath: 2

** Note: Displayed temperature units are specified at time of order.*

NOTES:

- If the Rate or Reset values are equal to zero, they are disabled.
- All of the above parameters can be changed during startup or normal operation.

CONFIGURATION

3.1 OVERVIEW

The BMS-2500 Burner Management System is configured by adjusting a series of password protected menu items. This menu is accessed by depressing the 'CONFIG' key on the BMS keypad.

Initial Display

```
Burners
 Parallel
```

Parameter open for change (signified by > symbol)

```
Burners
 >Parallel
```

To configure the BMS-2500:

1. Use the ▲ and ▼ buttons to navigate through the menu items.
2. Select an item for configuration by depressing the 'ACK' button. The > symbol will appear behind the variable to be changed.
3. Use the ▲ and ▼ buttons to scroll through the list of options.
4. When a numerical value appears and the cursor is flashing, the value is open for adjustment. Use the 'SELECT ITEM' key to move the cursor and the ▲ and ▼ buttons to change it.
5. If a numerical value appears in a list of options, depress the 'ACK' key again to get the cursor to flash.
6. Depress the 'ACK' key to confirm selection. Notice the > symbol disappear.
7. Resume scrolling through the menu items.
8. Depress the 'PAGE SCROLL' button to exit from the CONFIG menu.

NOTES:

- The BMS-2500 is pre-configured at the factory, and the CONFIG menu is password protected. See section 2.2.
- All shutdowns are factory set to YES by default. If a specific shutdown is not required, it must be manually set to NO in the CONFIG menu. An active shutdown with no field device will result in an error message and the controller will NOT be permitted to START.
- The CONFIG menu cannot be accessed while the BMS is in operation.

3.2 CONFIGURATION MENU ITEMS

Below are the BMS-2500 Version 5.03 CONFIG menu items and their options. See pp. 17 - 23 for a description of each.

Item #	Sequencing Items	Available Options	Notes
1	Burners	1 / 2 / Dual Parallel / Dual Series	
2	#1 T/C Flame 1st Level	0 - 800°C (32 - 1472°F) Preset at 250°C (482°F)	N/A when "Flame Detection" configured to "Contact" (flame rod, UV)
3	#1 T/C Flame 2nd Level	0 - 800°C (32 - 1472°F) Preset at 450°C (842°F)	N/A when "Flame Detection" configured to "Contact" (flame rod, UV)
4	#2 T/C Flame 1st Level	0 - 800°C (32 - 1472°F) Preset at 250°C (482°F)	N/A when "Flame Detection" configured to "Contact" (flame rod, UV)
5	#2 T/C Flame 2nd Level	0 - 800°C (32 - 1472°F) Preset at 450°C (842°F)	N/A when "Flame Detection" configured to "Contact" (flame rod, UV)
6	Trial for Ignition Timer	0 - 3.0 Minutes Preset to .15 (9 sec) for "Contact" Preset to 2 for "T/C"	Preset to 9 sec. when "Flame Detection" configured to "Contact" (flame rod, UV)
7	Flame T/C 2nd Level Timer	0 - 5.0 Minutes Preset to 3 for "T/C"	N/A when "Flame Detection" configured to "Contact" (flame rod, UV)
8	Purge Timer	0 - 10.0 Minutes	
9	Pre-purge	Yes / No	
10	Ignition	Steady / Pulsed	
11	Relight Attempts	0 / 1 / 2 / 3	
12	Flame Detection	Contact / T/C / Aux Contact	
13	Remote Start	Yes / No	
14	Remote Stop	Yes / No	
15	Power Failure Auto Relight	Yes / No	
Safety Interlocks			
16	Proof of Closure #1	Yes / No	
17	Proof of Closure #2	Yes / No	
18	Pilot	Continuous / Intermittent	
19	Flame Status	Independent / Common	
20	Fuel Low Pressure #1	Yes / No	
21	Fuel High Pressure #1	Yes / No	

Configuration Menu Items cont'd

Item #	Sequencing Items	Available Options	Notes
22	Fuel Pressure #2	None / Hi Press / Hi & Low Press	
23	Spare Temp. T/C #1	None / Indicate Only / 0 - 800°C (32 - 1472°F)	
24	Spare Temp. #1 T/C Label	Stack #1 / Bath / Process	
25	Spare Temp. T/C #2	None / Indicate Only / 0 - 800°C (32 - 1472°F)	
26	Spare Temp. #2 T/C Label	Stack #2 / Bath / Process	
27	Allow Auto / Manual	Yes / No	
28	Control Mode	None, Proportional, On-Off	
29	Main Bath T/C High Temp.	No / 0 - 600°C (32 - 1112°F)	
30	Bath High Temp. (Contact)	Yes / No	
31	Bath Low Level	Yes / No	
32	Low Voltage	10 - 30 Volts	
33	Spare Analog Input S/D	None / Indicate Only / 0 - 100%	
Temperature Control			
34	Control Output Mode	Steady / Latching Pulse	
35	Remote Set Point I/P	Yes / No	
36	Remote Temp. Indicate O/P	Yes / No	
Operational			
37	Backlight	Steady On / Off / Light Activated / Timed	
38	Audio	Yes / No	
39	New Access Code	0 - 9999	
40	R.F. Filter	0 - 1000	
41	L.P. Filter (Pilot, Spare #1)	0 - 9999	
42	L.P. Filter (Bath, Spare #2)	0 - 9999	
43	Modbus Address	0 - 247	

1	Burners	1 / 2 / Dual Parallel / Dual Series	

- Burner 1 operates only (see P&ID drawings pp. 31 - 35).
- Burner 2 operates only.
- Parallel - Dual Burner System. Both burners will run independently of each other
- Series - Dual Burner System. Both burners will shut down on any single flame fail.

2	#1 T/C Flame 1st Level	0 - 800°C (32 - 1472°F)	

This value represents the first level of the flame proving sequence for burner #1 if "Flame Detection" is configured to Thermocouple. Main burner #1 is allowed to open after crossing this set point. Preset at 250°C (482°F).

3	#1 T/C Flame 2nd Level	0 - 800°C (32 - 1472°F)	

This value represents the final level of flame verification for burner #1 if "Flame Detection" is configured to Thermocouple. Burner #1 will go into Normal Operation upon crossing this set point. Preset at 450°C (842°F).

4	#2 T/C Flame 1st Level	0 - 800°C (32 - 1472°F)	

This value represents the first level of the flame proving sequence for burner #2 if "Flame Detection" is configured to Thermocouple. Main burner #1 is allowed to open after crossing this set point. Preset at 250°C (482°F).

5	#2 T/C Flame 2nd Level	0 - 800°C (32 - 1472°F)	

This value represents the final level of flame verification for burner #1 if "Flame Detection" is configured to Thermocouple. Burner #1 will go into Normal Operation upon crossing this set point. Preset at 450°C (842°F).

6	Trial for Ignition	0 - 3.0 Minutes	

This value sets the amount of time the BMS will allow for the Flame Sensor to verify a flame. If the flame sensor does not send signal to BMS verifying a flame in the prescribed time, the ignition sequence is halted. Preset for 10 seconds on contact input.

7	Flame T/C 2nd Level Timer	0 - 5.0 Minutes	

This value sets the amount of time the BMS will allow for the flame to reach the second set point. The ignition sequence is halted if the flame fails to reach the second set point in this time.

8	Purge Timer	0 - 10.0 Minutes	

Purge is a prescribed time delay before relight on flame-fail. This value sets the pre- and post-purge time. Preset as required and password protected.

9	Pre-purge	Yes / No	

Pre-purge is a time delay before *any* start. Pre-purge utilizes the same timer as the Purge function.

10	Ignition	Steady / Pulsed	

The igniter output can be a steady 24VDC, or a pulsed (5 Hertz, 20% duty cycle) 24 Volt output.

11	Relight Attempts	0 / 1 / 2 / 3	

Note: The BMS-2500 will not initiate an auto re-ignition unless the unit was in normal operation at the time of flame fail and the purge timer has timed out.

12	Flame Detection	Contact / T/C / Aux. Contact	

- Contact: The unit will rely solely on the contact input from a flame sensor. B149.3 compliant.
- Thermocouple: The unit relies solely on the pilot T/C temperature for flame detection.
- Aux. Contact: The unit will require both T/C and Contact inputs to be valid for flame detection.

13	Remote Start	Yes / No	

If yes, then first momentary contact closure will try and clear shutdowns. Second momentary contact will achieve remote start if shutdowns no longer exist.

14	Remote Stop	Yes / No	

If enabled, this momentary input is used to remotely shut down the BMS-2500. Most commonly used as an ESD input.

15	Power Failure Relight	Yes / No	

If enabled, the unit will automatically relight when the power is restored after failure. Unit will only attempt relight if it was in normal operation at time of failure.

16	Proof of Closure #1	Yes / No	

If enabled, the unit will require proof of closure from burner #1 main valve before ignition sequence will be enabled.

17	Proof of Closure #2	Yes / No	

If enabled, the unit will require proof of closure from burner #2 main valve before ignition sequence will be enabled.

18	Pilot	Continuous / Intermittent	

- When utilizing ON/OFF temperature control, the main burner is cycled on and off to maintain bath and/or process set point.
- Continuous = Pilot remains on continuously
- Intermittent = Pilot turns off with the main burner. The pilot is then relit when the unit calls for heat.

19	Flame Status	Independent / Common	

For Dual Burner Systems:

- Independent: Status #1 and Status #2 will reflect the status of their respective burners.
- Common: Both Status #1 and Status #2 outputs will turn off if either one of the burner flames goes out.

20	Fuel Low Pressure #1	Yes / No	

Enables this contact input to be used as a shutdown.

21	Fuel High Pressure #1	Yes / No	

Enables this contact to be used as a shutdown.

22	Fuel Pressure #2	None / Hi Press / Hi & Low Press	

Two contact inputs are available for shutdown purposes. These are tagged as "High Fuel Pressure #2" and "Low Fuel Pressure #2".

- None: Both inputs are disabled
- Hi Press: High Fuel Pressure Burner #2 is enabled
- Hi & Low Press: High Fuel Pressure Burner #2 and Low Fuel Pressure Burner #2 are enabled.

23	Spare Temp T/C #1	None / Indicate Only / 0 - 800°C (32 - 1472°F)	

This item configures the spare #1 thermocouple input.

- None: Controller will disable this input.
- Indicate Only: Temperature will be displayed on page five.
- Numeric Value: Temperature will be displayed and the unit will shut down when this configured numeric temperature setting is crossed.

24	Spare Temp T/C #1 Label	Stack #1 / Bath / Process	

This applies the label to the previous thermocouple input. Whatever tag is chosen is displayed on page five. The "Bath" tag here should not be confused with the dedicated bath thermocouple input.

25	Spare Temp T/C #2	None / Indicate Only / 0 - 800°C (32 - 1472°F)	

This item configures the spare #2 thermocouple input.

- None: Controller will disable this input.
- Indicate Only: Temperature will be displayed on page five.
- Numeric Value: Temperature will be displayed and the unit will shut down when this configured numeric temperature setting is crossed.

26	Spare Temp T/C #2 Label	Stack #2 / Bath / Process	

This applies the label to the previous thermocouple input. Whatever tag is chosen is displayed on page five. The "Bath" tag here should not be confused with the dedicated bath thermocouple input.

27	Control Mode	Proportional / On-Off / None	

- Proportional: The unit will output a 4-20mA loop for the purpose of temperature control.
- On-Off: The unit will cycle the main burner(s) to maintain temperature.
- None: The unit will not monitor the bath T/C, or output any form of temperature control. This selection is used when temperature control is provided externally to the BMS-2500.

28	Allow Auto / Manual	Yes / No (password protected)	

- Yes: Allows access to the main output A/M option via the front screen.
- No: Controller output will stay in auto mode.

29	Main Bath T/C High Temp SD	No / 0 - 600°C (32 - 1112°F)	

This temperature is read off of the dedicated bath thermocouple.

- No: Controller will not use the bath T/C for HTSD.
- Yes: Controller will use the bath T/C for HTSD and will shut down when this configured numeric temperature setting is crossed. Recommended as a fall back to the bath high temperature contact.

30	Bath High Temp (Contact)	Yes / No	

Enables this contact input to be used as a shutdown.

31	Bath Low Level	Yes / No	

Enables this contact input to be used as a shutdown.

32	Low Voltage	0 - 30 Volts	

Unit will shut down if the voltage supplied to the controller drops below this value.

33	Spare Analog Input SD	None / Indicate Only / 0 - 100%	

This configures the spare 4-20mA input.

- None: Controller will disable this input.
- Indicate Only: Temperature will be displayed on page five.
- Numeric Value: Temperature will be displayed and unit will shut down when the configured percentage of temperature span setting is crossed.

34	Control Output Mode	Steady / Latching Pulse	

This sets the output mode for the pilot and main solenoid valves.

- Steady: Provides a constant voltage to the solenoid when on.
- Latching Pulse: For specialized solenoids only. This selection provides a pulse to open (latch) the solenoid, and another pulse to close (unlatch) the solenoid.

35	Remote Set Point I/P	Yes / No	

Enables the set point input options on page two of the controller display. See section 2.4.

36	Remote Temp. Indicate Out	Yes / No	

Enables the spare 4-20mA output to indicate bath temperature remotely.

37	Backlight	Steady On / Off / Light Activated / Timed	

This configures the behaviour of the controller display backlight.

- Steady On: Backlight stays on whenever the controller is powered up.
- Off: Backlight is disabled.
- Light Activated: Backlight will turn on when the ambient light becomes dim.
- Timed: Backlight will turn on when any key is pressed and will remain on for approx. five minutes.

38	Audio	Yes / No	

This feature is not available in this version of the BMS software.

39	New Access Code	0 - 9999	

This sets the 'USER' password to a user-defined value. Factory default is set to '1313'. See section 2.2.

40	R.F. Filter	0 - 1000	

When a sharp RF spike is detected, the BMS-2500 will hold the previous setting. The typical setting is 20, which gives approx. five seconds of hold time.

41	L.P. Filter (Pilot, Spare #1)	0 - 9999	

This sets the filter, which mathematically smooths noisy signals for the pilot and spare thermocouple input.

42	L.P. Filter (Pilot, Spare #2)	0 - 9999	

This sets the filter, which mathematically smooths noisy signals for the bath and process thermocouple input.

43	Modbus Address	0 - 247	

This sets the device ID when using the modbus computer interface.

CALIBRATION

4.1 OVERVIEW

NOTE: This page is password protected and cannot be accessed while the BMS is in normal operation. See section 2.2.

The BMS-2500 calibration menu is accessed by depressing the 'CALIB.' button on the controller's keypad.

Ensure that proper calibration equipment is available before entering the calibration menu. Once ready to calibrate, enter the configuration menu and ensure that the **'RF Filter' is set to a value of 0**. This will disable the filter and allow the BMS to respond more quickly to the changing of signals during calibration.

Once in the calibration menu:

1. Use the ▲ and ▼ buttons to scroll through the menu items.
2. Scroll to the 'Zero' value of the input to be calibrated.
3. Press the 'ACK' key. A flashing cursor allows the value to be changed.
4. Use the 'SELECT ITEM' key to move the cursor.
5. Use the ▲ and ▼ buttons to change the displayed value.
6. Match the displayed value with the known forced input value from the calibration equipment.
7. Press the 'ACK' key to save this calibration point.
8. Repeat the procedure for the 'Span' value.
9. To exit from the configuration menu, press 'PAGE SCROLL'.

Notes:

- Thermocouple input require a millivoltage signal. Refer to the Thermocouple Reference Chart for millivoltage values for type K thermocouples.
- When forcing (sending) T/C signals, compensate for reference junction temperature by subtracting the mV value that would represent reference junction temperature from your forced mV values.
- 4-20mA inputs require a current signal input for calibration.
- The voltage input is calibrated by varying the voltage supplied to the BMS.
- 4-20mA outputs do not require a known input or output. Simply assign the 'Zero' and 'Span' values in the calibration menu.

4.2 CALIBRATION MENU ITEMS

Inputs	Range Allowed / Type of Signal
Pilot #1 Flame Zero Value	0 - 800°C (32 - 1472°F) / Type K Thermocouple Input
Pilot #1 Flame Span Value	0 - 800°C (32 - 1472°F) / Type K Thermocouple Input
Pilot #2 Flame Zero Value	0 - 800°C (32 - 1472°F) / Type K Thermocouple Input
Pilot #2 Flame Span Value	0 - 800°C (32 - 1472°F) / Type K Thermocouple Input
Bath Temp. Zero Value	0 - 800°C (32 - 1472°F) / Type K Thermocouple Input
Bath Temp. Span Value	0 - 800°C (32 - 1472°F) / Type K Thermocouple Input
Spare #1 Temp. Zero Value	0 - 800°C (32 - 1472°F) / Type K Thermocouple Input
Spare #1 Temp. Span Value	0 - 800°C (32 - 1472°F) / Type K Thermocouple Input
Spare #2 Temp. Zero Value	0 - 800°C (32 - 1472°F) / Type K Thermocouple Input
Spare #2 Temp. Span Value	0 - 800°C (32 - 1472°F) / Type K Thermocouple Input
Remote Set Point Zero (4ma)	0 - 800°C (32 - 1472°F) / Current Loop Input
Remote Set Point Span (20ma)	0 - 800°C (32 - 1472°F) / Current Loop Input
Spare Analog #1 Zero (4ma)	0 - 100% / Current Loop Input
Spare Analog #1 Span (20ma)	0 - 100% / Current Loop Input
Power Input (Low)	10 - 30 Volts / Voltage Input
Power Input (High)	10 - 30 Volts / Voltage Input

Outputs	Range Allowed / Type of Signal
Bath Temp. Zero (4ma)	0 - 800°C (32 - 1472°F) / Current Loop Output
Bath Temp. Span (20ma)	0 - 800°C (32 - 1472°F) / Current Loop Output
Process Temp. Zero (4ma)	0 - 800°C (32 - 1472°F) / Current Loop Output
Process Temp. Span (20ma)	0 - 800°C (32 - 1472°F) / Current Loop Output

Note: Bath and Spare #2 Thermocouple Inputs are range selectable on the front board via DIP switches.

- Low Range allows inputs 0 - 150°C (32 - 302°F)
- Medium Range allows inputs 0 - 300°C (32 - 572°F)
- High Range allows inputs 0 - 800°C (32 - 1472°F)

4.3 THERMOCOUPLE REFERENCE CHART

THERMOCOUPLE TO MILLIVOLTAGE REFERENCE CHART			
Thermocouple Temp. (°C)	Type K Voltage (mV)	Thermocouple Temp. (°C)	Type K Voltage (mV)
0	0.000	380	15.552
10	0.397	400	16.395
20	0.798	420	17.241
25	1.000	440	18.088
30	1.203	460	18.938
40	1.611	480	19.788
50	2.022	500	20.640
60	2.436	520	21.493
80	3.266	540	22.346
100	4.095	560	23.198
120	4.919	580	24.050
140	5.733	600	24.092
160	6.539	620	25.751
180	7.338	640	26.599
200	8.137	660	27.445
220	8.938	680	28.128
240	9.745	700	28.288
260	10.560	720	29.165
280	11.381	740	30.799
300	12.207	760	31.629
320	13.039	780	32.455
340	13.874	800	33.277
360	14.712		

°C

THERMOCOUPLE TO MILLIVOLTAGE REFERENCE CHART			
Thermocouple Temp. (°F)	Type K Voltage (mV)	Thermocouple Temp. (°F)	Type K Voltage (mV)
32	0.000	640	13.782
40	0.176	680	14.713
50	0.397	720	15.647
60	0.619	760	16.585
70	0.843	800	17.526
80	1.068	840	18.469
90	1.294	880	19.414
100	1.521	920	20.360
120	1.977	960	21.308
140	2.436	1000	22.255
160	2.897	1040	23.203
180	3.359	1080	24.149
200	3.820	1120	25.094
240	4.738	1160	26.037
280	5.644	1200	26.978
320	6.540	1240	27.915
360	7.429	1280	28.849
400	8.316	1320	29.780
440	9.208	1360	30.706
480	10.108	1400	31.628
520	11.017	1440	32.545
560	11.933	1480	33.458
600	12.855		

°F

INSTALLATION

5.1 OVERVIEW

Controller Location

The BMS-2500 is INTERTEK certified for Class 1, Division 2 Groups A, B, C and D hazardous locations. It is also rated NEMA 4 and can be readily installed outdoors. The BMS is ideally located away from the flame arrestor in an area not subject to extreme heat and vibration. The distance between the BMS unit and pilot / ignitor assembly can be up to 50 feet at specified interconnecting wiring guages (see below). Greater distances can be achieved if the wiring gauge is increased and line resistance does not exceed 0.5Ω. When installed on the outside wall of a building, care must be taken to protect the controller from heavy runoff or falling snow and ice. Particular attention must be paid to Class 1, Div. 1 building vents which limit the location of Div. 2 rated equipment to within 1.5 meters of such openings.

Conduit Entry

The preferred location for conduit entry is the bottom of the BMS-2500 enclosure. Top entry is also available, but care must be taken to ensure a weather tight seal through the use of a Myers Hub or other approved CEC wiring methods.

Wiring Methods

1. Use rigid steel or aluminum conduit.
2. Interconnecting wiring:
   - Power to the BMS and interconnecting power to the igniter should be (minimum) gauge 14 Belden or equivalent with shields tied to the BMS end only. Note: *If the distance between the BMS and pilot / ingitor assembly is greater than 50 feet, increase the wire gauge to achieve line resistance no greater than 0.5Ω.*
   - All other digital and analog inputs should be (minimum) gauge 16 or equivalent.
3. Interconnecting wiring between thermocouples and the BMS must be type K extension grade thermocouple wire with a shield. Tie shields to the BMS end only.
4. Ground the negative of the power input to the chassis ground.

Solenoids

The pilot and main solenoids must be rated for the same voltage as supplied to the BMS, and approved for the area classification where they are being installed. Solenoid valves must be configured in accordance with the instrumentation P&ID drawings contained in this manual (see pp. 31 - 35). All tubing should be a minimum of 3/8" and properly supported using raceway or tubing clips.

Power Supply Requirements

The BMS-2500 requires a 10 - 30 volt DC supply free of spikes and interference. The power source should be rated for at least 3 Amperes for a typical system. This requirement will be higher if additional solenoids or other loads are driven from the BMS outputs.

5.2 ANALOG INPUT CONNECTIONS

Five type K thermocouple inputs are available:

1. Pilot Flame #1 (N/A if using contact input for flame sensing)
2. Pilot Flame #2 (N/A if using contact input for flame sensing)
3. Spare #1
4. Process
5. Bath

Two 4-20mA inputs are available:

1. Remote Bath Temperature Set Point
2. Remote Process Temperature Set Point

5.3 DIGITAL INPUT CONNECTIONS

Twelve dry contact inputs are available:

1. Remote Stop
2. Remote Start
3. Flame Detection #1 Input
4. Flame Detection #2 Input
5. Bath Low Level
6. Aux. High Temp.
7. Low Fuel Pressure Burner #1
8. Low Fuel Pressure Burner #2
9. Proof of Closure Burner #1
10. Proof of Closure Burner #2
11. High Fuel Pressure Burner #1
12. High Fuel Pressure Burner #2

Note: All digital inputs require a dry set of contacts for operation. The BMS provides excitation power (5 Volts) for the contact. **Any attempt to provide the input with an external supply may result in damage to the controller.**

5.4 ANALOG OUTPUT CONNECTIONS

Two 4-20mA outputs are available:

1. Remote Process Temperature Indication
2. Remote Bath Temperature Indication

Note: These outputs are powered directly from the BMS controller. **Any attempt to power externally will damage the controller.**

5.5 DIGITAL OUTPUT CONNECTIONS

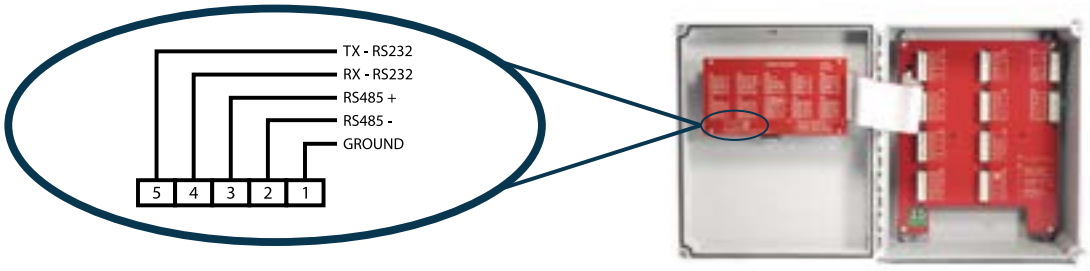
Sixteen digital outputs are available:

1. Igniter #1
2. Igniter #2
3. Status #1
4. Status #2
5. Pilot #1
6. Pilot #2
7. Main #1 SD Valve
8. Main #2 SD Valve
9. Main #1 ON/OFF Control
10. Main #2 ON/OFF Control
11. Purge Blower
12. Spare #1 (not utilized in this software version)
13. Spare #2 (not utilized in this software version)
14. Spare #3 - SD indication (ON when there are no shutdowns active; OFF when there are any shutdowns active)
15. Pilot #1 Unlatch (available upon request - for latching solenoids only)
16. Pilot #2 Unlatch (available upon request - for latching solenoids only)

Note: These outputs are powered directly from the BMS controller. **Any attempt to power externally will damage the controller.** All outputs will be at the same potential as the supplied power to the BMS.

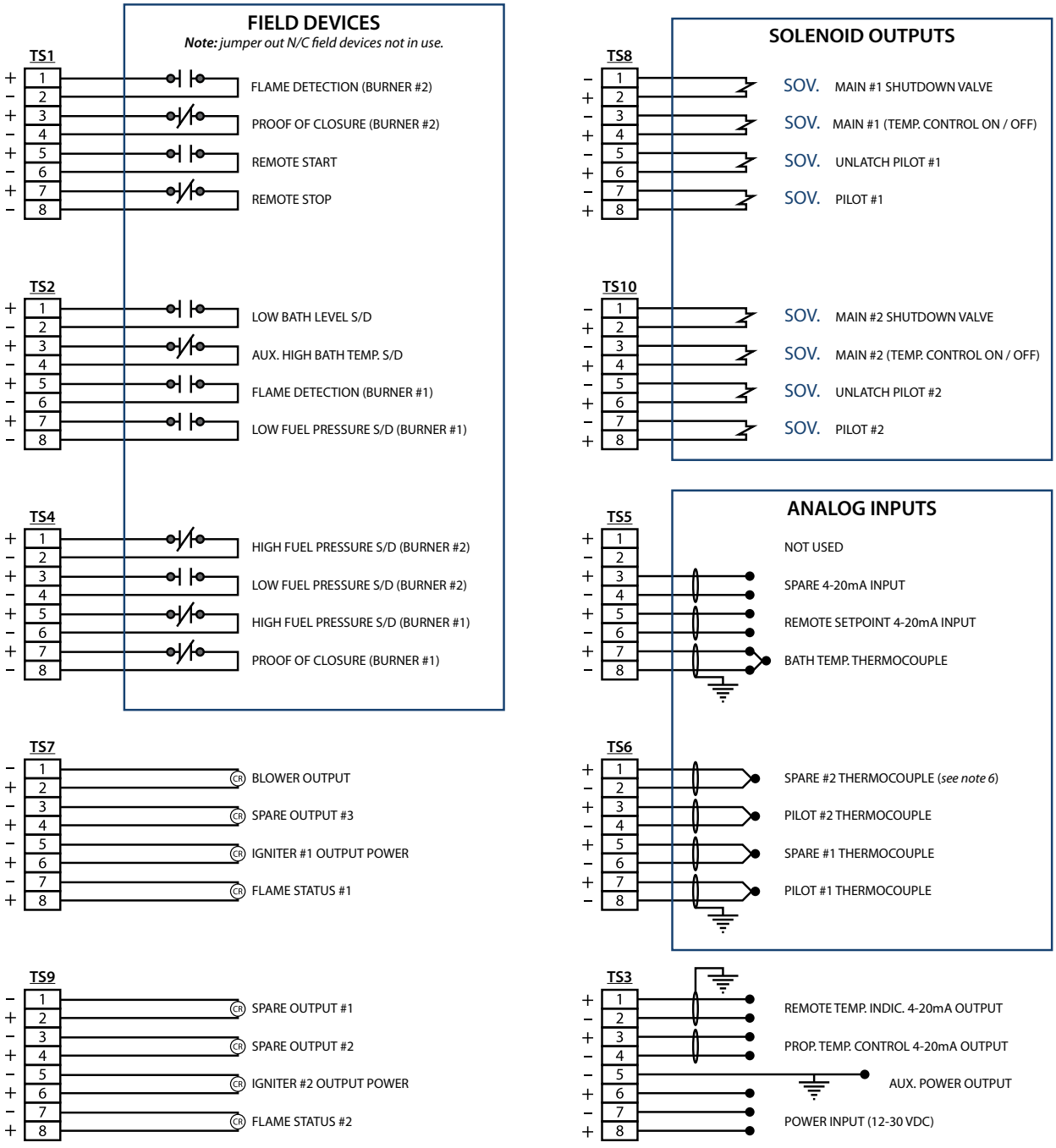
5.6 MODBUS CONNECTIONS

Five Modbus terminals are located on the front circuit board of the Combustex BMS controller: two terminals for Modbus RS232, two terminals for Modbus RS485, and one for ground. Ensure power to the BMS controller is off before terminating wires. A Modbus Map is available by contacting Combustex directly.



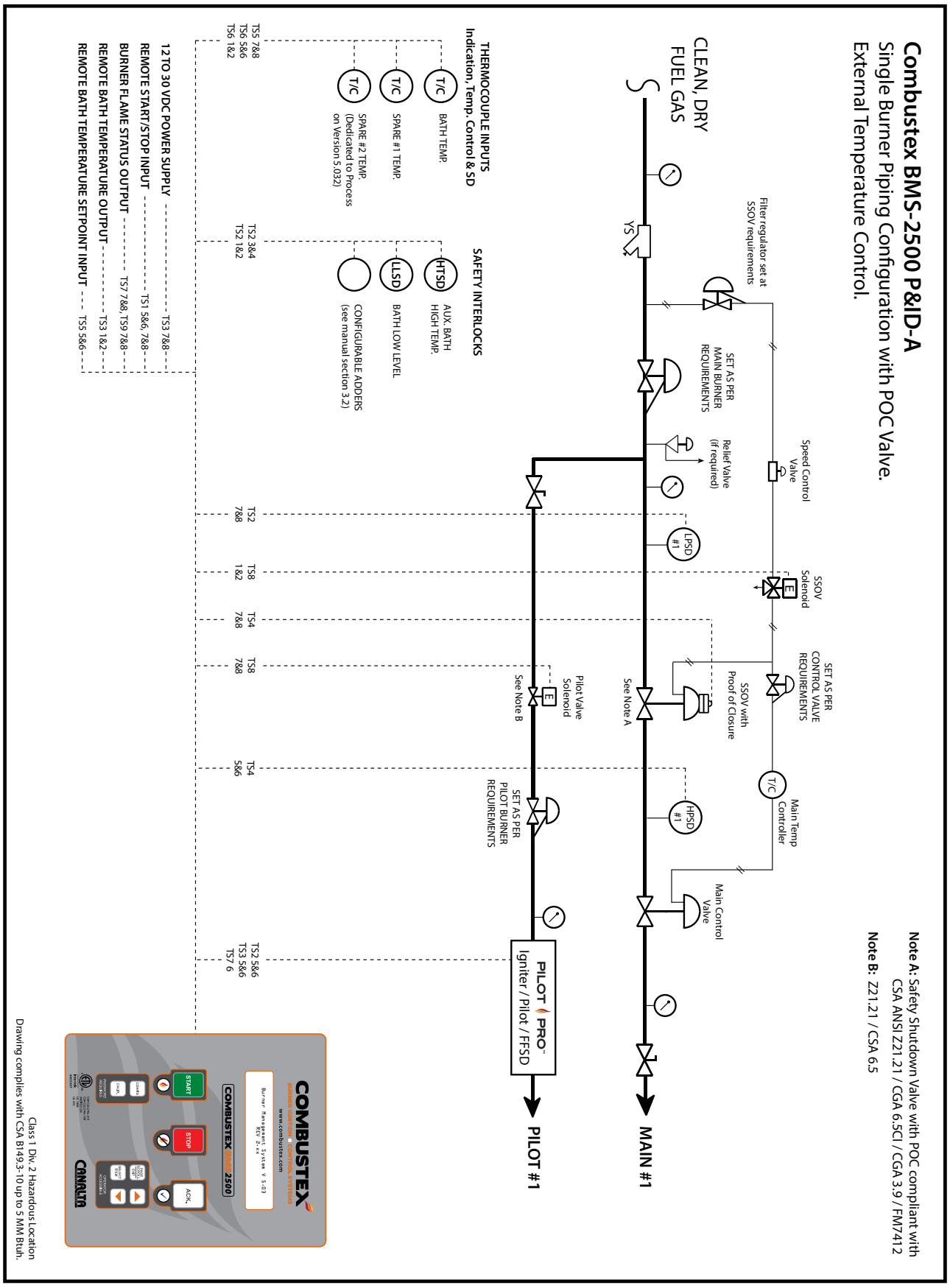
DIAGRAMS

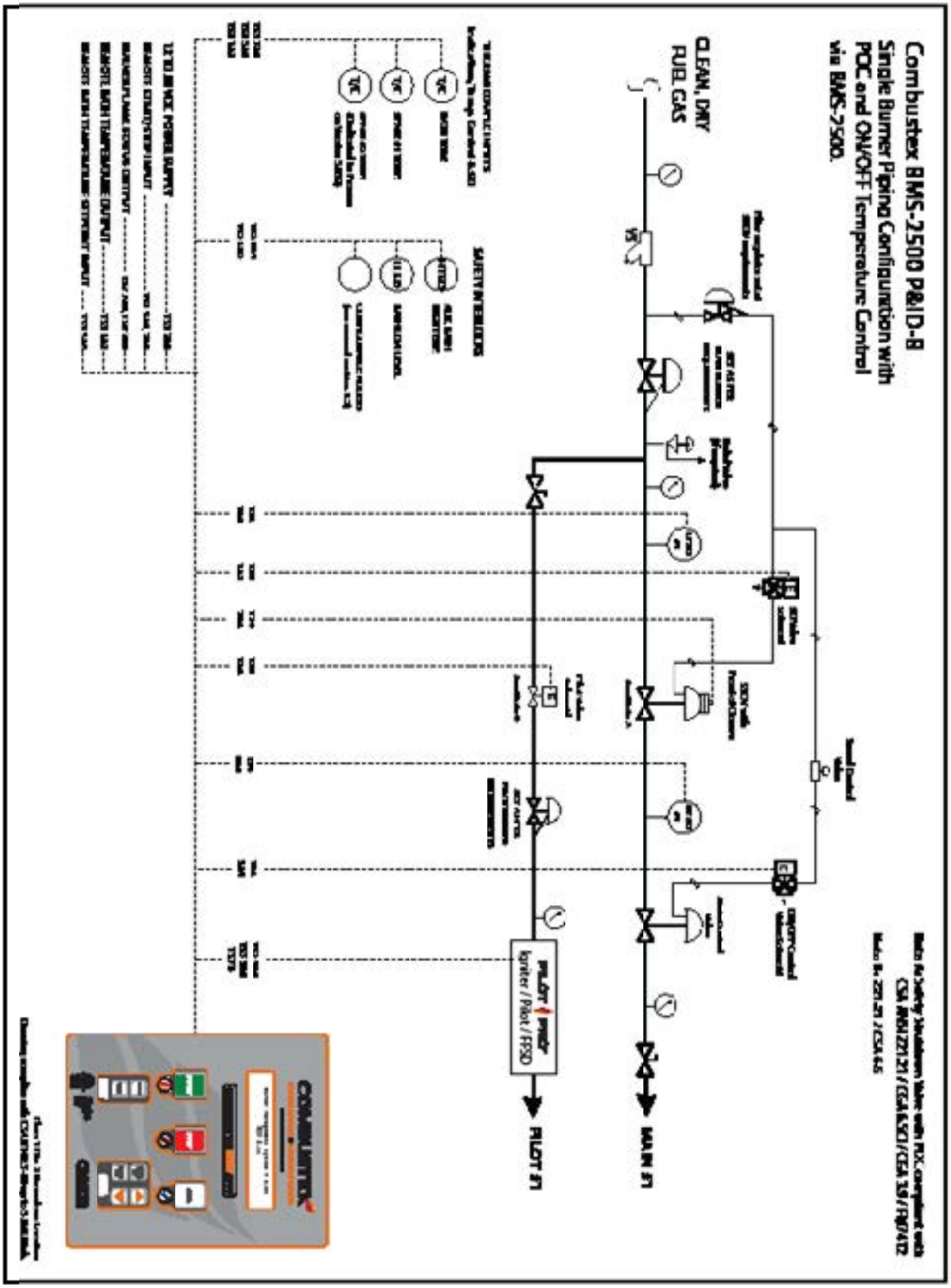
BMS 2500 Wiring Diagram - *Version 5.03 / 5.032*

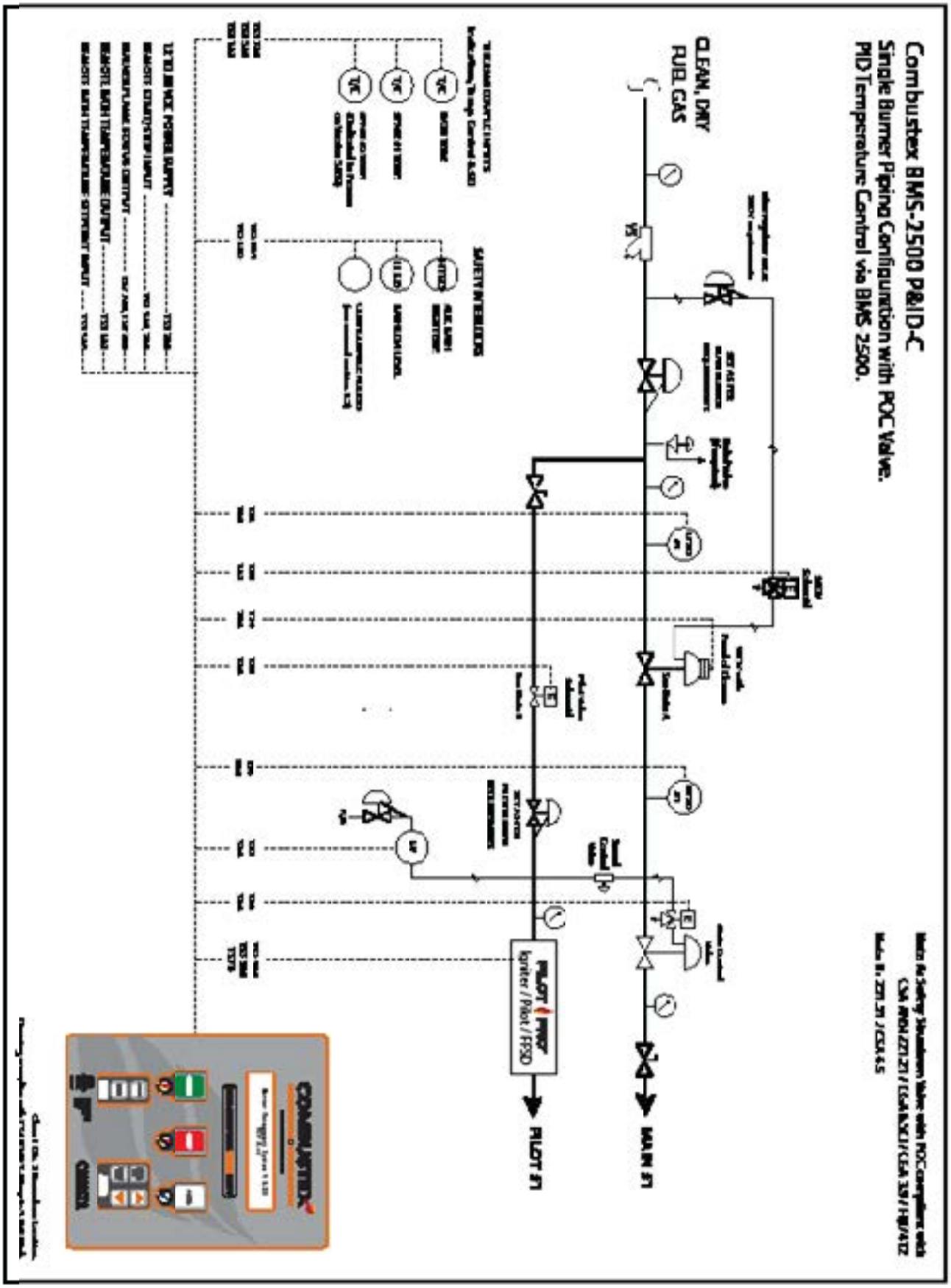


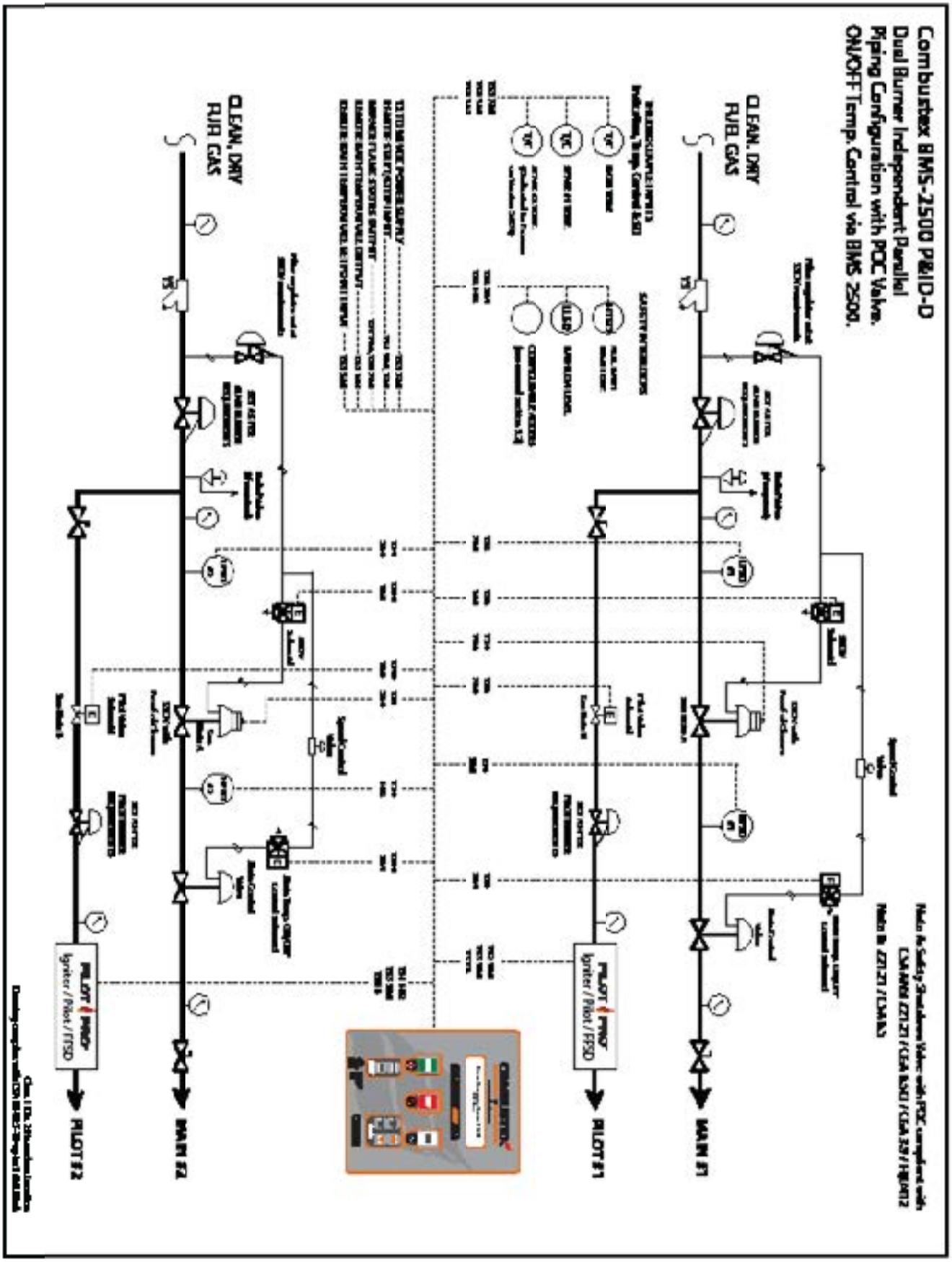
Notes

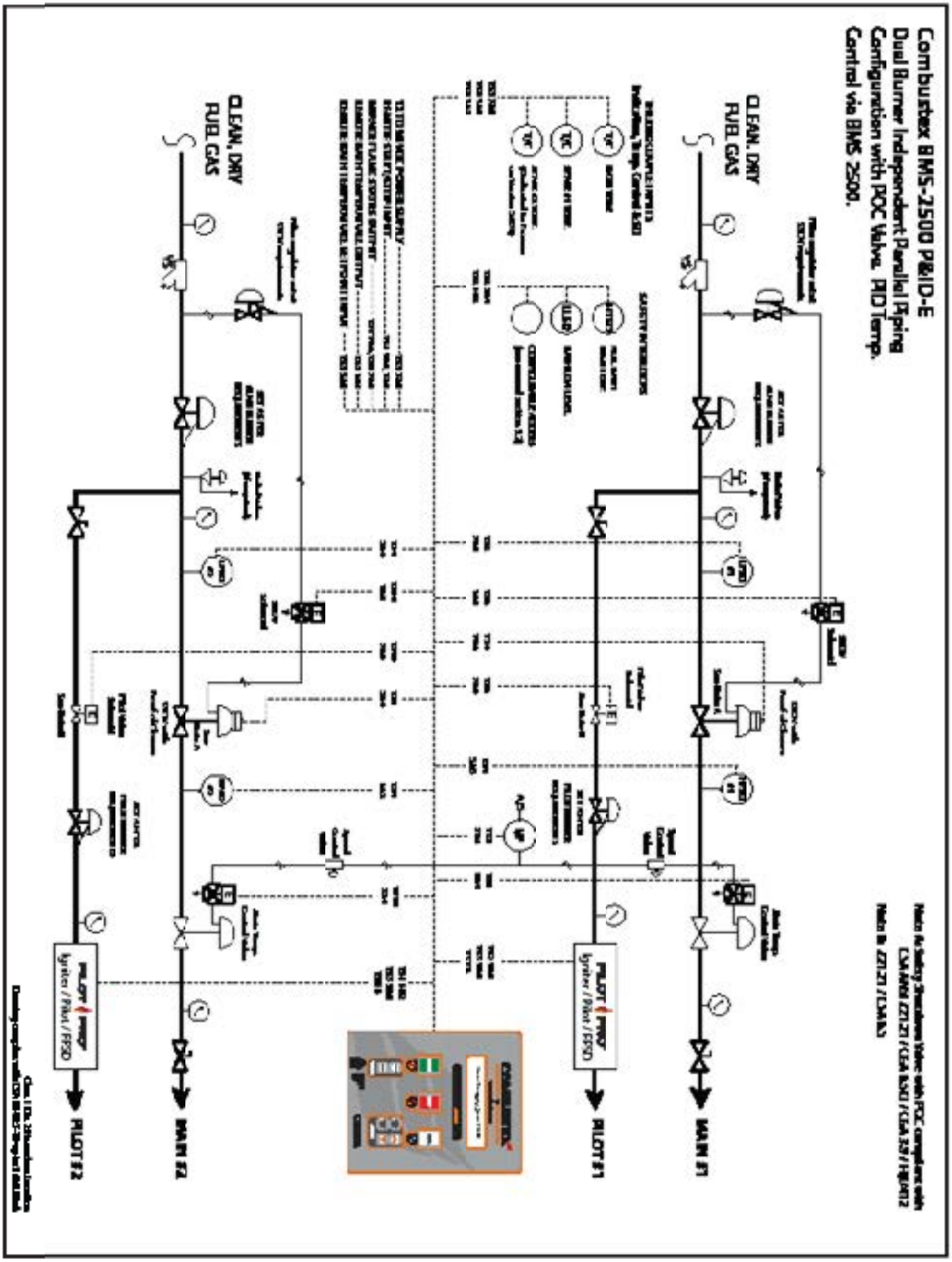
1. 4-20mA outputs are current sourcing.
2. Thermocouples (+) yellow (-) red.
3. Shielded thermocouple ext. wire must be used for accurate readings.
4. 4-20mA inputs are current sinking (loop powered).
5. TS7, TS8, TS9 and TS10 are INTERNALLY powered outputs.
6. TS6 1&2 are dedicated to PROCESS in software version 5.032.


Combustex BMS-2500 P&ID-A
Single Burner Piping Configuration with POC Valve.
External Temperature Control.
CLEAN, DRY FUEL GAS
YS
Filter regulator set at SSOV requirements
SET AS PER MAIN BURNER REQUIREMENTS
Relief Valve (if required)
LPSD #1
Speed Control Valve
SSOV Solenoid
SET AS PER CONTROL VALVE REQUIREMENTS
SSOV with Proof of Closure
See Note A
Pilot Valve Solenoid
See Note B
HPSD #1
T/C
Main Temp Controller
Main Control Valve
MAIN #1
SET AS PER PILOT BURNER REQUIREMENTS
PILOT PRO™
Igniter / Pilot / FFSD
PILOT #1
Note A: Safety Shutdown Valve with POC compliant with CSA ANSI Z21.21 / CGA 6.5CI / CGA 3.9 / FM7412
Note B: Z21.21 / CSA 6.5
THERMOCOUPLE INPUTS
Indication, Temp. Control & SD
T/C
BATH TEMP.
SPARE #1 TEMP.
SPARE #2 TEMP. (Dedicated to Process on Version 5.032)
SAFETY INTERLOCKS
HTSD
AUX. BATH HIGH TEMP.
LLSD
BATH LOW LEVEL
CONFIGURABLE ADDERS (see manual section 3.2)
TS5 7&8
TS6 5&6
TS6 1&2
TS2 3&4
TS2 1&2
TS2 7&8
TS8 1&2
TS4 7&8
TS8 7&8
TS4 5&6
TS2 5&6
TS3 5&6
TS7 6
12 TO 30 VDC POWER SUPPLY ---------- TS3 7&8
REMOTE START/STOP INPUT ---------- TS1 5&6, 7&8
BURNER FLAME STATUS OUTPUT ---------- TS7 7&8, TS9 7&8
REMOTE BATH TEMPERATURE OUTPUT ---------- TS3 1&2
REMOTE BATH TEMPERATURE SETPOINT INPUT ---- TS5 5&6
COMBUSTEX
COMBUSTEX BMS-2500
START
STOP
ACK
CANALTA
Class 1 Div. 2 Hazardous Location
Drawing complies with CSA B149.3-10 up to 5 MM Btuh.


Combustex BMS-2500 P&ID-8
Single Burner Piping Configuration with
POC and ON/OFF Temperature Control
via BMS-2500.
CLEAN, DRY
FUEL GAS
PILOT ST
MAIN ST
Ignitor / Pilot / FFSD


Combustex BMS-2500 P&ID-C
Single Burner Piping Configuration with POC Valve.
PID Temperature Control via BMS 2500.
CLEAN, DRY
FUEL GAS
PILOT FWG
Igniter / Pilot / FFSD
PILOT ST
MAIN ST
COMBUSTEX


Combustex BMS-2500 P&ID-D
Dual Burner Independent Parallel
Piping Configuration with POC Valve.
ON/OFF Temp. Control via BMS 2500.
CLEAN, DRY
FUEL GAS
CLEAN, DRY
FUEL GAS
PILOT #1
MAIN #1
PILOT #2
MAIN #2


Combustex BMS-2500 P&ID-E
Dual Burner Independent Parallel Piping
Configuration with POC Valve, PID Temp.
Control via BMS 2500.
CLEAN, DRY
FUEL GAS
CLEAN, DRY
FUEL GAS
PILOT #2
MAIN #2
PILOT #1
MAIN #1

TROUBLESHOOTING SHUTDOWN CONDITIONS

6.1 ERROR MESSAGES AND SHUTDOWN CONDITIONS

System function errors resulting from equipment failure or faulty wiring (including BMS hardware) are indicated in one of two ways:

- An error message is displayed on the BMS 2500 LCD screen (e.g. **Flame #1 T/C Failed** indicating a faulty thermocouple on pilot #1).
- A shutdown cannot be cleared from the annunciation screen despite having it's condition satisfied (e.g. **Bath High Temp.** cannot be cleared when actual bath temperature falls below the preset HTSD value).

Note: All shutdowns are factory set to YES by default. If a specific shutdown is not required, it must be manually set to NO in the Configuration Menu (see Section 3 pp. 15 - 24). If a specific shutdown is configured to YES but no field device device is terminated to its slot at the BMS controller, a shutdown message will be displayed and the controller will NOT be permitted to START.

DI Test 01 is a generic procedure to test the function of all discrete inputs on the BMS controller, and should be used if the recommended corrective actions described below fail to remedy the problem. To perform the test, disconnect both wires from the DI terminal (refer to the BMS 2500 wiring diagram p. 31). If the specific shutdown is enabled in the configuration menu, the DI will be activated. Use a wire to jumper the +/- terminal of the DI. Note: *Power down the controller when removing wires and installing jumper wire.* With acknowledgement, the S/D should automatically clear from the shutdown list on display Page 1. The test result is classified as *positive* if the DI functions as above. If the DI fails to perform as above, the test result is classified as *negative* and may indicate a hardware malfunction on the BMS controller. Contact Combustex for assistance, service or warranty.

NO.	BMS ERROR MESSAGE / SHUTDOWN	ERROR SOURCE / DESCRIPTION	CORRECTIVE ACTION
1	**Auxiliary Bath High Temp**	Bath Aux. Contact sensor indicating high temperature of vessel. (BMS TS2 #3-4)	If S/D is activated and there is no indication by other sensors that alarm level was crossed, check wiring of DI Bath HTSD. If wiring is OK, check bath temperature sensor's contact switch. Replace if switch is faulty. Otherwise, wait for Bath Temperature to fall below preset alarm level and shutdown should be satisfied. If problem persists, perform *DI Test 01*.
2	**Bath High Temp.**	Bath T/C probe indicating High Temperature Alarm. Bath temp from T/C at TS5 #7-8 has exceeded the HTSD value.	If bath temperature (indicated by a reference gauge) falls below preset HTSD value (set in CONFIG menu) and S/D cannot be cleared, check wiring and condition of Bath T/C with a mV or T/C calibrator. If T/C is faulty, replace with new one. If T/C and wiring is OK, perform a field calibration to Bath T/C input. If proper tools are not accessible or problems persist, contact Combustex for repair request.

NO.	BMS ERROR MESSAGE / SHUTDOWN	ERROR SOURCE / DESCRIPTION	CORRECTIVE ACTION
3	**Bath T/C Failed**	Bath T/C sensor indicates OPEN thermocouple state.	Message indicates open/faulty thermocouple on T/C input TS5 #7-8. Check wiring of thermocouple to BMS and ensure wires are securely and properly terminated. Check T/C condition with mV meter or T/C calibrator. If T/C is faulty, replace with new one. If wiring and T/C are OK, disconnect T/C and jumper terminals. If S/D is still active with terminal jumpered, contact Combustex for replacment of T/C modules.
4	**Flame 1 Failed On 1st Level**	Pilot 1 failed to reach 1st level (usually 250˚C) within Trial for Ignition Timer value	Verify thermocouple condition with mV source or T/C calibrator. If T/C is faulty, replace with new one. If T/C is in good condition, check the position of the T/C in the pilot head to ensure it is getting good exposure to flame. Also, ensure pilot assembly is correctly installed and aligned with main burner. **Note:** Flame T/C levels and timers may need to be adjusted slightly to best suit pilot and burner conditions.
5	**Flame 1 Failed On 2nd Level**	Pilot 1 failed to reach 2nd level (usually 450˚C) within Flame T/C 2nd Level Timer value.	Verify thermocouple condition with mV source or T/C calibrator. If T/C is faulty, replace with new one. If T/C is in good condition, check the position of the T/C in the pilot head to ensure it is getting good exposure to flame. Also, ensure pilot assembly is correctly installed and aligned with main burner. **NOTE:** Flame T/C levels and timers may need to be adjusted slightly to best suit pilot and burner conditions.
6	**Flame 1 Failed During Relite**	Pilot 1 failed to ignite within all preset relite attempts.	Verify thermocouple condition with mV source or T/C calibrator. If T/C is faulty, replace with new one. If T/C is in good condition, check the position of the T/C in the pilot head to ensure it is getting good exposure to flame. Also, ensure pilot assembly is correctly installed and aligned with main burner. Verify spark plug is producing strong spark. If spark plug is faulty, replace with new one.
7	**Flame 1 Off or Flame 1 Failed to Ignite**	Contact Type flame detection on pilot 1 failed to confirm flame within Trial for Ignition Timer value.	Check wiring of Ignition Module or Flame Scanner back to BMS at TS2 #5-6. Refer to Model 900 or 550 manual for Ignition Module to BMS wiring schematic. If wiring is OK, check condition of pilot ignition module for burner 1 or 3rd party flame sensing equipment (Flame Scanner). Also check condition and installation of all pilot assembly equipment. Replace any faulty piece of equipment as required. Contact Combustex if problems persist.
8	**Flame 1 T/C Failed**	Pilot 1 Flame T/C sensor indicates OPEN thermocouple state.	Message indicates open/faulty thermocouple on T/C input TS6 #7-8. Check wiring of thermocouple to BMS and ensure wires are securely and properly terminated. Check T/C condition with mV meter or T/C calibrator. If T/C is faulty, replace with new one. If wiring and T/C are OK, disconnect T/C and jumper terminals. If S/D is still active with terminal jumpered, contact Combustex for replacement of T/C modules.
9	**Flame 2 Failed On 1st Level**	Pilot 2 failed to reach 1st level (usually 250˚C) within Trial for Ignition Timer value	Verify thermocouple condition with mV source or T/C calibrator. If T/C is faulty, replace with new one. If T/C is in good condition, check the position of the T/C in the pilot head to ensure it is getting good exposure to flame. Also, ensure pilot assembly is correctly installed and aligned with main burner. **NOTE:** Flame T/C levels and timers may need to be adjusted slightly to best suit pilot and burner conditions.
10	**Flame 2 Failed On 2nd Level**	Pilot 2 failed to reach 2nd level (usually 450˚C) within Flame T/C 2nd Level Timer value.	Verify thermocouple condition with mV source or T/C calibrator. If T/C is faulty, replace with new one. If T/C is in good condition, check the position of the T/C in the pilot head to ensure it is getting good exposure to flame. Also, ensure pilot assembly is correctly installed and aligned with main burner. **NOTE:** Flame T/C levels and timers may need to be adjusted slightly to best suit pilot and burner conditions.

NO.	BMS ERROR MESSAGE / SHUTDOWN	ERROR SOURCE / DESCRIPTION	CORRECTIVE ACTION
11	**Flame 2 Failed During Relite**	Pilot 2 failed to ignite within all preset relite attempts.	Verify thermocouple condition with mV source or T/C calibrator. If T/C is faulty, replace with new one. If T/C is in good condition, check the position of the T/C in the pilot head to ensure it is getting good exposure to flame. Also, ensure pilot assembly is correctly installed and aligned with main burner. Verify spark plug is producing strong spark. If spark plug is faulty, replace with new one.
12	**Flame 2 Off or Flame 2 Failed to Ignite**	Contact Type flame detection on pilot 2 failed to confirm flame within Trial for Ignition Timer value.	Check wiring of Ignition Module or Flame Scanner back to BMS at TS1 #1-2. Refer to Model 900 or 550 manual for Ignition Module to BMS wiring schematic. If wiring is OK, check condition of pilot ignition module for burner #1 or 3rd party flame sensing equipment (Flame Scanner). Also check condition and installation of all pilot assembly equipment. Replace any faulty piece of equipment as required. Contact Combustex if problems persist.
13	**Flame 2 T/C Failed**	Pilot 2 Flame T/C sensor indicates OPEN thermocouple state.	Message indicates open/faulty thermocouple on T/C input TS6 #3-4. Check wiring of thermocouple to BMS and ensure wires are securely and properly terminated. Check T/C condition with mV meter or T/C calibrator. If T/C is faulty, replace with new one. If wiring and T/C are OK, disconnect T/C and jumper terminals. If S/D is still active with terminal jumpered, contact Combustex for replacment of T/C modules.
14	**High Fuel Press. 1**	Gas supply signal for Main Burner 1 indicating high input fuel pressure. (BMS TS4 #5-6)	Check wiring of High Fuel Pressure Switch. If wiring is OK, check High Fuel Pressure sensor. Replace sensor if faulty. If problem persists, perform *DI Test 01*.
15	**High Fuel Press. 2**	Gas supply signal for Main Burner 2 indicating high input fuel pressure. (BMS TS4 #1-2)	Check wiring of High Fuel Pressure Switch. If wiring is OK, check High Fuel Pressure sensor. Replace sensor if faulty. If problem persists, perform *DI Test 01*.
16	**Local Manual S/D**	Local STOP Key on BMS 2500 was pressed to S/D unit from Normal Operation.	If STOP key was NOT hit and Local Manual S/D cannot be cleared from annunciation screen, call Combustex. Problem could be a faulty keypad or main front board circuitry.
17	**Low Bath Level**	Level sensor indicating Low Bath Level. (BMS TS2 #1-2)	Check wiring of Low Bath sensor to BMS. If wiring is OK, check Low level sensor contact. Replace Low level sensor if contact is faulty. If problem persists, perform *DI Test 01*.
18	**Low Fuel Press. 1**	Gas supply signal for Main Burner 1 indicating low input fuel pressure. (BMS TS2 #7-8)	Check wiring of Low Fuel Pressure Switch. If wiring is OK, check Low Fuel Pressure sensor. Replace sensor if faulty. If problem persists, perform *DI Test 01*.

NO.	BMS ERROR MESSAGE / SHUTDOWN	ERROR SOURCE / DESCRIPTION	CORRECTIVE ACTION
19	**Low Fuel Press. 2**	Gas supply signal for Main Burner 2 indicating low input fuel pressure. (BMS TS4 #3-4)	Check wiring of Low Fuel Pressure Switch. If wiring is OK, check Low Fuel Pressure sensor. Replace sensor if faulty. If problem persists, perform *DI Test 01*.
20	**Low Input Voltage**	BMS-2500 Input Power Voltage fell below preset value.	Press ACK key to see if error clears. If still active, measure input voltage at TS3 # 7-8 and confirm that it's value matches the Supply Voltage reading on display Page 4 of the BMS. If values do not coincide, a calibration is required. Contact Combustex. Refer to CONFIG menu for preset Low Power S/D value and if supply voltage is below set value, check power supply to controller for problem. If input has been re-calibrated and voltage is still below set value, contact Combustex for controller repair.
21	**P.O.Closure 1 Failed**	Proof of closure contact failed to close, indicating OPEN status of main P.O.C. valve 1. (BMS TS4 #7-8)	Check wiring of P.O.C. limit switch to the BMS and the condition of the switch itself. If wiring is OK, check P.O.C. contact function. Replace limit switch if contact is faulty. If problem persists, perform *DI Test 01*.
22	**P.O.Closure 2 Failed**	Proof of Closure contact failed to close, indicating Open status of Main P.O.C. valve 2. (BMS TS1 #3-4)	Check wiring of P.O.C. Limit Switch to the BMS and the condition of the switch itself. If wiring is OK, check P.O.C. contact function. Replace Limit Switch if contact is faulty. If problem persists, perform *DI Test 01*.
23	**Remote Shutdown**	Remote S/D discrete input signal is activated from remote location. (BMS TS1 #7-8)	If Remote S/D indicated but not issued by Remote Stop source, check wiring of DI and verify the source of REMOTE STOP is *NORMALLY CLOSED* and not triggered. If problem persists, perform *DI Test 01*.
24	**Spare 1 High Temp.**	Spare T/C 1 input indicates T/C reading has exceeded preset S/D temp	If Spare #1 temperature (indicated by a reference gauge) falls below preset HTSD value (set in CONFIG menu) and S/D cannot be cleared, check wiring and condition of Spare #1 T/C with a mV or T/C calibrator. If T/C is faulty, replace with new one. If T/C and wiring is OK, perform a field calibration to Spare #1 T/C input. If proper tools are not accessible or problems persist, contact Combustex for repair request.
25	**Spare 1 T/C Failed**	Spare 1 T/C sensor indicates OPEN thermocouple state.	Message indicates open/faulty thermocouple on T/C input TS6 #5-6. Check wiring of thermocouple to BMS and ensure wires are securely and properly terminated. Check T/C condition with mV meter or T/C calibrator. If T/C is faulty, replace with new one. If wiring and T/C are OK, disconnect T/C and jumper terminals. If S/D is still active with terminal jumpered, contact Combustex for replacement of T/C modules.
26	**Spare 2 High Temp.**	Spare T/C 2 input indicates T/C reading has exceeded preset S/D temp	If Spare 2 temperature (indicated by a reference gauge) falls below preset HTSD value (set in CONFIG menu) and S/D cannot be cleared, check wiring and condition of Spare #2 T/C with a mV or T/C calibrator. If T/C is faulty, replace with new one. If T/C and wiring is OK, perform a field calibration to Spare #2 T/C input. If proper tools are not accessible or problems persist, contact Combustex for repair request.

NO.	BMS ERROR MESSAGE / SHUTDOWN	ERROR SOURCE / DESCRIPTION	CORRECTIVE ACTION
27	**Spare 2 T/C Failed**	Spare 2 T/C sensor indicates OPEN thermocouple state.	Message indicates open/faulty thermocouple on T/C input TS6 #1-2. Check wiring of thermocouple to BMS and ensure wires are securely and properly terminated. Check T/C condition with mV meter or T/C calibrator. If T/C is faulty, replace with new one. If wiring and T/C are OK, disconnect T/C and jumper terminals. If S/D is still active with terminal jumpered, contact Combustex for replacment of T/C modules.
28	**Spare Analog #1 S/D**	Spare 4-20 mA analog input value has exceeded preset S/D limit. (BMS TS5 #3-4)	If analog signal drops back below the preset S/D level and error still does not clear (after ACK is pressed), check the wiring of the 4-20 mA transmitter back to the BMS. If wiring is OK, check proper functioning of transmitter and calibration of BMS by measuring the 4-20 signal with mA meter and compare to BMS reading. If required, perform a field calibration. If proper tools are not accessible and/or problems still persist, contact Combustex for repair request.

NOTES

Combustex BMS 2500 503 Manual Online (.indd/.pdf)
THIS MANUAL REV 2.4 - 10/2013

COMBUSTEX
BURNER IGNITION & CONTROL SYSTEMS
A Canalta Controls Company

For operational, technical or installation assistance, please contact us.

Phone: 403.342.4494 | **Web:** www.combustex.com
Call Us Toll Free: *1-855-226-2582*