PF2200 - SB

Modbus Configuration Guide

DOC-001107

V6.0

PROFIRE

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1 CONFIGURATION

This document outlines configuration details for using Modbus with the PF2200-SB BMS and is applicable for the following hardware and firmware versions:

BMS Card Hardware Version	UI Card Hardware Version	PF2200-SB Firmware Version
v2.3.x	v3.2.x	SB 2.2.0

The protocol used is Modbus RTU as a slave device and the physical implementation is half-duplex RS-485.

1.1 PF2200 MODBUS CONFIGURATION SETTINGS

Navigate to the Modbus Menu (Settings > Setup > Modbus) on the PF2200 User Interface to configure the following settings:

Name	Default	Options	Description
Modbus RTU Communication	Disabled	Disabled Enabled	Enables or disables Modbus the Modbus port on the User Interface Card. This must be enabled to utilize Modbus functionality.
Modbus Termination	Disabled	Disabled Enabled	Enables or disables a 100 Ω termination resistor across the A and B signal lines. This should be enabled if this device is the last drop on the Modbus line.
Baud Rate	9600	9600 19200	Baud rate of the communication protocol. 9600 should be used for noisy or long run lengths. Ensure that master and slave are using the same baud rate.
Stop Bits	1	1 2	Number of stop bits used for Modbus communication.
Parity	None	None Odd Even	Parity bit used for Modbus communication.
Slave Address	1	1 - 247	Modbus slave address of the PF2200. Ensure that the address is not used by any other devices on the Modbus line, and ensure that the master device is configured to match.

1.2 MODBUS MASTER CONFIGURATION REQUIREMENTS

1. Modbus Master must be in RTU mode and not ASCII mode
2. The minimum delay between Modbus poll packets should be longer than 20ms. Recommended interpacket delay is 20ms.
3. Response timeout should be longer than 500ms. The recommended timeout is 1 second.
4. Writing settings values via Modbus will overwrite any local user settings changes. It is recommended to keep setting writes to a minimum and either only write settings when changed, or if continually writing settings keep the write rate to a minimum of 5 seconds.
5. When reading settings, the fastest scan rate is recommended to be greater than 1 second.
6. Many of the registers use units that match the configured user interface units (i.e. unless otherwise noted all temperatures will either be reported in Celsius or Fahrenheit depending on the temperature unit configured on the UI). Units for Registers read or written should be confirmed on the user interface and converted on the Modbus master side if required.
7. Many of the registers are represented as 10 times their actual value to increase the resolution of the data. For example, a register with a value of 12.1 may be multiplied by a factor of 10 to return a value of 121, this allows once decimal place to be retained over the Modbus read/write. Check each register description to see if it is multiplied by this factor. The Modbus master will be required to convert the value back to a decimal format by dividing by 10.

1.3 TROUBLESHOOTING

The following section outlines some common issues with Modbus configuration and installation.

Problem	Proposed Solutions
Device not responding	1. Check that configuration parameters match between the Master and Slave device such as baud rate, stop bits and parity. 2. Check that the slave address matches. 3. Check the Modbus response timeout is greater than 1000ms. 4. Check that the RS-485 Lines are not connected backwards. A wire connects to A or D-. B wire connects to B or D+. 5. Confirm a signal ground wire is connected between the Master and Slave device. 6. Confirm the Slave device is enabled in settings. 7. Try communication with termination enabled or disabled. Sometimes termination enabled can cause the Modbus Master to be incorrectly biased. 8. Confirm if the Modbus master has internal pullup and pulldown termination on the data lines. Some Master devices require external biasing resistors to be installed
CRC Errors	1. Check that configuration parameters match between the Master and Slave device such as baud rate, stop bits and parity. 2. Check if there is noise on the line. This can be caused by external equipment or long run lengths. 3. Check if the data lines are reversed.
Data returned is always 0	1. Check that the Modbus port is enabled on the user interface. 2. Check that the UI is communicating with the BMS. The Modbus communication register will return a value of 1 if communications have been lost with the BMS. 3. Check that the correct register is addressed. If the register is invalid it will return an exception code or a zero.
BMS shuts down when writing setpoints	1. The setpoints may not be formatted correctly. Check the register definition. 2. The units may not be configured as expected. Check the temperature units in the UI units configuration. 3. The setpoints may be written out of range. Check the PF2200 user manual for setpoint configuration errors. For example, if the process setpoint is written to be higher than the high temperature setpoint the system will shut down.
BMS will not start when Start command sent via Modbus	1. Confirm the correct value is written to the start register. 2. Confirm the lockout code is cleared and no alarms are present prior to attempting to start the system.
Read values don't make sense	1. Check the pressure, level and temperature units configured on the UI. The Modbus representation matches the UI Units. For example, pressure can be in PSI, kPa, etc. 2. Check if the register is using a multiplier such as x10. If this is the case then the Modbus Master will need to divide by 10 to get the actual value.
Can't tell if read/write is working	1. Read the available Test Registers and confirm the results match as described. These registers always return a specific value when read so that addressing and formatting can be confirmed. These registers may also be written. If the write is incorrect, they will return an exception code. 2. Modbus Master may require the address offset (index starting at 0) or the address itself (index starting at 1). Attempt to read the test registers at both the address and the offset to see which result provides the correct response.

1.3.1 MODBUS DIAGNOSTICS

Check the Modbus Diagnostics screen (System > Diagnostics > Modbus) for useful troubleshooting information.

Diagnostic Name	Description	Potential Cause
Transmitted Packets	The total number of packets transmitted.	N/A
Checksum Error	The Modbus packet has been received but the CRC check has failed indicating a corrupt packet.	Noise or missed bits on the RS485 line.
Illegal Function Code	The requested Modbus function code is not supported.	Modbus master programming error
Invalid Address count	The number of received packets that are not addressed to this slave device.	Configured Slave Address setting is incorrect
Frame Error	The received Modbus packet has frames that do not match the current configuration.	Configured Baud Rate, Parity, and/or Stop Bits settings do not match the Modbus master communication settings
Noise Error	The slave Modbus port has detected noise on the RS-485 line.	Incorrect configuration or noise from external sources.
Received Packets	The total number of packets received without protocol error.	N/A
Illegal Register Address	The requested register address is not supported.	Modbus master programming error
Parity Error	The received Modbus packet has a parity failure.	Corruption, noise, or incorrect configuration
Illegal Data Value	The data written to the register is out of range, or if the register spans multiple addresses not all addresses are written to in a single write request.	Modbus master programming error
Exceptions	The total count of illegal packet codes.	Incorrect configuration or Modbus master programming error

1.4 MODBUS COMMANDS

Only the Modbus RTU commands specified below are supported are supported. All other Modbus RTU commands are not supported and will return an exception code for invalid command. Modbus TCP is not directly supported but can be used if a third-party bridge is used.

Settings may be written one by one or multiple settings may be written at once if they are sequential in the register table.

Some settings such as floats and uint32_t span multiple registers and hence all registers for each of these settings must be written at the same time or else the write request will fail.

Registers may be read one by one or multiple registers can be requested in one packet

If an individual register is requested that does not exist an exception code will be returned

If multiple registers are requested - as long as the first register has a valid address, the following registers regardless of their validity will return successfully. This allows for multiple registers to be read out without worrying about breaking up the register table for reads. Registers without a valid address will simply return 0.

Name	Command	Description
Read Input Registers	4 = 0x04	Two bytes per register are returned.
Read Coil	1 = 0x01	Bits pack the response.
Read Holding Registers	3 = 0x03	Two bytes per register are returned.
Read Discrete Input	2 = 0x02	Bits pack the response.
Write Multiple Holding Registers	16 = 0x10	Two bytes per register must be sent.
Write Single Holding Register	6 = 0x06	Two bytes per register must be sent.
Write Multiple Coils	15 = 0x0F	NOT SUPPORTED.
Write Single Coil	5 = 0x05	NOT SUPPORTED.

1.5 REGISTER ADDRESS VS REGISTER OFFSET

Some Modbus configuration software requires the 5-digit Register Address to be entered while other software uses the 1 to 4 digit Register Offset. Consult the software documentation for your Modbus master device to determine which is required in your case. This guide displays both numbers for each register.

1.6 REGISTER DATA FORMAT

The PF2200 supports multiple data formats in addition to the standard Modbus definitions. These include floats, uint32_t and arrays. These types require multiple (16bit) registers for representation and are described as follows:

- uint32_t are held in two sequential registers: (ABCD) = Reg 1: AB, Reg 2: CD
- uint64_t are held in four sequential registers: (ABCDEFGH) = Reg 1: AB, Reg 2: CD, Reg 3: EF, Reg 4: GH
- Arrays are held in sequential registers with 2 bytes per register. The number of registers to read/write will be the length of the array divided by 2. If the size of the array is odd the last byte is extended to a full word.
- Floating Point numbers (ABCD) are held in two sequential registers (Reg 1 - AB, Reg 2 – CD) and are represented in IEEE-754 Standard format.

All registers must be read/written in one request. Hence a multi-read or multi-write command must be used with a minimum length of the size of the data type.

Big-Endian format - the most significant byte and the most significant word are sent first (in the lower register).

1.7 LATCHED VS UNLATCHED REGISTERS

Latched registers have the same function as their corresponding unlatched registers, but once set will remain set until the system is stopped and then restarted. All registers are unlatched unless explicitly listed as latched.

1.8 SYSTEM UNITS

Settings and status registers may be displayed in the same unit as the user interface is configured for. If a register does not follow the corresponding UI unit it will be mentioned in the register description. Commonly temperature, pressures, levels and aux inputs will use the UI display unit. Registers that show the span of an input (such as pressure, level, or aux span min and max) when set to a unit of % or ma will display as 0 from Modbus. The reason for this is because span cannot be mapped back into its own base unit (of ma or %). In these cases, the span will always be 4 - 20mA as 0 - 100% of the span of the input.

1.9 PF2100 BACKWARDS COMPATIBILITY

The PF2200 Modbus register map has been substantially expanded over the PF2100 to include registers for all settings and system status information. Register mapping from the PF2100 have been included as a subset to maintain backwards compatibly for Profire products. These registers are labeled as Legacy PF2100 registers in their descriptions. This allows for PF2200 units to be a drop-in replacement for PF2100 units without requiring an update to the Modbus Master on most sites. Some register formats from the PF2100 are not supported identically in this map as hardware IO may be different between platforms. It is recommended to leave the Legacy PF2100 unused when possible.

1.10 COMMUNICATION LOSS

The PF2200 user interface communicates to the BMS card via a proprietary communication protocol called PFN. With the Slave Modbus port being accessible on the user interface data must be transferred from the BMS card to the user interface over the PFN link. If the user interface loses communication to the BMS card it can no longer retrieve Modbus setting and status information. In this case the Modbus registers will return all zeros except for the Modbus communication loss register (which will indicate a 1) and the communication loss counter (which will increment every second that communication is not present between the UI and BMS card).

2 MODBUS REGISTER MAP

2.1 READ ONLY COILS & DISCRETE INPUTS [0X01, 0X02]

Function codes 0x01 (Read Coil) and 0x02 (Read Input Status) can both be used to access the single-bit, read-only values from the following table. Reading one input will result in a single byte being returned with the least significant bit holding the value. Reading multiple inputs per command will result in a bit packed vector being returned.

Example 1: Read Single - Reading 1 register starting from Register Offset 3 will result in one data byte being returned with the least significant bit containing the value from Register Offset 3. All other unused bits will be set to zero.

Example 2: Read Multiple - Reading 12 registers starting from Register Offset 3 will result in two data bytes being returned. The value of the registers will be populated in the bits of each byte, beginning with the least significant bit of each byte. All other unused bits will be set to zero.

Address (Offset)		Name	0	1
10001/20001	(0)	Run *Legacy PF2100 Register	System not in a running state	System in a running state
10002/20002	(1)	Pilot *Legacy PF2100 Register	Pilot outputs de-energized	Pilot 1 or Pilot 2 output energized
10003/20003	(2)	Stage 1 (low fire) *Legacy PF2100 Register	SSV output de-energized	SSV output energized
10004/20004	(3)	Stage 2 (high fire) *Legacy PF2100 Register	High Fire output de-energized	High Fire output energized
10017/20017	(16)	Level Input *Legacy PF2100 Register	Closed	Open
10018/20018	(17)	Main Solenoid Feedback *Legacy PF2100 Register	No voltage at SSV output	Voltage at SSV output
10019/20019	(18)	Pilot Solenoid Feedback *Legacy PF2100 Register	No voltage at Pilot output	Voltage at Pilot output
10020/20020	(19)	High Pressure Input *Legacy PF2100 Register	Closed	Open
10021/20021	(20)	Proof of Closure *Legacy PF2100 Register	Closed	Open
10022/20022	(21)	ESD Input *Legacy PF2100 Register	Closed	Open
10023/20023	(22)	Start Input *Legacy PF2100 Register	Closed	Open
10024/20024	(23)	Low Pressure *Legacy PF2100 Register	Closed	Open
10025/20025	(24)	Flame Detected *Legacy PF2100 Register	Flame absent	Flame present
10026/20026	(25)	Flame Test Fail *Legacy PF2100 Register	Flame test passed	Flame test failed
10027/20027	(26)	Unit Failure *Legacy PF2100 Register	Unit test passed	Unit test failed
10028/20028	(27)	Low or High Voltage *Legacy PF2100 Register	Input voltage OK	Input voltage Low/High
10029/20029	(28)	HiTemp Alarm *Legacy PF2100 Register	Alarm not set	Alarm set
10030/20030	(29)	4-20 Alarm *Legacy PF2100 Register	Alarm not set	Alarm set
10033/20033	(32)	Level Input (Latched) *Legacy PF2100 Register	Closed	Open
10034/20034	(33)	Main Solenoid Feedback (Latched) *Legacy PF2100 Register	No voltage at SSV output	Voltage at SSV output
10035/20035	(34)	Pilot Solenoid Feedback (Latched) *Legacy PF2100 Register	No voltage at Pilot output	Voltage at Pilot output
10036/20036	(35)	High Pressure Input (Latched) *Legacy PF2100 Register	Closed	Open
10037/20037	(36)	Proof of Closure (Latched) *Legacy PF2100 Register	Closed	Open
10038/20038	(37)	ESD Input (Latched) *Legacy PF2100 Register	Closed	Open
10039/20039	(38)	Start Input (Latched) *Legacy PF2100 Register	Closed	Open
10040/20040	(39)	Low Pressure (Latched) *Legacy PF2100 Register	Closed	Open
10041/20041	(40)	Flame Detected (Latched) *Legacy PF2100 Register	Flame absent	Flame present
10042/20042	(41)	Flame Test Fail (Latched) *Legacy PF2100 Register	Flame test passed	Flame test failed
10043/20043	(42)	Unit Failure (Latched) *Legacy PF2100 Register	Unit test passed	Unit test failed
10044/20044	(43)	Low or High Voltage (Latched) *Legacy PF2100 Register	Input voltage OK	Input voltage Low/High
10045/20045	(44)	HiTemp Alarm (Latched) *Legacy PF2100 Register	Alarm not set	Alarm set
10046/20046	(45)	4-20 Alarm (Latched) *Legacy PF2100 Register	Alarm not set	Alarm set
10101/20101 To 10357/20357	(100) To (356)	Alarm Bit AL000 To Alarm Bit AL256	Alarm not set	Alarm set
10501/20501 To 10565/20565	(500) To (564)	Wait Bit WT000 To Wait Bit WT064	Wait not set	Wait set
10601/20601 To 10665/20665	(600) To (664)	Warning Bit WN000 To Warning Bit WN064	Warning not set	Warning set
10701/20701 To 10765/20765	(700) To (764)	Main Permissive Bit MP000 To Main Permissive Bit MP064	Main Permissive not set	Main Permissive set

Address (Offset)		Name	0	1
10801/20801	(800)	Proof of Closure	Open	Closed
10802/20802	(801)	ESD	Open	Closed
10803/20803	(802)	Start	Open	Closed
10804/20804	(803)	Pressure Low	Open	Closed
10805/20805	(804)	Pressure High	Open	Closed
10806/20806	(805)	Proof of Light Off	Open	Closed
10807/20807	(806)	Level/Flow	Open	Closed
10808/20808	(807)	Aux In 1	Open	Closed
10809/20809	(808)	Aux In 2	Open	Closed
10810/20810	(809)	Aux Temp	Open	Closed
10811/20811	(810)	UV Fault	Open	Closed
10812/20812	(811)	UV Flame On	Open	Closed
10813/20813	(812)	UV Flame Off	Open	Closed
10821/20821	(820)	Pilot 1	De-energized	Energized
10822/20822	(821)	Pilot 2	De-energized	Energized
10823/20823	(822)	SSV 1	De-energized	Energized
10824/20824	(823)	SSV 2	De-energized	Energized
10825/20825	(824)	High Fire	De-energized	Energized
10961/20961	(960)	Flame 1 Load Monitor Check Failure	Alarm not set	Alarm set
10962/20962	(961)	Flame 2 Load Monitor Check Failure	Alarm not set	Alarm set
10963/20963	(962)	Flame 1 Voltage Fault	Alarm not set	Alarm set
10964/20964	(963)	Flame 2 Voltage Fault	Alarm not set	Alarm set
10965/20965	(964)	Flame 1 DC Input Open Fault	Alarm not set	Alarm set
10966/20966	(965)	Flame 2 DC Input Open Fault	Alarm not set	Alarm set
10967/20967	(966)	Flame Detect Software Watchdog Trip	Alarm not set	Alarm set
10981/20981	(980)	UV Flame Detect Fault	Alarm not set	Alarm set
10982/20982	(981)	UV Flame Detect Mismatch	Alarm not set	Alarm set
11001/21001	(1000)	Switch Run Short	Alarm not set	Alarm set
11002/21002	(1001)	Switch Ignition Short	Alarm not set	Alarm set
11003/21003	(1002)	Start Short	Alarm not set	Alarm set
11004/21004	(1003)	Proof of Closure Short	Alarm not set	Alarm set
11005/21005	(1004)	UV Flame Off Short	Alarm not set	Alarm set
11006/21006	(1005)	UV Fault Short	Alarm not set	Alarm set
11007/21007	(1006)	ESD Short	Alarm not set	Alarm set
11021/21021	(1020)	Pressure Communication Bus Fault	Alarm not set	Alarm set
11022/21022	(1021)	Pressure High Communication Bus Fault	Alarm not set	Alarm set
11023/21023	(1022)	Proof of Light Off Communication Bus Fault	Alarm not set	Alarm set
11024/21024	(1023)	Level/Flow Communication Bus Fault	Alarm not set	Alarm set
11025/21025	(1024)	Aux Temp Communication Bus Fault	Alarm not set	Alarm set
11026/21026	(1025)	Aux In 1 Communication Bus Fault	Alarm not set	Alarm set
11027/21027	(1026)	Aux In 2 Communication Bus Fault	Alarm not set	Alarm set
11028/21028	(1027)	Pilot 1 Communication Bus Fault	Alarm not set	Alarm set
11029/21029	(1028)	Pilot 2 Communication Bus Fault	Alarm not set	Alarm set
11030/21030	(1029)	SSV1 Communication Bus Fault	Alarm not set	Alarm set
11031/21031	(1030)	SSV2 Communication Bus Fault	Alarm not set	Alarm set
11032/21032	(1031)	High Fire Communication Bus Fault	Alarm not set	Alarm set
11033/21033	(1032)	System Voltage Communication Bus Fault	Alarm not set	Alarm set
11041/21041	(1040)	Pilot Start Internal Board Fault	Alarm not set	Alarm set
11042/21042	(1041)	Pilot Read Internal Board Fault	Alarm not set	Alarm set
11043/21043	(1042)	Pilot Stop Internal Board Fault	Alarm not set	Alarm set
11044/21044	(1043)	System Start Internal Board Fault	Alarm not set	Alarm set
11045/21045	(1044)	System Read Internal Board Fault	Alarm not set	Alarm set
11046/21046	(1045)	System Stop Internal Board Fault	Alarm not set	Alarm set
11047/21047	(1046)	Digital Input Start Internal Board Fault	Alarm not set	Alarm set
11048/21048	(1047)	Digital Input Read Internal Board Fault	Alarm not set	Alarm set
11049/21049	(1048)	Digital Input Stop Internal Board Fault	Alarm not set	Alarm set
11061/21061	(1060)	Aux Out 1 Fault	Alarm not set	Alarm set
11062/21062	(1061)	Aux Out 2 Fault	Alarm not set	Alarm set
11063/21063	(1062)	TCV Output Fault	Alarm not set	Alarm set

2.2 INPUT/HOLDING REGISTERS [READ: 0X03, 0X04 WRITE: 0X06, 0X10]

The Input Registers (300xx) are duplicated in the corresponding Holding Registers (400xx) for convenience and to maintain compatibility with some PLCs.

Use the Read Input Register command (0x04) to read the Input Registers (300xx).

Use the Read Holding Registers command (0x03) to read the Holding Registers (400xx).

Use the Preset Single Register command (0x06) or the Preset Multiple Registers command (0x10) to write these registers.

Example 1: Read Single Register

Reading 1 register starting from Register Offset 3 will result in two data bytes being returned. The first byte will be the most significant byte of Register Offset 3, and the second byte will be the least significant byte.

Example 2: Read Multiple Registers

Reading 2 registers starting from Register Offset 3 will result in four data bytes being returned. The first byte will be the most significant byte of Register Offset 3, the second byte will be the least significant byte of Register Offset 3, the third byte will be the most significant byte of Register Offset 4, and the fourth byte will be the least significant byte of Register Offset 4.

Example 3: Read Float or uint32_t

Reading 1 float register starting from Register Offset 3 will result in four data bytes being returned. The first byte will be the most significant byte of the Register Offset 3, the second byte will be the least significant byte of Register offset 3, the third byte will be the most significant byte of Register Offset 4, and the fourth byte with be the least significant byte of Register Offset 4.

Example 4: Write Single Register

Writing 1 register starting from Register Offset 100 will require two data bytes to be sent. The first byte will be the most significant byte of Register Offset 100 and the second byte will be the least significant byte.

Example 5: Write Multiple Register

Writing 2 registers starting from Register Offset 100 will require four data bytes to be sent. The first byte will be the most significant byte of Register Offset 100, the second byte will be the least significant byte of Register Offset 100, the third byte will be the most significant byte of Register Offset 101, and the fourth byte will be the least significant byte of Register Offset 101.

Example 6: Write float or uint32_t

Writing 2 registers starting from Register Offset 100 will require four data bytes to be sent. The first byte will be the most significant byte of Register Offset 100, the second byte will be the least significant byte of Register Offset 100, the third byte will be the most significant byte of Register Offset 101, and the fourth byte will be the least significant byte of Register Offset 101.

2.2.1 BMS SETTINGS AND FUNCTIONS

Address (Offset)		Read/Write	Name	Type	10x	Range
30008/40008	(7)	Read Only	High Fire/Process Setpoint *Legacy PF2100 Register	uint16		0°C to 1350°C *Celsius Only
30009/40009	(8)	Read Only	Low Fire Setpoint *Legacy PF2100 Register	uint16		0°C to 1350°C *Celsius Only
30010/40010	(9)	Read Only	Pilot Off Setpoint *Legacy PF2100 Register	uint16		0°C to 1350°C *Celsius Only
30100/40100	(99)	R/W	Start Stop	uint16		Read 0 = Command Accepted
						Write 1234 = Start system
						Write 4321 = Stop System
30101/40101	(100)	R/W	Process Setpoint Change Request *Legacy PF2100 Register	uint16		0 - 1350°C *Celsius Only
30102/40102	(101)	R/W	Low Fire Setpoint Change Request *Legacy PF2100 Register	uint16		0 - 1350°C *Celsius Only
30103/40103	(102)	R/W	Pilot Off Setpoint Change Request *Legacy PF2100 Register	uint16		0 - 1350°C *Celsius Only
30110/40110	(109)	R/W	UI Clock Seconds	uint16		0 – 59 seconds
30111/40111	(110)	R/W	UI Clock Minutes	uint16		0 – 59 minutes
30112/40112	(111)	R/W	UI Clock Hour	uint16		0 – 23 hours
30113/40113	(112)	R/W	UI Clock Day	uint16		1 – 31 days
30114/40114	(113)	R/W	UI Clock Month	uint16		1 – 12 months
30115/40115	(114)	R/W	UI Clock Year	uint16		2000 – 2099 years
30121/40121	(120)	R/W	Modbus Remote Echo for Aux 1	uint16	10x	Sets Aux Out 1 output when configured in Modbus Echo Mode
30122/40122	(121)	R/W	Modbus Remote Echo for Aux 2	uint16	10x	Sets Aux Out 2 output when configured in Modbus Echo Mode
30143/40143	(142)	R/W	Clear Shutdown Code	uint16		0 = No effect
						1 = Acknowledge Lockout
31001/41001	(1000)	Read Only	Bath Type	uint16		0 = TC
						1 = RTD
31002/41002	(1001)	Read Only	Bath Mode	uint16		0 = Process Control
						1 = High Temp ESD
31003/41003	(1002)	Read Only	Bath Input	uint16		0 = Dual
						1 = Single
31004/41004	(1003)	Read Only	Bath High Temp Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
31005/41005	(1004)	R/W	Bath Pilot Off Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
* Write must be between the Bath Main Off Setpoint and the Bath High Temp Setpoint while running. Writes below or above the bounds will set the register to its lowest or highest allowable value, respectively.						
31006/41006	(1005)	R/W	Bath Main Off Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
* Write must be between the Bath Process Setpoint and the Bath Pilot Off Setpoint while running. Writes below or above the bounds will set the register to its lowest or highest allowable value, respectively.						
31007/41007	(1006)	R/W	Bath Process Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
* Write must be between the Bath Low Temp Setpoint and the Bath Main Off Setpoint while running. Writes below or above the bounds will set the register to its lowest or highest allowable value, respectively.						
31008/41008	(1007)	Read Only	Bath Low Temp Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
31009/41009	(1008)	R/W	Bath Deadband	uint16		0 - 100 °C (32 - 212 °F)
31010/41010	(1009)	Read Only	Outlet Type	uint16		0 = TC
						1 = RTD
31011/41011	(1010)	Read Only	Outlet Mode	uint16		0 = Disabled
						1 = Process Control
						2 = High Temp ESD
						3 = Display Only
31012/41012	(1011)	Read Only	Outlet High Temp Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
31013/41013	(1012)	R/W	Outlet Pilot Off Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
* Write must be between the Outlet Main Off Setpoint and the Outlet High Temp Setpoint while running. Writes below or above the bounds will set the register to its lowest or highest allowable value, respectively.						
31014/41014	(1013)	R/W	Outlet Main Off Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
* Write must be between the Outlet Process Setpoint and the Outlet Pilot Off Setpoint while running. Writes below or above the bounds will set the register to its lowest or highest allowable value, respectively.						
31015/41015	(1014)	R/W	Outlet Process Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
* Write must be between the Outlet Low Temp Setpoint and the Outlet Main Off Setpoint while running. Writes below or above the bounds will set the register to its lowest or highest allowable value, respectively.						
31016/41016	(1015)	Read Only	Outlet Low Temp Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)

Address (Offset)		Read/Write	Name	Type	10x	Range
31017/41017	(1016)	R/W	Outlet Deadband	uint16		0 - 100 °C (32 - 212 °F)
31018/41018	(1017)	Read Only	Stack Type	uint16		0 = TC
						1 = RTD
31019/41019	(1018)	Read Only	Stack Mode	uint16		0 = Disabled
						1 = High Temp ESD
						2 = Display Only
31020/41020	(1019)	Read Only	Stack High Temp Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
31021/41021	(1020)	R/W	Stack Deadband	uint16		0 - 100 °C (32 - 212 °F)
31022/41022	(1021)	Read Only	Aux Temp Mode	uint16		0 = Disabled
						1 = Process Control
						2 = High Temp ESD
						3 = Display Only
31023/41023	(1022)	Read Only	Aux Temp Type	uint16		0 = Disabled
						2 = 4-20
31024/41024	(1023)	Read Only	Aux High Temp Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
31025/41025	(1024)	R/W	Aux Pilot Off Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
* Write must be between the Aux Temp Main Off Setpoint and the Aux Temp High Temp Setpoint while running. Writes below or above the bounds will set the register to its lowest or highest allowable value, respectively.						
31026/41026	(1025)	R/W	Aux Main Off Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
* Write must be between the Aux Temp Process Setpoint and the Aux Temp Pilot Off Setpoint while running. Writes below or above the bounds will set the register to its lowest or highest allowable value, respectively.						
31027/41027	(1026)	R/W	Aux Process Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
* Write must be between the Aux Temp Low Temp Setpoint and the Aux Temp Main Off Setpoint while running. Writes below or above the bounds will set the register to its lowest or highest allowable value, respectively.						
31028/41028	(1027)	Read Only	Aux Low Temp Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
31029/41029	(1028)	R/W	Aux Deadband	uint16		0 - 100 °C (32 - 212 °F)
31030/41030	(1029)	Read Only	Aux Temp Span Min	int16		-100 - 1350 °C (-459 - 2462 °F)
31031/41031	(1030)	Read Only	Aux Temp Span Max	int16		-100 - 1350 °C (-459 - 2462 °F)
31032/41032	(1031)	Read Only	Proof of Closure	uint16		0 = Disabled
						1 = Enabled
31033/41033	(1032)	Read Only	Remote Start	uint16		0 = Disabled
						1 = Enabled
31034/41034	(1033)	Read Only	Pressure Type	uint16		0 = Disabled
						1 = Digital
						2 = 4-20
31035/41035	(1034)	Read Only	Pressure Span Min	int32	10x	Reading multiplied by 10 in configured Pressure Units
31037/41037	(1036)	Read Only	Pressure Span Max	int32	10x	Reading multiplied by 10 in configured Pressure Units
31039/41039	(1038)	Read Only	Pressure Low Trip	int32	10x	Reading multiplied by 10 in configured Pressure Units
31041/41041	(1040)	Read Only	Pressure High Trip	int32	10x	Reading multiplied by 10 in configured Pressure Units
31043/41043	(1042)	Read Only	Pressure Deadband	uint16	10x	Reading multiplied by 10 in configured Pressure Units
31044/41044	(1043)	Read Only	Low Pressure Delay	uint16		2 - 20 seconds
31045/41045	(1044)	Read Only	Low Pressure Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
						3 = Main Permissive
31046/41046	(1045)	Read Only	Pressure High Type	uint16		0 = Disabled
						1 = Digital
31047/41047	(1046)	Read Only	Pressure High	uint16		0 = Disabled
						1 = Enabled
31048/41048	(1047)	Read Only	Level/Flow Type	uint16		0 = Disabled
						1 = Digital
						2 = 4-20
31049/41049	(1048)	Read Only	Level/Flow Digital Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
31050/41050	(1049)	Read Only	Level/Flow Low Trip Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
31051/41051	(1050)	Read Only	Level/Flow High Trip Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
31052/41052	(1051)	Read Only	Level/Flow Span Min	int32	10x	Reading multiplied by 10 in configured Level/Flow Units
31054/41054	(1053)	Read Only	Level/Flow Span Max	int32	10x	Reading multiplied by 10 in configured Level/Flow Units

Address (Offset)		Read/Write	Name	Type	10x	Range
31056/41056	(1055)	Read Only	Level/Flow Low Trip	int32	10x	Reading multiplied by 10 in configured Level/Flow Units
31058/41058	(1057)	Read Only	Level/Flow High Trip	int32	10x	Reading multiplied by 10 in configured Level/Flow Units
31060/41060	(1059)	Read Only	Level/Flow Deadband	uint16	10x	Reading multiplied by 10 in configured Level/Flow Units
31061/41061	(1060)	Read Only	Level/Flow Delay	uint16		2 - 20 seconds
31062/41062	(1061)	Read Only	Proof of Light Off Position Type	uint16		0 = Disabled
						1 = Digital
						2 = 4-20
31063/41063	(1062)	Read Only	Proof of Light Off Position Setpoint	uint16	10x	0 - 1000 (0 - 100%)
31064/41064	(1063)	Read Only	Proof of Light Off Position Tolerance	uint16	10x	0 - 62 (0 - 6.2%)
31065/41065	(1064)	Read Only	Aux In 1 Type	uint16		0 = Disabled
						1 = Digital
						2 = 4-20
31066/41066	(1065)	Read Only	Aux In 1 4-20 Mode	uint16		0 = High/Low Trip
						1 = Appliance Firing Rate
						2 = Bath Process SP Adjust
						3 = Outlet Process SP Adjust
						4 = Aux Temp Process SP Adjust
						5 = UV Flame Quality
31067/41067	(1066)	Read Only	Aux In 1 Digital Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
						3 = Main Permissive
31068/41068	(1067)	Read Only	Aux In 1 Low Trip Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
						3 = Main Permissive
31069/41069	(1068)	Read Only	Aux In 1 High Trip Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
						3 = Main Permissive
31070/41070	(1069)	Read Only	Aux In 1 Low Trip	int32	10x	Reading multiplied by 10 in configured Aux In 1 Units
31072/41072	(1071)	Read Only	Aux In 1 High Trip	int32	10x	Reading multiplied by 10 in configured Aux In 1 Units
31074/41074	(1073)	Read Only	Aux In 1 Deadband	uint16	10x	Reading multiplied by 10 in configured Aux In 1 Units
31076/41076	(1075)	Read Only	Aux In 1 Span Min	int32	10x	Reading multiplied by 10 in configured Aux In 1 Units
31078/41078	(1077)	Read Only	Aux In 1 Span Max	int32	10x	Reading multiplied by 10 in configured Aux In 1 Units
31080/41080	(1079)	Read Only	Aux In 2 Type	uint16		0 = Disabled
						1 = Digital
						2 = 4-20
31081/41081	(1080)	Read Only	Aux In 2 4-20 Mode	uint16		0 = High/Low Trip
						1 = Appliance Firing Rate
						2 = Bath Process SP Adjust
						3 = Outlet Process SP Adjust
						4 = Aux Temp Process SP Adjust
						5 = UV Flame Quality
31082/41082	(1081)	Read Only	Aux In 2 Digital Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
						3 = Main Permissive
31083/41083	(1082)	Read Only	Aux In 2 Low Trip Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
						3 = Main Permissive
31084/41084	(1083)	Read Only	Aux In 2 High Trip Mode	uint16		0 = Alarm
						1 = Wait
						2 = Warning
						3 = Main Permissive
31085/41085	(1084)	Read Only	Aux In 2 Low Trip	int32	10x	Reading multiplied by 10 in configured Aux In 2 Units
31087/41087	(1086)	Read Only	Aux In 2 High Trip	int32	10x	Reading multiplied by 10 in configured Aux In 2 Units
31089/41089	(1088)	Read Only	Aux In 2 Deadband	uint16	10x	Reading multiplied by 10 in configured Aux In 2 Units
31090/41090	(1089)	Read Only	Aux In 2 Span Min	int32	10x	Reading multiplied by 10 in configured Aux In 2 Units
31092/41092	(1091)	Read Only	Aux In 2 Span Max	int32	10x	Reading multiplied by 10 in configured Aux In 2 Units

Address (Offset)		Read/Write	Name	Type	10x	Range
31094/41094	(1093)	Read Only	Status Contact Mode	uint16		0 = Run Status
						1 = Heating Status
						2 = Low Temp Warning
						3 = Level/Flow Control
31095/41095	(1094)	Read Only	Aux Out 1 Mode	uint16		0 = Disabled
31096/41096	(1095)	Read Only	Aux Out 2 Mode	uint16		1 = Level/Flow Echo
						2 = N/A
						3 = Aux In 1 Echo
						4 = Aux In 2 Echo
						5 = N/A
						6 = N/A
						7 = N/A
						8 = Modbus Echo
						9 = Bath Temp Echo
						10 = Outlet Temp Echo
						11 = Stack Temp Echo
31097/41097	(1096)	Read Only	Aux Out 1 Temp Echo Span Min	int16		-100 - 1350 °C
31098/41098	(1097)	Read Only	Aux Out 1 Temp Echo Span Max	int16		-100 - 1350 °C
31099/41099	(1098)	Read Only	Aux Out 2 Temp Echo Span Min	int16		-100 - 1350 °C
31100/41100	(1099)	Read Only	Aux Out 2 Temp Echo Span Max	int16		-100 - 1350 °C
31101/41101	(1100)	Read Only	Pilot Valve PWM	uint16		10 - 100 %
31102/41102	(1101)	Read Only	SSV PWM	uint16		10 - 100 %
31103/41103	(1102)	Read Only	Aux PWM	uint16		10 - 100 %
31104/41104	(1103)	Read Only	TCV Min Position	uint16		0 - 70 %
31105/41105	(1104)	Read Only	TCV Purge Position	uint16		0 - 100 %
31106/41106	(1105)	Read Only	TCV Pilot Position	uint16		0 - 100 %
31107/41107	(1106)	Read Only	TCV Manual Override	uint16		0 = Disabled
						1 = Enabled
31108/41108	(1107)	Read Only	TCV Manual Position	uint16		0 - 100 %
31109/41109	(1108)	R/W	Process Proportional Band	uint16	10x	°C Range: 0 - 10000 (0 - 1000°C)
						°F Range: 320 - 18320 (32 - 1832°F)
31110/41110	(1109)	R/W	Process Integral Time	uint16	10x	0 - 10000 (0 - 1000 min/rep)
31111/41111	(1110)	R/W	Process Derivative Time	uint16	10x	0 - 10000 (0 - 1000 min)
31112/41112	(1111)	R/W	Process Integral Reset Range	uint16	10x	°C Range: 0 - 10000 (0 - 1000°C)
						°F Range: 320 - 18320 (32 - 1832°F)
31113/41113	(1112)	R/W	Cascade SP Proportional Band	uint16	10x	°C Range: 0 - 10000 (0 - 1000°C)
						°F Range: 320 - 18320 (32 - 1832°F)
31114/41114	(1113)	R/W	Cascade SP Integral Time	uint16	10x	0 - 10000 (0 - 1000 mins/rep)
31115/41115	(1114)	R/W	Cascade SP Derivative Time	uint16	10x	0 - 10000 (0 - 1000 min)
31116/41116	(1115)	R/W	Cascade SP Integral Reset Range	uint16	10x	°C Range: 0 - 10000 (0 - 1000°C)
						°F Range: 320 - 18320 (32 - 1832°F)
31117/41117	(1116)	R/W	PID Output Rate Limit	uint16	10x	1 - 1000 (0.1 = 100 %/sec)
31118/41118	(1117)	R/W	PID Ramp Time	uint16		0 - 255 seconds
31119/41119	(1118)	Read Only	Process Control Mode	uint16		0 = On/Off Control
						1 = Staged Heating
						2 = Bath PID Control
						3 = Outlet PID Control
						4 = Aux PID Control
						5 = Cascaded PID Control
						6 = External Firing Rate
31120/41120	(1119)	Read Only	Pilot Off Mode	uint16		0 = Disabled
						1 = Off At Pilot Off Setpoint
						2 = Off At Main Off Setpoint
						3 = Interrupted
31121/41121	(1120)	Read Only	Pilot 2	uint16		0 = Disabled
						1 = Enabled
31122/41122	(1121)	Read Only	Relight Attempts	uint16		0 - 3
31123/41123	(1122)	Read Only	Ignition Mode	uint16		0 = Coil
						1 = HEI
31124/41124	(1123)	Read Only	Purge Time	uint16		10 - 900 seconds
31125/41125	(1124)	Read Only	Pilot Startup Delay Time	uint16		5 - 600 seconds
31126/41126	(1125)	Read Only	Main Startup Delay Time	uint16		30 - 600 seconds

Address (Offset)		Read/Write	Name	Type	10x	Range
31127/41127	(1126)	Read Only	Voltage Setting	uint16		0 = 12V
						1 = 24V
31128/41128	(1127)	Read Only	Voltage Restart	uint16		0 = Disabled
						1 = Enabled
31129/41129	(1128)	Read Only	L1 Password Enable	uint16		0 = Disabled
						1 = Enabled
31130/41130	(1129)	Read Only	Commissioning Complete	uint16		0 = Incomplete
						1 = Complete
31131/41131	(1130)	Read Only	Slave Address	uint16		1 - 247
31132/41132	(1131)	Read Only	Baud Rate	uint16		0 = 9600
						1 = 19200
31133/41133	(1132)	Read Only	Stop Bits	uint16		0 = 1
						1 = 2
31134/41134	(1133)	Read Only	Parity	uint16		0 = None
						1 = Odd
						2 = Even
31135/41135	(1134)	Read Only	Modbus Termination	uint16		0 = Disabled
						1 = Enabled
31136/41136	(1135)	Read Only	Remote Access	uint16		0 = Disabled
						1 = Enabled
31137/41137	(1136)	Read Only	Temperature Units	uint16		0 = Celsius
						1 = Fahrenheit
31138/41138	(1137)	Read Only	Pressure Units	uint16		0 = kPa
						1 = psi
						2 = inch wc
						3 = oz/in2
						4 = kg/cm2
						5 = Percent
						6 = Milliamps
31139/41139	(1138)	Read Only	Level Units	uint16		0 = Litres
						1 = m3
						2 = US Gallons
						3 = bbl
						4 = ft3
						5 = Percent
						6 = Milliamps
31140/41140	(1139)	Read Only	Aux In 1 Units	uint16		0 = Percent
						1 = Milliamps
						2 = Temperature
						3 = Pressure
						4 = Level
						5 = Flow
31141/41141	(1140)	Read Only	Aux In 2 Units	uint16		0 = Percent
						1 = Milliamps
						2 = Temperature
						3 = Pressure
						4 = Level
						5 = Flow
31142/41142	(1141)	Read Only	Light Off Positioning Timeout	uint16		5 - 900 seconds
31143/41143	(1142)	Read Only	Minimum Pilots Running	uint16		1 = 1 Pilot required
						2 = 2 Pilots required
31144/41144	(1143)	Read Only	Level/Flow Control Setpoint	int32	10x	Reading multiplied by 10 in configured Level/Flow Units
31146/41146	(1145)	Read Only	Reignition	uint16		0 = Disabled
						1 = Enabled
31213/41213	(1212)	Read Only	UV Flame Detect Mode	uint16		0 = Disabled
						1 = Main Only
						2 = Pilot and Main
31228/41228	(1227)	Read Only	Bath Standby Mode	uint16		0 = Disabled
						1 = Enabled
31230/41230	(1229)	R/W	Bath Standby Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)

Address (Offset)	Read/Write	Name	Type	10x	Range
31301/41301 (1300)	Read Only	Flow Units	uint16		0 = L/sec
					1 = L/min
					2 = m3/sec
					3 = m3/min
					4 = US Gal/sec
					5 = US Gal/min
					6 = bbl/sec
					7 = bbl/min
					8 = ft3/sec
					9 = ft3/min
					10 = Percent
					11 = Milliamps
31302/41302 (1301)	Read Only	Level/Flow Input Units	uint16		0 = Level
					1 = Flow

2.2.2 BMS READ ONLY STATUS INFORMATION

Address (Offset)		Name	Type	10x	Range
30001/40001	(0)	Run and Valve Status Bits *Legacy PF2100 Register	Bitset		BIT 0 - Run 0 = Not Running
					BIT 1 - Pilot 0 = De-energized 1 = Pilot 1 or 2 energized
					BIT 2 - Low Fire 0 = De-energized
					BIT 3 - High Fire 0 = De-energized
30002/40002	(1)	Input Status and Flags (non latching)	Bitset		BIT 0 - Level Input 0 = Closed
30007/40007	(6)	Input Status and Flags (latching) *Legacy PF2100 Registers			BIT 1 - Main Solenoid Feedback 0 = De-energized
					BIT 2 - Pilot Solenoid Feedback 0 = De-energized
					BIT 3 - High Pressure Input 0 = Closed
					BIT 4 - Proof of Closure 0 = Closed
					BIT 5 - ESD Input 0 = Closed
					BIT 6 - Start Input 0 = Closed
					BIT 7 - Low Pressure 0 = Closed
					BIT 8 - Flame Detected 0 = No Flame
					BIT 9 - Flame Test Fail 0 = Flame Test OK
					BIT 10 - Unit Failure 0 = Unit OK
					BIT 11 - Low or High Voltage 0 = Voltage OK
					BIT 12 - HiTemp Alarm 0 = No Alarm
					BIT 13 - 4-20 Card Alarm 0 = No Alarm
30003/40003	(2)	High Temp Thermocouple Reading *Legacy PF2100 Register	int16		-50°C to 1350°C *Celsius Only
30004/40004	(3)	Process Thermocouple Reading *Legacy PF2100 Register	int16		-50°C to 1350°C *Celsius Only
30005/40005	(4)	Aux Thermocouple Reading *Legacy PF2100 Register	int16		-50°C to 1350°C *Celsius Only
30006/40006	(5)	Pilot Flame Quality *Legacy PF2100 Register	uint16		0% = No Flame
					100% = Good Flame
30011/40011	(10)	4-20mA Level Reading *Legacy PF2100 Register	uint16		4-20 Level/Flow Input reading
30012/40012	(11)	4-20mA Pressure Reading *Legacy PF2100 Register	uint16	10x	4-20 Pressure Input reading multiplied by 10
30014/40014	(13)	4-20mA Input Alarm *Legacy PF2100 Register	Bitset		BIT 0 - Level Low Alarm 0 = No Alarm
					BIT 1 - Level High Alarm 0 = No Alarm
					BIT 2 - Pressure Low Alarm 0 = No Alarm
					BIT 3 - Pressure High Alarm 0 = No Alarm
					BIT 4 - 4-20 Card Failure 0 = No Alarm
30015/40015	(14)	Modbus - Terminal Communication Error *Legacy PF2100 Register	uint16		0 = No Error
					1 = Communication Error
30016/40016	(15)	Modbus - Terminal Comm Error Counter *Legacy PF2100 Register	uint16		Consecutive communication errors while 30015/40015 = 1
30018/40018	(17)	Ambient Board Temp *Legacy PF2100 Register	int16		-100°C to 1350°C *Celsius Only
30019/40019	(18)	Aux 1 Input Current *Legacy PF2100 Register	uint16	10x	0 - 300 (0mA - 30mA)
30020/40020	(19)	Aux 2 Input Voltage/Current *Legacy PF2100 Register	uint16	10x	0 - 300 (0mA - 30mA)
30021/40021	(20)	UI Clock Seconds *Legacy PF2100 Register	uint16		0 - 59 Seconds
30022/40022	(21)	UI Clock Minutes *Legacy PF2100 Register	uint16		0 - 59 Minutes
30023/40023	(22)	UI Clock Hour *Legacy PF2100 Register	uint16		0 - 23 Hours
30024/40024	(23)	UI Clock Day *Legacy PF2100 Register	uint16		1 - 31 Days
30025/40025	(24)	UI Clock Month *Legacy PF2100 Register	uint16		1 - 12 Months
30026/40026	(25)	UI Clock Year *Legacy PF2100 Register	uint16		2000 - 2099 Years
30030/40030	(29)	System Bundle Firmware Version *Legacy PF2100 Register	uint16		BYTE 1 - Major version
					BYTE 2 - Minor version
30031/40031	(30)	Pilot One Flame Quality *Legacy PF2100 Register	uint16		Pilot 1 flame quality in %.
30032/40032	(31)	Pilot Two Flame Quality	uint16		Pilot 2 flame quality in %.

Address (Offset)		Name	Type	10x	Range
33001/43001	(3000)	Controller State	int16		-1 = Invalid
33002/43002	(3001)	Primary Next Controller State	int16		0 = Lockout
33003/43003	(3002)	Secondary Next Controller State	int16		1 = Alarm
					2 = Power On
					3 = Ready
					4 = Waiting – Confirm start
					5 = Waiting
					6 = Ignition – Pre-ignition
					7 = Ignition
					8 = Pilot – Pilot startup delay
					9 = Pilot
					10 = Main Light Off - Request light off
					11 = Main Light Off – Startup checks
					12 = Main Light Off – Light off
					13 = Main Light Off – Main detect
					14 = Main – Main startup delay
					15 = Main
					16 = Stage 1
					17 = Stage 2
					18 = PID Control
33004/43004	(3003)	Shutdown Code	uint16		0 - 255
33005/43005	(3004)	Relights Remaining	uint16		0 - 3
33006/43006	(3005)	State Timer	uint16		Current state timer in seconds.
33007/43007	(3006)	Purge Timer	uint16		Purge timer in seconds.
33008/43008	(3007)	Delta Time	uint16		Processors delta time in milliseconds.
33010/43010	(3009)	Pilot Flame Establishment Failures	uint16		Pilot flame establishment failures since last power on
33012/43012	(3011)	Main Flame Establishment Failures	uint16		Main flame establishment failures since last power on
33101/43101	(3100)	Alarm Bits	Bitset		0 - 256 bits (AL000 - AL255)
33201/43201	(3200)	Wait Bits	Bitset		0 - 64 bits (WT000 - WT063)
33301/43301	(3300)	Warning Bits	Bitset		0 - 64 bits (WN000 - WN063)
33401/43401	(3400)	Main Permissive Bits	Bitset		0 - 64 bits (MP000 - MP063)
33501/43501	(3500)	System Voltage	int16	10x	System Voltage reading multiplied by 10
33502/43502	(3501)	Authentication Level	uint16		0 = None
					1 = Remote
					2 = L1
					3 = L2
					4 = SYS
33503/43503	(3502)	Is Running	uint16		0 = Not Running
					1 = Running
33504/43504	(3503)	Sync Count	uint32		Processor synchronization count
33506/43506	(3505)	Transition Status	int16		-1 = Invalid
					0 = Lockout
					1 = Alarm
					2 = Power On
					3 = Ready
					4 = Waiting – Confirm start
					5 = Waiting
					6 = Ignition – Pre-ignition
					7 = Ignition
					8 = Pilot – Pilot startup delay
					9 = Pilot
					10 = Main Light Off - Request light off
					11 = Main Light Off – Startup checks
					12 = Main Light Off – Light off
					13 = Main Light Off – Main detect
					14 = Main – Main startup delay
					15 = Main
					16 = Stage 1
					17 = Stage 2
					18 = PID Control
33507/43507	(3506)	Hardware Model Number	uint32		Expected reading: 0x220002
33509/43509	(3508)	Firmware Product Variant	uint16		0 = Invalid
					1 = Single Burner

Address (Offset)		Name	Type	10x	Range
33510/43510	(3509)	Region Code	uint16		0 = Invalid
					1 = North America
33511/43511	(3510)	Bundle Version	uint32		BYTE 0 = Release Number
					BYTE 1 = Minor
					BYTE 2 = Major
					BYTE 3 = Product Variant
33513/43513	(3512)	Firmware Version	uint32		BYTE 0= Release number low byte
					BYTE 1 = Release number high byte
					BYTE 2 = Minor
					BYTE 3 = Major
33515/43515	(3514)	Bootloader Version	uint32		BYTE 0= Release number low byte
					BYTE 1 = Release number high byte
					BYTE 2 = Minor
					BYTE 3 = Major
33517/43517	(3516)	BOM Version	uint32		BYTE 0= Release number low byte
					BYTE 1 = Release number high byte
					BYTE 2 = Minor
					BYTE 3 = Major
33519/43519	(3518)	Manufacturer Serial Number	Array		BMS unique serial number. Formatted as 6 bytes
33522/43522	(3521)	Manufacture Date	uint32		BYTE 0 =day
					BYTE 1 = Month
					BYTE 2 = Year + 2000
33524/43524	(3523)	Manufacture Test Date	uint32		BYTE 0 =day
					BYTE 1 = Month
					BYTE 2 = Year + 2000
33526/43526	(3525)	PFN Version	uint32		BYTE 0= Release number low byte
					BYTE 1 = Release number high byte
					BYTE 2 = Minor
					BYTE 3 = Major
33605/43605	(3604)	Bath Temp	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)
					°F Range: -1480 - 24620 (-148 - 2462°F)
33606/43606	(3605)	Bath 2 Temp	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)
					°F Range: -1480 - 24620 (-148 - 2462°F)
33607/43607	(3606)	Outlet Temp	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)
					°F Range: -1480 - 24620 (-148 - 2462°F)
33608/43608	(3607)	Stack Temp	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)
					°F Range: -1480 - 24620 (-148 - 2462°F)
33609/43609	(3608)	Aux Temp	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)
					°F Range: -1480 - 24620 (-148 - 2462°F)
33610/43610	(3609)	Ambient Temp 1	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)
					°F Range: -1480 - 24620 (-148 - 2462°F)
33611/43611	(3610)	Ambient Temp 2	int16	10x	°C Range: -1000 - 13500 (-100 - 1350°C)
					°F Range: -1480 - 24620 (-148 - 2462°F)
33612/43612	(3611)	Bath 1 Faults	Bitset		BIT 0 = TC Open 0 = No Alarm
33622/43622	(3621)	Bath 2 Faults	Bitset		BIT 1 = RTD Open 0 = No Alarm
33632/43632	(3631)	Outlet Faults	Bitset		BIT 2 = RTD Short 0 = No Alarm
33642/43642	(3641)	Stack Faults	Bitset		BIT 3 = Out of Range 0 = No Alarm
33652/43652	(3651)	Ambient Temp 1 Faults	Bitset		BIT 4 = Stale Data 0 = No Alarm
33662/43662	(3661)	Ambient Temp 2 Faults	Bitset		
33672/43672	(3671)	Pilot 1 Flame Status	uint16		0 = No Flame
					1 = Flame
33673/43673	(3672)	Pilot 2 Flame Status	uint16		0 = No Flame
					1 = Flame
33674/43674	(3673)	UV Flame Status	uint16		0 = No Flame
					1 = Flame
33675/43675	(3674)	Pilot Faults	Bitset		BIT 0 = Flame 1 Load Monitor Check Failure 0 = No Alarm
					BIT 1 = Flame 2 Load Monitor Check Failure 0 = No Alarm
					BIT 2 = Flame 1 Voltage Fault 0 = No Alarm
					BIT 3 = Flame 2 Voltage Fault 0 = No Alarm
					BIT 4 = Flame 1 DC Input Open Fault 0 = No Alarm
					BIT 5 = Flame 2 DC Input Open Fault 0 = No Alarm
					BIT 6 = Flame Detect Software Watchdog Trip 0 = No Alarm

Address (Offset)		Name	Type	10x	Range
33680/43680	(3679)	UV Faults	Bitset		BIT 0 = UV Flame Detect Fault 0 = No Alarm
					BIT 1 = UV Flame Detect Mismatch 0 = No Alarm
33685/43685	(3684)	Interlock Input Contact Status	Bitset		BIT 0 = Proof of Closure 0 = De-energized
					BIT 1 = ESD 0 = De-energized
					BIT 2 = Start 0 = De-energized
					BIT 3 = Pressure Low 0 = De-energized
					BIT 4 = Pressure High 0 = De-energized
					BIT 5 = Proof of Light Off 0 = De-energized
					BIT 6 = Level/Flow 0 = De-energized
					BIT 7 = Aux In 1 0 = De-energized
					BIT 8 = Aux In 2 0 = De-energized
					BIT 9 = Aux Temp 0 = De-energized
					BIT 10 = UV Fault 0 = De-energized
					BIT 11 = UV Flame On 0 = De-energized
					BIT 12 = UV Flame Off 0 = De-energized
33690/43690	(3689)	IO Short Faults	Bitset		BIT 0 = Switch Run 0 = No Alarm
					BIT 1 = Switch Ignition 0 = No Alarm
					BIT 2 = Start 0 = No Alarm
					BIT 3 = Proof of Closure 0 = No Alarm
					BIT 4 = UV Flame Off 0 = No Alarm
					BIT 5 = UV Fault 0 = No Alarm
					BIT 6 = ESD 0 = No Alarm
33695/43695	(3694)	UV Flame Fault Voltage	int16	10x	UV Flame Fault Input Voltage multiplied by 10
33696/43696	(3695)	UV Flame On Voltage	int16	10x	UV Flame On Input Voltage multiplied by 10
33697/43697	(3696)	UV Flame Off Voltage	int16	10x	UV Flame Off Input Voltage multiplied by 10
33698/43698	(3697)	ESD Voltage	int16	10x	ESD Input Voltage multiplied by 10
33699/43699	(3698)	Start Voltage	int16	10x	Start Input Voltage multiplied by 10
33700/43700	(3699)	POC Voltage	int16	10x	POC Input Voltage multiplied by 10
33701/43701	(3700)	4-20 Level/Flow	int32	10x	4-20 Level/Flow Input reading multiplied by 10
33703/43703	(3702)	4-20 Pressure	int32	10x	4-20 Pressure Input reading multiplied by 10
33705/43705	(3704)	4-20 High Pressure	int32	10x	4-20 High Pressure Input reading multiplied by 10
33707/43707	(3706)	4-20 Proof of Light Off	int16	10x	4-20 Proof of Light Off Input reading multiplied by 10
33708/43708	(3707)	4-20 Aux Temp	int16	10x	4-20 Aux Temp Input reading multiplied by 10
33709/43709	(3708)	4-20 Aux In 1	int32	10x	4-20 Aux In 1 Input reading multiplied by 10
33711/43711	(3710)	4-20 Aux In 2	int32	10x	4-20 Aux In 2 Input reading multiplied by 10
33713/43713	(3712)	Process SP Adjust Setpoint	int16	10x	Process SP Adjust Setpoint Input reading multiplied by 10
33714/43714	(3713)	External Switch State	uint16		0 = Stop
					1 = Run
					2 = Ignite
					3 = Invalid
					4 = Stuck
33715/43715	(3714)	I2C Bus Faults	Bitset		BIT 0 = Pressure 0 = No Alarm
					BIT 1 = Pressure High 0 = No Alarm
					BIT 2 = Proof of Light Off 0 = No Alarm
					BIT 3 = Level/Flow 0 = No Alarm
					BIT 4 = Aux Temp 0 = No Alarm
					BIT 5 = Aux In 1 0 = No Alarm
					BIT 6 = Aux In 2 0 = No Alarm
					BIT 7 = Pilot 1 0 = No Alarm
					BIT 8 = Pilot 2 0 = No Alarm
					BIT 9 = SSV1 0 = No Alarm
					BIT 10 = SSV2 0 = No Alarm
					BIT 11 = High Fire 0 = No Alarm
					BIT 12 = System Current 0 = No Alarm
33720/43720	(3719)	ADC Faults	Bitset		BIT 0 = Pilot Start 0 = No Alarm
					BIT 1 = Pilot Read 0 = No Alarm
					BIT 2 = Pilot Stop 0 = No Alarm
					BIT 3 = System Start 0 = No Alarm
					BIT 4 = System Read 0 = No Alarm
					BIT 5 = System Stop 0 = No Alarm
					BIT 6 = Digital Input Start 0 = No Alarm
					BIT 7 = Digital Input Read 0 = No Alarm
					BIT 8 = Digital Input Stop 0 = No Alarm

Address (Offset)		Name	Type	10x	Range
33725/43725	(3724)	Valve Driver Status	Bitset		BIT 0 = Pilot 1 0 = De-energized
					BIT 1 = Pilot 2 0 = De-energized
					BIT 2 = SSV 1 0 = De-energized
					BIT 3 = SSV 2 0 = De-energized
					BIT 4 = HFV 0 = De-energized
33730/43730	(3729)	Status Contact State	uint16		0 = Deenergized
					1 = Energized
33732/43732	(3731)	Analog Output 1 Fault	uint16		0 = Absent
					1 = Present
33733/43733	(3732)	Analog Output 2 Fault	uint16		0 = Absent
					1 = Present
33734/43734	(3733)	Analog Output 3 Fault	uint16		0 = Absent
					1 = Present
33737/43737	(3736)	TCV Output Percent	uint16		0 - 100%
33738/43738	(3737)	Firing Rate	uint16		0 - 100%
33739/43739	(3738)	Reserved			
33740/43740	(3739)	Cascade PID Setpoint	int16	10x	Cascaded PID setpoint in configured Temperature units multiplied by 10
33742/43742	(3741)	Pilot 1 Voltage	int16	10x	Pilot 1 Voltage multiplied by 10
33743/43743	(3742)	Pilot 1 Current	int16	10x	Pilot 1 Current multiplied by 10
33744/43744	(3743)	Pilot 2 Voltage	int16	10x	Pilot 2 Voltage multiplied by 10
33745/43745	(3744)	Pilot 2 Current	int16	10x	Pilot 2 Current multiplied by 10
33746/43746	(3745)	SSV 1 Voltage	int16	10x	SSV 1 Voltage multiplied by 10
33747/43747	(3746)	SSV 1 Current	int16	10x	SSV 1 Current multiplied by 10
33748/43748	(3747)	SSV 2 Voltage	int16	10x	SSV 2 Voltage multiplied by 10
33749/43749	(3748)	SSV 2 Current	int16	10x	SSV 2 Current multiplied by 10
33750/43750	(3749)	HFV Voltage	int16	10x	HFV Voltage multiplied by 10
33751/43751	(3750)	HFV Current	int16	10x	HFV Current multiplied by 10
33752/43752	(3751)	System Current	int16	10x	System Current multiplied by 10
33753/43753	(3752)	System Power	int16	10x	System Power multiplied by 10
33754/43754	(3753)	Pilot 1 Flame DC High Voltage	int16		Pilot 1 Flame DC High Voltage in millivolts
33755/43755	(3754)	Pilot 1 Flame DC Low Voltage	int16		Pilot 1 Flame DC Low Voltage in millivolts
33756/43756	(3755)	Pilot 1 AC Voltage	int16		Pilot 1 AC Voltage in millivolts
33757/43757	(3756)	Pilot 2 Flame DC High Voltage	int16		Pilot 2 Flame DC High Voltage in millivolts
33758/43758	(3757)	Pilot 2 Flame DC Low Voltage	int16		Pilot 2 Flame DC Low Voltage in millivolts
33759/43759	(3758)	Pilot 2 AC Voltage	int16		Pilot 2 AC Voltage in millivolts
33760/43760	(3759)	Valve Power Status	Bitset		BIT 0 = Pilot 1 0 = De-energized or Fault
					BIT 1 = Pilot 2 0 = De-energized or Fault
					BIT 2 = SSV 1 0 = De-energized or Fault
					BIT 3 = SSV 2 0 = De-energized or Fault
					BIT 4 = High Fire 0 = De-energized or Fault
33765/43765	(3764)	System Up Time	uint16		System Up Time since last power on in hours
33766/43766	(3765)	Average Hourly Energy Consumption	uint16	10x	Average Hourly Energy Consumption multiplied by 10 in Watts/hour
33767/43767	(3766)	Pilot 1 Solenoid Run Time	uint16		Pilot 1 Solenoid Run Time since last power on in hours
33768/43768	(3767)	SSV Run Time	uint16		SSV Run Time since last power on in hours
33769/43769	(3768)	HFV Run Time	uint16		HFV Run Time since last power on in hours
33770/43770	(3769)	Average Firing Rate	uint16		Average Firing Rate since last power on in %
33771/43771	(3770)	Pilot 1 Flame Fail Count	uint16		Pilot 1 Flame Fail Count since last power on
33772/43772	(3771)	Pilot 2 Flame Fail Count	uint16		Pilot 2 Flame Fail Count since last power on
33773/43773	(3772)	Pilot 1 Flame Strength	int16		Pilot 1 Flame Strength in millivolts
33774/43774	(3773)	Pilot 2 Flame Strength	int16		Pilot 2 Flame Strength in millivolts
33775/43775	(3774)	System Voltage Fault	uint16		0 = Absent
					1 = Present
33780/43780	(3779)	Hardware Product Variant	uint16		0 = Invalid
					1 = Single Burner
33781/43781	(3780)	Pilot 2 Solenoid Run Time	uint16		Pilot 2 Solenoid Run Time since last power on in hours

3 DOCUMENT REVISION HISTORY

Document Version	Release Date	Applicable Hardware		Applicable Firmware	Changes
		BMS	UI		
v6.0	28 SEP 2021	v2.3.x	v3.2.x	SB 2.2.0	No changes. Updated to specify applicability to SB 2.2.0
v5.0	04 MAR 2021	v2.3.x	v3.2.x	SB 2.1.3	Corrected register 10001/20001 behavior
v4.0	04 MAR 2021	v2.3.x	v3.2.x	SB 2.0.4	Corrected register 10001/20001 behavior
v3.0	27 JAN 2021	v2.3.x	v3.2.x	SB 2.1.3	

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