PF2200 - SB

Modbus Configuration Guide

DOC-001107

V7.0

PROFIRE

CONTENTS

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 and v2.4.x	v3.2.x and v3.3.x	SB 2.3.1

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 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.
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.

1.2 MODBUS MASTER CONFIGURATION REQUIREMENTS

Ensure that Modbus Master device is configured as follows:

Name	Requirement	Notes
Baud Rate	As desired	Must match the Baud Rate setting configured on the PF2200 above.
Stop Bits	As desired	Must match the Stop Bits setting configured on the PF2200 above.
Parity	As desired	Must match the Parity setting configured on the PF2200 above.
Slave Address	As desired	Must match the Slave Address setting configured on the PF2200 above.
Mode	RTU	Modbus TCP is not directly supported but can be used with a TCP/IP to RTU Gateway installed.
Minimum Interpacket Delay	20ms	
Minimum Response Timeout	500ms	Recommended response timeout is 1 second or larger.
Minimum Time Between Writes	5 seconds	It is recommended that settings be written only when changed; continuous writing of settings should be avoided.
Minimum Time Between Reads	1 second	
Multiplication Factor	As required	A “10x” in the register tables below indicates that the value returned is 10 times its actual value. Any required conversion must be done by the master device.

1.3 TROUBLESHOOTING

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

Problem	Proposed Solutions
Device not responding	• Ensure configuration parameters match between the master device and the PF2200. • Ensure RS-485 lines are connected properly – The A wire connects to A or D- and the B wire connects to B or D+. • Ensure the PF2200 Modbus RTU Communication setting is set to "Enabled". • Ensure a signal ground wire is connected between the master and slave device. • Raise the response timeout on the master device. • Toggle the PF2200 Modbus Termination setting and retry. A termination resistor can cause the master device to be incorrectly biased in some cases. • Confirm that the master device has internal pullup and pulldown termination on the data lines as some devices require external biasing resistors to be installed.
CRC Errors	• Ensure configuration parameters match between the master device and the PF2200. • Ensure there is no noise on the line caused by external equipment or long run lengths. • Ensure RS-485 lines are connected properly – The A wire connects to A or D- and the B wire connects to B or D+.
Data returned is always 0	• Ensure the PF2200 Modbus RTU Communication setting is set to "Enabled". • Ensure the UI is communicating with the BMS (see Communication Loss). • Ensure register address is correct.
BMS shuts down when writing setpoints	• Ensure Modbus writes are correctly formatted. • Ensure master device is configured to write in the correct units for each register. • Ensure that setpoint writes are not causing configuration alarms on the PF2200 (e.g., the system will go to Lockout if the Process Setpoint is written to be higher than its configured High Temperature Setpoint. Refer to the Product Manual for additional details.
BMS will not start when Start command sent via Modbus	• Ensure the correct value is being written to the Start/Stop Register. • Ensure that no active alarms are present on the PF2200 and all on-screen lockout messages have been acknowledged at the PF2200 UI or with the Clear Shutdown Code Register.
Read values don't make sense	• Ensure that the master device is configured to read values in the units configured on the PF2200 UI • Ensure that the master device is configured to apply a 0.1 multiplication factor for any registers that are marked with a "10x" in the Modbus Register Map below.
Read values are not matching expected results	• Ensure that master device is configured with the correct data type for each register. Use the Test Registers to verify configuration. • Ensure register address (or offset – see Register Address vs. Register Offset) is correct.

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

The table below specifies the supported Modbus RTU commands.

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 [1]
Write Single Coil	5 = 0x05	NOT SUPPORTED [1]

[1] An exception code is returned for any unsupported commands.
[2] An exception code is returned for any request to an invalid register address.
[3] Multiple-register requests return 0 for all invalid registers (rather than returning an exception code) as long as the first register has a valid address.

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 Modbus master device manufacturer documentation to determine which is required. The Modbus Register Map displays both the address and the offset for each register.

1.6 REGISTER DATA FORMAT

The following table specifies the data types supported and indicates how controller status information is represented for each data type:

Data Type	Status Information (Hexadecimal)	Modbus Representation		Endianness
int16/uint16	0x0A0B	0x0A0B in a single 16-bit register		Big-endian
int32/uint32	0x0A0B0C0D	0x0A0B0C0D in two sequential 16-bit registers	0x0A0B in first register	Big-endian
			0x0C0D in second register	
Bitset	0x0000	0x0000 in a single 16-bit register where each binary digit represents separate status information	Bit 0: 0b0000 0000 0000 0000	Big-endian
			Bit 1: 0b0000 0000 0000 0000	
			⋮	
			Bit 14: 0b0000 0000 0000 0000	
			Bit 15: 0b0000 0000 0000 0000	
Array	0x0A0B0C0D0E0F	0x0F0E0D0C0B0A held in consecutive 16- bit registers	0x0F0E in first register	Little-endian
			0x0D0C in second register	
			0x0B0A in third 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 are represented in their respective display units as configured on the UI (Settings > Setup > Units) unless indicated.

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 has 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.

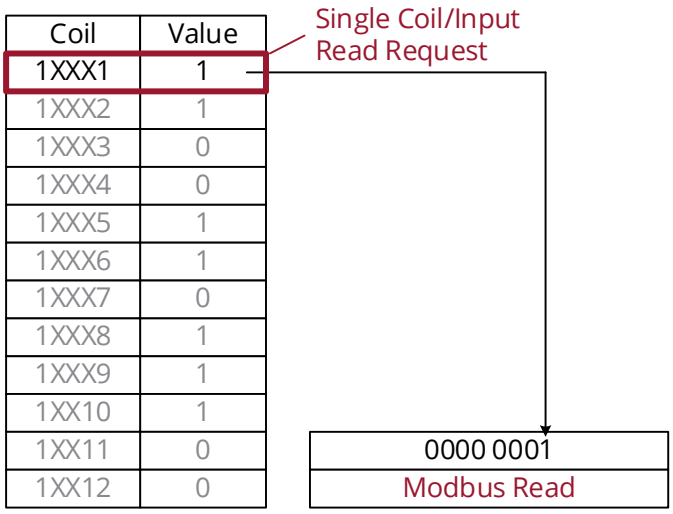
1.10 COMMUNICATION LOSS

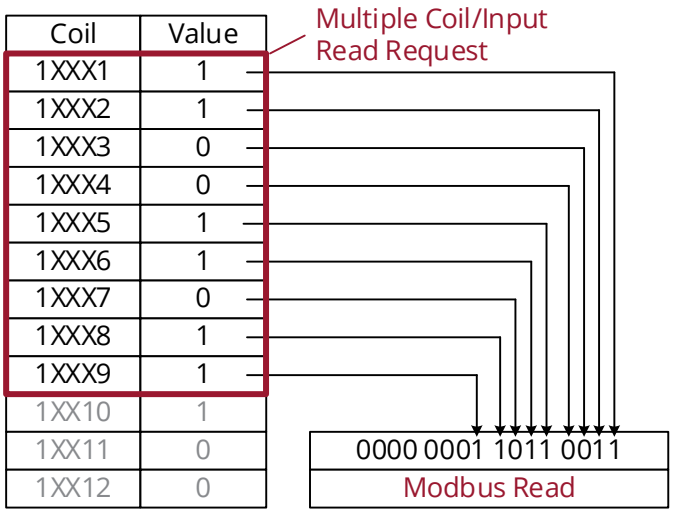
The PF2200 user interface communicates with the BMS card via a proprietary communication protocol called PFN. Modbus data is transferred from the BMS card to the user interface over the PFN link. When the user interface loses communication with the BMS card all Modbus registers return a value of 0 except for the Modbus Communication Error registers (30015/40015) and the Modbus Communication Error registers (30016/40016).

2 MODBUS REGISTER MAP

2.1 READ ONLY COILS & DISCRETE INPUTS [FUNCTION CODE 0x01 OR 0x02]

Reading a single coil/input returns a single byte holding the requested coil/input value in its least significant bit and reading multiple coils/inputs returns a bit packed vector containing the requested coil/input values. Only requested values are returned (all other bits are set to 0) as indicated in the diagrams below:





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

Address (Offset)		Name	0	1
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

Address (Offset)		Name	0	1
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
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

Address (Offset)		Name	0	1
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]

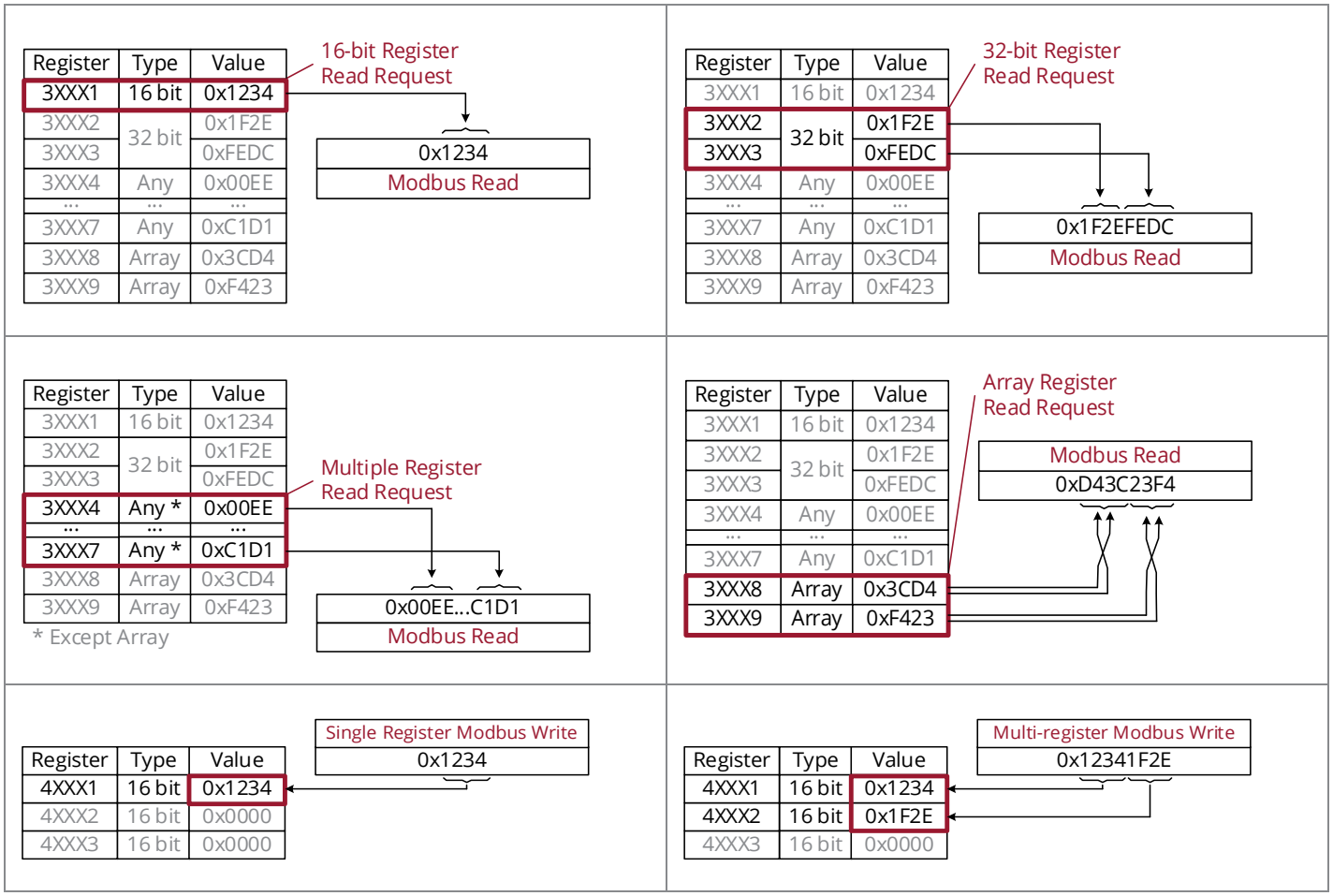
The Input Registers (300xx) are duplicated in the corresponding Holding Registers (400xx) for convenience and to maintain compatibility with some PLCs.

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 the Holding Registers.

The following diagrams provide read and write examples for various register types.



2.2.1 TEST REGISTERS

The following registers can be used to test whether the Modbus Master is correctly configured and to confirm that both unsigned and signed values can be read properly.

Address (Offset)		Read/Write	Name	Type	Read Value		
					Decimal	Hexadecimal	Binary
30123/40123	(122)	Read Only	Test Read - Unsigned	uint16	1234	0x04D2	0b0000 0100 1101 0010
30124/40124	(123)	Read Only	Test Read - Signed	int16	-1234	0xFB2E	0b1111 1011 0010 1110

2.2.2 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.						

Address (Offset)		Read/Write	Name	Type	10x	Range
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)
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

Address (Offset)		Read/Write	Name	Type	10x	Range
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
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

Address (Offset)		Read/Write	Name	Type	10x	Range
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
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
						12 = Aux Temp Echo
						13 = N/A
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)

Address (Offset)		Read/Write	Name	Type	10x	Range
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
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

Address (Offset)		Read/Write	Name	Type	10x	Range
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
						6 = Percent O2
31141/41141	(1140)	Read Only	Aux In 2 Units	uint16		0 = Percent
						1 = Milliamps
						2 = Temperature
						3 = Pressure
						4 = Level
						5 = Flow
						6 = Percent O2
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
31229/41229	(1228)	Read Only	Bath Standby Cool Off Mode	unit16		0 = Waiting
						1 = Pilot
31230/41230	(1229)	R/W	Bath Standby Setpoint	uint16		0 - 1350 °C (32 - 2462 °F)
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

2.2.3 BMS READ ONLY STATUS INFORMATION

Address (Offset)		Name	Type	10x	Range	
30001/40001	(0)	Run and Valve Status Bits *Legacy PF2100 Register	Bitset		0b0000 Run	0 = Not Running 1 = Running
					0b0000 Pilot	0 = De-energized 1 = Pilot 1 or 2 energized
					0b0000 Low Fire	0 = De-energized 1 = Energized
					0b0000 High Fire	
30002/40002 30007/40007	(1) (6)	Input Status and Flags (non latching) Input Status and Flags (latching) *Legacy PF2100 Registers	Bitset		0b0000 0000 0000 0000 Level Input	0 = Closed 1 = Open
					0b0000 0000 0000 0000 Main Solenoid Feedback	0 = De-energized 1 = Energized
					0b0000 0000 0000 0000 Pilot Solenoid Feedback	
					0b0000 0000 0000 0000 High Pressure Input	0 = Closed 1 = Open
					0b0000 0000 0000 0000 Proof of Closure	
					0b0000 0000 0000 0000 ESD Input	
					0b0000 0000 0000 0000 Start Input	
					0b0000 0000 0000 0000 Low Pressure	
					0b0000 0000 0000 0000 Flame Detected	0 = No Flame 1 = Flame Detected
					0b0000 0000 0000 0000 Flame Test Fail	0 = Flame Test Passed 1 = Flame Test Failed
					0b0000 0000 0000 0000 Unit Failure	0 = No unit failure 1 = Unit failure
					0b0000 0000 0000 0000 Low or High Voltage	0 = Alarm not set 1 = Alarm set
					0b0000 0000 0000 0000 HiTemp Alarm	
					0b0000 0000 0000 0000 4-20 Card 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		0b0000 0000 Level Low Alarm	0 = Alarm not set 1 = Alarm set
					0b0000 0000 Level High Alarm	
					0b0000 0000 Pressure Low Alarm	
					0b0000 0000 Pressure High Alarm	
					0b0000 0000 4-20 Card Failure	
30015/40015	(14)	Modbus Communication Error	uint16		0 = No error, 1 = Communication Error	
30016/40016	(15)	Modbus Comm Error Counter	uint16		0 - 65535	
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	

Address (Offset)		Name	Type	10x	Range	
30030/40030	(29)	System Bundle Firmware Version *Legacy PF2100 Register	uint16		0x**0A**0B: Major version 0x0A**0B**: Minor version	
30031/40031	(30)	Pilot 1 Flame Quality *Legacy PF2100 Register	uint16		Pilot 1 flame quality in %.	
30032/40032	(31)	Pilot 2 Flame Quality	uint16		Pilot 2 flame quality in %.	
33001/43001 33002/43002 33003/43003	(3000) (3001) (3002)	Controller State Primary Next Controller State Secondary Next Controller State	int16 int16 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	
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	
33107/43107	(3106)	Alarm Bits 144 to 159	Bitset		0b**0**000 0000 0000 0000: AL159 0b0000 0000 0000 000**0**: AL144	
33108/43108	(3107)	Alarm Bits 128 to 143	Bitset		0b**0**000 0000 0000 0000: AL143 0b0000 0000 0000 000**0**: AL128	
33109/43109	(3108)	Alarm Bits 112 to 127	Bitset		0b**0**000 0000 0000 0000: AL127 0b0000 0000 0000 000**0**: AL112	
33110/43110	(3109)	Alarm Bits 96 to 111	Bitset		0b**0**000 0000 0000 0000: AL111 0b0000 0000 0000 000**0**: AL096	
33111/43111	(3110)	Alarm Bits 80 to 95	Bitset		0b**0**000 0000 0000 0000: AL095 0b0000 0000 0000 000**0**: AL080	0 = Alarm not set 1 = Alarm set
33112/43112	(3111)	Alarm Bits 64 to 79	Bitset		0b**0**000 0000 0000 0000: AL079 0b0000 0000 0000 000**0**: AL064	
33113/43113	(3112)	Alarm Bits 48 to 63	Bitset		0b**0**000 0000 0000 0000: AL063 0b0000 0000 0000 000**0**: AL048	
33114/43114	(3113)	Alarm Bits 32 to 47	Bitset		0b**0**000 0000 0000 0000: AL047 0b0000 0000 0000 000**0**: AL032	
33115/43115	(3114)	Alarm Bits 16 to 31	Bitset		0b**0**000 0000 0000 0000: AL031 0b0000 0000 0000 000**0**: AL016	
33116/43116	(3115)	Alarm Bits 0 to 15	Bitset		0b**0**000 0000 0000 0000: AL015 0b0000 0000 0000 000**0**: AL000	
33204/43204	(3203)	Wait Bits 0 to 15	Bitset		0b**0**000 0000 0000 0000: WT015 0b0000 0000 0000 000**0**: WT000	0 = Wait not set 1 = Wait set
33302/43302	(3301)	Warning Bits 32 to 47	Bitset		0b**0**000 0000 0000 0000: WN047 0b0000 0000 0000 000**0**: WN032	
33303/43303	(3302)	Warning Bits 16 to 31	Bitset		0b**0**000 0000 0000 0000: WN031 0b0000 0000 0000 000**0**: WN016	0 = Warning not set 1 = Warning set
33304/43304	(3303)	Warning Bits 0 to 15	Bitset		0b**0**000 0000 0000 0000: WN015 0b0000 0000 0000 000**0**: WN000	
33404/43404	(3403)	Main Permissive Bits 0 to 15	Bitset		0b**0**000 0000 0000 0000: MP015 0b0000 0000 0000 000**0**: MP000	0 = Main Permissive not set 1 = Main Permissive set

Address (Offset)		Name	Type	10x	Range	
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	
33510/43510	(3509)	Region Code	uint16		0 = Invalid	
					1 = North America	
33511/43511	(3510)	Bundle Version	uint32		0x**0A**0B0C0D: Product Variant	Example: A read of 0x01020200 corresponds to firmware bundle SB 2.2.0
					0x0A**0B**0C0D: Major	
					0x0A0B**0C**0D: Minor	
					0x0A0B0C**0D**: Release Number	
33513/43513	(3512)	BMS Firmware Version	uint32		0x**0A**0B0C0D: Major	
					0x0A**0B**0C0D: Minor	
					0x0A0B**0C**0D: Release number high byte	
					0x0A0B0C**0D**: Release number low byte	
33515/43515	(3514)	BMS Bootloader Version	uint32		0x**0A**0B0C0D: Major	
					0x0A**0B**0C0D: Minor	
					0x0A0B**0C**0D: Release number high byte	
					0x0A0B0C**0D**: Release number low byte	
33517/43517	(3516)	BMS BOM Version	uint32		0x**0A**0B0C0D: Major	
					0x0A**0B**0C0D: Minor	
					0x0A0B**0C**0D: Release number high byte	
					0x0A0B0C**0D**: Release number low byte	
33519/43519	(3518)	BMS Serial Number Byte 0 and 1	Array		e.g., S/N: 0A0B 0C0D **0E0F** Register read: 0x**0F0E** * Note that the byte order is reversed between the serial number and the register read.	
33520/43520	(3519)	BMS Serial Number Byte 2 and 3	Array		e.g., S/N: 0A0B **0C0D** 0E0F Register read: 0x**0D0C** * Note that the byte order is reversed between the serial number and the register read.	
33521/43521	(3520)	BMS Serial Number Byte 4 and 5	array		e.g., S/N: **0A0B** 0C0D 0E0F Register read: 0x**0B0A** * Note that the byte order is reversed between the serial number and the register read.	

Address (Offset)		Name	Type	10x	Range	
33522/43522	(3521)	Manufacture Date	uint32		0x**0A**0B0C0D: N/A	
					0x0A**0B**0C0D: Year - 2000	
					0x0A0B**0C**0D: Month	
					0x0A0B0C**0D**: Day	
33524/43524	(3523)	Manufacture Test Date	uint32		0x**0A**0B0C0D: N/A	
					0x0A**0B**0C0D: Year - 2000	
					0x0A0B**0C**0D: Month	
					0x0A0B0C**0D**: Day	
33526/43526	(3525)	PFN Version	uint32		0x**0A**0B0C0D: Major	
					0x0A**0B**0C0D: Minor	
					0x0A0B**0C**0D: Release number high byte	
					0x0A0B0C**0D**: Release number low byte	
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 33622/43622 33632/43632 33642/43642 33652/43652 33662/43662	(3611) (3621) (3631) (3641) (3651) (3661)	Bath 1 Faults Bath 2 Faults Outlet Faults Stack Faults Ambient Temp 1 Faults Ambient Temp 2 Faults	Bitset Bitset Bitset Bitset Bitset Bitset		0b0000 000**0**: TC Open 0b0000 00**0**0: RTD Open 0b0000 0**0**00: RTD Short 0b0000 **0**000: Out of Range 0b000**0** 0000: Stale Data	0 = Alarm not set 1 = Alarm set
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		0b0000 000**0**: Flame 1 Load Monitor Check Failure 0b0000 00**0**0: Flame 2 Load Monitor Check Failure 0b0000 0**0**00: Flame 1 Voltage Fault 0b0000 **0**000: Flame 2 Voltage Fault 0b000**0** 0000: Flame 1 DC Input Open Fault 0b00**0**0 0000: Flame 2 DC Input Open Fault 0b0**0**00 0000: Flame Detect Software Watchdog Trip	0 = Alarm not set 1 = Alarm set
33680/43680	(3679)	UV Faults	Bitset		0b0000 000**0**: UV Flame Detect Fault 0b0000 00**0**0: UV Flame Detect Mismatch	0 = Alarm not set 1 = Alarm set
33685/43685	(3684)	Interlock Input Contact Status	Bitset		0b0000 0000 0000 000**0**: Proof of Closure 0b0000 0000 0000 00**0**0: ESD 0b0000 0000 0000 0**0**00: Start 0b0000 0000 0000 **0**000: Pressure Low 0b0000 0000 000**0** 0000: Pressure High 0b0000 0000 00**0**0 0000: Proof of Light Off 0b0000 0000 0**0**00 0000: Level/Flow 0b0000 0000 **0**000 0000: Aux In 1 0b0000 000**0** 0000 0000: Aux In 2 0b0000 00**0**0 0000 0000: Aux Temp 0b0000 0**0**00 0000 0000: UV Fault 0b0000 **0**000 0000 0000: UV Flame On 0b000**0** 0000 0000 0000: UV Flame Off	0 = De-energized 1 = Energized

Address (Offset)		Name	Type	10x	Range	
33690/43690	(3689)	IO Short Faults	Bitset		0b0000 000**0**: Switch Run	0 = Alarm not set 1 = Alarm set
					0b0000 00**0**0: Switch Ignition	
					0b0000 0**0**00: Start	
					0b0000 **0**000: Proof of Closure	
					0b000**0** 0000: UV Flame Off	
					0b000**0** 0000: UV Fault	
					0b0**0**00 0000: ESD	
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		0b0000 0000 0000 000**0**: Pressure	0 = Alarm not set 1 = Alarm set
					0b0000 0000 0000 00**0**0: Pressure High	
					0b0000 0000 0000 0**0**00: Proof of Light Off	
					0b0000 0000 0000 **0**000: Level/Flow	
					0b0000 0000 000**0** 0000: Aux Temp	
					0b0000 0000 00**0**0 0000: Aux In 1	
					0b0000 0000 0**0**00 0000: Aux In 2	
					0b0000 0000 **0**000 0000: Pilot 1	
					0b0000 000**0** 0000 0000: Pilot 2	
					0b0000 00**0**0 0000 0000: SSV1	
					0b0000 0**0**00 0000 0000: SSV2	
					0b0000 **0**000 0000 0000: High Flre	
					0b000**0** 0000 0000 0000: System Current	
33720/43720	(3719)	ADC Faults	Bitset		0b0000 0000 0000 000**0**: Pilot Start	0 = Alarm not set 1 = Alarm set
					0b0000 0000 0000 00**0**0: Pilot Read	
					0b0000 0000 0000 0**0**00: Pilot Stop	
					0b0000 0000 0000 **0**000: System Start	
					0b0000 0000 000**0** 0000: System Read	
					0b0000 0000 00**0**0 0000: System Stop	
					0b0000 0000 0**0**00 0000: Digital Input Start	
					0b0000 0000 **0**000 0000: Digital Input Read	
					0b0000 000**0** 0000 0000: Digital Input Stop	
33725/43725	(3724)	Valve Driver Status	Bitset		0b0000 000**0**: Pilot 1	0 = De-energized 1 = Energized
					0b0000 00**0**0: Pilot 2	
					0b0000 0**0**00: SSV 1	
					0b0000 **0**000: SSV 2	
					0b000**0** 0000: High Fire	
33730/43730	(3729)	Status Contact State	uint16		0 = Deenergized	
					1 = Energized	
33732/43732	(3731)	Analog Output 1 Fault	uint16		0 = Absent	
					1 = Present	

Address (Offset)		Name	Type	10x	Range	
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)	High Fire Valve Voltage	int16	10x	High Fire Valve Voltage multiplied by 10	
33751/43751	(3750)	High Fire Valve Current	int16	10x	High Fire Valve 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		0b0000 000**0**: Pilot 1	0 = De-energized or fault 1 = Energized
					0b0000 00**0**0: Pilot 2	
					0b0000 0**0**00: SSV 1	
					0b0000 **0**000: SSV 2	
					0b000**0** 0000: High Fire	
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)	High Fire Valve Run Time	uint16		High Fire Valve 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	
33786/43786	(3785)	Aux Out 1 Percent	uint16		0 – 100%	
33787/43787	(3786)	Aux Out 2 Percent	uint16		0 – 100%	
33791/43791	(3790)	Reserved	Bitset			

3 DOCUMENT REVISION HISTORY

Document Version	Release Date	Applicable BMS Hardware	Applicable UI Hardware	Applicable Firmware
v7.0	15 JUL 2022	v2.3.x / v2.4.x	v3.2.x / v3.3.x	SB 2.3.1
v6.0	28 SEP 2021	v2.3.x	v3.2.x	SB 2.2.0
v5.0	04 MAR 2021	v2.3.x	v3.2.x	SB 2.1.3
v4.0	04 MAR 2021	v2.3.x	v3.2.x	SB 2.0.4
v3.0	27 JAN 2021	v2.3.x	v3.2.x	SB 2.1.3

3.1 CHANGE SUMMARY

3.1.1 VERSION 7.0

- Added register 31229/41229 for new Bath Standby Cool Off Mode setting
- Added register 33786/43786 and 33787/43787 for Aux Out 1 and 2 ouput statuses
- Updated bitset and array representation for clarity
- Added Test Registers (Section 2.2.1)
- Replaced text examples with graphics
- Updated troubleshooting section to include links to referenced information

3.1.2 VERSION 6.0

- No changes – Updated to specify applicability to SB 2.2.0

3.1.3 VERSION 4.0/5.0

- Corrected register 10001/20001 behavior

PROFIRE

UNITED STATES
1.801.796.5127
321 South, 1250 West Suite 1
Lindon, UT 84042, USA
support@profireenergy.com

CANADA
1.780.960.5278
9671 – 283 Street
Acheson, AB T7X 6J5, Canada
support@profireenergy.com