PF3100

PF3107-00 Modbus Register Map

DOC-001071 v4.0

PROFIRE

1 INTRODUCTION

This document outlines key configuration and register information for PF3100 systems utilizing a PF3107-00 Modbus card. Refer to the Version History section for a list of hardware and firmware versions to which this document applies.

1.1 GENERAL INFORMATION

The Modbus Card implements a Modbus slave device which allows BMS controller setting and status information to be read remotely by a PLC or other remote Modbus master device. The protocol used is Modbus RTU and the physical implementation is half-duplex RS-485. The Modbus Card interfaces with each connected BMS controller independently.

1.2 CONFIGURATION

There are no configurable Modbus settings available on the PF3100. The Modbus master device must be configured in accordance with the specifications below to ensure proper functionality:

The slave address of each BMS Controller card is the last byte of its MAC address (e.g., A BMS with MAC address A0:00:00:00:00:2B has a Modbus address of 2B hex (43 decimal). Ensure that slave addresses are updated when BMS Controller cards are replaced in the system.

The baud rate is automatically selected upon power up based on the baud rate setting of the master device (either 9600 or 19200 bps). Ensure that the PF3100 system is power cycled after changing the baud rate for the change to take effect.

Data bits must be set to 8.

Parity must be set to none.

Stop Bit must be set to 1.

A 120 Ω termination resistor is present on the Modbus card and can be enabled or disabled using the DIP switch next to the Modbus connection terminals.

The Start and Status contacts on the Modbus card are not currently supported.

1.3 LED INDICATORS

The Modbus card has two LEDs (Tx and Rx) mounted on the board for communications troubleshooting to help troubleshoot communications.

Each LED blinks three times when the card is powered up.

The Rx LED blinks twice every time a valid message is received and once every time an invalid message is received.

The Tx LED blinks once every time the card transmits a Modbus message.

Note: When troubleshooting Modbus communication issues, ensure all other slave devices are removed from the bus to minimize transmissions that are not intended for the PF3100.

2 MODBUS REGISTER MAP

The following is a complete list of Modbus registers supported by the PF3100 system.

Note: If an input becomes invalid, its corresponding Modbus register will report a value of 0. Similarly, all registers associated with BMS controllers that are not communicating with the system will also report values of 0.

2.1 READ-ONLY DISCRETE INPUTS

The Discrete Inputs (100xx) are single byte read-only values. 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.

Use the "Read Input Status" command (0x02) to read the Discrete Inputs.

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 (0)	Run	System not in a running state	System in a running state
10002 (1)	Pilot	Pilot output de-energized	Pilot output energized
10004 (3)	High Fire	HFV output de-energized	HFV output energized
10005 (4)	SSV1	SSV1 output de-energized	SSV1 output energized
10006 (5)	SSV2	SSV2 output de-energized	SSV2 output energized
10015 (14)	Aux Input	Aux Input Open	Aux Input Closed
10016 (15)	Pressure Input	Pressure Input Open	Pressure Input Closed
10017 (16)	Level Input	Level Input Open	Level Input Closed
10021 (20)	POC Input	POC Input Open	POC Input Closed
10022 (21)	ESD Input	ESD Input Open	ESD Input Closed
10023 (22)	Start Input	Start Input Open	Start Input Closed
10024 (23)	BMS Communication Status	No Communication	Communicating

2.2 READ-ONLY INPUT/HOLDING REGISTERS

The Input Registers (300xx) are 2 byte read-only values which are mirrored in 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 and the "Read Holding Registers" command (0x03) to read Holding Registers.

Example 1: Read Single – Reading 1 register starting from Register Offset 3 results 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 – 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.

Address (Offset)	Name	Range
30001/40001 (0)	Run	0 = Not Running
		1 = Running
30004/40004 (3)	Process Thermocouple Reading	-50 - 1350°C (-58 - 2462°F) *Per units specified in register 30060/40060
30006/40006 (5)	Pilot Flame Presence	0 = Flame absent on all pilot modules
		100 = Flame present on at least one pilot module
30008/40008 (7)	Process Temp Setpoint	0 - 1350°C (32 - 2462°F) *Per units specified in register 30060/40060
30009/40009 (8)	Low Fire Setpoint	0 - 1350°C (32 - 2462°F) *Per units specified in register 30060/40060
30010/40010 (9)	Pilot Off Setpoint	0 - 1350°C (32 - 2462°F) *Per units specified in register 30060/40060
30011/40011 (10)	Level/Flow Input	Digital Mode: 0 = Open, 1 = Closed
		4-20 Mode: 0 – 100%
30012/40012 (11)	Pressure Input	Digital Mode: 0 = Open, 1 = Closed
		4-20 Mode: 0 – 100%
30017/40017 (16)	Low Temp Setpoint	0 - 1350°C (32 - 2462°F) *Per units specified in register 30060/40060
30018/40018 (17)	High Temp Setpoint	0 - 1350°C (32 - 2462°F) *Per units specified in register 30060/40060
30020/40020 (19) To 30039/40039 (38)	Temperature Wizard Input 1 To Temperature Wizard Input 20	-50 - 1350°C (-58 - 2462°F) *Per units specified in register 30060/40060

Address (Offset)	Name	Range
30040/40040 (39)	Main Flame Presence	0 = Flame absent
		100 = Flame present
30041/40041 (40)	Valve Output Status Bits	BIT 0: Pilot, 0 = De-energized
		BIT 1: Reserved
		BIT 2: SSV1, 0 = De-energized
		BIT 3: Reserved
		BIT 4: SSV2, 0 = De-energized
		BIT 5: Reserved
		BIT 6: High Fire, 0 = De-energized
		BIT 7: Reserved
30042/40042 (41)	Aux Output Percentage	0 – 100 %
30043/40043 (42)	Shutdown Codes * Refer to BMS Controller Shutdown Code document for list of shutdowns and associated Modbus codes.	0 = No outstanding shutdown codes
		Not 0 = 16-bit shutdown code
30044/40044 (43)	Dry Input State Bits	BIT 0: Start, 0 = Open; 1 = Closed
		BIT 1: ESD, 0 = Open; 1 = Closed
		BIT 2: POC, 0 = Open; 1 = Closed
		BIT 3: Aux In, 0 = Open; 1 = Closed
		BIT 4: Level, 0 = Open; 1 = Closed
		BIT 5: Pressure, 0 = Open; 1 = Closed
30050/40050 (49)	Modbus Receive Counter *Running total of properly addressed Modbus messages received by a BMS in the system	0 - 65535 *Rolls over to 0 when count exceeds 65535
30051/40051 (50)	Ethernet Message Receive Counter *Running total of properly addressed Ethernet messages received by a BMS in the system	0 - 65535 *Rolls over to 0 when count exceeds 65535
30060/40060 (59)	Modbus Temperature Units *Used for all temperature reads/writes except where indicated.	0 = Celsius
		1 = Fahrenheit

Address (Offset)	Name	Range
30061/40061 (60) (Note 1) To 30065/40065 (64)	I/O Expansion Module 1 MAC Address To I/O Expansion Module 5 MAC Address	Low Byte: Last byte of address High Byte: Second last byte of address
30070/40070 (69) (Note 1) To 30073/40073 (72)	I/O Expansion Module 1, Input 1 To I/O Expansion Module 1, Input 4	Digital Mode: 0 = Open, 1 = Closed 4-20 Mode: Input value in mA x 100
30074/40074 (73) (Note 1) To 30077/40077 (76)	I/O Expansion Module 2, Input 1 To I/O Expansion Module 2, Input 4	Digital Mode: 0 = Open, 1 = Closed 4-20 Mode: Input value in mA x 100
30078/40078 (77) (Note 1) To 30081/40081 (80)	I/O Expansion Module 3, Input 1 To I/O Expansion Module 3, Input 4	Digital Mode: 0 = Open, 1 = Closed 4-20 Mode: Input value in mA x 100
30082/40082 (81) (Note 1) To 30085/40085 (84)	I/O Expansion Module 4, Input 1 To I/O Expansion Module 4, Input 4	Digital Mode: 0 = Open, 1 = Closed 4-20 Mode: Input value in mA x 100
30086/40086 (85) (Note 1) To 30089/40089 (88)	I/O Expansion Module 5, Input 1 To I/O Expansion Module 5, Input 4	Digital Mode: 0 = Open, 1 = Closed 4-20 Mode: Input value in mA x 100
30110/40110 (109)	Modbus Check Sum Failure Count	0 – 65535 *Capped at 65535 – Power cycle to reset
30111/40111 (110)	Modbus Invalid Device Addressing Count	0 – 65535 *Capped at 65535 – Power cycle to reset
30112/40112 (111)	Modbus Receive Timeout Fail Count	0 – 65535 *Capped at 65535 – Power cycle to reset
30113/40113 (112)	Modbus Invalid Function Code Fail Count	0 – 65535 *Capped at 65535 – Power cycle to reset
30114/40114 (113)	Modbus Unsupported Register Fail Count	0 – 65535 *Capped at 65535 – Power cycle to reset
30115/40115 (114)	Modbus Incoming Packet Fault Count	0 – 65535 *Capped at 65535 – Power cycle to reset
30501/40501 (500) To 30545/40545 (544)	IO Expansion Logical Input 1 To IO Expansion Logical Input 45	Digital Mode: 0 = Open, 1 = Closed 4-20 Mode: Input value in units specified in the IO Expansion Wizard [Note 2].
30601/40601 (600) To 30645/40645 (644)	IO Expansion Logical Input 1 To IO Expansion Logical Input 45	Digital Mode: 0 = Open, 10 = Closed 4-20 Mode: Input value x 10 in units specified in the IO Expansion Wizard [Note 2].
30701/40701 (700) To 30790/40790 (789)	IO Expansion Logical Input 1 [Note 3] To IO Expansion Logical Input 45 [Note 3]	Digital Mode: 0 = Open, 1 = Closed 4-20 Mode: Input value as a floating-point number in units specified in the IO Expansion Wizard.

[1] Care must be taken when reading the I/O Expansion inputs over Modbus as the I/O Expansion modules may become re-ordered upon power cycle or settings modification (e.g., the module represented as Module 2 over Modbus may be represented as Module 1 following a power cycle). For this reason, the following procedure is recommended when reading I/O Expansion Inputs via registers 30070 through 30089:

i. Scan input registers 30061 to 30065 for the MAC address of the module from which you wish to read.
ii. Use the following formula to determine the correct register to read:
30070 + 4 x (register from step i - 30061) + (desired module input – 1)

Ex. Desired input = Input 2 from I/O expansion module with MAC address ending in "A1B2"
Associated Modbus register = scan of 30061-30065 looking for "A1B2" = 30063 for this example
Register associated with reading for Input 2: 30070 + 4 x (30063 – 30061) + (2 – 1) = 30070 + 8 + 1 = 30079

[2] Values below 0 are represented as 0, and values above 65535 are represented as 65535. Consider using registers 30701/40701 through 30790/40790 if values are not between 0 and 65535.

[3] Floating-point numbers are held in two sequential registers and are represented in IEEE-754 standard format.

Ex. IO Expansion Input 1 is held in consecutive registers 30701 & 30702 (and 40701 & 40702).
IO Expansion Input 45 is held in consecutive registers 30789 & 30790 (and 40789 & 40790).

2.3 READ/WRITE HOLDING REGISTERS

The Holding Registers (400xx) are 2 byte read/write values.

Use either the "Pre-set Single Register" command (0x06) or the "Pre-set Multiple Registers" command (0x10) to write to the Holding Registers.

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

Example 1: Write Single – 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 2: Write Multiple – 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.

Address (Offset)	Name	Range	Bit Representation
40100 (99)	Start/ Stop Register *Send start command to all connected BMS within 10 seconds to start entire appliance.	1234: Start BMS	0x04D2
		4321: Stop BMS	0x10E1
40101 (100)	Process Temp Setpoint Change Request *Check register 30008/40008 to verify change has been accepted.	-50 - 1350°C (-58 - 2462°F) *Per units specified in register 30060/40060	int16 -50 = 0xFFCE 0 = 0x0000 2464 = 0x099E
40102 (101)	Low Fire Setpoint Change Request *Check register 30009/40009 to verify change has been accepted.	-50 - 1350°C (-58 - 2462°F) *Per units specified in register 30060/40060	
40103 (102)	Pilot Off Setpoint Change Request *Check register 30010/40010 to verify change has been accepted.	-50 - 1350°C (-58 - 2462°F) *Per units specified in register 30060/40060	
40104 (103)	Low Temperature Setpoint Change Request *Check register 30017/40017 to verify change has been accepted.	-50 - 1350°C (-58 - 2462°F) *Per units specified in register 30060/40060	
40143 (142)	Clear Shutdown Code *Allow 5 seconds between consecutive write attempts to this register.	1 = Acknowledge shutdown	0x0001
		Not 1 = No effect	
40160 (159)	Temperature Unit Change Request *Check register 30060/40060 to verify change has been accepted.	0 = Celsius	0x0000
		1 = Fahrenheit	0x0001
40161 (160)	Secondary PID Setpoint	0 - 65535 in base units only [1]	uint16
	Temperature card input	0 – 65535 Celsius (°C)	30°C = 0x001E
	I/O Expansion Pressure input	0 – 65535 Kilopascals (kPa)	30kPA = 0x001E
	I/O Expansion Level input	0 – 65535 Liters (L)	30L = 0x001E
	I/O Expansion Flow input	0 – 65535 Cubic metres per second (m^3/s)	30 m^3/s = 0x001E
	I/O Expansion Custom Temperature input	0 – 65535 Celsius (°C)	30°C = 0x001E
	I/O Expansion Custom (Non-temperature) input	0 – 65535 Percent (%)	30% = 0x001E

[1] All Secondary PID Setpoint change requests must be written in the appropriate base units as specified in the table (e.g., for a temperature card thermocouple input configured as a Secondary PID Input with UI Temperature Units setting set to Fahrenheit - the UI displays the input readings in Fahrenheit, but all Secondary PID Setpoint change requests written to register 40161 must be in Celsius. Similarly, reads of register 40161 are represented in Celsius).

3 VERSION HISTORY

Document Version	Release Date	Applicable System Firmware	Applicable PF3107-00 Modbus Card Hardware
v4.0	14NOV2022	NA-43.3	v1.3.x
v3.0	26 OCT 2022	NA-43.2	v1.3.x
v2.0	31 JAN 2022	NA-43	v1.3.x
v1.0	03 MAR 2021	NA-42	v1.3.x

3.1 DOCUMENT CHANGE SUMMARY

3.1.1 VERSION 4.0

- No material changes – Applicable System Firmware updated to include NA-43.3 software.

3.1.2 VERSION 3.0

- No material changes – Applicable System Firmware updated to include NA-43.2 software.

3.1.3 VERSION 2.0

- Added registers 30501/40501 to 30545/40545
- Added registers 30601/40601 to 30645/40645
- Added registers 30701/40701 to 30790/40790
- Added register 40161 and corresponding note on base units
- Removed registers 30116/40116 to 30160/40160 (functionality duplicated by new registers 30601/40601 to 30645/40645

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