



PF3100

PF3107-00 Modbus Register Map
DOC-001071 v1.0

1 INTRODUCTION

This document outlines key configuration and register information for PF3100 systems utilizing a PF3107-00 Modbus card. The information below is applicable for Modbus card hardware v1.3.x and NA-42.0 firmware.

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 100 = Flame present
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
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 <small>* Refer to BMS Controller Shutdown Code document for list of shutdowns and associated Modbus codes.</small>	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

Address (Offset)	Name	Range
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)	Temperature Unit *Used for all Modbus temperature data.	0 = Celsius 1 = Fahrenheit
(Note 1) 30061/40061 (60) 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
(Note 1) 30070/40070 (69) 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
(Note 1) 30074/40074 (73) 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
(Note 1) 30078/40078 (77) 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
(Note 1) 30082/40082 (81) 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
(Note 1) 30086/40086 (85) 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
30116/40116 (115) To 30160/40160 (159)	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 individually specified units for each input.

(Note 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:

$$30070 + 4 \times (\text{register from step i} - 30061) + (\text{desired module input} - 1)$$

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: $30070 + 4 \times (30063 - 30061) + (2 - 1) = 30070 + 8 + 1 = \underline{30079}$

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
40100 (99)	Start/ Stop Register <i>*Send start command to all connected BMS within 10 seconds to start entire appliance.</i>	1234: Start BMS
		4321: Stop BMS
40101 (100)	Process Temp Setpoint Change Request <i>*Check register 30008/40008 to verify change has been accepted.</i>	-50 - 1350°C (-58 - 2462°F) <i>*Per units specified in register 30060/40060</i>
40102 (101)	Low Fire Setpoint Change Request <i>*Check register 30009/40009 to verify change has been accepted.</i>	-50 - 1350°C (-58 - 2462°F) <i>*Per units specified in register 30060/40060</i>
40103 (102)	Pilot Off Setpoint Change Request <i>*Check register 30010/40010 to verify change has been accepted.</i>	-50 - 1350°C (-58 - 2462°F) <i>*Per units specified in register 30060/40060</i>
40104 (103)	Low Temperature Setpoint Change Request <i>*Check register 30017/40017 to verify change has been accepted.</i>	-50 - 1350°C (-58 - 2462°F) <i>*Per units specified in register 30060/40060</i>
40143 (142)	Clear Shutdown Code <i>*Allow 5 seconds between consecutive write attempts to this register.</i>	1 = Acknowledge shutdown
		Not 1 = No effect
40160 (159)	Temperature Unit Change Request <i>*Check register 30060/40060 to verify change has been accepted.</i>	0 = Celsius
		1 = Fahrenheit



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