# *PF3107-00*

MODBUS REGISTER MAP

v1.4
Revised Nov 29, 2016

PROFIRE ENERGY INC

## TRADEMARKS AND COPYRIGHT



## DISCLAIMERS

All the information described in this document is “as is,” without warranty of any kind and is published in good faith and for general information purposes only. Profire does not make any guarantees about the completeness, reliability and accuracy of this information. Profire may make changes in this manual or in the product(s) described in this manual at any time.

## CONTACT US

Contact your Profire Sales representative for questions, comments or further assistance.

www.profireenergy.com | 1.855.PRO.FIRE

# *Table of Contents*

# 1 Overview

The PF3107-00 Modbus Card is designed for use with PF3100 Burner Management Systems. It implements a Modbus Slave Device which allows settings and measurements in the PF3101-00 BMS to be read remotely by a PLC or other remote Master Device. The protocol used is Modbus RTU and the physical implementation is half-duplex RS-485.

This document outlines key configuration information needed to utilize the PF3107-00 Modbus Card. This information applies to hardware version v1.3.x and firmware bundle numbers NA-19 thru NA-00029.

## 1.1 General Information

The PF3107-00 Modbus Card currently can only be used to control and read status information from PF3101-00 BMS Controller Cards. The Modbus Card does not understand “appliances” at present but can be used to access all BMSes individually within an appliance. If all BMSes are functioning correctly in an appliance, the first configured BMS in the appliance is the one for which overall appliance status should be read from. To determine which is the first configured BMS, look at the list of BMS Controllers on the Appliance Status Screen of the PF3100-00 User Interface. The first BMS in the list on the right side of this screen is the first configured BMS. If this BMS is not available for some reason (e.g., it is damaged, power is lost, Modbus communications are down), then the second BMS in the list should be used. This failover scheme continues for all BMSes in the list.

## 1.2 Communications

The Modbus Card implements Modbus RTU protocol over RS-485. The Modbus address used to communicate with each BMS Controller Card in a PF3100 system is the last 2 digits of the **MAC Address of the BMS**, not the MAC address of the Modbus card itself. For example, a BMS with MAC address A0:00:00:00:00:2B has a Modbus address of 2B hex (43 decimal).

The Baud rate of the Modbus communications is set to 19200bps by default with no parity bits, eight data bits, and one stop bit (N-8-1). The Baud rate can be changed between 19200bps and 9600bps partially automatically. To change the baud rate, send several messages to the Modbus card using the desired baud rate. Once a response is received from the PF3107-00, the baud rate will be set. It cannot be changed again unless the unit is power cycled.

A termination resistor is present on the board next to the Modbus wiring connector and can be enabled or disabled using the switch.

Most units for the various registers described in this document are currently hardcoded and cannot be changed. There is a Modbus register (30160/40160) that can be written to in order to change the temperature unit to Celsius or Fahrenheit. The default value is Fahrenheit. If different units are required, they will need to be converted by an external PLC.

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

The Modbus Module does not currently show up on the PF3100-00 User Interface and therefore settings and status cannot be viewed there. A future firmware release will add this functionality and allow many

settings to be adjusted through the UI including Appliance Settings, MAC Addresses, baud rate, parity bits, data bits, stop bits, register units, and Start/Status contact behaviour.

## 1.3 LED Indicators

The PF3107-00 Modbus Card has two LEDs mounted on the board to help troubleshoot communications. Both LEDs blink 3 times when the PF3107-00 is powered up.

If a valid message that is addressed to a BMS connected to the PF3107-00 is received, the RX LED will blink twice. If an error, or an invalid message is received the RX LED will blink once.

When the PF3107-00 transmits a Modbus message it will blink the TX LED once.

Note: When troubleshooting the communications perform the testing when the PF3107-00 is the only slave device on the bus to minimize other communications not intended for the PF3107-00.

## 1.4 Modbus Register Map

The following are the registers that are currently supported by the Modbus Card firmware

Note that if a given input (such as temperature) becomes invalid for any reason (such as a hardware or wiring error on the temperature module) the register will report a value of 0. Similarly, if the Modbus Card loses communications with a BMS Controller Card for 10 seconds or more, all registers associated with that BMS will report a value of 0.

### 1.4.1 READ-ONLY DISCRETE INPUTS

These are single bit values that are read only. 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.

| **Register Address (Offset)** | **Names and Values** | **Description** | **Minimum Version Supported** |
|---|---|---|---|
| **10001 (0)** | Run<br>0 = Not Running<br>1 = Running | The Run bit is set when the PF3100 BMS is actively firing, is attempting to relight, or is waiting for a wait condition to clear before relighting. | NA-19 |
| **10002 (1)** | Pilot<br>0 = Deenergized<br>1 = Energized | The Pilot bit is set whenever the controller is attempting to drive the Pilot Solenoid to an open position. This is not a proof of position. | NA-00023 |

| Register Address (Offset) | Names and Values | Description | Minimum Version Supported |
|---|---|---|---|
| **10004 (3)** | High Fire<br>0 = Deenergized<br>1 = Energized | The High Fire bit is set whenever the controller is attempting to drive the High Fire Solenoid to an open position. This is not a proof of position. | NA-00023 |
| **10005 (4)** | SSV1<br>0 = Deenergized<br>1 = Energized | The SSV1 bit is set whenever the controller is attempting to drive the SSV1 Solenoid to an open position. This is not a proof of position. | NA-00023 |
| **10006 (5)** | SSV2<br>0 = Deenergized<br>1 = Energized | The SSV2 bit is set whenever the controller is attempting to drive the SSV2 Solenoid to an open position. This is not a proof of position. | NA-00023 |
| **10015 (14)** | Aux Input<br>0 = open<br>1 = closed | The Aux Input bit shows the state of the Aux In input on the BMS. The bit is set to 1 if the input is closed. This bit will be set to zero if the input is open. Depending on the Aux In Contact Mode setting in the user interface, this register may represent Proof of Low Fire, Proof Of Closure 2, Proof of Pilot, Low Fuel Pressure, or Chamber Pressure. | NA-00023 |
| **10016 (15)** | Pressure Input<br>0 = open<br>1 = closed | The Pressure Input bit shows the state of the Pressure input on the BMS. The bit is set to 1 if the input is closed. This bit will be set to zero if the input is open. | NA-00023 |
| **10017 (16)** | Level Input<br>0 = open<br>1 = closed | The Level Input bit shows the state of the Level input on the BMS. The bit is set to 1 if the input is closed. This bit will be set to zero if the input is open. | NA-00023 |
| **10021 (20)** | POC Input<br>0 = open<br>1 = closed | The POC Input bit shows the state of the Proof Of Closure input on the BMS. The bit is set to 1 if the input is closed. This bit will be set to zero if the input is open. | NA-00023 |
| **10022 (21)** | ESD Input<br>0 = open<br>1 = closed | The ESD Input bit shows the state of the Emergency Shutdown input on the BMS. The bit is set to 1 if the input is closed. This bit will be set to zero if the input is open. | NA-00023 |
| **10023 (22)** | Start Input<br>0 = open<br>1 = closed | The Start Input bit shows the state of the Start input on the BMS. The bit is set to 1 if the input is closed. This bit will be set to zero if the input is open. | NA-00023 |

### 1.4.2 READ-ONLY INPUT/HOLDING REGISTERS

The Input Registers (300xx) are 2-byte read-only values. They are mirrored in corresponding Holding Registers (400xx) for convenience and to maintain compatibility with some PLCs.

Use the “Read Input Registers” Command (0x04) to read the Input Registers (300xx).
Use the “Read Holding Registers” Command (0x03) to read the Holding Registers (400xx).

Example 1: Read Single - 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 - 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,.

| Register Address (Offset) | Names and Values | Description | Version Supported |
|---|---|---|---|
| **30001/40001 (3)** | Run<br>0 = Not Running<br>1 = Running | The Run bit is set when the PF3100 BMS is actively firing, is attempting to relight, or is waiting for a wait condition to clear before relighting. | NA-00023 |
| **30004/40004 (3)** | Process Thermocouple Reading<br>-58 to 2462 °F | This is the current reading of the Process Thermocouple, encoded as a 16-bit signed integer in °F. | NA-19 |
| **30006/40006 (5)** | Pilot Flame Quality<br>0 to 100% | This number represents the quality of the pilot flame. The higher the number the better the flame. In a multi-pilot system, if any one pilot module is reporting pilot flame quality of 100%, this register will contain 100%. | NA-19 |
| **30008/40008 (7)** | Process Temp Setpoint<br>32 to 2462 °F | This is the current value of the Process Temperature Setpoint, encoded as a 16-bit signed integer in °F. | NA-19 |
| **30009/40009 (8)** | Low Fire Setpoint<br>32 to 2462 °F | This is the current value of the Low Fire Temperature Setpoint, encoded as a 16-bit signed integer in °F. | NA-00029 |
| **30010/40010 (9)** | Pilot Off Setpoint<br>32 to 2462 °F | This is the current value of the Pilot Off Temperature Setpoint, encoded as a 16-bit signed integer in °F. | NA-00029 |
| **30011/40011 (10)** | Level Input:<br>Dry contact: 0 = open, 1 = closed<br>4-20mA input: mA * 100, or hundredths of mA. | This number represents the state of the Level input. This value will depend on the input configuration. If the input is configured as a 4-20mA input, the value reported will represent the mA reading. If the input is configured as a dry contact, it will represent the state of the switch. | NA-19 |
| **30012/40012 (11)** | Pressure Input<br>Dry contact: 0 = open, 1 = closed<br>4-20mA input: mA * 100, or hundredths of mA. | This number represents the state of the Pressure input. This value will depend on the input configuration. If the input is configured as a 4-20mA input, the value reported will represent the mA reading. If the input is configured as a dry contact, it will represent the state of the switch. | NA-19 |
| **30017/40017 (16)** | Low Temperature Setpoint<br>32 to 2462 °F | This is the current value of the Low Temperature Setpoint, encoded as a 16-bit signed integer in °F. | NA-00029 |
| **30018/40018 (17)** | High Temperature Setpoint<br>32 to 2462 °F | This is the current value of the High Temperature Setpoint, encoded as a 16-bit signed integer in °F. | NA-00029 |
| **30020-30039/ 40020-40039 (19-38)** | Temperature Inputs<br>-58 to 2462 °F | These registers report the current readings of the logical temperature inputs encoded as a 16-bit signed integer in °F.<br><br>These are reported in the same order they appear in the temperature wizard on the PF3100-00 UI. The top one on the configuration screen corresponds to x0020, the next one down will be x0021, and so on. | NA-00020 |

| | | | |
|---|---|---|---|
| **30040/40040 (39)** | Main Flame Quality<br>0 to 100% | This number represents the quality of the main flame. The higher the number the better the flame. In a multi-pilot system, if any one pilot module is reporting main flame quality of 100%, this register will contain 100%. | NA-00023 |
| **30041/40041 (40)** | Valve Output Status Bits<br>0 = Deenergized<br>1 = Energized<br>Bit 0: Pilot<br>Bit 1: reserved<br>Bit 2: SSV1<br>Bit 3: reserved<br>Bit 4: SSV2<br>Bit 5: reserved<br>Bit 6: High Fire<br>Bit 7: reserved | This register contains a bitmap reporting the status of each valve output on the BMS card. The Ion Pilot Card valve output is not currently reported. See registers 10002, 10004, 10005, 10006 for more details. | NA-00023 |
| **30042/40042 (41)** | Aux Output Percentage:<br>0 to 100% | This number represents the Aux Output Percentage. If the output is being driven with 4ma it will report 0% and if the output is being driven with 20mA, it will report 100%.<br>Depending on the 4-20 Aux Out Mode setting in the user interface, this register may represent Process Temperature, Fuel Pressure, Tank Level, LEL Input Reading, or Proportional Valve Position. | NA-00023 |
| **30043/40043 (42)** | Shutdown Code | This is a 16 bit code that represents the reason that the BMS last shut down.<br>If the shutdown code has been acknowledged, or if the controller is running, this value will be zero. | NA-00023 |
| **30044/40044 (43)** | Dry Input State Bits<br>0 = Open<br>1 = Closed<br>Bit 0: Start<br>Bit 1: ESD<br>Bit 2: POC<br>Bit 3: AUX_IN<br>Bit 4: LEVEL<br>Bit 5: PRESSURE | This register contains a bitmap reporting the status of each dry contact switch input on the BMS card. See registers 10015, 10016, 10017, 10021, 10022 and 10023 for more details. | NA-00023 |
| **30050/40050 (49)** | Modbus Receive Counter | This number is a rolling counter that is incremented every time a Modbus message is received that is properly addressed to any PF3100 BMS on the system. This number has a range of 0 to 65535, and will roll over to 0 if a message is received when the counter is at the maximum value. | NA-00029 |

| | | | |
|---|---|---|---|
| **30051/40051 (50)** | Ethernet Message Receive Counter | This number is a rolling counter that is incremented every time a message is received by the Modbus card over Ethernet, from the PF3100 BMS. This number has a range of 0 to 65535, and will roll over to 0 if a message is received when the counter is at the maximum value. This number should be periodically increasing if the BMS is connected to the Modbus card. | NA-00029 |
| **30060/40060 (59)** | Temperature Unit<br>0 = Celsius<br>1 = Fahrenheit | This number represents the temperature unit used for all of the temperature data reported from the Modbus card. | NA-00029 |

### 1.4.3 READ/WRITE HOLDING REGISTERS

These are 2-byte read/write values.

Use the “Pre-set Single Register” command (0x06) or the “Pre-set Multiple Registers” command (0x10) to write these registers.
Use the “Read Holding Registers” command (0x03) to read these 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.

| **Register Address (Offset)** | **Names and Values** | **Description** | **Version Supported** |
|---|---|---|---|
| **40100 (99)** | Start/Stop Register<br>Set register to decimal 1234 to start BMS<br>Set register to decimal 4321 to stop BMS | This register is used to remotely stop or start a single PF3101-00 BMS, and will clear when the command is accepted. To start an entire appliance, send the same start command to every BMS in the appliance within a 10 second window. | NA-19 |
| **40101 (100)** | Process Temp Setpoint Change Request<br>-58 to 2462 F | This register is used to request the PF3101-00 BMS to change the Process Temperature Setpoint to the specified value. Read register 30008/40008 to verify that the change was accepted. | NA-00029 |

| Register Address (Offset) | Names and Values | Description | Version Supported |
|---|---|---|---|
| **40102 (101)** | Low Fire Setpoint Change Request<br>-58 to 2462 F | This register is used to request the PF3101-00 BMS to change the Low Fire Setpoint to the specified value. Read register 30009/40009 to verify that the change was accepted. | NA-00029 |
| **40103 (102)** | Pilot Off Setpoint Change Request<br>-58 to 2462 F | This register is used to request the PF3101-00 BMS to change the Pilot Off Setpoint to the specified value. Read register 300010/400010 to verify that the change was accepted. | NA-00029 |
| **40104 (103)** | Low Temperature Setpoint Change Request<br>-58 to 2462 F | This register is used to request the PF3101-00 BMS to change the Low Temperature Setpoint to the specified value. Read register 300017/400017 to verify that the change was accepted. | NA-00029 |
| **40105 (104)** | High Temperature Setpoint Change Request<br>-58 to 2462 F | This register is used to request the PF3101-00 BMS to change the High Temperature Setpoint to the specified value. Read register 300018/400018 to verify that the change was accepted. | NA-00029 |
| **40160 (159)** | Temperature Unit Change Request<br>Set register value to 0 to set to degrees Celsius.<br>Set register value to 1 to set the degrees to Fahrenheit. | This register is used to request the Modbus card to change the temperature unit for reported values. Read register 300060/400060 to verify that the change was accepted. | NA-00029 |

# 2 Document Revision History

| Versio | Date | Who | Description of Changes |
|---|---|---|---|
| v1.0 | 2016-04-12 | CS | Initial Release |
| v1.1 | 2016-04-25 | CS | Added registers for valve status, as well as 4-20 Aux Output percentage, and Shutdown code. |
| v1.2 | 2016-04-25 | CS | Added registers for dry contact switch inputs. |
| v1.3 | 2016-07-29 | CS | Added auto-baud, temperature unit configurability, TX and RX LED Indicators and made a few minor updates in the information/communications sections.<br><br>Added registers to both the read-only and read/write register sections for release NA-00029. |
| v1.4 | 2016-11-29 | CS | Minor formatting changes |