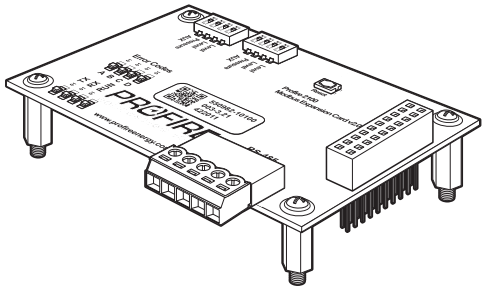


PF2100

MODBUS ***EXPANSION CARD***

REGISTER MAP **v2.1**

FOR HARDWARE v2.0 ONLY
FOR FIRMWARE v2.0, v4.0, v4.1, v4.3

PROFIRE

FIRMWARE VERSION HISTORY

FIRMWARE VERSION	DESCRIPTION
v2.0	First version compatible with Modbus Card HW v2.0. Requires DC FW v1.6.3CE and TC FW v1.6.38.
v4.0	Requires DC FW E1.8.005 or higher and TC FW E1.8.005 or higher.
v4.1	Compatible with all FW versions DC FW v1.6.3CE/TC FW v1.6.38 and higher. Added comm error counters. Reliability improvements
v4.3	Added latching registers.

MODBUS COMMANDS

Only the following Modbus RTU commands are supported by the PF2100 Modbus Card. All other Modbus RTU commands are not supported. Modbus TCP is not directly supported but can be used if a third party bridge is purchased.

Name	Command	Address Range	Description
Read Input Status	**2 = 0x02**	10001 - 19999	Bit packs the response.
Read Holding Registers	**3 = 0x03**	40001 - 49999	Two bytes per register are returned.
Read Input Registers	**4 = 0x04**	30001 - 39999	Two bytes per register are returned.
Preset Single Register	**6 = 0x06**	40001 - 49999	Two bytes per register must be sent.
Preset Multiple Registers	**16 = 0x10**	40001 - 49999	Two bytes per register must be sent.

Refer to the official "Modicon Modbus Protocol Reference Guide" available on the Modicon website for further details on Modbus RTU commands.

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. This guide provides both numbers for your convenience. Consult your software documentation to determine which is required in your case.

To understand why this is, it is useful to know a bit about how Modbus RTU packets are structured. Modbus RTU packets encode the Register Address using a Command and a Register Offset. Each Command represents a Base Address which is the same as the first address listed in the table above next to each command. The Register Offset is calculated by subtracting the Base Address from the Register Address as follows:

Register Offset = Register Address – Base Address

For example, the Base Address for Command 0x03 is 40001. If you want to read register 40003, then the Register Offset encoded in the Modbus RTU packet would be 40003 – 40001 = 2.

REGISTER VALUE DEFINITIONS

The following definitions are terms used in this guide to refer to register values.

For Data Bits, positive logic is used:
Set = Logic High = ON = 1
Clear = Logic Low = OFF = 0

For Dry Contacts:
Open = the attached switch is open  and current does not flow.
Closed = the attached switch is closed and current is flowing.

For Powered Valve Outputs:
Energized = Open = the attached valve is open and fluid is flowing.
Deenergized = Closed = the attached valve is closed and fluid is not flowing.

LATCHED VS UNLATCHED REGISTERS

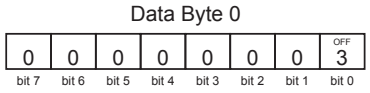
Latched registers have the same function as their corresponding unlatched registers, but once set will remain set until the system is stopped and then restarted.

READ-ONLY DISCRETE INPUTS

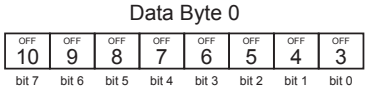
These are single bit values that are read only. Reading one input will result in a single byte being returned with the least significant bit holding the value. Reading multiple inputs per command will result in a bit packed vector being returned.

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	VER.
10001 (0)	Run 0 = Not Running 1 = Running	The Run bit is set when the PF2100 is running in Auto Mode in any state other than Ready, Alarm, and Shutdown. This indicates that the system is actively firing, is attempting to relight, or is waiting for an enabled wait condition to clear before relighting. The Run bit will never be set if the system is in Manual Mode.	2.0+
10002 (1)	Pilot 0 = Deenergized 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.	2.0+
10003 (2)	Low Fire 0 = Deenergized 1 = Energized	The Low Fire bit is set whenever the controller is attempting to drive the Low Fire Solenoid to an open position. This is not a proof of position.	2.0+
10004 (3)	High Fire 0 = Deenergized 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.	2.0+
10017 (16)	Level Input 0 = Closed 1 = Open	The Level Input bit shows the state of the Level Input. When the Level Input is closed (normal condition), the Level Input bit is off. When the Level Input is open (alarm condition), the bit is on.	2.0+
10018 (17)	Main Solenoid Feedback 0 = LF & HF Deenergized 1 = LF or HF Energized	The Main Solenoid Feedback bit can be used to verify the proper operation of the circuitry and wiring that powers the Main Solenoids (both Low Fire and High Fire). This bit will be set if either output has voltage present on it, regardless of the source of the voltage. Therefore, if this bit is set but both 10003 and 10004 are clear, a circuitry/wiring short to 12/24V may be present. Similarly, if this bit is clear but either 10003 or 10004 are set, a circuitry/wiring short to ground may be present. This is not a proof of position.	2.0+
10019 (18)	Pilot Solenoid Feedback 0 = Deenergized 1 = Energized	The Pilot Solenoid Feedback bit can be used to verify the proper operation of the circuitry and wiring that powers the Pilot Solenoid. This bit will be set if the output has voltage present on it, regardless of the source of the voltage. Therefore, if this bit is set but 10002 is clear, a circuitry/wiring short to 12/24V may be present. Similarly, if this bit is clear but 10002 is set, a circuitry/wiring short to ground may be present. This is not a proof of position.	2.0+
10020 (19)	High Pressure Input 0 = Closed 1 = Open	The High Pressure Input bit shows the state of the High Pressure Input. When the High Pressure Input is closed (normal condition), the High Pressure Input bit is clear. When the High Pressure Input is open (alarm condition), the bit is set.	2.0+
10021 (20)	Proof of Closure 0 = Closed 1 = Open	The Proof of Closure Input bit shows the state of the Proof of Closure Input. When the Proof of Closure Input is closed (normal condition), the Proof of Closure Input bit is clear. When the Proof of Closure Input is open (unit not safe to start condition), the bit is set.	2.0+
10022 (21)	ESD Input 0 = Closed 1 = Open	The ESD Input bit shows the state of the ESD Input. When the ESD Input is closed (normal condition), the ESD Input bit is clear. When the ESD Input is open (alarm condition), the bit is set.	2.0+

REGISTER ADDRESS (OFFSET)	NAMES AND VALUES	DESCRIPTION	VER.
10023 (22)	Start Input 0 = Closed 1 = Open	The Start Input bit shows the state of the Start Input. When the Start Input is closed (normal condition), the Start Input bit is clear. When the Start Input is open, (unit off), the bit is set.	2.0+
10024 (23)	Low Pressure 0 = Closed 1 = Open	The Low Pressure Input bit shows the state of the Low Pressure Input. When the Low Pressure Input is closed (normal condition), the Low Pressure Input bit is clear. When the Low Pressure Input is open (alarm condition), the bit is set.	2.0+
10025 (24)	Flame Detected 0 = No Flame 1 = Flame Detected	The Flame Detected bit shows the state of the flame detection circuitry. When there is no flame or the flame does not meet minimum requirements, the bit is clear. When the flame meets or exceeds the minimum flame detection requirements, the bit is set.	2.0+
10026 (25)	Flame Test Fail 0 = Flame Test OK 1 = Flame Test Failed	The Flame Test Fail bit shows the state of the flame test system. The flame detection circuitry is does a self test every 1.2 seconds, if the flame test is OK the Flame Test Fail bit is off. If the flame test fails, the Flame Test Fail bit will be on.	2.0+
10027 (26)	Unit Failure 0 = Unit OK 1 = Unit Failed	The Unit Failure bit shows the state of the unit self tests. During operation the unit does many self tests and verifications of the internal operation of the unit. If the unit is passing these tests, the Unit Failure bit is clear. If any of the tests fail, the Unit Failure bit will be set.	2.0+
10028 (27)	Low or High Voltage 0 = Voltage OK 1 = Voltage Bad	The Low or High Voltage bit shows whether the voltage applied to the controller is within acceptable limits. If the voltage is within limits, the Low or High Voltage bit is clear. If the voltage is out of limits, the bit is set.	2.0+
10029 (28)	HiTemp Alarm 0 = No Alarm 1 = Alarm	The HiTemp Alarm shows the state of the High Temperature Shutdown. If the process temperature is below the High Temperature Shutdown limit, the bit is clear. If the High Temperature Shutdown limit is exceeded, the bit will be set.	2.0+
10030 (29)	4-20 Alarm 0 = No Alarm 1 = Alarm	The 4-20 Alarm bit is set whenever one or more bits are set in register 30014/40014. This could mean any of the following: The level or pressure inputs are below their respective low setpoints, above their respective high setpoints, disconnected, or there is a hardware failure on the 4-20 card.	2.0+
10033 (32)	Level Input (Latched)	Latched version of 10017.	4.3+
10034 (33)	Main Solenoid Feedback (Latched)	Latched version of 10018.	4.3+
10035 (34)	Pilot Solenoid Feedback (Latched)	Latched version of 10019.	4.3+
10036 (35)	High Pressure Input (Latched)	Latched version of 10020.	4.3+
10037 (36)	Proof of Closure (Latched)	Latched version of 10021.	4.3+
10038 (37)	ESD Input (Latched)	Latched version of 10022.	4.3+
10039 (38)	Start Input (Latched)	Latched version of 10023.	4.3+
10040 (39)	Low Pressure (Latched)	Latched version of 10024.	4.3+
10041 (40)	Flame Detected (Latched)	Latched version of 10025.	4.3+
10042 (41)	Flame Test Fail (Latched)	Latched version of 10026.	4.3+
10043 (42)	Unit Failure (Latched)	Latched version of 10027.	4.3+
10044 (43)	Low or High Voltage (Latched)	Latched version of 10028.	4.3+
10045 (44)	HiTemp Alarm (Latched)	Latched version of 10029.	4.3+
10046 (45)	4-20 Alarm (Latched)	Latched version of 10030.	4.3+

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.

Data Byte 0	Data Byte 1
REG OFF 3 MSB	REG OFF 3 LSB

Example 2: Read Multiple

Reading 2 registers 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. The next two bytes will contain the value of Register Offset 4.

Data Byte 0	Data Byte 1	Data Byte 2	Data Byte 3
REG OFF 3 MSB	REG OFF 3 LSB	REG OFF 4 MSB	REG OFF 4 LSB

REGISTER ADDRESS (OFFSET)	BIT #	NAME	VALUES	DESCRIPTION	VER.
30001/40001 (0)		**Run and Valve Status Bits**		See the following Register Addresses:	2.0+
	BIT 0	RUN	0 = Not Running	10001	
	BIT 1	Pilot	0 = Deenergized	10002	
	BIT 2	Low Fire	0 = Deenergized	10003	
	BIT 3	High Fire	0 = Deenergized	10004	
30002/40002 (1)		**Input Status and Flags (Non Latching Shutdowns)**		See the following Register Addresses:	2.0+
	BIT 0	Level Input	0 = Closed	10017	
	BIT 1	Main Solenoid Feedback	0 = Deenergized	10018	
	BIT 2	Pilot Solenoid Feedback	0 = Deenergized	10019	
	BIT 3	High Pressure Input	0 = Closed	10020	
	BIT 4	Proof of Closure	0 = Closed	10021	
	BIT 5	ESD Input	0 = Closed	10022	
	BIT 6	Start Input	0 = Closed	10023	
	BIT 7	Low Pressure	0 = Closed	10024	
	BIT 8	Flame Detected	0 = No Flame	10025	
	BIT 9	Flame Test Fail	0 = Flame Test OK	10026	
	BIT 10	Unit Failure	0 = Unit OK	10027	
	BIT 11	Low or High Voltage	0 = Voltage OK	10028	
	BIT 12	HiTemp Alarm	0 = No Alarm	10029	
	BIT 13	4-20 Card Alarm	0 = No Alarm	10030	
30003/40003 (2)		**High Temp Thermocouple Reading**	-50 to 1350°C *	This is the current reading of the High Temp Thermocouple encoded as a 16-bit signed integer in °C.	2.0+
30004/40004 (3)		**Process Thermocouple Reading**	-50 to 1350°C *	This is the current reading of the Process Thermocouple encoded as a 16-bit signed integer in °C.	2.0+
30005/40005 (4)		**Aux Thermocouple Reading**	-50 to 1350°C *	This is the current reading of the Aux Thermocouple encoded as a 16-bit signed integer in °C.	2.0+
30006/40006 (5)		**Pilot Flame Quality**	0% = No Flame 100% = Good Flame	This number represents the quality of the pilot flame. The higher the number the better the flame.	2.0+

* These thermocouple readings are all encoded using 16-bit signed integers and are always reported in °C even if the PF2100 is set to display temperature in Fahrenheit.

REGISTER ADDRESS (OFFSET)	BIT #	NAME	VALUES	DESCRIPTION	VER.
30007/40007 (6)		**Input Status and Flags (Latching Shutdowns)**		See the following Register Addresses:	4.3+
	BIT 0	Level Input	0 = Closed	10033	
	BIT 1	Main Solenoid Feedback	0 = Deenergized	10034	
	BIT 2	Pilot Solenoid Feedback	0 = Deenergized	10035	
	BIT 3	High Pressure Input	0 = Closed	10036	
	BIT 4	Proof of Closure	0 = Closed	10037	
	BIT 5	ESD Input	0 = Closed	10038	
	BIT 6	Start Input	0 = Closed	10039	
	BIT 7	Low Pressure	0 = Closed	10040	
	BIT 8	Flame Detected	0 = No Flame	10041	
	BIT 9	Flame Test Fail	0 = Flame Test OK	10042	
	BIT 10	Unit Failure	0 = Unit OK	10043	
	BIT 11	Low or High Voltage	0 = Voltage OK	10044	
	BIT 12	HiTemp Alarm	0 = No Alarm	10045	
	BIT 13	4-20 Card	0 = No Alarm	10046	
30008/40008 (7)		**High Fire/Process Setpoint**	0 to 1350°C *	This is the current High Fire Setpoint (sometimes called the Process Setpoint).	2.0+
30009/40009 (8)		**Low Fire Setpoint**	0 to 1350°C *	This is the current Low Fire Setpoint. Valve has no meaning if Low Fire is disabled.	2.0+
30010/40010 (9)		**Pilot Off Setpoint**	0 to 1350°C *	This is the current Pilot Off Setpoint. Valve has no meaning if Pilot Off is disabled.	2.0+
30011/40011 (10)		**4-20mA Level Reading**	"LVL Offset" to "LVL Range"	This is encoded as a 16-bit unsigned integer in the units specified in the PF2100 settings.	2.0+
30012/40012 (11)		**4-20mA Pressure Reading**	0 to "PRS Range"	This is encoded as a 16-bit unsigned integer in units specified in the PF2100 settings, but the value is encoded x10 (ie. 30psi would be encoded as 300).	2.0+
30013/40013 (12)		**Reserved**		Reserved for future use.	2.0+
30014/40014 (13)		**4-20mA Expansion Card Alarm**		This indicates the Alarm Status of the 4-20mA Expansion card. Each bit represents an error as shown on the left. Also: • If bits 0 and 1 are both set, the Level Input is disconnected. • If bits 2 and 3 are both set, the Pressure Input is disconnected.	2.0+
	BIT 0	Level Low Alarm	0 = No Alarm		
	BIT 1	Level High Alarm	0 = No Alarm		
	BIT 2	Pressure Low Alarm	0 = No Alarm		
	BIT 3	Pressure High Alarm	0 = No Alarm		
	BIT 4	4-20 Card Failure	0 = No Alarm		
30015/40015 (14)		**Modbus - Terminal Communication Error** 0 = No Error 1 = Communication Error		If there is a Modbus Card to Terminal Card Communication Error, this register will be set to 1 and all other Modbus registers will clear to zero.	4.1+
30016/40016 (15)		**Modbus - Terminal Comm Error Counter** 0 to 65535		Counts consecutive communications timeouts within the Terminal Card when register 30015/40015 = 1. Will reset to zero when register 30015/40015 = 0.	4.1+

* These thermocouple settings are all encoded using 16-bit signed integers and are always reported in °C even if the PF2100 is set to display temperature in Fahrenheit.

READ/WRITE HOLDING REGISTERS

These are 2-byte read/write values. Setpoints are checked to be within range before being accepted. To verify that a setpoint is accepted, read back the setpoint registers in 30008-30010 or 40008-40010. See the Modbus Manual for recommended procedures.

Use the "Preset Single Register" command (0x06) or the "Preset 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.

Data Byte 0	Data Byte 1
REG OFF 3 MSB	REG OFF 3 LSB

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 and the second byte will be the least significant byte. The next two bytes will contain the value of Register Offset 101.

Data Byte 0	Data Byte 1	Data Byte 2	Data Byte 3
REG OFF 3 MSB	REG OFF 3 LSB	REG OFF 4 MSB	REG OFF 4 LSB

REGISTER ADDRESS/ OFFSET	NAME AND VALUES	VALUES	DESCRIPTION	VER.
40100 (99)	**Write Command Register** Set register to decimal 1234 to start unit Set register to decimal 4321 to stop unit	0, 1234, 4321	This register is used to remotely stop or start the PF2100, and will clear when the command is accepted.	2.0+
40101 (100)	**High Fire/Process Setpoint Change Request**	0 to 1350°C *	This register is used to request the PF2100 to change the HF SP to the specified value, and will clear when the setpoint is accepted. Read register 30008/40008 to verify that the change was accepted.	2.0+
40102 (101)	**Low Fire Setpoint Change Request**	0 to 1350°C *	This register is used to request the PF2100 to change the LF SP, and will clear when the setpoint is accepted. Read register 30009/40009 to verify that the change was accepted.	2.0+
40103 (102)	**Pilot Off Setpoint Change Request**	0 to 1350°C *	This register is used to request the PF2100 to change the PO SP, and will clear when setpoint is accepted. Read register 30010/40010 to verify that the change was accepted.	2.0+

* Note that a setpoint cannot be set above/below the setpoint that bounds it above/below.
These thermocouple settings are all encoded using 16-bit signed integers and are always reported in °C even if the PF2100 is set to display temperature in Fahrenheit.