PF2100 4-20mA Input Card

User Manual

v1.2

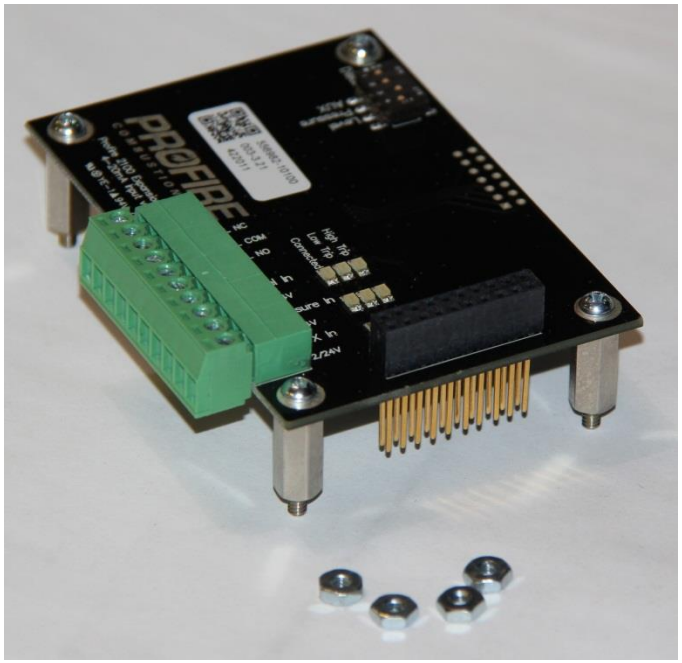

Table of Contents

Specifications and System Requirements

This manual was written for use with 4-20mA Input Cards that have the following model and version:

Model Number	1PS166
Hardware Version	v3.0
Firmware Version	v4.1

PF2100 System Requirements

This input card is designed to be used only with PF2100 systems that meet the following requirements:

Minimum Compatible Hardware Versions

Door Card	v1.6
Terminal Card	v1.61

Minimum Compatible Firmware Versions

PF2100 Model	Door	Terminal	4-20	Note
S “Standard”	v1.6.3CE	v1.6.3B	v2.0/v4.1	v1.6.3D or higher Door and Terminal FW required for pressure input
E “Expansion”	E1.8.000	E1.8.000	v4.0/v4.1	
F “Flare - Enclosed”	N/A	N/A	N/A	Not Supported
F “Flare - Open”	F1.7.041	F1.7.041	v4.1	
I “Incinerator”	I1.9.103	I1.9.103	v4.0/v4.1	Pressure Input Only
C “Combustor”	C1.8.400	C1.8.400	v4.0/v4.1	

To check your firmware version, do the following with the PF2100 powered on. Simultaneously hold both the Up and Down buttons on the keypad. If the firmware version of any card does not meet minimum requirements, contact Profire to arrange for a firmware upgrade.

Description

The 4-20mA Input Card is an Expansion Card designed for use with PF2100 Burner Management Systems. It provides two separate 4-20mA Analog Current Loop Receivers, one for Level and one for Pressure, each of which can be enabled or disabled using a DIP switch on the card. The third loop, the “Auxiliary” Current Loop, is not supported by firmware:

1. “Level” Current Loop
2. “Pressure” Current Loop
3. “Auxiliary” Current Loop (Not Supported)

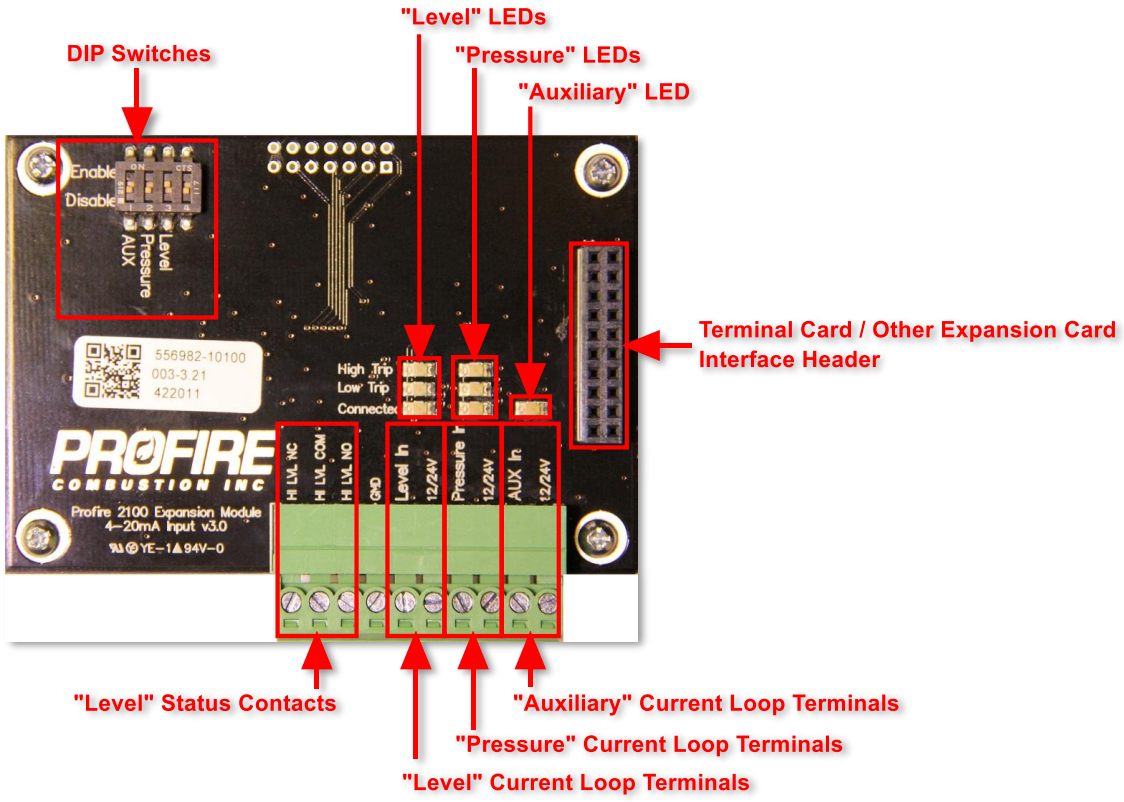

Figure 1

"Level" Current Loop

The "Level" Current Loop is designed to control a pump and heater system that pumps liquid into a heated tank. The 4-20 input card will sense the level of liquid in the tank and shut off the pump when it is full. It will also de-energize all valves if the tank is empty to prevent damage to the tank.

The level can be displayed on the PF2100 control panel and can be read remotely over Modbus using a Modbus Expansion card (sold separately).

A normally open status contact and a normally closed status contact are provided for use as a high level shutoff for the pump and/or to control external alarm circuitry.

A software selectable low and high setpoint can be programmed into the PF2100. The PF2100 will de-energize all valves if the level drops below the low level threshold. Exceeding the high level threshold will toggle the status contacts but will not shutdown or otherwise affect the operation of the burner control system.

Three LEDs are also provided on the card to indicate if the 4-20mA Level loop is connected, if the level is below the low setpoint, and if the level is above the high setpoint.

"Pressure" Current Loop

The "Pressure" Current Loop allows the main valve train pressure to be monitored. If the pressure is lower than the low threshold or higher than the high threshold, the system will de-energize all valves. The PF2100 can also be configured to control the main valves based on the low-pressure input. Three LEDs are also provided on the card to indicate if the 4-20mA pressure loop is connected, if the pressure is below the low setpoint, and if the pressure is above the high setpoint.

"Auxiliary" Current Loop

This input is not currently supported by any firmware revision.

Quick Start Checklist

Follow these steps in order to install and setup the 4-20mA Card properly. Check off each step after it is completed to ensure that you don't miss a step. More detailed information on how to complete each step is located in later sections of this document.

Preparation:

- □ **1. Verify System Requirements**. See instructions on page 1.
- □ **2. Verify Included Hardware**. See instructions on page 6.
- □ **3. Verify DIP Switch Settings**. See instructions on page 13.
- □ **4. Disconnect Power to Your PF2100 System**.

Install and Wiring:

- □ **5. Install the 4-20mA Input Card in Your PF2100 System.** See instructions on page 6.
- □ **6. Check the Required System Voltage for Your Transmitter.** See instructions on page 8.
- □ **7. Wire up the "Level" Current Loop.** See instructions on page 10.
- □ **8. Wire up the "Level" Status Contacts, if Required.** See instructions on page 11.
- □ **9. Wire up the "Pressure" Current Loop.** See instructions on page 12.

Menu Settings: See instructions beginning on page 13.

- □ **10. Enable the 4-20mA Input Card.** Use Menu 6.1.
- □ **11. Select the Tank Volume Units.** Use Menu 6.2.
- □ **12. Set the Tank's Maximum Volume Level.** Use Menu 6.4.
- □ **13. Set the Low and High "Level" Setpoints.** Use Menus 6.5 and 6.6.
- □ **14. Set the Pressure Units.** Use Menu 6.7.
- □ **15. Set the Maximum Pressure of the Fuel Train.** Use Menu 6.8.
- □ **16. Set the Low and High "Pressure" Setpoints.** Use Menus 6.9 and 6.10.

Calibration:

- □ **17. Ensure that the Level Transmitter is Calibrated Correctly.** See instructions beginning on page 15.
- □ **18. Calibrate the "Level" input's zero point.** See instructions beginning on page 15.
- □ **19. Calibrate the "Level" input's span (max point).** See instructions beginning on page 16.
- □ **20. Calibrate the "Pressure" input's zero point.** See instructions beginning on page 16.
- □ **21. Calibrate the "Pressure" input's span (max point).** See instructions beginning on page 16.

4-20mA Input Card Specifications

The 4-20mA Input Card has the following specifications:

Spec	Value
Operating Temperature:	-40 C to +60 C
12/24VDC Output Pin:	
Voltage	PF2100 System Voltage
Max Current	250 mA (thermally fused on the Input Card)
Status Contacts:	
Closed Impedance (NC/NO to Com)	35 Ohms
Maximum Current (NC/NO to Com)	120 mA
Maximum Voltage (NC/NO to Com)	+/-350 VDC (247 VAC)
Bandwidth	>100 Hz
Current Loop Inputs:	
Input Impedance	162 Ohms
Precision	~ +/-1%
Terminal Block:	
Recommended Wire Gauge	16 AWG
Physical Dimensions (including components):	
Width	59.1 mm
Width (including pluggable header)	68.1 mm
Length	85.7 mm
Height	25.5 mm
Height (including standoff threads)	30.0 mm

Installing the Card

Included Components

Your 4-20mA Input Card should have come with the following components. If any components are missing, please contact Profire immediately. A picture of these components is included in Figure 2.

Item	Quantity	Notes
4-20mA Input Card v3.0	1	
Pluggable Header	1	Pre-installed on the card
Aluminum Standoffs	4	Pre-installed on the card
Phillips Machine Screws	4	Pre-installed on the card
Hex Nuts	4	

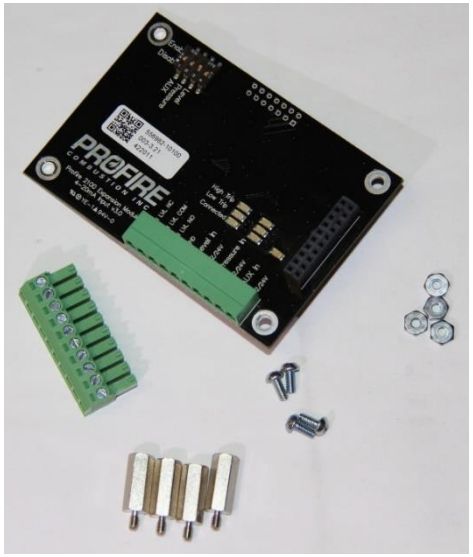

Figure 2

If your system did not have a 4-20mA Input Card pre-installed at the factory, follow these steps to install it. Otherwise, skip to the next section of this document.

Procedure When Another Expansion Card is Preinstalled

1. Shut off the power to the PF2100 system.
2. Remove the 4 machine screws from the expansion card that is already installed in your PF2100 system. See Figure 3.
3. Remove the 4 machine screws and 4 standoffs from the new 4-20mA card that you are about to install. See Figure 4.
4. Attach the 4 standoffs to the expansion card that is already installed in your PF2100 system. Tighten to 4 in*lbs. Do not over tighten or the standoffs may break. See Figure 5.
5. Carefully install the new 4-20mA Input Card on top of the existing expansion card such that the long pinned header on the 4-20mA Input Card mates with the socket on the old expansion card. Be careful not to bend any pins while doing this. Continue to apply pressure to the 4-20mA Input Card until the header is fully inserted. See Figure 6.
6. Finish attaching the new 4-20mA Input Card to the old expansion card using the 4 machine screws that were previously removed. Tighten to 4 in*lbs. See Figure 6.
7. You are done installing the card! You should have the following extra parts left over which you can either discard or keep for future use: 4 machine screws and 4 hex nuts.

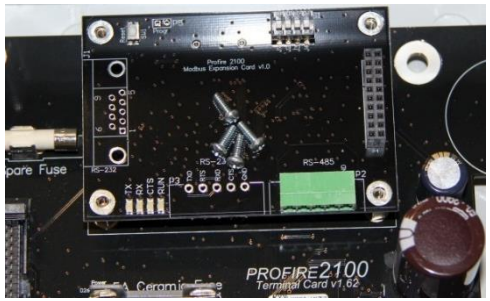

Figure 3

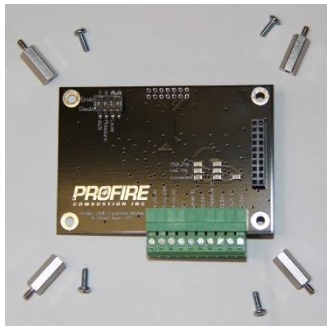

Figure 4

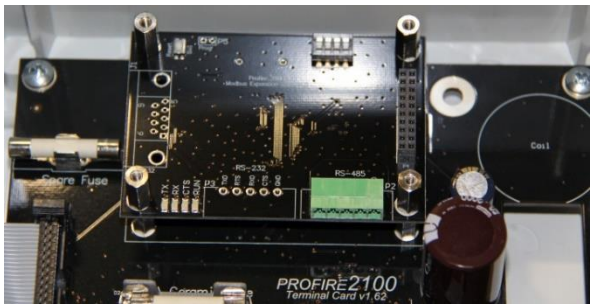

Figure 5

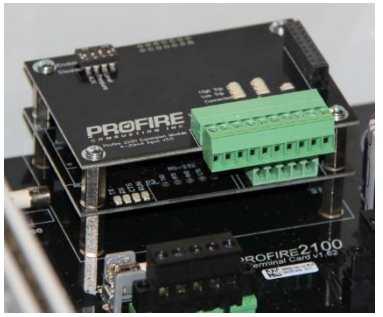

Figure 6

Procedure When No Expansion Card is Preinstalled

1. Shut off the power to the PF2100 system.
2. Remove the 4 screws that hold the terminal card in place in the product enclosure. Do not lose these screws as you will need them later. See Figure 7.
3. Carefully install the 4-20mA Input Card onto the Terminal Card such that the long-pinned header on the 4-20mA Input Card mates with the socket P1 on the Terminal Card. Be careful not to bend any pins while doing this. Continue to apply pressure to the 4-20mA Input Card until the 4 standoffs fit into the holes in the PCBA. See Figure 8.
4. On the back side of the Terminal Card, install 4 hex nuts onto the standoffs to hold the 4-20mA Input Card in place. Tighten to 4 in*lbs. Do not over tighten or the standoffs may break. See Figure 8.
5. Place the terminal card back into the product enclosure and fasten it using the 4 screws removed previously. Tighten to between 12 and 26 in*lbs taking care to not leave screws loose enough that the terminal card rattles around and not too tight that the enclosure holes begin to strip out. See Figure 7.
6. You are done installing the card! There should not be any extra parts left over. If there are, double check if you have missed a step.

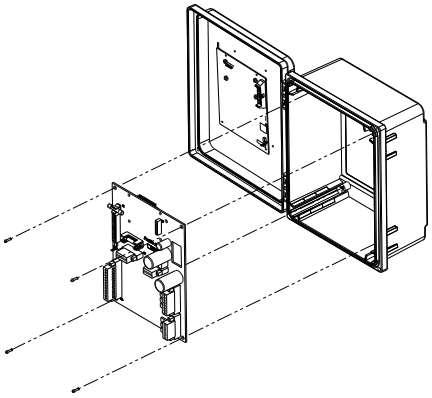

Figure 7

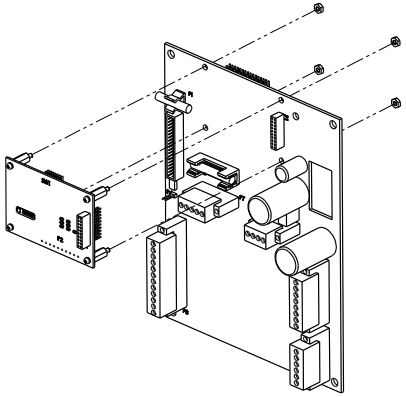

Figure 8

Transmitter Requirements

Level and Pressure Transmitter Requirements

Any 4-20mA level or pressure transmitter will work with the 4-20mA Input Card. It is, however, important to take into consideration the following two items when selecting a transmitter:

1. **Minimum Operating Voltage** – Some transmitters have a relatively high minimum operating voltage. Check that the transmitter will work with your current system voltage to ensure an easier integration. A detailed explanation of how to do this can be found below.
2. **Level Transmitter Mounting Height Compensation** – Some level transmitters are programmable so that the mounting height of the transmitter relative to the tank bottom can be compensated for. Some versions of PF2100 firmware (E1.8.202 and higher) have a feature called "Level Offset" that will allow you to compensate for this in the PF2100 settings.

Transmitter Supply Voltage

Different transmitters will have different power supply requirements. It is important to verify what these requirements are before wiring up the system. If the supply voltage is not high enough, the 4-20mA output of the transmitter may not function properly as it gets closer to 20mA or it may cause the PF2100 system to report a level error.

To determine the minimum supply voltage for the PF2100 (V_{PF2100_MIN} in volts) required to properly operate a given transmitter, first lookup the minimum operating voltage ($V_{TRANSMITTER\_MIN}$ in volts) from the transmitter's datasheet. Then plug that number into the following equation to determine the minimum supply voltage that will guarantee proper operation across the entire 4-20mA output range. V_{PF2100_MIN} is the voltage required at header P7, terminals "12/24VDC" and "Common" on the Terminal Card.

Equation 1: $$V_{PF2100\_MIN} = V_{TRANSDUCER\_MIN} + 4.44V$$

If powering the transmitter from a separate power supply, and not via. the 4-20mA Input Card, use the following equation to determine the minimum supply voltage (V_{SUPPLY_MIN} in volts):

Equation 2: $$V_{SUPPLY\_MIN} = V_{TRANSDUCER\_MIN} + 3.24V$$

Use Equations 1 and 2 when troubleshooting your device to ensure you have enough voltage to properly operate over the entire range of your transmitter.

Example Ignoring Cable Length

As an example, the "Rosemount 2088 Gage and Absolute Pressure Transmitter" has a datasheet minimum operating voltage requirement of 10.5V. Using Equation 1 above, this would require a minimum voltage supply of 14.94V for proper operation. There are three ways to achieve this:

1. **Run the PF2100 on 15V** – When the PF2100 is configured through its menu for 12V operation, it can safely run on anything from 10V-15.5V without causing a low or high voltage alarm. It is therefore safe to set the system to run from 15V and connect the transmitter up to the "12/24V" pin on the 4-20mA Card which will output 15V.
2. **Run the PF2100 on 24V** – Many transmitters can run on a system voltage of 24V or higher. The Rosemount 2088 can run on as much as 36V. If you change the PF2100's menu settings to expect 24V using menu 4.8 and then change its power supply to 24V, the "12/24V" pin on the 4-20mA Card will also output 24V which can be used to power the transmitter.
3. **Use a Separate Power Supply** – The PF2100 and the transmitter can run from separate power supplies if desired. The PF2100 can run from 12V or 24V and the transmitter can run from some other voltage source as required. If you do this, ensure that the external supply has a common ground connection with the PF2100 using a chassis ground or the ground pin provided on the 4-20mA Input Card.

Compensating for Cable Length

If your cable length is very long (>500 feet) and/or your wire gauge is very narrow (>16 AWG), you may also need to account for the DC resistance of the cable (R_{CABLE}). In most cases, the cable resistance is negligible and can be ignored ($R_{CABLE} = 0$).

To account for cable resistance, first add up the total length of cable (L_{CABLE} in feet) that runs from the voltage supply to the transmitter, from the transmitter to the 4-20mA Input Card's "Level" input, and the length of ground wire running from the Input Card back to the voltage supply.

$$\text{Equation 3:} \quad L_{CABLE} = L_{SUPPLY-TO-TRANSDUCER} + L_{TRANSDUCER-TO-CARD} + L_{CARD-TO-SUPPLY}$$

You will then need to look up the DC resistance from the cable's datasheet which is typically specified in Ohms per thousand feet at a given gauge and for a given type (stranded vs non-stranded). Plug this into the following equation to determine the DC resistance of your cable:

$$\text{Equation 4:} \quad R_{CABLE} = \frac{L_{CABLE} * R_{PER\_THOUSAND\_FEET}}{1000}$$

Then use the corresponding equations to determine the minimum supply voltage. If powering the transmitter via. the 4-20mA card use Equation 5, if powering the transmitter from a separate power supply use Equation 6:

$$\text{Equation 5:} \quad V_{PF2100\_MIN} = V_{TRANSDUCER\_MIN} + 4.44V + R_{CABLE} * 0.02$$

$$\text{Equation 6:} \quad V_{SUPPLY\_MIN} = V_{TRANSDUCER\_MIN} + 3.24V + R_{CABLE} * 0.02$$

Example Compensating for Cable Length

As an example, let's again consider the Rosemount 2088 but this time with a non-negligible 1000 feet of 20 gauge stranded wire. If the wire had a datasheet resistance of 11 Ohms per thousand feet, using Equation 5, the new minimum voltage supply would be 15.16V (0.2V higher than before).

Electrical Wiring

The following steps should be followed to wire up the pluggable header on the 4-20mA Input Card. More detailed instructions for each step can be found later in this section of the document.

1. Disconnect power from the PF2100 to prevent accidentally shorting any component of the system.
2. Remove the pluggable header from the 4-20mA Input Card.
3. Wire up the "Level" Current Loop using either the onboard or an external power supply.
4. Wire up the "Level" Status Contacts if required.
5. Wire up the "Pressure" Current Loop using either the onboard or an external power supply.
6. Ensure that nothing is connected to the "Auxiliary" Current Loop input.
7. Replace the pluggable header back onto the 4-20mA Input Card and ensure that it is fully inserted.
8. Reconnect power to the PF2100.

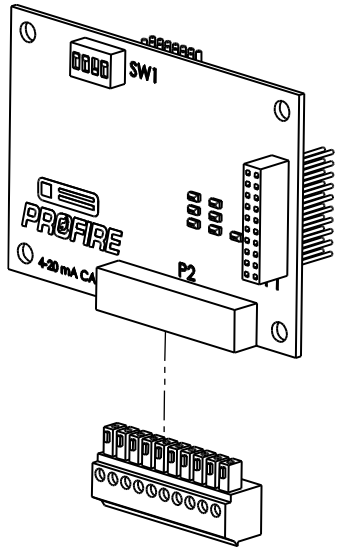

Figure 9

The Pluggable Header

The terminal block on the 4-20mA card includes a pluggable header. You may find it easier to wire up if you first remove the pluggable header from the 4-20mA Input Card by pulling it out as shown in Figure 9.

The pluggable header has set screws to loosen or tighten the wire cages on the front of the connector. Turn the screw clockwise to raise and thus tighten the cage. Turn the screw counter clockwise to lower and thus loosen the cage.

Wires should not be stripped longer than 9mm to prevent bare conductor from being exposed after insertion into the terminal block.

Insert each wire fully into the front of the pluggable header and then ensure that the corresponding set screws are tight enough to securely clamp the wires in place.

Connecting the "Level" Current Loop Using the Onboard Power Source

If after consulting the "Transmitter " section of this document you have determined that it is acceptable to use the 4-20mA Input Card's Onboard Power Source, then wire the pluggable header according to Figure 10.

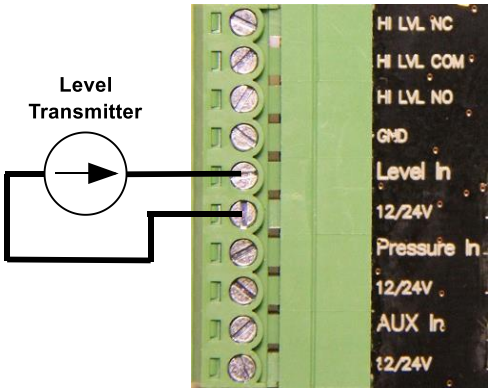

Figure 10

Connecting the "Level" Current Loop Using an External Power Source

If after consulting the "Transmitter " section of this document you have determined that it is necessary to use an External Power Source, then wire the pluggable header according to Figure 11.

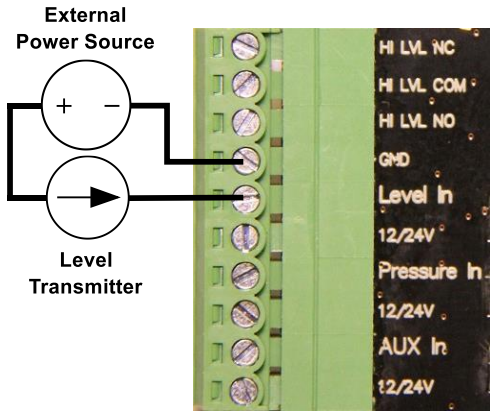

Figure 11

Connecting the "Level" Status Contacts

The "NO" (normally open) contact is closed (connected to the "COM" pin) when the level input is below the high setpoint and is open (not connected to the "COM" pin) when it is equal to or greater than the high setpoint. A common use for this contact is to control a pump that is designed to pump liquid into the tank until it is full.

The "NC" (normally closed) contact always has the opposite status of the "NO" contact. A common use for this contact is to turn on an indicator light or send a signal to a remote location when the tank becomes full.

Contact	PF2100 Powered Off	PF2100 On and Level < High Trip	PF2100 On and Level >= High Trip
NO	Contact Open Pump Off	Contact Closed Pump On*	Contact Open Pump Off
NC	Contact Closed Lamp On*	Contact Open Lamp Off	Contact Closed Lamp On*
*Assumes Power to AC Voltage Source shown in figure 12 is still on.			

Figure 12 shows an example of how to wire the contacts to a pump and indicator lamp as described above.

IMPORTANT: Be sure that you do not exceed the current rating of the contacts with whatever equipment you hook up. Use relays if you need to switch higher power devices.

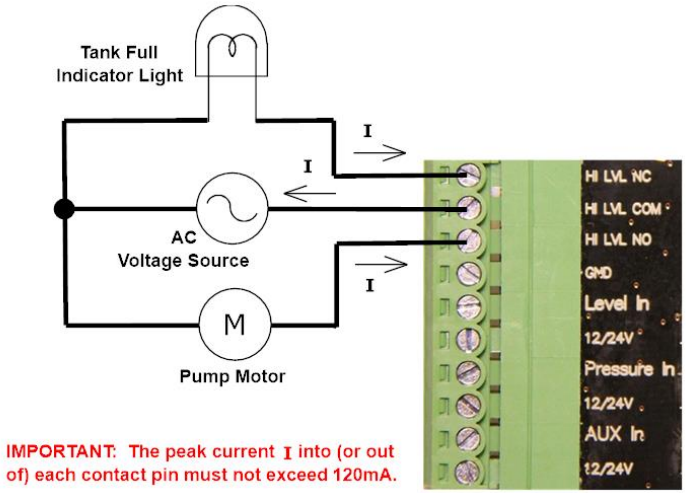

Figure 12

Connecting the "Pressure" Current Loop Using the Onboard Power Source

If after consulting the "Transmitter " section of this document you have determined that it is acceptable to use the 4-20mA Input Card's Onboard Power Source, then wire the pluggable header according to Figure 13.

Connecting the "Pressure" Current Loop Using an External Power Source

If after consulting the "Transmitter " section of this document you have determined that it is necessary to use an External Power Source, then wire the pluggable header according to Figure 14.

Connecting the "Auxiliary" Current Loop

The "Auxiliary" Current Loop is not currently supported by the current firmware version. Do not connect anything to these pins.

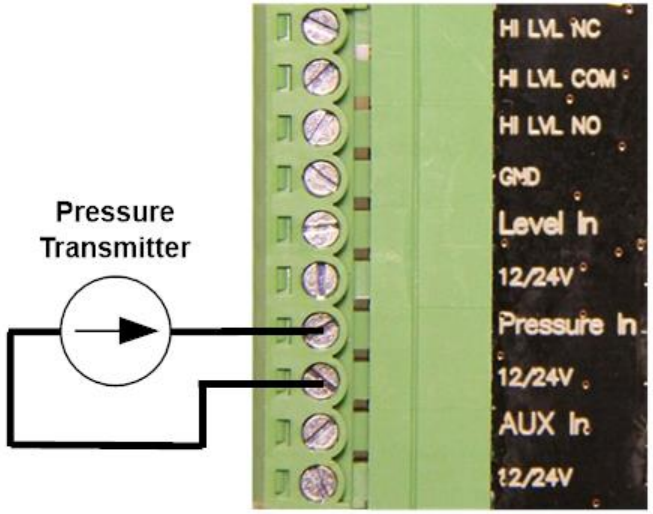

Figure 13

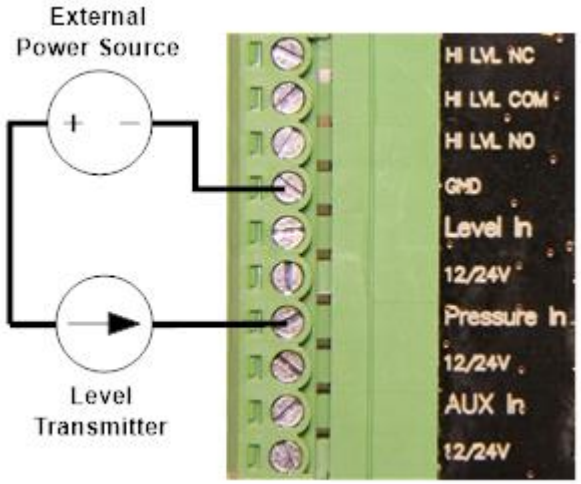

Figure 14

Configuring the 4-20mA Settings

DIP Switch Settings

There are 4 DIP switches included on the 4-20mA Input Card. The card is shipped in the configuration shown in Figure 15 which enables only the Level Input. If it is desired to use the 4-20 Pressure Input, the Pressure DIP switch must also be enabled.

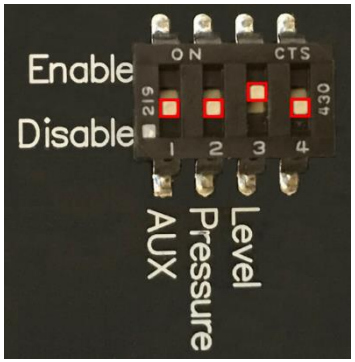

Figure 15

DIP #	Name	Description
1	AUX	Unused by current firmware.
2	Pressure	Used to enable/disable the Pressure Current Loop.
3	Level	Used to enable/disable the Level Current Loop.
4	Unnamed	Unused by current firmware.

Menu 6 – Expansion Modules

Menu 6 is the expansion card menu where most settings for the 4-20mA Input Card can be found. This menu is not present in all versions of firmware so it is important to verify that your firmware is compatible with expansion cards. From the status menu, press the "menu" button 6 times to get to Menu 6. The text "6 – Expansion Modules" will display on the screen. Press the "OK" button to view the first menu item, 6.1. The following table shows the organization of the expansion card menu as implemented in Door Card FW E1.8.217. Refer to the PF2100 User Manual for further details.

Menu #	Prompt	Description
6.1	4-20 Input Card Enabled	Used to enable/disable the 4-20mA Input Card
6.2	4-20 LVL Units	Adjusts the display units for the 4-20mA Input Card
6.3	4-20 LVL Range	Adjusts the maximum level of the tank
6.4	4-20 LVL Zero Offset	Adjusts the level reading corresponding to a 4mA input.
6.5	4-20 LVL Low Setpnt	Used to set the Level input's low set point
6.6	4-20 LVL High Setpnt	Used to set the Level input's high set point
6.7	4-20 PRS Units	Adjusts the display units for the 4-20mA Input Card
6.8	4-20 PRS Range	Adjusts the maximum pressure of the fuel train
6.9	4-20 PRS Low Setpnt	Used to set the Pressure input's low set point
6.10	4-20 PRS High Setpnt	Used to set the Pressure input's high set point
6.11	Modbus Card	N/A
6.12	4-20 FW	Displays the firmware version of the 4-20mA Input Card
6.13	MBUS FW	N/A

Follow these steps to configure the menu settings for the 4-20mA Card:

1. If you are unfamiliar with the operation of the PF2100 menu system, review the "Appendix B – Using the PF2100 Menu System" section of this document before proceeding further.
2. Ensure that the 4-20mA card is enabled using menu 6.1. Menu 6.1 should end with the word "Yes" if configured correctly.
3. Perform the following steps if you intend to use the 4-20 level input:
    a. Ensure that the Level DIP Switch is enabled on the 4-20 Input Card.
    b. Set the level units that are applicable to your installation using menu 6.2. These are the units that you want the PF2100 to use when displaying readings from the 4-20mA "Level" input.
    c. Set the tank's maximum volume level using menu 6.3. This is the level at which the tank is full and results in 20mA on the "Level" input.
    d. If the level transmitter is not mounted at the very bottom of the tank, use menu 6.4 to specify the offset.
    e. Set the Low Level setpoint using menu 6.5. This is the level below which the system will alarm.
    f. Set the High Level setpoint using menu 6.6. This is the level above which the system will toggle the High Level status contacts.
4. Perform the following steps if you intend to use the 4-20 pressure input:
    a. Ensure that the Pressure DIP Switch is enabled on the 4-20 Input Card.
    b. Set the pressure units that are applicable to your installation using menu 6.7. These are the units that you want the PF2100 to use when displaying readings from the 4-20mA "Pressure" input.
    c. Set the maximum pressure of the fuel train using menu 6.8. This is the pressure at which the transmitter will output 20mA.
    d. Set the Low Pressure setpoint using menu 6.9. This is the pressure below which the system alarms.
    e. Set the High Pressure setpoint using menu 6.10. This is the pressure above which the system alarms and shutdown.

Menu 4 – System Setup

Menu 4 is the System Setup menu and contains several settings that can be used to adjust the functionality of the pressure and level inputs. From the status menu, press the "menu" button 4 times to get to Menu 4. The text "4 – System Setup" will display on the screen. Press the "OK" button to view the first menu item, 4.1. The following table shows the relevant menu items as implemented in Door Card FW E1.8.217. Refer to the PF2100 User Manual for further details.

Menu #	Prompt	Description
4.5	Level Event Restart	Enables recovery from a Low Level event
4.6	PRS/LVL Delay	Pressure and Level shutdown delay
4.7	PRS Restart	Allows the system to automatically restart when a low pressure event clears. Can also enable control of the main valve based on the Low Pressure Contact or Low Pressure Setpoint.

Calibrating the "Level" Current Loop

If your Level Transmitter is programmable, you should first verify that it is calibrated correctly. You should ensure that the transmitter outputs 20mA when the tank is full and 4mA when it is empty. Alternatively, if your transmitter is not mounted at the bottom of the tank, you may want to program it to output more than 4mA to indicate the volume of liquid that may be present in the portion of the tank below the transmitter. For some firmware versions, a Level Offset feature is available which may be used to accomplish this.

After initial installation, the "Level" input on the 4-20mA Input Card needs to be calibrated. The calibration data is stored in non-volatile memory on the Door Card, not on the 4-20mA Input Card itself. For this reason, Input Cards cannot ship from the factory pre-calibrated. This calibration procedure should be repeated whenever the Door Card or 4-20mA Input Card are replaced.

There are three steps to calibrating the "Level" Current Loop:

1. Calibrate the Level Transmitter.
2. Calibrate the Zero Point for the "Level" Input on the 4-20 Input Card.
3. Calibrate the Span (Max Point) for the "Level" Input on the 4-20 Input Card.

The calibration of the 4-20mA input card is done in Menu 7. To unlock the calibration menu hit the up and down arrow keys simultaneously.

Calibrating the Level Transmitter

This procedure will differ from device-to-device. In general, you may require a handheld process calibrator such as the Fluke 725 and a HART protocol programmer. Consult the documentation for your Level Transmitter to determine the proper procedure for calibrating your device.

Calibrating the Level Input's Zero Point

To calibrate the Level Input's Zero Point, you will need a handheld process calibrator such as the Fluke 725. Follow this procedure to calibrate the zero point:

1. Navigate to Menu 7 and press OK. Cycle through the submenu items until "4-20 Level Zero Calibration = No" is displayed on the PF2100.
2. Press the Up or Down key to begin the calibration process. The display will now read "Apply 4mA then press OK".
3. Turn on the process calibrator and set it to source a current of 4mA (0%).
4. Disconnect the wire from the "Level" input and instead attach the process calibrator's positive lead in its place.
5. Connect the process calibrator's negative lead to the ground pin on the 4-20mA Input Card.
6. Press the "OK" key on the PF2100. The message "Calibrating Wait…" will appear for several seconds followed by the message "Parameter Set" after the calibration has successfully completed.
7. Disconnect the process calibrator and reconnect the wire that was removed in step 4 to the "Level" input.

Calibrating the Level Input's Span (Max Point)

To calibrate the Level Input's Span (Max Point), you will need a handheld process calibrator such as the Fluke 725. Follow this procedure to calibrate the zero point:

1. Navigate to Menu 7 and press OK. Cycle through the submenu items until "4-20 Level Span Calibration = No" is displayed on the PF2100.
2. Press the Up or Down key to begin the calibration process. The display will now read "Apply 20mA then press OK".
3. Turn on the process calibrator and set it to source a current of 20mA (100%).
4. Disconnect the wire from the "Level" input and instead attach the process calibrator's positive lead in its place.
5. Connect the process calibrator's negative lead to the ground pin on the 4-20mA Input Card.
6. Press the "OK" key on the PF2100. The message "Calibrating Wait…" will appear for several seconds followed by the message "Parameter Set" after the calibration has successfully completed.
7. Disconnect the process calibrator and reconnect the wire that was removed in step 4 to the "Level" input.

Calibrating the "Pressure" Current Loop

To calibrate the Pressure Current Loop, follow the same procedure as described for calibrating the Level Current Loop but use the corresponding Pressure inputs and menu items.

Appendix A – Analog 4-20mA Current Loop Background Info

An Analog 4-20mA Current Loop is a signalling scheme commonly used in industrial control and monitoring. It is a fairly old standard circa the 1950s (older than RS-232). It works by encoding some physical property such as temperature, pressure, pH, or flow rate into a current on a wire in the range of 4 to 20mA.

There are four required components in a typical current loop:

1. **Power Supply** – Provides the power for the transmitter, typically in the range of 12V to 36V. Must be able to source at least 20mA.
2. **Transmitter** – Is a type of transducer that converts some physical property (temperature, pressure, pH, flow rate, etc.) to a current in the range of 4mA to 20mA. It is a current source so it has a high output impedance. May be designed to be either self-powered or to draw its power from the loop.
3. **Receiver** – A device that receives the current from the transmitter. It has a low input impedance. It may be designed to be either self-powered or to draw its power from the loop.
4. **Wire** – Connects the other components together. Only a single wire is required between each of the three components listed above which are arranged in a loop.

The encoding scale between 4 and 20mA is typically linear (although for rate of flow, it is often the square root of the flow that is encoded). The minimum current output of 4mA represents 0% and the maximum output of 20mA represents 100%. By encoding the minimum value as 4mA, the following benefits are realized:

1. The receiver can detect when there is a wiring fault (the loop is open) since it can differentiate between no current being present (0mA) and an encoded value of 0% (4mA).
2. The transmitter can be powered from the loop.
3. The system has a high degree of immunity to industrial noise which might superimpose voltage offsets onto the loop.

Appendix B – Using the PF2100 Menu System

Menu Structure

The menu system (for door card firmware E1.8.217) is comprised of a status menu followed by six numbered menus containing the system settings and other information. When the system is powered on, it will default to displaying the status menu. Each menu has a number of menu items. The menus are:

-	Status Menu
1	Setpoints
2	History
3	System Info
4	System Setup
5	Control Setup
6	Expansion Modules
7	Calibration

Navigating Menus

Press the "menu" button to cycle through the menus in sequence.

Viewing Menu Items

While viewing any numbered menu, press the "OK" button to view the first menu item in that menu. Then press the "menu" button to cycle through the menu items in sequence. Press the "OK" button to return to the parent menu.

System Password

When you attempt to view a menu's menu items, you may be prompted to enter the system password if it has not already been entered. The password is Up-Down-Up-Up-Down-Up-OK.

Editing a Menu Item Setting

Some menu items have user editable settings. To edit the currently displayed menu item's setting, press the up or down button. Hold the up/down button continuously to automatically increment/decrement the value. The longer you hold the button, the faster the system will count. At first the system will count by 1's, later by 10's, and finally by 50's.

Saving an Edited Menu Item Setting

To accept the currently displayed value, press the "OK" button. The message "Parameter Saved" will display briefly on the screen and then the system will return to the status menu.

Reverting an Edited Menu Item Setting

To cancel editing and revert to the previous value, press the “menu” button. The message “Parameter NOT Saved” will display briefly on the screen and the system will advance to the next menu item.

Menu Item Setting Storage

The settings for the PF2100 System (including those for the 4-20mA Input Card) are physically stored on the door card in non-volatile memory. This means that the settings will be retained even if power is lost. No battery is required to maintain these settings. Since the 4-20mA calibration settings are not stored on the 4-20mA card itself, a 4-20mA card must be calibrated in the system that it is intended to be used in.

Setting the System Voltage

The PF2100 can be programmed to expect either 12V nominal or 24V nominal for its power source using menu 4.8. This setting only affects the under voltage and over voltage alarm points that the system uses. It does not in any other way affect the system. The PF2100 electronics are designed to operate correctly from about 8.5V to 32V regardless of this menu setting.

Resetting the System to Factory Defaults

To reset the PF2100 system to factory default settings (including the 4-20mA card settings), use menu 4.14. From the status menu, press the “menu” button 4 times and then press “OK”. Enter the system password if prompted. Then press the “menu” button 13 times. The screen should display the message “Reset to Factory Defaults = No”. Press the up or down key to change the display to “Reset to Factory Defaults = Yes” and then press the “OK” button. The screen will briefly display “Parameter Set” and then the system will reboot using the factory default settings. The system will now alternately flash the messages “Configuration Reset to Default” and “Check Settings and Setpoints” on the screen to remind you to check all system settings. Press “OK” to dismiss this message and return to the status menu.

Appendix C – Troubleshooting

If you are having trouble with your 4-20mA card, please consult the following resources in this order:

1. Consult the following list of common problems to see if one matches yours.
2. Consult the support section of our website at http://www.profireenergy.com.
3. Contact us on our support line at 1-855-PRO-FIRE (776-3473).

Display Showing "4-20 Level Open"

The wiring on the 4-20mA Level current loop is not properly closed or the system voltage is not high enough for the Level Transmitter to source 20mA.

- Ensure that the 12/24V power is connected to the positive input of the level transmitter and the negative output of the transmitter is connected to the "Level" input on the 4-20mA Input Card. See wiring instructions on page 10.
- Ensure that the voltage supplied to the transmitter is high enough. See instructions to verify the system voltage on page 8.

Display Showing "4-20 Pressure Open"

The wiring on the 4-20mA Pressure current loop is not properly closed or the system voltage is not high enough for the Pressure Transmitter to source 20mA.

- Ensure that the 12/24V power is connected to the positive input of the pressure transmitter and the negative output of the transmitter is connected to the "Pressure" input on the 4-20mA Input Card. See wiring instructions on page 12.
- Ensure that the voltage supplied to the transmitter is high enough. See instructions to verify the system voltage on page 8.

"Level" and/or "Pressure" Connected LED Flashing

The "Level" and/or "Pressure" 4-20mA current loop has not been wired correctly.

- Verify that the wiring is correct using the procedure on pages 10 to 12.
- If the Level and/or Pressure inputs are not being used, disable them using the DIP switch on the 4-20 card. See procedure on page 13.

"Auxiliary" Connected LED Flashing

The "Auxiliary" DIP Switch is set to "Enable" but should be set to "Disable".

- Verify the DIP switch settings using the procedure on page 13.

"Level" and/or "Pressure" LEDs are All Off and the Card Seems Non-functional

The "Level" and/or "Pressure" DIP Switches are set to "Disable" or the Input Card is not getting power.

- Verify the DIP switch settings using the procedure on page 13.
- Verify that the Input Card is seated properly on the terminal card header and that no pins are bent or missing.

"Level" LEDs are Functioning but the Contacts Won't Toggle at the High Setpoint

The menu settings or calibration are incorrect.

- Ensure that the 4-20mA Input Card is enabled in the menu system using the procedure on page 12.
- Ensure that the high setpoint is correct using the procedure on page 12.
- Ensure that the Level Transmitter is calibrated correctly using the procedure on page 15.
- Ensure that the "Level" input of the 4-20mA Input Card has the span calibrated correctly using the procedure on page 16.

"Level" LEDs are Functioning but the PF2100 Won't Shutdown at the Low Setpoint

The menu settings or calibration are incorrect.

- Ensure that the 4-20mA Input Card is enabled in the menu system using the procedure on page 12.
- Ensure that the low setpoint is correct using the procedure on page 12.
- Ensure that the Level Transmitter is calibrated correctly using the procedure on page 15.
- Ensure that the "Level" input of the 4-20mA Input Card has the zero calibrated correctly using the procedure on page 15.

Menu 6 Does Not Exist on my PF2100

The firmware version is too old and does not support expansion cards.

- Verify that the firmware version in your PF2100 is old using the procedure on page 1.
- Install the card in a different system with the correct firmware version.
- Contact Profire to arrange for a firmware update.

The PF2100 is Reporting an Impossible Level (Higher than the Tank Maximum) or Pressure (Higher than Max Pressure)

The menu settings are corrupted, the calibration is incorrect, or the card may be physically damaged.

- Write down all of your system settings, reset the PF2100 to factory default settings using the procedure on page 19, and then re-enter all of your settings.
- Recalibrate the zero and span using the procedure on page 15.
- Your 4-20mA Input Card may be physically damaged. Contact Profire to arrange for a replacement.

Version History

Version	Date	Description of Changes
v1.0	2011-11-02	• Initial Release
v1.1	2018-11-02	• Fixed Level Status Contact Behaviour
v1.2	2021-06-02	• Added Pressure Input Functionality • Updated Minimum Voltage Requirements