



DATA LOGGING CARD USER MANUAL
EXPANSION CARD

1.4

Table of Contents

| | | |
|-----|-------------------------------------|----|
| 1 | Overview | 2 |
| 1.1 | System Requirements | 2 |
| 1.2 | Modbus Features | 2 |
| 1.3 | Data Logging Card Image | 3 |
| 1.4 | Terminal Descriptions | 4 |
| 2 | Installation and Setup | 5 |
| 2.1 | Included Components | 5 |
| 2.2 | Physical Installation..... | 5 |
| 2.3 | Software Enable | 6 |
| 2.4 | Configuring the Date and Time | 7 |
| 2.5 | 4-20mA Input Configuration | 8 |
| 2.6 | DIP Switches | 9 |
| 2.7 | USB Key | 10 |
| 2.8 | 4-20mA Input Wiring..... | 11 |
| 3 | Accessing Logged Data | 12 |
| 3.1 | USB Key Contents..... | 12 |
| 3.2 | Accessing the Log File | 12 |
| 3.3 | Log File Structure | 12 |
| 3.4 | Log File Contents..... | 13 |

1 Overview

The Profire Data Logging Card allows a Profire system to log process data to a standard USB key as well as communicate with other devices using Modbus. The expansion card periodically logs the state of the BMS to the USB key in a spreadsheet, recording information such as temperature readings, solenoid valve status and temperature setpoints along with corresponding timestamp information. The Data Logging Card also has two additional inputs for a 0-20mA and 0-30V signal which are logged along with the system data. The Data Logging Card also supports communication with Modbus over an RS-485 link, allowing it to log status data to a USB key and a remote device such as a PLC simultaneously.

This document has been revised to reflect the latest hardware and firmware version of the PF2100 (HW v2.4 FW E1.8.217) and Data Logging Card (HW v2.4 FW v5.1). Note that if your system does not match this configuration, some of the information presented in this document may not be applicable.

1.1 System Requirements

The Data Logging Card is designed to work with Profire systems that meet the following requirements:

Hardware

| Hardware Version | |
|------------------|-----------------|
| Door Card | v1.6 or higher |
| Terminal Card | v1.61 or higher |

Firmware

The Data Logging Card is supported by PF2100, PF2100F, and PF2100i systems. The firmware requirements for each are given below:

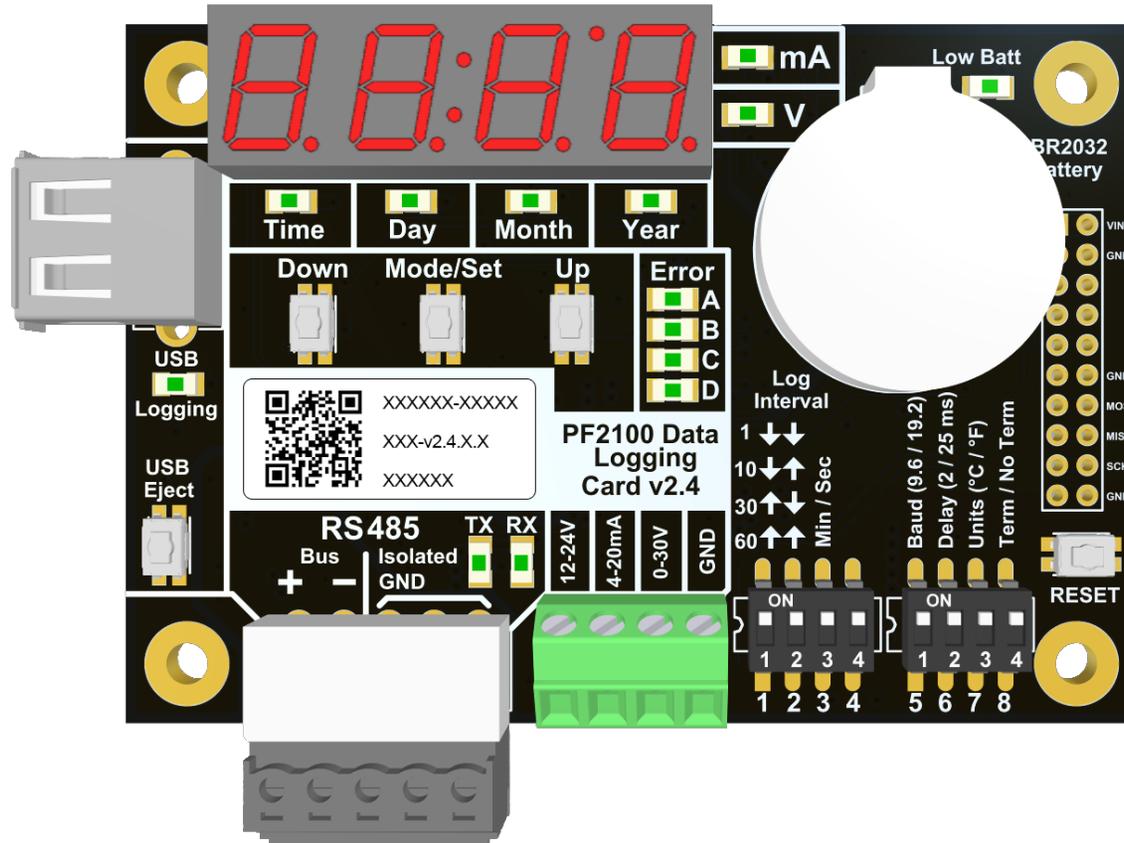
| Minimum Recommended Firmware Version | | | |
|--------------------------------------|----------|----------|----------|
| | PF2100 | PF2100F | PF2100i |
| Door Card | v1.6.3CE | F1.7.039 | v1.6.3BI |
| Terminal Card | v1.6.3B | F1.7.039 | V1.6.3BI |

1.2 Modbus Features

The Data Logging Card supports Modbus communication over an RS-485 link with the Profire system acting as a Modbus slave. This functionality is identical to that of the Profire Modbus Expansion Card, and this document does not cover these features. Once the Data Logging Card is mounted in a Profire system, the system will treat it like a Modbus Expansion Card. For detailed information about setting up and configuring the Data Logging Card for Modbus communications, refer to the *Modbus Expansion Card User Manual*, available at www.profireenergy.com.

1.3 Data Logging Card Image

The Data Logging Card is pictured below. A description of the various components on the card and their usage are given in the following sections.



1.4 Terminal Descriptions

The Data Logging Card has nine terminal block connections. A description of each is provided below:

| Label | Description |
|--------------------|---|
| RS485 Bus + | Non-inverting RS-485 input. This pin should have a positive voltage relative to “RS485 Bus -“when idle. |
| RS485 Bus - | Inverting RS-485 input. This pin should have a negative voltage relative to “RS485 Bus +” when idle. |
| RS485 Isolated GND | Common ground for RS-485. Although RS-485 is differential and uses two wires for its signal, it is critical that a common ground exists between all devices on the bus. This ground is not connected to the Profire system’s ground. |
| 12/24V Output | 12V or 24V output, depending on the Profire system’s voltage. This can be used to power an external transmitter. See Section 2.8 for details on this application. |
| 4-20mA Input | Current input which is measured and logged to the USB key. See Section 2.8 for instructions on using this input. This can also be configured to measure a voltage and log a digital value according to Section 2.5. |
| 0-30V Input | Voltage input which is measured relative to GND and logged to the USB key. |
| GND | Ground for 4-20mA and 0-30V inputs. |

2 Installation and Setup

2.1 Included Components

The Profire Data Logging Card should include the following components:

| Item | Quantity | Notes |
|-------------------------|----------|----------------------------|
| Data Logging Card | 1 | |
| Lithium Coin Battery | 1 | Pre-installed on the card. |
| Pluggable Header | 1 | Pre-installed on the card. |
| Aluminum Standoffs | 4 | |
| Phillips Machine Screws | 4 | |
| Hex Nuts | 4 | |

2.2 Physical Installation

The Data Logging Card is physically installed in the same manner as the 4-20mA Expansion Card and Modbus Expansion Card, with the pins on the Data Logging Card sliding into the header on the Profire system's Terminal Card or into the header on another installed expansion card. Refer to the *4-20mA Expansion Card User Manual* or *Modbus Expansion Card User Manual*, both available at www.profireenergy.com, to see detailed instructions and pictures to assist with mounting the Data Logging Card in a Profire system.

2.3 Software Enable

For the Data Logging Card to operate correctly, it must be enabled within the Profire system's firmware. For backwards-compatibility purposes, Profire systems treat the Data Logging Card the same as a Modbus Expansion Card, so the process to enable the Data Logging Card in firmware is the same as the process to enable a Modbus Expansion Card.

This procedure may differ slightly across systems based on the model and firmware version. The following procedure is an example of how to enable the Data Logging Card on a Profire PF2100 system running v1.8.200 terminal card and door card firmware versions; if the following procedure does not match your system, consult the Product Manual for the system to see how a Modbus Expansion Card is enabled.

1. Press the "menu" key repeatedly until the screen displays "6 – Expansion Cards".
2. Press the "OK" key to enter the menu and enter the L2 Password if prompted.
3. Press the "menu" key repeatedly until the screen displays "Modbus Card".
4. Use the up and down arrows to enable the Data Logging Card and set the Modbus address.

If you are using the Data Logging Card to communicate over Modbus, the selected address should be chosen to match the address expected by the Modbus master device (e.g. PLC). If the Data Logging Card is only being used for logging purposes and is not connected to a Modbus network, any address can be used.

2.4 Configuring the Date and Time

When the Data Logging Card writes status information from the Profire system to the inserted USB key, it attaches a timestamp to each log entry. When the Data Logging Card is initially powered up, it displays the current Time, Day, Month and Year on its LED display. To view these values again, press and release the Mode button repeatedly to cycle through the currently set time and date.

If the displayed date and time is not correct, it can be modified using the buttons on the Data Logging Card. The procedure to set the date and time is given below:

1. Press and hold the Mode/Set button for three seconds.
2. Press the Up and Down buttons to modify the value flashing on the display.
3. Press the Mode/Set button to confirm the change and switch to the next value.
4. Repeat the previous steps until all the values have been confirmed.

After the year has been set by pressing the Mode/Set button, the display will show “4 – 20”. This setting is not related to the time or date used by the Data Logging Card. Refer to Section 2.5 for information on this setting.

2.5 4-20mA Input Configuration

The Data Logging Card has its own 4-20mA input, which is logged along with the status of the Profire system. This 4-20mA input can be used to log two different types of data:

- **Current Input (Analog)**

In this mode, the Data Logging Card measures the input current, and logs a corresponding percentage (0 – 100% mapping to 0 – 20mA) to the USB key.

- **Voltage Input (Digital)**

In this mode, the Data Logging Card measures an input voltage, and logs a digital value indicating if a voltage is applied. The Data Logging Card **does not** log the voltage reading from the input in this mode; it only logs whether the input is grounded or has an applied voltage.

The following procedure can be used to switch between the two modes of the 4-20mA input:

1. Follow the time and date configuration procedure from Section 2.4 until the display shows “4 – 20”.
2. Press the Up and Down buttons to switch between the two modes. The two LEDs to the right of the display are used to determine the selected mode, according to the table below:

| LED | Mode | Logging Type |
|-----------|---------------|--------------|
| mA | Current Input | Analog |
| V | Voltage Input | Digital |

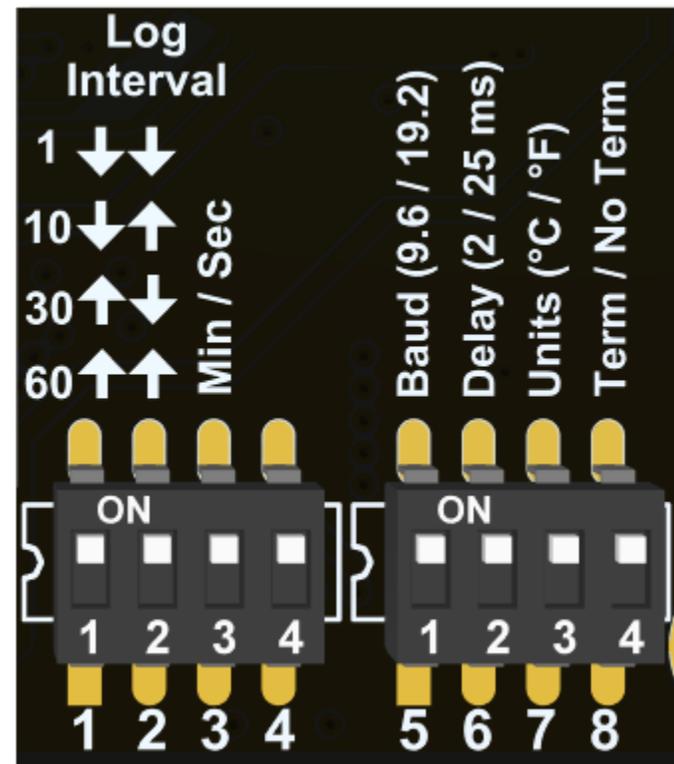
3. Press the Mode/Set button to confirm the selected mode.

The Data Logging Card will immediately begin logging data in the configured mode.

2.6 DIP Switches

The Data Logging Card uses eight DIP switches to change the behaviour of data logging and Modbus communications. A picture of the DIP switches is shown below, along with a description of the purpose of each DIP switch.

| # | Setting | Description |
|---|-------------------------|---|
| 1 | Logging Interval | These switches determine how often the Data Logging Card writes data to the USB key. The value configured by these switches can represent either seconds or minutes, depending on the position of the Min/Sec switch. The encoding is as follows: OFF OFF = 1 (Minutes) OR 5 (Seconds) OFF ON = 10 ON OFF = 30 ON ON = 60 |
| 2 | | |
| 3 | Minute/Second Time Base | This determines the units for the Logging Interval set using the previous two switches. OFF = Minutes ON = Seconds |
| 4 | Unused | Unused. |
| 5 | RS-485 Baud Rate | Baud rate used for Modbus communications. OFF = 9600 bps ON = 19200 bps |
| 6 | Rx-to-Tx Delay | Delay between receiving and transmitting Modbus messages. OFF = 2ms ON = 25ms |
| 7 | Temperature Units | Temperature units for USB key logging and Modbus communication. OFF = Celsius ON = Fahrenheit |
| 8 | RS-485 Termination | Internal termination for RS-485. OFF = 120Ω Termination ON = No Termination |



2.7 USB Key

USB Key Requirements

The Data Logging Card works with any USB key that meets the following requirements:

- Capacity of 4GB or less. While a USB with over 4GB of storage can be used, the size of stored data can not exceed 4GB.
- Formatted using FAT16 or FAT32.
- Empty except for files written by the Data Logging Card.

If a USB key meeting these requirements is inserted, the Data Logging Card will immediately begin to log data onto it. The “USB Logging” LED will momentarily blink every time that the Data Logging Card writes data to the USB key.

Removing the USB Key

Before removing the USB key, press the “USB Eject” button until the display flashes “EJ”. While this message is flashing on the display, it is safe to remove the USB key without any risk of corrupting its data.

Error LEDs

The Data Logging Card has four error LEDs labeled A, B, C, and D. A description of these LEDs is given below:

| Error LEDs | Description |
|------------|--|
| All ON | USB error detected. This could mean the following: <ul style="list-style-type: none">• Inserted USB is corrupted.• Inserted USB is full.• Inserted USB is incorrectly formatted.• Error in writing to and reading from the USB. |
| All OFF | No error detected. |

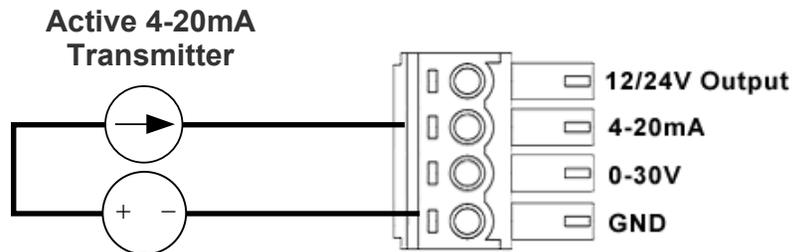
2.8 4-20mA Input Wiring

The 4-20mA input on the Data Logging Card can be used with nearly any 4-20mA transmitter, but the type of transmitter being used must be considered when wiring the Data Logging Card. There are two basic kinds of 4-20mA transmitters:

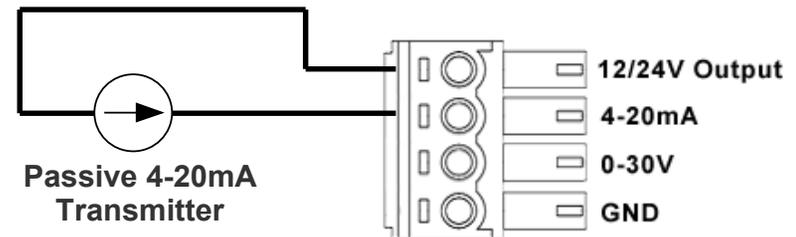
- **Passive (Loop-powered)** – The 4-20mA transmitter does not have its own power supply, and it requires external power transferred across the 4-20mA current loop to operate. The 4-20mA input is responsible for providing this power to the transmitter.
- **Active (Self-powered)** – The 4-20mA transmitter has its own power supply, and it does not require external power from the 4-20mA current loop to operate.

The wiring of the Data Logging Card's 4-20mA input changes based on the type of 4-20mA transmitter used. The diagram below illustrates the difference between the two wiring configurations:

Active 4-20mA Transmitter



Passive 4-20mA Transmitter



3 Accessing Logged Data

3.1 USB Key Contents

When a USB key is removed from the Data Logging Card and connected to a computer, two files should be present on the USB key:

- **PF2100.CSV** – This comma-separated value file contains the logged data.
- **VERSION.TXT** – This text file contains the firmware version of the Data Logging Card.

3.2 Accessing the Log File

The log file is saved in the CSV file format, which stands for Comma-Separated Value. This is a simple file format which can be read with a variety of software tools, although spreadsheet software such as Microsoft Excel is recommended.

3.3 Log File Structure

The table below shows an example of the structure of the CSV log file, as it would be displayed in spreadsheet software such as Microsoft Excel:

| Log Date | Log Time | Restart Flag | Run | |
|-----------|----------|--------------|-----|-------|
| 24-Jun-14 | 11:16:20 | 1 | 0 | |
| 24-Jun-14 | 11:17:20 | 0 | 0 | |
| | | ⋮ | | |

The first row of the CSV file contains headers describing the meaning of each column’s data. Every subsequent row corresponds to a single sample of data from the Data Logging Card.

3.4 Log File Contents

The CSV log file system status information as well as specific information related to the Data Logging Card itself. The data available in the CSV log file is described below:

System Status

The Data Logging Card stores system status information that is accessible externally using the Modbus Expansion Card. The *Modbus Expansion Card Register Map*, available at www.profireenergy.com, provides descriptions of the logged data. Specifically, the contents of the following registers are logged:

- **40001 – 40006**
- **40008 – 40012**
- **40014**

The order of the data in the CSV file follows the order of these registers, but the header from each column can be used to confirm which columns correspond to each register. In addition, the encoding of the values stored in each column of the CSV file match the descriptions in the *Modbus Expansion Card Register Map* (e.g. ON = 1, OFF = 0).

It should be noted that **the headers used to describe each column in the CSV file assume that the Data Logging Card is connected to a PF2100**. If the Data Logging Card is connected to a PF2100F, the logged data is still valid, but certain columns may have meaningless data or misleading descriptions (e.g. Low Fire status/setpoint). The manual for PF2100F systems supporting the Data Logging Card cover

the differences in Modbus registers between the PF2100 and PF2100F, so that document should be consulted if assistance is required in understanding the CSV file's format. In addition to the standard status information available via Modbus, the Data Logging Card also stores the following:

Restart Flag

This field will equal '1' on the first log entry after a restart. Either of the following events are considered a restart:

- Power is removed and reapplied to the Profire system.
- The USB key is removed and reinserted into the Data Logging Card.

This field will not equal '1' if the system shuts down and enters a waiting state, such as waiting for a low voltage event to clear.

Log Board Temp

This field represents the temperature of the Profire system itself. This is measured using an internal temperature sensor. This is logged as an integer value with no decimal precision.

Log Volt Input

This field equals the voltage measured on the 0 – 30V input on the Data Logging Card itself. This value is logged with one decimal point of precision.

Log 4-20 Input

This field equals the measurement of the 4 – 20 input on the Data Logging Card itself. The meaning of this data depends on the configuration of the 4-20mA input, as described in Section 2.5:

- *Current Input (Analog)*
The field stores 0 – 100, which corresponds to the percentage of the 0-20mA range measured at the input. This value is logged with one decimal point of precision.
- *Voltage Input (Digital)*
This field will equal '1' when a voltage is detected at the input.

Run Time Sec

This field stores the number of seconds during the last logging interval where the Profire system was running. This value can range from zero to the logging interval of the Data Logging Card, measured in seconds (e.g. 3600 if a 60 minute logging interval is used).

A Profire system is considered “running” when the Run bit is set. Generally, this bit is set and the Run Time Sec value increases when the Profire system is performing automatic process control. As an example, if the Profire system is purging or waiting to restart from a recoverable alarm condition, the Data Logging Card considers the system “running” even though all attached valves are closed and no fuel is being consumed.