PROFIRE

PF2200 - GP

PRODUCT MANUAL

DOC-001191
v1.0

PROFIRE

Warning:

All PF2200 installations must follow the installation, commissioning, operation, and maintenance procedures outlined in this manual. Failure to comply with the instructions and warnings in this manual may result in death, serious injury, electrocution, property damage, product damage, and/or government fines. All PF2200 installations must be performed in accordance with local electrical code(s) by a capable electrician, and must be field inspected by the Authority Having Jurisdiction to ensure compliance with local electrical and gas codes.

Explosion Hazard. Do not connect or disconnect when energized.

Do not service or open enclosure unless power has been switched off or the area is known to be non-hazardous.

Do not remove or replace fuse when system is powered. Replacement fuses must be ceramic and of correct rating (10A, 150V_{DC}, Slow Blow). Contact Profire for fuse replacements.

Substitution of components may impair suitability for Class I, Division 2.

Avertissement:

Toutes les installations PF2200 doivent être conformes aux procédures d'installation, de mise en service, d'utilisation et d'entretien décrites dans ce manuel. Le non-respect des instructions et des avertissements de ce manuel peut entraîner la mort, des blessures graves, l'électrocution, des dommages matériels, des dommages au produit et/ou des amendes gouvernementales. Toutes les installations PF2200 doivent être effectuées conformément au(x) code(s) électrique(s) local(aux) par un électricien compétent, et doivent être inspectées sur place par l'autorité compétente afin de garantir la conformité aux codes locaux de l'électricité et du gaz.

Risque d'explosion. Ne pas brancher ni débrancher sous tension.

Ne pas réparer ou ouvrir le boîtier si l'instrument est sous tension ou que la zone est reconnue pour être non-dangereuse.

Ne pas retirer ou remplacer le fusible lorsque le système est sous tension. Les fusibles de remplacement doivent être en céramique et de valeur nominale correcte (10A, 150V_{DC}, Slow Blow). Contactez Profire pour le remplacement des fusibles.

Toutes les fonctions de sécurité doivent être éprouvées de bout en bout après la mise en service du système.

La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe I, Division 2.

TABLE OF CONTENTS

1 SCOPE

The PF2200-GP Glycol Pump Controller automates the glycol circulation pump in a natural gas dehydration system. The controller provides the following core capabilities:

Automatic Pump Control — Estimates the saturated water content of the gas stream from a measured temperature and contactor pressure, then drives the glycol circulation pump via a 4-20 mA output to maintain a configured water content setpoint.

Manual Pump Control — Allows the operator to directly set a target glycol flow rate, giving full control of pump output without the automatic water content algorithm.

Closed-loop PID Flow Control — When a glycol flow feedback signal is available, the controller can operate in closed-loop PID mode to regulate actual glycol flow to a setpoint. In Automatic mode the setpoint is derived from the water content algorithm; in Manual mode the setpoint is configured by the operator.

Monitoring and Diagnostics — The user interface displays real-time system status, active alerts, and I/O diagnostics. An event log provides alarm history and a record of system events and setting changes, with USB export for offline review.

Remote communication — All process values, system state, and configurable settings are accessible via RS-485 Modbus RTU for integration with SCADA or an external HMI.

This document provides detailed descriptions of the PF2200-GP inputs, outputs, and operating sequence as well as installation, maintenance, and commissioning instructions. This document is applicable for the following hardware and firmware versions:

CONTROLLER CARD HARDWARE VERSION	UI CARD HARDWARE VERSION	PF2200-GP FIRMWARE VERSION
v2.4.3	v3.4.3	GP 0.3.x

Previous versions of the PF2200-GP Product Manual can be found at profireenergy.com.

The card hardware versions and current system firmware can be found on the Information screen (System > Firmware > Info) of the User Interface, where the BOM Version corresponds to the card hardware and Bundle Version corresponds to the system firmware. Additionally, the card hardware version is printed on the last line of the QR code label affixed to each card.

Note that the Controller firmware version and the UI firmware version must match in order for the system to operate correctly. Mismatched firmware is not supported.

2 APPROVALS AND RATINGS

The PF2200-GP is certified to the following standards:

- 12/24 V_{DC}, 10 Amps, 2-Wire Input Supply
- Class I, Division 2, Grp ABCD, T4A
- Enclosure Type 4/4X
- POWER INPUT MUST BE SUPPLIED BY A CLASS 2 POWER SOURCE.

REGION	CERTIFICATION
USA	**ENCLOSED INDUSTRIAL CONTROL PANEL** CONFORMS TO UL STD. 508A & UL STD. 121201
CAN	**INDUSTRIAL CONTROL PANEL / PANNEAU INDUSTRIEL DE COMMANDE** CERTIFIED TO CAN/CSA STD. C22.2 #286 & #213

2.1 ELECTRICAL AND MECHANICAL RATINGS

2.1.1 PRODUCT RATINGS

ITEM	RATING
Temperature – Operating/Storage	-40°C to 40°C (-40°F to 104°F)
Voltage Range	12V Mode: 10.2 – 16.2 V_{DC} • 24V Mode: 20.4 – 32.4 V_{DC}
Humidity - Product	0% to 100% Condensing
Humidity - Controller and UI Card	0% to 90% Non-condensing
Vibration - Tested	3g swept from 10Hz to 150Hz, 10 consecutive sweeps, 3-axis

POWER CONSUMPTION [1]	12V MODE	24 MODE
Running • Backlight off • No USB	0.7W	0.9W
Running • Backlight off • USB installed	1.1W	1.3W
Running • Backlight on • USB installed	1.3W [2]	1.5W [2]

[1] Power consumption numbers are for the PF2200 controller only. Ensure that all external loads (e.g., 4-20 mA transmitters, pump drive, etc.) are factored in when selecting a power supply for the system.

[2] The screen backlight remains on while UI buttons are being pressed and turns off after 10 minutes of inactivity.

2.1.2 ENCLOSURE DETAILS

ITEM	PF2200-GP-B
Material	Polycarbonate
Type Rating	Type 4/4X
Ingress Protection Rating	IP66
Dimensions	291mm x 243mm x 176mm (11.5" x 9.6" x 6.9")
Weight	2.7 kg / 5.9 lbs

2.1.3 USER INTERFACE CARD ELECTRICAL RATINGS

TERMINAL	INPUT/ OUTPUT	RATING	AWG — MIN	AWG — MAX	TORQUE [NM] — MIN	TORQUE [NM] — MAX
MODBUS (1 A)	–	RS-485, -7V – 7V Common Mode Range with reference to terminal 3 (-)	30	14	0.22	0.25
MODBUS (2 B)	–	RS-485, -7V – 7V Common Mode Range with reference to terminal 3 (-)	30	14	0.22	0.25
MODBUS (3 -)	–	RS-485, -7V – 7V Common Mode Range with reference to terminal 3 (-)	30	14	0.22	0.25
PFN (4 +)	O	Power In: 7-35V_{DC}, 500mA Max PFN: -7V – 7V Common Mode Range	30	14	0.22	0.25
PFN (5 PFN) A	I/O	Power In: 7-35V_{DC}, 500mA Max PFN: -7V – 7V Common Mode Range	30	14	0.22	0.25
PFN (6 PFN) B	I/O	Power In: 7-35V_{DC}, 500mA Max PFN: -7V – 7V Common Mode Range	30	14	0.22	0.25
PFN (7 -)	O	Power In: 7-35V_{DC}, 500mA Max PFN: -7V – 7V Common Mode Range	30	14	0.22	0.25
USB (- USB)	I/O	5V_{DC}, 200mA max	–	–	–	–
KEYPAD (- KEYPAD)	I	3V_{DC}, 4.75kΩ source impedance	–	–	–	–

2.1.4 CONTROL CARD ELECTRICAL RATINGS

NAME	TERMINAL	INPUT/ OUTPUT	RATING	AWG [3] — MIN	AWG [3] — MAX	TORQUE [NM] — MIN	TORQUE [NM] — MAX
USER INTERFACE	1 +	O	Power Out: 7-35V_{DC}, 500mA Max PFN: -7V – 7V Common Mode Range	30	14	0.22	0.25
USER INTERFACE	2 PFN A	I/O	Power Out: 7-35V_{DC}, 500mA Max PFN: -7V – 7V Common Mode Range	30	14	0.22	0.25
USER INTERFACE	3 PFN B	I/O	Power Out: 7-35V_{DC}, 500mA Max PFN: -7V – 7V Common Mode Range	30	14	0.22	0.25
USER INTERFACE	4 -	O	Power Out: 7-35V_{DC}, 500mA Max PFN: -7V – 7V Common Mode Range	30	14	0.22	0.25
GAS PRESSURE	5 PWR	O	13.5V_{DC} max [5], 30mA Max	30	12	0.5	0.6
GAS PRESSURE	6 SIG IN	I	30V_{DC} Max [1 2 4]	30	12	0.5	0.6
GAS FLOW	7 PWR	O	13.5V_{DC} max [5], 30mA Max	30	12	0.5	0.6
GAS FLOW	8 SIG IN	I	30V_{DC} Max [1 2 4]	30	12	0.5	0.6
LP FILTER DP	9 PWR	O	13.5V_{DC} max [5], 30mA Max	30	12	0.5	0.6
LP FILTER DP	10 SIG IN	I	30V_{DC} Max [1 2 4]	30	12	0.5	0.6
LEVEL LOW	11 PWR	O	13.5V_{DC} max [5], 30mA Max	30	12	0.5	0.6
LEVEL LOW	12 SIG IN	I	30V_{DC} Max [1 2 4]	30	12	0.5	0.6
FLASH BP OUT	13 OUT	O	20mA Max Output, Expected Load: < 350Ω ±0.1 mA Accuracy	30	12	0.5	0.6
FLASH BP OUT	14 GND	–	20mA Max Output, Expected Load: < 350Ω ±0.1 mA Accuracy	30	12	0.5	0.6
PUMP 1	19 +	O	Matches system input voltage 5A Max Output Expected Load: Inductive/Resistive	30	12	0.5	0.6

NAME	TERMINAL	INPUT/ OUTPUT	RATING	AWG [3] — MIN	AWG [3] — MAX	TORQUE [NM] — MIN	TORQUE [NM] — MAX
PUMP 1	20 -	O	Matches system input voltage 5A Max Output Expected Load: Inductive/Resistive	30	12	0.5	0.6
PUMP 2	21 +	O	Matches system input voltage 5A Max Output Expected Load: Inductive/Resistive	30	12	0.5	0.6
PUMP 2	22 -	O	Matches system input voltage 5A Max Output Expected Load: Inductive/Resistive	30	12	0.5	0.6
RUN STATUS	25 A	–	120V, 170Vpk Max 1500V Max impulse 1ARMS Max	30	12	0.5	0.6
RUN STATUS	26	Not Used					
RUN STATUS	27 B	–	120V, 170Vpk Max 1500V Max impulse 1ARMS Max	30	12	0.5	0.6
POWER IN	28 -	–	Class 2 Power Supply [1] $12V_{DC}/24V_{DC}$ 10A Max	30	12	0.5	0.6
POWER IN	29 -	–	Class 2 Power Supply [1] $12V_{DC}/24V_{DC}$ 10A Max	30	12	0.5	0.6
POWER IN	30 -	I	Class 2 Power Supply [1] $12V_{DC}/24V_{DC}$ 10A Max	30	12	0.5	0.6
POWER IN	31 +	I	Class 2 Power Supply [1] $12V_{DC}/24V_{DC}$ 10A Max	30	12	0.5	0.6
POWER IN	32 +	–	Class 2 Power Supply [1] $12V_{DC}/24V_{DC}$ 10A Max	30	12	0.5	0.6
STOP	33 PWR	O	$13.5V_{DC}$ max [5], 30mA Max	30	12	0.5	0.6
STOP	34 SIG IN	I	$30V_{DC}$ Max [1]	30	12	0.5	0.6
START	35 PWR	O	$13.5V_{DC}$ max [5], 30mA Max	30	12	0.5	0.6

NAME	TERMINAL	INPUT/ OUTPUT	RATING	AWG [3] — MIN	AWG [3] — MAX	TORQUE [NM] — MIN	TORQUE [NM] — MAX
START	36 SIG IN	I	$30V_{DC}$ Max [1]	30	12	0.5	0.6
PUMP 1 SPEED	37 OUT	O	20mA Max Output, Expected Load: < 350Ω ±0.1 mA Accuracy	30	12	0.5	0.6
PUMP 1 SPEED	38 GND	–	20mA Max Output, Expected Load: < 350Ω ±0.1 mA Accuracy	30	12	0.5	0.6
PUMP 2 SPEED	39 OUT	O	20mA Max Output, Expected Load: < 350Ω ±0.1 mA Accuracy	30	12	0.5	0.6
PUMP 2 SPEED	40 GND	–	20mA Max Output, Expected Load: < 350Ω ±0.1 mA Accuracy	30	12	0.5	0.6
GLYCOL FLOW	41 PWR	O	$13.5V_{DC}$ max [5], 30mA Max	30	12	0.5	0.6
GLYCOL FLOW	42 SIG IN	I	$30V_{DC}$ Max [1 2 4]	30	12	0.5	0.6
AUX TEMP (4-20)	43 PWR	O	$13.5V_{DC}$ max [5], 30mA Max	30	12	0.5	0.6
AUX TEMP (4-20)	44 SIG IN	I	$30V_{DC}$ Max [1 2 4]	30	12	0.5	0.6
HP FILTER DP	45 PWR	O	$13.5V_{DC}$ max [5], 30mA Max	30	12	0.5	0.6
HP FILTER DP	46 SIG IN	I	$30V_{DC}$ Max [1 2 4]	30	12	0.5	0.6
FLASH PRESSURE	47 PWR	O	$13.5V_{DC}$ max [5], 30mA Max	30	12	0.5	0.6
FLASH PRESSURE	48 SIG IN	I	$30V_{DC}$ Max [1 2 4]	30	12	0.5	0.6
PUMP STATUS	49 PWR	O	$13.5V_{DC}$ max [5], 30mA Max	30	12	0.5	0.6
PUMP STATUS	50 PUMP1	I	$30V_{DC}$ Max [1 2]	30	12	0.5	0.6
PUMP STATUS	51 PUMP2	I	$30V_{DC}$ Max [1 2]	30	12	0.5	0.6
PRIMARY TEMP A	61 +	I	Thermocouple Mode: Type K Grounded or Ungrounded -100°C to 1350°C • ±2°C Accuracy RTD Mode: PT-100 RTD -100°C to 850°C • ±0.5°C Accuracy	30	12	0.22	0.25

NAME	TERMINAL	INPUT/ OUTPUT	RATING	AWG [3] — MIN	AWG [3] — MAX	TORQUE [NM] — MIN	TORQUE [NM] — MAX
PRIMARY TEMP A	62 -	I	(see above)	30	12	0.22	0.25
PRIMARY TEMP A	63 R	I	(see above)	30	12	0.22	0.25
PRIMARY TEMP B	64 +	I	(see above — second element for Dual configuration)	30	12	0.22	0.25
PRIMARY TEMP B	65 -	I	(see above)	30	12	0.22	0.25
PRIMARY TEMP B	66 R	I	(see above)	30	12	0.22	0.25
SECONDARY TEMP	67 +	I	Thermocouple or RTD (see above)	30	12	0.22	0.25
SECONDARY TEMP	68 -	I	(see above)	30	12	0.22	0.25
SECONDARY TEMP	69 R	I	(see above)	30	12	0.22	0.25
TERTIARY TEMP	70 +	I	Thermocouple or RTD (see above)	30	12	0.22	0.25
TERTIARY TEMP	71 -	I	(see above)	30	12	0.22	0.25
TERTIARY TEMP	72 R	I	(see above)	30	12	0.22	0.25

[1] The PF2200 must be powered from a Class 2 circuit as defined in the Canadian Electrical Code (CSA 22.2 No 1-15) or US National Electrical Code (NFPA 70).

[2] A digital input with an input current of 1.25mA or greater will be seen by the system as an energized input, while a digital input with an input current of 500µA or less will be seen by the system as a de-energized input.

[3] All wire sizes listed indicate the size restrictions of the control card connector only. All wires must be adequately sized for their respective current requirements in accordance with local electrical codes.

[4] Input accuracy when configured in 4-20 mA mode: ±0.1 mA

[5] PWR terminal output voltage is equal to the system voltage (voltage applied between the power in terminals) to a maximum of 13.5V. For system voltages above this value, the PWR terminal output voltage is held at 13.5V.

3 USER INTERFACE CARD

The User Interface Card allows interaction with the system through the use of the keypad, display, Modbus port, and USB port. The card interacts with the Control Card through a proprietary communication protocol called PFN, which utilizes the RS-485 physical transport layer. PFN and power to the User Interface are factory wired to the Control Card through a wiring harness.

3.1 KEYPAD

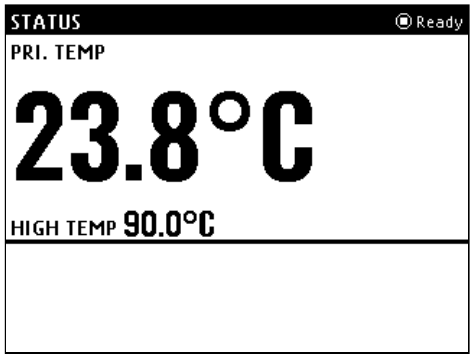
BUTTON	FUNCTIONS
START	Start the system from **Ready** state
STOP	**Stop** the system
⮌	**Return** to previous screen from an on-screen menu
⧉	Cycle through **Status**, **Settings**, and **System** screens
?	Display keypad functionality help screen
	Switch to **Commissioner Mode** to see all available settings
	Switch to **Operator Mode** to see only essential settings and setpoints
◀ ▶ ▲ ▼	Navigate **Menus** and highlight items
OK	Select highlighted item
OK	Open settings adjustment dialog when highlighting numeric settings
− +	Change **Status** screen display mode
− +	Make incremental changes to numeric settings
− +	Scroll **Event Log** by full page

Use the Keypad Diagnostic Tool (System > Diagnostics > Keypad) to check the functionality of each button individually.

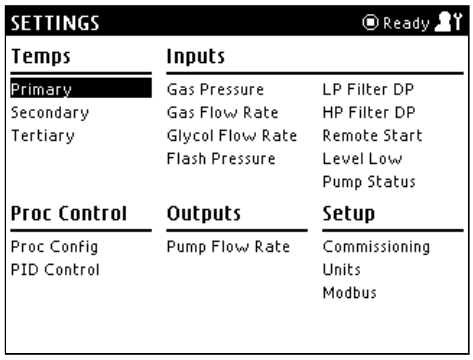
3.2 CONTROLLER INTERFACE

The PF2200-GP controller consists of 3 main screens: *Press* ⌷ *to cycle between Status, Settings, and System screens*

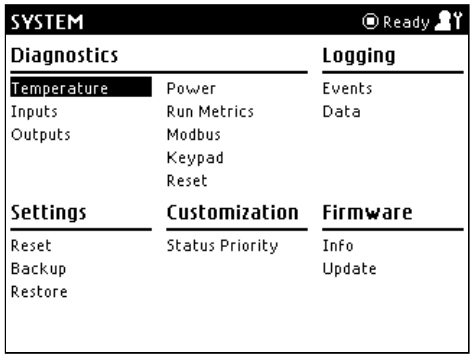
1. **Status Screen:** Provides real-time monitoring of process values, system state, and active alerts. Displays values such as Gas Temperature, Gas Pressure, Gas Flow Rate, Glycol Flow Rate, Pump Speed, and system status (e.g., Ready). Displayed elements are configurable and update continuously.



2. **Settings Screen:** Contains all configuration settings required to commission the system, organized into columns for **Temps** (Primary, Secondary, Tertiary), **Inputs** (Pressure, Gas Flow, Glycol Flow, HP Filter DP, LP Filter, Flash Pressure, Level, Pump Status), **Outputs** (Pump Output), **Control** (PID Control), and **Setup** (Commissioning, Units, Modbus). A limited Operator view is available for routine setpoint adjustments after commissioning.



3. **System Screen:** Provides tools for maintenance and troubleshooting, organized into columns for **Diagnostics** (Temperature, Inputs, Outputs), **Logging** (Events, Data), **Settings** (Reset, Backup, Restore), **Customization** (Status Priority), and **Firmware**.

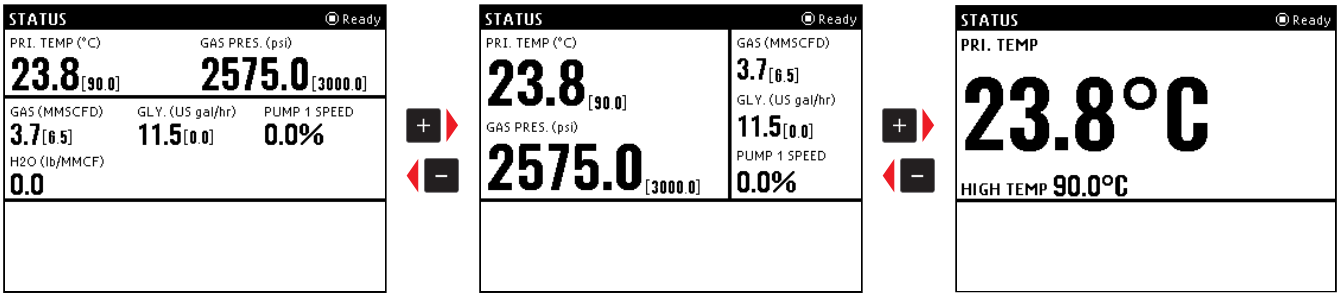


4. **Controller Status Bar:** A persistent display element visible on all screens that indicates the current screen, system run state, and current operating mode.

3.2.1 STATUS SCREEN

The Status Screen displays the current controller state in the Status Bar at the top of the Status Screen. All current alarms, waits, and warnings are displayed in the Alerts Pane at the bottom of the Status Screen. The main window of the Status Screen shows the current states/readings of the connected input devices.

> The information displayed can be customized to show one, five, or eight status elements; use + and – to cycle between the one-item, five-item, and eight-item zoom levels. The order in which the status elements are displayed on each zoom level can be customized using the Status Priority Tool (System > Customization > Status Priority).



Eight Elements **Five Elements** **One Element**

The following status elements are available for display on the Status Screen. Elements are shown only when their corresponding I/O is enabled:

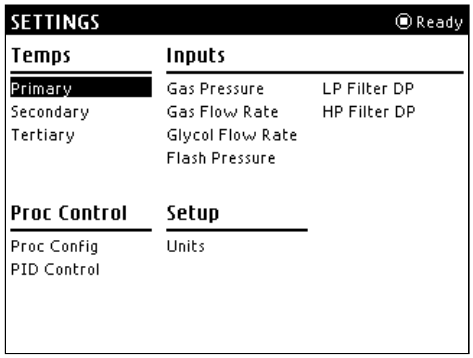
ELEMENT	DESCRIPTION
Primary Temp	Current primary contactor temperature reading (sourced from the primary temp TC/RTD input or, if aux temp override is enabled, the aux temp input 4-20 mA input)
Gas Pressure	Current contactor pressure reading
Gas Flow Rate	Current gas flow rate reading
Glycol Flow Rate	Current desiccant (glycol) flow rate reading
Pump 1 Speed	Current pump 1 output in % of full scale
Pump 2 Speed	Current pump 2 output in % of full scale (if enabled)
Secondary Temp	Current secondary temperature reading
Tertiary Temp	Current tertiary temperature reading
LP Filter DP	Current LP filter differential pressure reading
HP Filter DP	Current HP filter differential pressure reading
Flash Pressure	Current flash tank pressure reading
Flash BP Out	Current flash back-pressure output reading
Level Low	Current level low digital input state
Pump 1 Status	Current pump 1 permissive digital input state

ELEMENT	DESCRIPTION
Pump 2 Status	Current pump 2 permissive digital input state
Calculated Water Content	Current calculated water content value

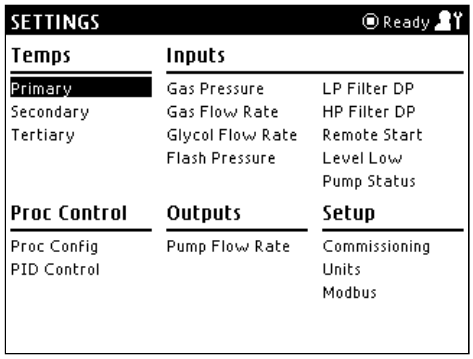
3.2.2 SETTINGS SCREEN

The Settings Screen contains sub-menus for all configuration settings required to commission a system. Use ◀ ▲ ▼ ▶ to select a menu and press OK to see a list of all related settings. By default, the Settings Screen is shown in Operator Mode, so a limited number of settings are displayed for quickly making changes after the system has been commissioned. Pressing 🔧 will switch to Commissioning Mode and read-only access will be granted to all settings.

- **Operator Mode:** Displays a limited set of menus for Temps, Inputs, Control, and Setup. Intended for quick changes post-commissioning.



- **Commissioning Mode:** Accessed via the Commissioning icon (wrench/person symbol), this mode displays expanded menus including all Inputs, Outputs, and Setup options.



A valid password must be entered when prompted in order to adjust any setting. Each setting has a pre-determined security level based on its potential safety and reliability impact, and each security level has a separate password.

- L1 security level: settings that can impact process operation.

> If the **L1 Password Enable** setting is **Enabled**, L1 setting modification requires the L1 password. If the **L1 Password Enable** setting is **Disabled**, L1 settings can be modified with no password.

- L2 security level: settings that impact higher-level process operation or system configuration.

For L1 and L2 passwords, please contact Profire customer service. Passwords will only be distributed to individuals that are capable of assessing the impact of the changes they intend to make.

After entering a valid password, the user is authenticated and can make changes to the associated settings. The authentication will timeout after 15 minutes regardless of activity. Any further attempt to adjust settings requires the user to re-authenticate.

DROP DOWN SETTINGS MODIFICATION

Settings with discrete options (e.g., Disabled/Enabled, TC/RTD) are modified using a drop-down selector:

- Pressing **[OK]** opens a "Change Value" window. Users can select a value and press **Accept** OK to confirm or **Cancel** ⮌ to exit.
- Using **[+]** and **[-]** buttons allows for quick adjustment of the selected option. The change takes effect immediately.

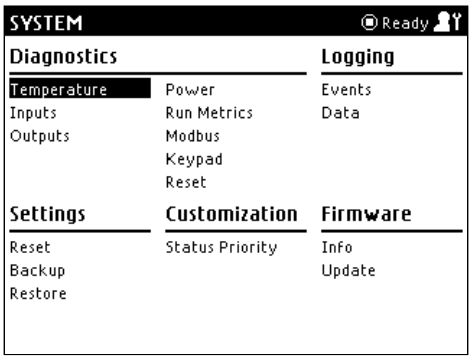
NUMERIC SETTINGS MODIFICATION

Settings with numeric values are modified using one of two methods:

1. **Accepted Change Method:** Press **[OK]** to open a dialog, use arrow keys or **[+]/[-]** to adjust, then press **Accept** to confirm. The change does not take effect until accepted.
2. **Quick Settings Adjustment Method:** Use **[+]** or **[-]** while a numeric setting is highlighted. The change takes effect immediately.

3.2.3 SYSTEM SCREEN

The PF2200 System screen contains tools for system monitoring, troubleshooting, and customization. The diagnostics menus contain useful real-time troubleshooting information, the logging tools provide detailed event history and data logging functionality, the settings tools allow saving and loading of settings between controllers, and the status priority tool allows for customization of the information displayed on the Status screen.



DIAGNOSTICS

MENU ITEM	DESCRIPTION
Temperature Diagnostics	Displays real-time temperature readings of all temperature inputs and ambient temperature sensors.
Input Diagnostics	Displays real-time digital input states and voltage or current readings of all analog inputs.
Output Diagnostics	Displays real-time pump output position (mA and %) and current readings.

MENU ITEM	DESCRIPTION
Power Diagnostics	Displays real-time and average hourly power consumption readings.
Run Metrics	Displays system run times since last power cycle.
Modbus Diagnostics	Displays Modbus transmission statistics, error counts and key troubleshooting information.
Keypad Diagnostics	Interactive tool for testing the functionality of each key on the keypad.

Temperature Diagnostics

The Temperature Diagnostics screen displays real-time readings for:

ITEM	DESCRIPTION
Primary 1	Primary contactor temperature, element 1.
Primary 2	Primary contactor temperature, element 2.
Primary Aux	Mapped temperature reading from the auxiliary 4-20 mA input.
Secondary	Secondary temperature input reading.
Tertiary	Tertiary temperature input reading.
Ambient 1	Ambient temperature sensor 1 reading.
Ambient 2	Ambient temperature sensor 2 reading.
Aux Temp Override	Raw 4-20 mA signal value of the auxiliary temperature input.

Input Diagnostics

The Input Diagnostics screen displays real-time analog input readings and digital input voltages:

ITEM	DESCRIPTION
Gas Pressure	Gas pressure 4-20 mA transmitter reading.
Gas Flow Rate	Gas flow rate 4-20 mA transmitter reading.
Glycol Flow Rate	Instantaneous glycol flow rate feedback reading.
Averaged Glycol Flow Rate	Time-averaged glycol flow rate used by the control loop.
LP Filter DP	Low-pressure filter differential pressure reading.
HP Filter DP	High-pressure filter differential pressure reading.
Flash Pressure	Flash pressure 4-20 mA transmitter reading.
Stop Voltage	Voltage measured on the Stop digital input.
Start Voltage	Voltage measured on the Start digital input.
Level Low Voltage	Voltage measured on the Level Low digital input.

ITEM	DESCRIPTION
Pump 1 Status Voltage	Voltage measured on the Pump 1 status input.
Pump 2 Status Voltage	Voltage measured on the Pump 2 status input.
External Switch State	Current state of the external switch input (Stop, Run, Invalid, Stuck).

Output Diagnostics

The Output Diagnostics screen displays real-time pump output values, powered-output measurements, and calculated control values:

Pump Speed

ITEM	DESCRIPTION
Pump 1 Speed %	Pump 1 commanded speed as a percentage of full scale.
Pump 2 Speed %	Pump 2 commanded speed as a percentage of full scale.
Average Pump 1 %	Time-averaged Pump 1 speed percentage.
Average Pump 2 %	Time-averaged Pump 2 speed percentage.

Powered Outputs

ITEM	DESCRIPTION
Pump 1 Voltage	Measured voltage on the Pump 1 enable output.
Pump 1 Current	Measured current on the Pump 1 enable output.
Pump 2 Voltage	Measured voltage on the Pump 2 enable output.
Pump 2 Current	Measured current on the Pump 2 enable output.

Calculated Output

ITEM	DESCRIPTION
Target Glycol Flow	Target glycol flow rate derived from the water content calculation.
Water Content	Current calculated water content of the gas stream.

Power Diagnostics

The Power Diagnostics screen displays real-time and average power consumption readings:

ITEM	DESCRIPTION
System Voltage	Real-time system supply voltage.
System Current	Real-time system current draw.

ITEM	DESCRIPTION
System Power	Real-time system power consumption.
Hourly Energy Usage	Average system energy consumption over the past hour.

Run Metrics

The Run Metrics screen displays system and pump run-time accumulators since the last power cycle:

Run Times

ITEM	DESCRIPTION
System Up Time	Total time the controller has been powered on.
Pump 1 Run Time	Cumulative time Pump 1 has been running.
Pump 2 Run Time	Cumulative time Pump 2 has been running.

Modbus Diagnostics

The Modbus Diagnostics screen displays Modbus transmission statistics and error counters:

ITEM	DESCRIPTION	POTENTIAL CAUSE
Received Packets	The total number of packets received without protocol error.	N/A
Transmitted Packets	The total number of packets transmitted.	N/A
Invalid Device Addresses	The number of received packets that are not addressed to this slave device.	Configured Slave Address setting is incorrect.
Exceptions	The total count of illegal packet codes.	Incorrect configuration or Modbus master programming error.
Illegal Function Codes	The requested Modbus function code is not supported.	Modbus master programming error.
Illegal Register Addresses	The requested register address is not supported.	Modbus master programming error.
Illegal Data Values	The data written to the register is out of range, or if the register spans multiple addresses, not all addresses are written to in a single write request.	Modbus master programming error.
Frame Errors	The received Modbus packet has frames that do not match the current configuration.	Configured Baud Rate, Parity, and/or Stop Bits settings do not match the Modbus master communication settings.
Noise Errors	The slave Modbus port has detected noise on the RS-485 line.	Incorrect configuration or noise from external sources.
Parity Errors	The received Modbus packet has a parity failure.	Corruption, noise, or incorrect configuration.

ITEM	DESCRIPTION	POTENTIAL CAUSE
Checksum Errors	The Modbus packet has been received but the CRC check has failed, indicating a corrupt packet.	Noise or missed bits on the RS-485 line.

LOGGING

Event Log

The Event Log screen displays a full history of system events for reference and troubleshooting. Events are continuously recorded to the USB storage device when inserted. The system stores a minimum of 500 events in volatile memory.

The event log displays all events that are stored on the USB storage device. If no USB is installed, the system displays the events retained in volatile memory. When the USB device is full, the oldest event will be deleted to make room for a new event.

Use the event log filter to view specific events on the system screen. All event types will still be logged to the USB storage device, regardless of the filters selected.

Data Logging

The Data logging tool logs input/output readings for up to 8 user selectable pieces of system information to the USB storage device. The data is logged in 15 second intervals and saved to the USB storage device regularly.

Use the Data Log Statistics window to see an estimate of how long the system will run before the USB storage device becomes full. Once full, the oldest data will be deleted and replaced with new data.

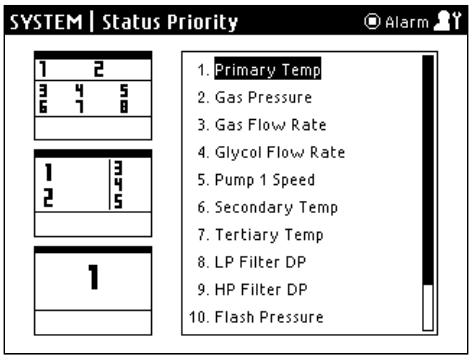
SETTINGS

MENU ITEM	DESCRIPTION
Reset	Resets all settings to their default values.
Backup	Saves all current settings to the USB storage device.
Restore	Tool to load settings from the USB storage device.

Some settings may not be restored when loading a settings file from a system with a different version of firmware installed. The settings restore tool provides a list of all settings that were not restored. Ensure that all settings are correct after using the Settings Restore tool.

STATUS PRIORITY

The Status Priority tool allows configuration of the items displayed on the main Status screen. Use ▲ and ▼ to select a status element and + and - to move it up or down the priority list.



FIRMWARE

Information

The Information screen displays useful firmware and hardware information associated with the Control Card and UI Card, including bundle version, hardware model, product variant, firmware version, bootloader version, BOM version, serial number, and manufacture date.

> It is useful to have this system information on hand when contacting Profire for technical support.

Update

The Firmware Update tool facilitates system software upgrades in the field. A USB drive containing an approved firmware bundle file can be used to update the system.

3.2.4 CONTROLLER STATUS BAR

The Controller Status Bar is displayed in the top-right corner of every screen and remains visible regardless of the active screen or menu. It provides at-a-glance visibility of: **Current Screen** - The screen path the UI is currently showing **Run State** — Indicates whether the system is currently RUNNING or STOPPED **Controller State** — Indicates the current operating mode (e.g., Auto, Manual, Ready, Waiting, PID/No PID)

3.3 STATUS LED

The LED on the front of the PF2200-GP indicates the current operating state of the system.

3.3.1 STATUS LED BEHAVIOR

SYSTEM STATE	CONDITION	BEHAVIOR
POWER ON	Any	Cycles Green, Amber, Red
LOCKOUT	Any	Fast flashing Red
ALARM	Any	Slow flashing Red
READY	Any	Solid Red
CONFIRM START	Any	Solid Red
WAITING	No Warning present	Slow flashing Green

SYSTEM STATE	CONDITION	BEHAVIOR
WAITING	Warning present	Slow flashing Amber
AUTO	No Warning present	Solid Green
AUTO	Warning present	Solid Amber
MANUAL	No Warning present	Solid Green
MANUAL	Warning present	Solid Amber

3.4 MODBUS COMMUNICATION

Remote access to status information and non-safety critical settings is available via the Modbus terminals on the UI card. Refer to Appendix A – Modbus Register Reference for detailed programming information.

3.4.1 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Modbus Communication Module – Terminating resistor not required	**Settings > Setup > Modbus** Modbus RTU Communication: Enabled Modbus Termination: Disabled All other settings: As desired	Section 6.2.14
Modbus Communication Module – Terminating resistor required	**Settings > Setup > Modbus** Modbus RTU Communication: Enabled Modbus Termination: Enabled All other settings: As desired	Section 6.2.14
Not Used	**Settings > Setup > Modbus** Modbus RTU Communication: Disabled	N/A

Navigate to the Modbus Diagnostics Screen (System > Diagnostics > Modbus) for useful Modbus troubleshooting information.

3.5 USB PORT

The USB port of the User Interface Card is used for data-logging as well as settings backup, restore, and firmware update functionality.

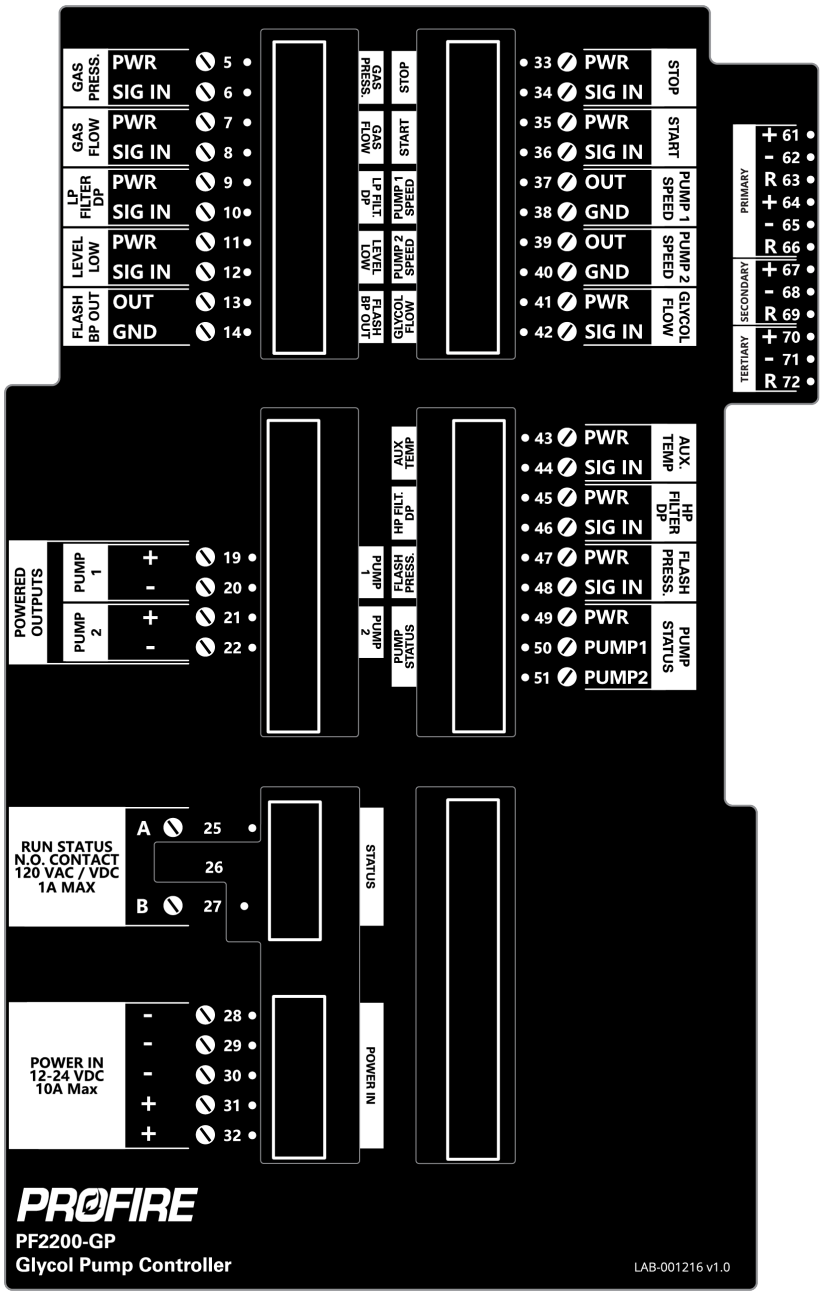
3.5.1 USB FUNCTIONS

FUNCTION	CONFIGURATION
Event logging to USB	**System > Logging > Events** No configuration required – Event log is automatically stored to USB when installed
Data logging to USB	**System > Logging > Data** Select up to 8 items to log
Saving current controller settings to USB	**System > Settings > Backup**
Loading saved controller settings from USB	**System > Settings > Restore** Select desired file to load
Firmware update	**System > Firmware > Update** Select firmware bundle file from USB

An approved USB storage device must be used; use of a non-approved USB storage device may compromise USB functionality. Each PF2200 is shipped with one approved USB storage device. Please contact Profire for replacements.

4 CONTROL CARD I/O

The Control Card provides the necessary inputs and outputs to monitor the gas dehydration process and control the glycol circulation pump. The following sections outline the behavior and intended device connections for each input and output, and provide brief configuration instructions.



A detailed diagram showing the physical layout of terminals, switches, and components on the Control Card.

4.1 PRIMARY TEMPERATURE INPUT

4.1.1 DETAILS

The Primary Temperature input measures the gas stream temperature at the contactor. This temperature, combined with the Gas Pressure, is used to estimate the water content of the gas. The input supports either a Type K thermocouple or a PT-100 RTD, configured as Dual (two elements for cross-comparison) or Single (one element).

When the **Primary Aux Temp Override** setting is Enabled, this TC/RTD input is disabled and the Auxiliary 4-20 mA Temperature Input (Section 4.2) is used instead as the water content temperature source. The two temperature source options are mutually exclusive.

ITEM	DETAILS
Input Type	TC (Type K) or RTD (PT-100), Dual or Single element
Configuration Path	Settings > Temps > Primary Temp
Connection Terminals	61 (+), 62 (−), 63 (R) — Element 1 64 (+), 65 (−), 66 (R) — Element 2 (Dual only)
Fail-Safe Options	Stop, Hold Last, Drive to Min, Drive to Max

4.1.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Dual Type K Thermocouple	**Settings > Temps > Primary Temp** Type: TC • Input: Dual Aux Temp Override: Disabled	Section 6.2.15
Single Type K Thermocouple	**Settings > Temps > Primary Temp** Type: TC • Input: Single Aux Temp Override: Disabled	Section 6.2.16
Dual 3-Wire RTD	**Settings > Temps > Primary Temp** Type: RTD • Input: Dual Aux Temp Override: Disabled	Section 6.2.17
Single 3-Wire RTD	**Settings > Temps > Primary Temp** Type: RTD • Input: Single Aux Temp Override: Disabled	Section 6.2.18
Not Used / Using 4-20 mA	**Settings > Temps > Primary Temp** Aux Temp Override: Enabled (see Section 4.2)	N/A

4.2 AUXILIARY TEMPERATURE INPUT (4-20 MA)

4.2.1 DETAILS

The Auxiliary Temperature Input accepts a 4-20 mA signal from an external temperature transmitter. When the **Primary Aux Temp Override** setting is Enabled, this input replaces the TC/RTD Primary Temperature Input (Section 4.1) as the water content temperature source. The 4-20 mA span is configured using the **Primary Aux Temp Span Min** and **Primary Aux Temp Span Max** settings.

ITEM	DETAILS
Input Type	4-20 mA (always fixed; cannot be configured as Digital)
Configuration Path	Settings > Temps > Primary Temp (Aux Temp Override: Enabled)
Connection Terminals	43 (PWR), 44 (SIG IN)
Fail-Safe Options	Stop, Hold Last, Drive to Min, Drive to Max

4.2.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Loop Powered 4-20 mA Transmitter	**Settings > Temps > Primary Temp** Aux Temp Override: Enabled Span Min/Max: Per transmitter datasheet	Section 6.2.3
Self-Powered 4-20 mA Transmitter	**Settings > Temps > Primary Temp** Aux Temp Override: Enabled Span Min/Max: Per transmitter datasheet	Section 6.2.4
4-20 mA Output from PLC	**Settings > Temps > Primary Temp** Aux Temp Override: Enabled Span Min/Max: Per PLC scaling	Section 6.2.5
Not Used / Using TC/RTD	**Settings > Temps > Primary Temp** Aux Temp Override: Disabled (see Section 4.1)	N/A

4.3 SECONDARY TEMPERATURE INPUT

4.3.1 DETAILS

The Secondary Temperature input monitors a secondary temperature point in the process. When enabled, this input can trigger alert conditions based on configurable high and low setpoints. The Secondary Temperature is a monitoring-only input and does not participate in the water content calculation.

ITEM	DETAILS
Input Type	TC (Type K) or RTD (PT-100), Single element
Configuration Path	Settings > Temps > Secondary Temp
Connection Terminals	67 (+), 68 (−), 69 (R)
Fail-Safe Options	Stop, Hold Last, Drive to Min, Drive to Max, Warning

4.3.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Type K Thermocouple	**Settings > Temps > Secondary Temp** Type: TC • Enable: Enabled High/Low setpoints as required	Section 6.2.16

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
3-Wire RTD	**Settings > Temps > Secondary Temp** Type: RTD • Enable: Enabled High/Low setpoints as required	Section 6.2.18
Not Used	**Settings > Temps > Secondary Temp** Enable: Disabled	N/A

4.4 TERTIARY TEMPERATURE INPUT

4.4.1 DETAILS

The Tertiary Temperature input monitors a third temperature point in the process. When enabled, this input can trigger alert conditions based on configurable high and low setpoints. The Tertiary Temperature is a monitoring-only input and does not participate in the water content calculation.

ITEM	DETAILS
Input Type	TC (Type K) or RTD (PT-100), Single element
Configuration Path	Settings > Temps > Tertiary Temp
Connection Terminals	70 (+), 71 (−), 72 (R)
Fail-Safe Options	Stop, Hold Last, Drive to Min, Drive to Max, Warning

4.4.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Type K Thermocouple	**Settings > Temps > Tertiary Temp** Type: TC • Enable: Enabled High/Low setpoints as required	Section 6.2.16
3-Wire RTD	**Settings > Temps > Tertiary Temp** Type: RTD • Enable: Enabled High/Low setpoints as required	Section 6.2.18
Not Used	**Settings > Temps > Tertiary Temp** Enable: Disabled	N/A

4.5 GAS PRESSURE INPUT

4.5.1 DETAILS

The Gas Pressure input measures the gas pressure at the glycol contactor. Together with the Primary Temperature, the gas pressure is used to estimate the water content of the gas stream. This input supports 4-20 mA analog transmitters. The input type must be configured during commissioning; selecting Disabled removes this input from the water content calculation and prevents Auto mode operation.

ITEM	DETAILS
Input Type	Disabled or 4-20 mA
Configuration Path	Settings > Inputs > Pressure
Connection Terminals	5 (PWR), 6 (SIG IN)
Fail-Safe Options	Stop, Hold Last, Drive to Min, Drive to Max

4.5.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Loop Powered 4-20 mA Transmitter	**Settings > Inputs > Pressure** Type: 4-20 Span Min/Max, Low/High Trip: per process design	Section 6.2.3
Self-Powered 4-20 mA Transmitter	**Settings > Inputs > Pressure** Type: 4-20 Span Min/Max, Low/High Trip: per process design	Section 6.2.4
Not Used	**Settings > Inputs > Pressure** Type: Disabled	N/A

4.6 GAS FLOW RATE INPUT

4.6.1 DETAILS

The Gas Flow Rate input measures the volumetric flow rate of gas through the dehydration system. The gas flow rate is used directly in the glycol circulation rate calculation. This input supports 4-20 mA analog transmitters. Selecting Disabled removes this input from the algorithm; in that case the system will use a fixed gas flow assumption if in Manual mode, or cannot enter Auto mode.

ITEM	DETAILS
Input Type	Disabled, or 4-20 mA
Configuration Path	Settings > Inputs > Gas Flow Rate
Connection Terminals	7 (PWR), 8 (SIG IN)
Fail-Safe Options	Stop, Hold Last, Drive to Min, Drive to Max

4.6.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Loop Powered 4-20 mA Transmitter	**Settings > Inputs > Gas Flow Rate** Type: 4-20 Span Min/Max, Low/High Trip: per meter range	Section 6.2.3

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Self-Powered 4-20 mA Transmitter	**Settings > Inputs > Gas Flow Rate** Type: 4-20 Span Min/Max, Low/High Trip: per meter range	Section 6.2.4
Not Used	**Settings > Inputs > Gas Flow Rate** Type: Disabled	N/A

4.7 GLYCOL FLOW RATE INPUT

4.7.1 DETAILS

The Glycol Flow Rate input measures the actual glycol circulation rate. In Auto mode, the measured desiccant flow rate is used as the process variable (PV) in the PID control loop. The calculated target circulation rate is the setpoint. In addition to control feedback, this input can trigger alarms based on configurable high and low trip setpoints. A signal averaging filter can be applied using the **Glycol Flow Input Averaging Time** setting (0–60 seconds) to reduce measurement noise. The averaging only starts once the system first reaches manual or auto.

ITEM	DETAILS
Input Type	Disabled, or 4-20 mA
Configuration Path	Settings > Inputs > Glycol Flow Rate
Connection Terminals	41 (PWR), 42 (SIG IN)
Fail-Safe Options	Stop, Hold Last, Drive to Min, Drive to Max

4.7.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Loop Powered 4-20 mA Transmitter	**Settings > Inputs > Glycol Flow Rate** Type: 4-20 Span Min/Max: per meter range Averaging Time: per process requirements	Section 6.2.3
Self-Powered 4-20 mA Transmitter	**Settings > Inputs > Glycol Flow Rate** Type: 4-20 Span Min/Max: per meter range	Section 6.2.4
Not Used	**Settings > Inputs > Glycol Flow Rate** Type: Disabled	N/A

4.8 FLASH TANK PRESSURE INPUT

4.8.1 DETAILS

The Flash Tank Pressure input monitors the pressure at the glycol flash tank separator. When enabled, this input can trigger alert conditions based on configurable high and low trip setpoints. This is a monitoring-only input and does not participate in the control algorithm.

ITEM	DETAILS
Input Type	Disabled, Digital, or 4-20 mA
Configuration Path	Settings > Inputs > Flash Pressure
Connection Terminals	47 (PWR), 48 (SIG IN)
Fail-Safe Options	Stop, Hold Last, Drive to Min, Drive to Max, Warning

4.8.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Loop Powered 4-20 mA Transmitter	**Settings > Inputs > Flash Pressure** Type: 4-20 Span/Trip: per process	Section 6.2.3
Pressure Switch	**Settings > Inputs > Flash Pressure** Type: Digital	Section 6.2.1
Not Used	**Settings > Inputs > Flash Pressure** Type: Disabled	N/A

4.9 LP FILTER DIFFERENTIAL PRESSURE INPUT

4.9.1 DETAILS

The LP Filter Differential Pressure input monitors the pressure drop across the low-pressure filter in the glycol regeneration circuit. This input can trigger alert conditions. The input supports 4-20 mA analog transmitters or a Digital switch.

ITEM	DETAILS
Input Type	Disabled, Digital, or 4-20 mA
Configuration Path	Settings > Inputs > LP Filter DP
Connection Terminals	9 (PWR), 10 (SIG IN)
Fail-Safe Options	Stop, Hold Last, Drive to Min, Drive to Max, Warning

4.9.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Loop Powered 4-20 mA Transmitter	**Settings > Inputs > LP Filter DP** Type: 4-20 Span/Trip: per process	Section 6.2.3
Digital Differential Pressure Switch	**Settings > Inputs > LP Filter DP** Type: Digital	Section 6.2.1

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Not Used	**Settings > Inputs > LP Filter DP** Type: Disabled	N/A

4.10 HP FILTER DIFFERENTIAL PRESSURE INPUT

4.10.1 DETAILS

The HP Filter Differential Pressure input monitors the pressure drop across the high-pressure filter in the glycol contactor circuit. This input can trigger alert conditions. The input supports 4-20 mA analog transmitters or a Digital switch.

ITEM	DETAILS
Input Type	Disabled, Digital, or 4-20 mA
Configuration Path	Settings > Inputs > HP Filter DP
Connection Terminals	45 (PWR), 46 (SIG IN)
Fail-Safe Options	Stop, Hold Last, Drive to Min, Drive to Max, Warning

4.10.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Loop Powered 4-20 mA Transmitter	**Settings > Inputs > HP Filter DP** Type: 4-20 Span/Trip: per process	Section 6.2.3
Digital Switch	**Settings > Inputs > HP Filter DP** Type: Digital	Section 6.2.1
Not Used	**Settings > Inputs > HP Filter DP** Type: Disabled	N/A

4.11 LEVEL LOW INPUT

4.11.1 DETAILS

The Level Low input monitors the glycol storage level. When enabled and the input is de-energized (open), the system can be configured to stop, warn, or take another fail-safe action. This input uses energized-to-run logic: the contact must be closed (energized) for normal operation.

ITEM	DETAILS
Input Type	Digital (dry or wet contact)
Configuration Path	Settings > Inputs > Level Low (Enable: Enabled/Disabled)
Connection Terminals	11 (PWR), 12 (SIG IN)

ITEM	DETAILS
Fail-Safe Options	Stop, Hold Last, Drive to Min, Drive to Max, Warning

4.11.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Normally-open level switch (dry)	**Settings > Inputs > Level Low** Enable: Enabled Fail Safe Mode: per requirements	Section 6.2.1
Normally-open level switch (wet)	**Settings > Inputs > Level Low** Enable: Enabled Fail Safe Mode: per requirements	Section 6.2.2
Not Used	**Settings > Inputs > Level Low** Enable: Disabled	N/A

4.12 PUMP PERMISSIVE INPUTS

4.12.1 DETAILS

The Pump 1 Status and Pump 2 Status inputs monitor the run status or permissive signal from the pump drive or starter. These digital inputs use energized-to-run logic. When enabled, a de-energized input after the fail-safe delay can trigger a Stop, Warning, or other configured action. This allows the controller to respond to pump faults or loss of power to the pump circuit.

Pump 1 Status is associated with the primary pump output (Pump 1, 4-20 mA). **Pump 2 Status** is associated with the secondary pump enable output (Pump 2 discrete output).

ITEM	DETAILS
Input Type	Digital (dry or wet contact)
Configuration Path	Settings > Inputs > Pump 1 Status / Pump 2 Status (Enable: Enabled)
Connection Terminals	49 (PWR), 50 (PUMP1 SIG IN), 51 (PUMP2 SIG IN)
Fail-Safe Options	Stop, Hold Last, Drive to Min, Drive to Max, Warning

4.12.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
VFD / pump drive run feedback (dry)	**Settings > Inputs > Pump 1 Status** Enable: Enabled Fail Safe Mode and Delay: per requirements	Section 6.2.1
VFD / pump drive run feedback (wet)	**Settings > Inputs > Pump 1 Status** Enable: Enabled Fail Safe Mode and Delay: per requirements	Section 6.2.2

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Not Used	**Settings > Inputs > Pump 1 Status** or **Pump 2 Status** Enable: Disabled	N/A

4.13 STOP DISCRETE INPUT

4.13.1 DETAILS

The Stop input is a dedicated hardwired stop input that stops the system when de-energized. This input uses normally-energized logic: the contact must be continuously energized for the system to remain in the running state. De-energizing the input at any time and in any operating state causes an immediate pump shutdown.

This input is always active regardless of the system's operating mode or any software setting.

ITEM	DETAILS
Input Type	Digital (dry or wet contact), normally energized
Connection Terminals	33 (PWR), 34 (SIG IN)
Logic	Energized = Run permitted; De-energized = Stop immediately
Response Time	1s

The Stop input operates independently of the operating mode and cannot be disabled by any software setting. It is active at all times while the system is powered.

4.13.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Normally-closed safety contact (dry)	None required	Section 6.2.1
Normally-closed safety contact (wet)	None required	Section 6.2.2
Not Used (Stop jumpered energized)	Connect PWR to SIG IN	N/A

Warning: Do not leave the Stop input unconnected. An open Stop input will immediately prevent the system from running. If no external stop device is installed, the PWR and SIG IN terminals must be jumpered.

4.14 START DISCRETE INPUT

4.14.1 DETAILS

The Start Discrete Input provides a hardwired mechanism to remotely start the system. The input is enabled or disabled by the **Remote Start** setting. When enabled, the Start input follows a 3-step activation sequence to prevent accidental starts:

1. The contact must be **energized** (step 1).
2. The contact must be **de-energized** (step 2).
3. The contact must be **re-energized** (step 3) within 30 seconds of step 2 to confirm the start intent.

A 500 ms debounce is applied to each contact transition. The 30-second confirmation window begins when the contact is de-energized in step 2. If the contact is not re-energized within 30 seconds, the sequence resets and must be initiated again.

The system must be in the **Ready** state for a Start input sequence to result in a system start.

ITEM	DETAILS
Input Type	Digital (dry or wet contact)
Configuration Path	Settings > Inputs > Remote Start (Enable: Enabled)
Connection Terminals	35 (PWR), 36 (SIG IN)
Logic	3-step energize → de-energize → re-energize sequence
Debounce	500 ms per transition
Confirmation Window	30 seconds

4.14.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Momentary pushbutton (dry)	**Settings > Inputs > Remote Start** Enable: Enabled	Section 6.2.1
SCADA/PLC digital output (wet)	**Settings > Inputs > Remote Start** Enable: Enabled	Section 6.2.2
Not Used	**Settings > Inputs > Remote Start** Enable: Disabled	N/A

4.15 PUMP 1 DISCRETE OUTPUT

4.15.1 DETAILS

The Pump 1 discrete output is a switched-power (sourced) output used to enable or run Pump 1. The output energizes when the controller commands Pump 1 to run and de-energizes when the pump is stopped or disabled. This output can drive relay coils, solenoids, or direct pump enable inputs.

Output PWM can be configured to control peak-and-hold type devices or to limit inrush current.

ITEM	DETAILS
Output Type	Switched power (matches system voltage), 5A Max, PWM configurable
Configuration Path	Settings > Outputs > Pump Flow Rate
Connection Terminals	19 (+), 20 (−)
Energized When	System is RUNNING (Auto or Manual mode)
De-energized When	System stopped, alarm, or lockout

4.15.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONNECTION DIAGRAMS
Relay coil / contactor	Section 6.2.8
Peak-and-hold solenoid valve	Section 6.2.8
Pump enable input (direct)	Section 6.2.8
Not Used	N/A

Caution: Do not connect device minus (−) terminals to ground. The discrete output minus (−) terminals are not grounded.

4.16 PUMP 2 DISCRETE OUTPUT

4.16.1 DETAILS

The Pump 2 discrete output is a switched-power (sourced) output used to enable or run Pump 2. It operates identically to the Pump 1 discrete output (Section 4.15) and is active whenever the controller commands Pump 2 to run. This output requires the **Pump 2 Enable** setting to be Enabled.

ITEM	DETAILS
Output Type	Switched power (matches system voltage), 5A Max, PWM configurable
Configuration Path	Settings > Outputs > Pump Flow Rate > Pump 2 Enable
Connection Terminals	21 (+), 22 (−)
Energized When	Controller commands Pump 2 to run and Pump 2 Enable = Enabled
De-energized When	System stopped, alarm, lockout, or Pump 2 Enable = Disabled

4.16.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Relay coil / contactor	**Settings > Outputs > Pump Flow Rate > Pump 2 Enable**: Enabled	Section 6.2.8
Peak-and-hold solenoid valve	**Settings > Outputs > Pump Flow Rate > Pump 2 Enable**: Enabled	Section 6.2.8
Not Used	**Settings > Outputs > Pump Flow Rate > Pump 2 Enable**: Disabled	N/A

Caution: Do not connect device minus (−) terminals to ground. The discrete output minus (−) terminals are not grounded.

4.17 PUMP 1 SPEED (4-20 MA)

4.17.1 DETAILS

The Pump Output is a 4-20 mA analog output that drives the glycol circulation pump speed controller or control valve (VFD, pump controller, control valve, or similar). The output is calibrated to span from **Pump Flow Rate Min** (mA) to **Pump Flow Rate Max** (mA), which correspond to the minimum and maximum pump flow rates respectively (in glycol flow units). A **Pump Output Offset** setting allows a fixed percentage offset to be applied to the calculated output to compensate for system-specific characteristics.

A **Manual Pump** Flow Rate setting determines the operator-controlled target in Manual mode. Its effect depends on whether PID control is enabled:

- **PID Disabled**: the Manual Pump Flow Rate is scaled linearly to the 4-20 mA output with no feedback correction. The output tracks this value directly.
- **PID Enabled**: the Manual Pump Flow Rate becomes the PID setpoint. The controller adjusts the output to drive the measured glycol flow toward that target using closed-loop feedback.

The **Pump Flow Rate Min** and **Pump Flow Rate Max** settings define the hard output limits of the system — the pump output will never be driven below Min or above Max regardless of the calculated or operator-set target. These settings determine the position for the Drive to Min and Drive to Max fail safe modes.

A second pump (Pump 2) speed output (Section 4.18) tracks the same calculated flow rate as Pump 1. The discrete enable outputs for Pump 1 and Pump 2 (Sections 4.15 and 4.16) must be configured separately to energize each pump.

ITEM	DETAILS
Output Type	4-20 mA (sourced), ±0.1 mA accuracy
Configuration Path	Settings > Outputs > Pump Flow Rate
Connection Terminals	37 (OUT), 38 (GND)
Output Range	4 mA (Pump Flow Rate Min) to 20 mA (Pump Flow Rate Max)

4.17.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
VFD or pump controller (4-20 mA input)	**Settings > Outputs > Pump Flow Rate** Pump Flow Rate Min/Max: per VFD speed range Flow Span Min/Max: per process	Section 6.2.6
PLC Analog Input (echo/monitoring)	**Settings > Outputs > Pump Flow Rate** Pump Flow Rate Min/Max: per PLC scaling	Section 6.2.7

Installation Notes:

1. The 4-20 mA output GND terminal (terminal 38) must be connected back to the local power return to ensure proper output functionality.

4.18 PUMP 2 SPEED (4-20 MA)

4.18.1 DETAILS

The Pump 2 Speed output is a 4-20 mA analog output that drives the glycol circulation of a second pump (VFD, pump controller, control valve, or similar). It operates identically to the Pump 1 Speed output (Section 4.17.1), including all scaling, PID, Manual mode, and fail-safe behavior.

This output is only active when the **Pump 2 Enable** setting is Enabled. When Disabled, the output is held at 0 mA regardless of system state.

ITEM	DETAILS
Output Type	4-20 mA (sourced), ±0.1 mA accuracy
Configuration Path	Settings > Outputs > Pump Flow Rate > Pump 2 Enable
Connection Terminals	39 (OUT), 40 (GND)
Output Range	4 mA (Pump Flow Rate Min) to 20 mA (Pump Flow Rate Max)

4.18.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
VFD or pump controller (4-20 mA input)	**Settings > Outputs > Pump Flow Rate > Pump 2 Enable**: Enabled Pump Flow Rate Min/Max: per VFD speed range Flow Span Min/Max: per process	Section 6.2.6
Not Used	**Settings > Outputs > Pump Flow Rate > Pump 2 Enable**: Disabled	N/A

Installation Notes:

1. The 4-20 mA output GND terminal (terminal 40) must be connected back to the local power return to ensure proper output functionality.

4.19 FLASH BP OUTPUT (4-20 MA)

4.19.1 DETAILS

Note: The Flash BP (Back Pressure) output is currently not implemented. The hardware terminal is present on all PF2200-GP control cards. Software support will be enabled in a future firmware release.

4.20 RUN STATUS CONTACT

4.20.1 DETAILS

The Run Status Contact is a normally open, Form-A dry contact relay output that closes whenever the system is in a running state (Auto or Manual mode). It opens when the system is stopped (Lockout, Alarm, Ready, Confirm Start, or Waiting). This contact can be used to drive external status indicators or interlock other equipment with the controller run state.

ITEM	DETAILS
Output Type	Form-A relay contact (normally open)
Connection Terminals	25 (A), 27 (B) — Terminal 26 not used
Closed When	System is RUNNING (Auto or Manual mode)
Open When	System is STOPPED (Lockout, Alarm, Ready, Confirm Start, Waiting)

4.20.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
AC status indicator lamp	None required	Section 6.2.9
DC status indicator	None required	Section 6.2.10
External relay	None required	Section 6.2.12
Controller-powered indicator	None required	Section 6.2.11

Warning: 120VAC wiring should be installed by a qualified electrician.

4.21 CONTROLLER POWER INPUT

4.21.1 DETAILS

The PF2200-GP is powered by a $12V_{DC}$ or $24V_{DC}$ Class 2 power supply. The **Voltage Setting** must be configured to match the supply voltage during commissioning. An optional **Voltage Restart** feature can be enabled to automatically restart the system after a low or high voltage event has cleared.

ITEM	DETAILS
Input Voltage	12V Mode: 10.2–16.2 V_{DC} • 24V Mode: 20.4–32.4 V_{DC}
Maximum Current	10A
Power Supply Required	Class 2 (CSA 22.2 No 1-15 or NFPA 70)
Connection Terminals	30 (−), 31 (+) — primary; 28/29 (−), 32 (+) — additional terminals
Configuration Path	Settings > Setup > System (Voltage Setting: 12V or 24V)

4.21.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
12VDC Class 2 power supply	**Settings > Setup > System** Voltage Setting: 12V	Section 6.2.13
24VDC Class 2 power supply	**Settings > Setup > System** Voltage Setting: 24V	Section 6.2.13

Installation Notes:

1. The PF2200 must be powered from a listed Class 2 power supply, as required by NFPA 70 Article 725 (NEC) and CSA C22.1 (CEC).

5 OPERATING SEQUENCE

The PF2200-GP operates as a hierarchical state machine. At the top level, the system is either **STOPPED** or **RUNNING**.

The **Mode** (Auto or Manual) determines how the pump output is calculated when the system is running:

- **Auto Mode:** The controller calculates the target glycol circulation rate from the measured gas temperature, gas pressure, gas flow rate, and the configured Glycol To Water Ratio. The PID loop, when enabled, drives the pump output to match this calculated target using glycol flow feedback.
- **Manual Mode:** The operator specifies a fixed target pump flow rate. The PID loop, when enabled, drives the pump output to maintain this setpoint using glycol flow feedback.

Auto mode requires a valid water content temperature source (Primary TC/RTD or Auxiliary 4-20 mA), a configured Gas Pressure input, and a configured Gas Flow Rate input — all active and within range. If these requirements are not met, the system enters Manual mode. If configured inputs become unavailable while running, the system will alert based on the configured fail-safe mode for each input.

The **system states** in order are shown below. States 0–4 correspond to the STOPPED condition; states 5–7 correspond to the RUNNING condition.

VALUE	STATE	DESCRIPTION
0	Lockout	Fault requiring manual acknowledgement before restart
1	Alarm	Recoverable fault; system stopped
2	Power On	Startup initialization
3	Ready	No active alarms; awaiting start command
4	Confirm Start	UI start confirmation in progress
5	Waiting	Running; one or more Wait conditions active, pump at fail-safe
6	Auto	Running; output calculated from process conditions
7	Manual	Running; output set to operator-configured flow rate

The current system state is readable via Modbus register 3000 (Controller State).

5.1 POWER ON STATE

When power is applied to the PF2200-GP, the system enters the **Power On** state. During this state, the controller performs internal hardware and firmware startup checks including memory integrity verification, cross-compare initialization, and settings CRC validation. The pump output is held at 4 mA (minimum) during Power On.

Entry: Power is applied to the controller.

Checks performed:

- Factory calibration integrity
- Settings CRC verification
- Firmware descriptor validation

- Cross-compare processor synchronization
- Ambient temperature sensor validation

Exit to Ready: All startup checks pass and no alarm conditions are present. **Exit to Alarm:** A recoverable alarm condition is detected during startup. **Exit to Lockout:** A non-recoverable fault is detected during startup. **Auto-restart:** If **Voltage Restart** is enabled and the system was running at the time of power loss, the system will restart automatically upon completing Power On checks, bypassing the Ready state.

LED: Cycles Green → Amber → Red during initialization.

5.2 LOCKOUT STATE

The **Lockout** state is entered when a fault condition requiring manual acknowledgement is detected. While in Lockout, all running functions are suspended and the system cannot restart until the operator acknowledges the shutdown. Lockout conditions typically indicate internal hardware faults, corrupted firmware, or other failures that require human intervention before operation can resume.

Entry: A Lockout-class alarm condition is detected in any state.

Behavior while in Lockout:

- Powered discrete outputs (pump enable) are de-energized.
- Pump speed output (4-20 mA) is set to 4 mA (0%).
- The reason for shutdown is displayed on the Lockout screen and logged to the event log.
- The system cannot be started by any means (UI, Modbus, or Start discrete input).
- The LED flashes Red (fast).

Recovery: The operator must acknowledge the shutdown by:

1. Identifying and resolving the root cause of the Lockout alarm.
2. Pressing STOP on the keypad, or writing 4321 to Modbus register 99 (Start/Stop Register), or writing 1 to Modbus register 142 (Clear Shutdown Code).
3. The system transitions to Ready state if no alarm conditions are present, or to Alarm state if recoverable alarm conditions remain.

5.3 ALARM STATE

The **Alarm** state is entered when a recoverable alarm condition is detected. While in Alarm, the pump is always fully stopped — discrete outputs are de-energized and the pump speed output is set to 4 mA (0%).

Entry: A recoverable alarm condition is detected in any state.

Behavior while in Alarm:

- Powered discrete outputs (pump enable) are de-energized.
- Pump speed output (4-20 mA) is set to 4 mA (0%).
- All active alarms are displayed on the Status Screen and logged to the event log.
- The system cannot be started until all alarm conditions have cleared.
- The LED flashes Red (slow).

Recovery: When all alarm conditions have cleared, the system transitions back to the Ready state automatically.

5.4 READY STATE

The **Ready** state indicates that no alarm conditions are active and the system is awaiting a start command. Warnings and wait conditions may be present but do not prevent the system from being started. The pump output is held at 4 mA (minimum) while in Ready.

Entry: Power On checks pass with no alarms; or all alarm conditions clear from Alarm state.

Behavior while in Ready:

- Pump output held at 4 mA.
- Active warnings are displayed but do not prevent starting.
- The LED is solid Red.

Start Sources: The system can be started from the Ready state by any of three sources:

1. **UI:** Press the OK button on the keypad.
2. **Modbus:** Write decimal 1234 to register 99 (Start/Stop Register). Requires **Remote Access** setting to be Enabled.
3. **Start Discrete Input:** Complete the 3-step energize → de-energize → re-energize sequence, with each state held for a minimum of 500 ms and both transitions completing within a 30-second window (requires Remote Start setting to be Enabled).

Exit to Confirm Start: The OK button is pressed on the UI keypad. See Section 5.5. **Exit to Waiting:** A start command is received from Modbus or the Start Discrete Input AND one or more Wait conditions are active. **Exit to Auto/Manual:** A start command is received from Modbus or the Start Discrete Input AND no Wait conditions are active. The system enters Auto if all Auto mode requirements are met; otherwise Manual.

5.5 CONFIRM START STATE

The **Confirm Start** state is a transient state entered when the OK button is pressed on the UI keypad. The system displays a confirmation screen and waits for the operator to confirm before proceeding. The system will remain in this state for 10 seconds before timing out.

Entry: The OK button is pressed on the UI keypad while in Ready state.

Behavior while in Confirm Start:

- Pump output held at 4 mA.
- System awaits operator confirmation on the UI.
- The LED is solid Red.

Exit to Waiting: The operator confirms the start AND one or more Wait conditions are active. **Exit to Auto/Manual:** The operator confirms the start AND no Wait conditions are active. The system enters Auto if all Auto mode requirements are met; otherwise Manual. **Exit to Ready:** The operator cancels, or the confirmation times out. **Exit to Alarm:** An alarm condition develops before confirmation is complete.

Starts from Modbus or the Start Discrete Input bypass this state and proceed directly to Waiting or Auto/Manual.

5.6 WAITING STATE

The **Waiting** state is entered after a start command when one or more Wait conditions are active. Wait conditions are triggered when inputs configured with a fail-safe action enter their fail-safe state. The system drives the pump to the configured fail-safe position and waits for all Wait conditions to clear.

Entry: A start command is accepted AND one or more Wait conditions are active; OR a Wait condition develops while the system is transitioning through the start sequence.

Behavior while in Waiting:

- Pump output driven to the configured fail-safe position of the active Wait condition(s). If two or more active Wait conditions specify conflicting fail-safe actions, the system shuts down (see Section 5.10).
- All active Wait conditions are displayed on the Status Screen.
- The LED flashes Green (no warnings) or Amber (warnings present).

Exit to Auto/Manual: All Wait conditions clear. The system enters Auto if all Auto mode requirements are met; otherwise Manual. **Exit to Lockout:** A Lockout-class alarm condition develops, or a Stop command is received.

Wait Conditions: See Section 10.2 for a complete list of Wait conditions and their trigger criteria.

5.7 AUTO STATE

The **Auto** state (state 6) is the primary running state. The controller calculates the target glycol circulation rate from measured process conditions. When PID is enabled and a valid glycol flow signal is available, the PID controller drives the pump output to match the calculated target; otherwise the calculated rate is mapped linearly to the output.

Entry: A start command is accepted (or Wait conditions clear) AND the **Manual Mode Enable** setting (address 1200) is Disabled.

Control algorithm:

Glycol Circulation Rate = (Calculated Water Content − Water Content Setpoint) × Gas Flow Rate × Glycol To Water Ratio

Where:

- **Calculated Water Content** is estimated from the measured gas temperature and gas pressure using industry-standard equilibrium curves.
- **Water Content Setpoint** is the target outlet water content (configured as **Target Outlet Water Vapor Content**, address 1198).
- **Gas Flow Rate** is the measured volumetric flow rate from the Gas Flow Rate input.
- **Glycol To Water Ratio** (address 1196) is the configured circulation ratio.

Behavior while in Auto:

- Output clamped to Pump Flow Rate Min/Max bounds.
- When PID is enabled and glycol flow feedback is available, the PID controller drives the output to match the calculated target.
- The **Pump Output Offset** (address 1194) applies a fixed percentage bias to the calculated output.
- The LED is solid Green (no warnings) or Amber (warnings present).

Exit to Waiting: A Wait condition becomes active. **Exit to Lockout:** A Lockout-class condition develops.

5.8 MANUAL STATE

The **Manual** state (state 7) is entered when the **Manual Mode Enable** setting (address 1200) is Enabled. The only transition between Auto and Manual is a change to this setting — there is no runtime switching based on input availability.

Entry: A start command is accepted (or Wait conditions clear) AND the **Manual Mode Enable** setting (address 1200) is Enabled.

Control: The pump output is driven to maintain the **Manual Pump Flow Rate** setpoint (address 1192, in glycol flow units). When PID is enabled and a valid glycol flow signal is available, the PID controller drives the output to match this setpoint; otherwise the setpoint is mapped linearly to the output.

Behavior while in Manual:

- Output clamped to Pump Flow Rate Min/Max bounds.
- When PID is enabled and glycol flow feedback is available, the PID controller drives the output to match the Manual Pump Flow Rate setpoint.
- The **Pump Output Offset** (address 1194) applies a fixed percentage bias to the calculated output.
- The LED is solid Green (no warnings) or Amber (warnings present).

Exit to Waiting: A Wait condition becomes active. **Exit to Lockout:** A Lockout-class condition develops.

5.9 PID CONTROL PARAMETERS

The PID controller is an anti-windup implementation that applies to both Auto and Manual modes when enabled. It is active only when **PID Enable** is set to Enabled and a valid glycol flow feedback signal is available.

PARAMETER	DESCRIPTION
PID Enable	0 = Disabled; 1 = Enabled
Proportional Band	Proportional gain band in glycol flow units
Integral Time	Integral time constant in minutes/repeat
Derivative Time	Derivative time constant in minutes
Integral Reset Range	Range around the setpoint within which error accumulates
Output Rate Limit	Maximum rate of output change in %/second
Ramp Time	Startup ramp time in seconds

The pump output is clamped to the range defined by **Pump Flow Rate Min** and **Pump Flow Rate Max** (configured in glycol flow units). The **Pump Output Offset** applies a fixed percentage bias to the output and will not drive the output outside the Min/Max limits.

5.10 FAIL-SAFE CONFLICT RESOLUTION

If two or more active Wait conditions specify conflicting fail-safe actions (e.g., one requires Drive to Min and another requires Drive to Max), the controller cannot determine a safe output position. In this case:

- The system logs alarm AL111 (Conflicting Fail Safes Tripped).

- The system immediately stops.
- The pump output is driven to 4 mA.

Any combination of Stop actions from multiple inputs always results in a system stop, regardless of other active fail-safe actions.

6 INSTALLATION

Warning: Failure to provide a low-impedance path from the field instrumentation to the PF2200 may result in electric shock, product damage, or erroneous readings.

Installers and commissioners of the PF2200-GP system must:

- Understand local codes and how they apply to the installation (for both electrical and mechanical aspects of the installation).
- Understand the electrical and mechanical limitations of the product and how that relates to the installation.
- Understand the safety and operational effects of modifying system settings or wiring.
- Be fluent in the English language (the only language this product supports).

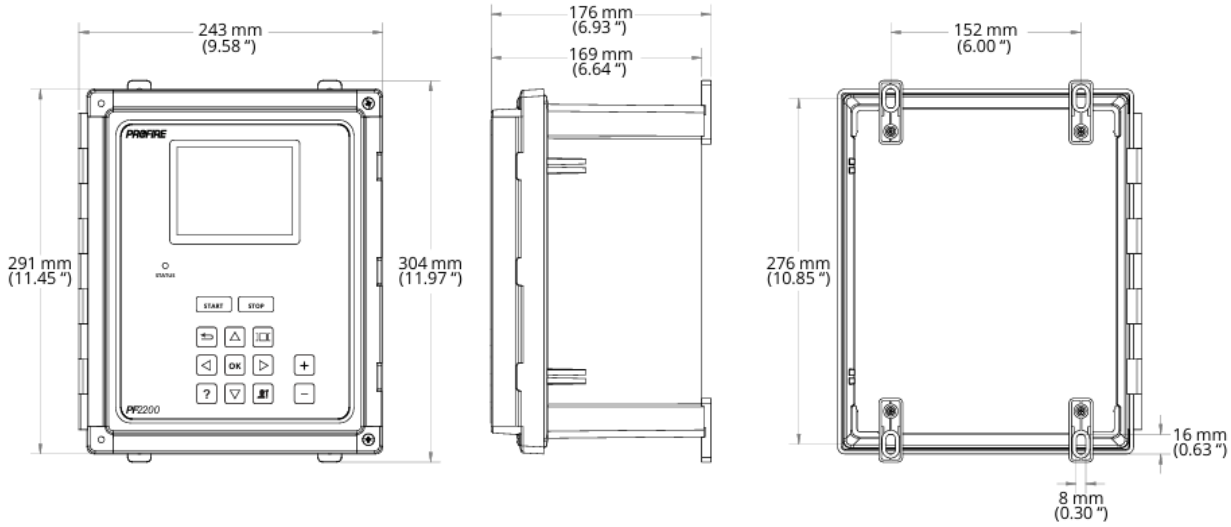
6.1 MOUNTING CONSIDERATIONS

The enclosure should be mounted:

- Upright in such a way that the screen is clearly visible and the keypad is easy to access. Recommended mounting height is 1.5m (5ft) above ground.
- Near to the process equipment being controlled in order to minimize cable run lengths to transmitters, sensors, and the pump drive.
- In such a way as to avoid direct sunlight exposure on the screen. Extended UV exposure may compromise viewability.
- Such that the enclosure door can be fully opened during maintenance and commissioning.

6.1.1 PF2200-GP-B POLYCARBONATE ENCLOSURE DIMENSIONS

ITEM	PF2200-GP-B
Material	Polycarbonate
Type Rating	Type 4/4X
Ingress Protection Rating	IP66
Dimensions	291mm x 243mm x 176mm (11.5" x 9.6" x 6.9")
Weight	2.7 kg / 5.9 lbs



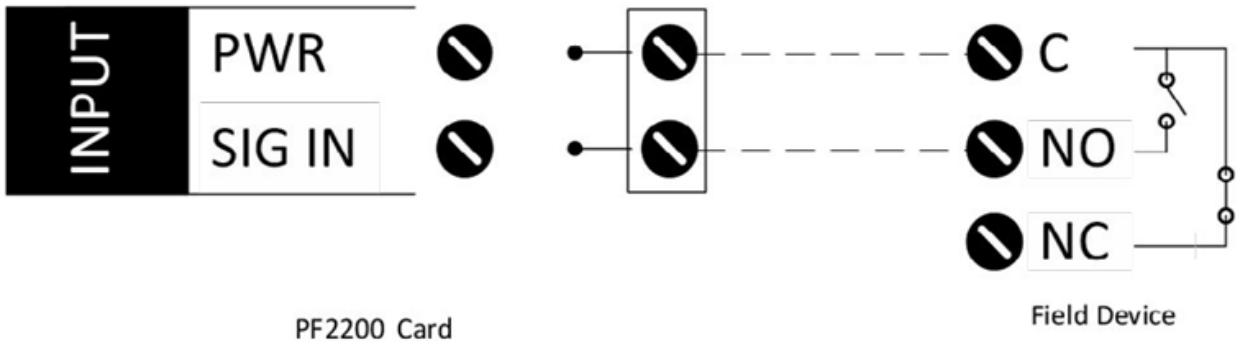
6.2 CONNECTION DIAGRAMS

Caution: Electrical devices connected to the controller must meet local electrical codes and be within the voltage limits specified in this manual.

Caution: All field wiring must be properly fused and sized in accordance with local codes.

Caution: Wires must be installed such that the connection does not rely on the structural integrity of the wire insulation, and that no more than one conductor is terminated in a single terminal.

6.2.1 DIGITAL INPUT – DRY CONTACT

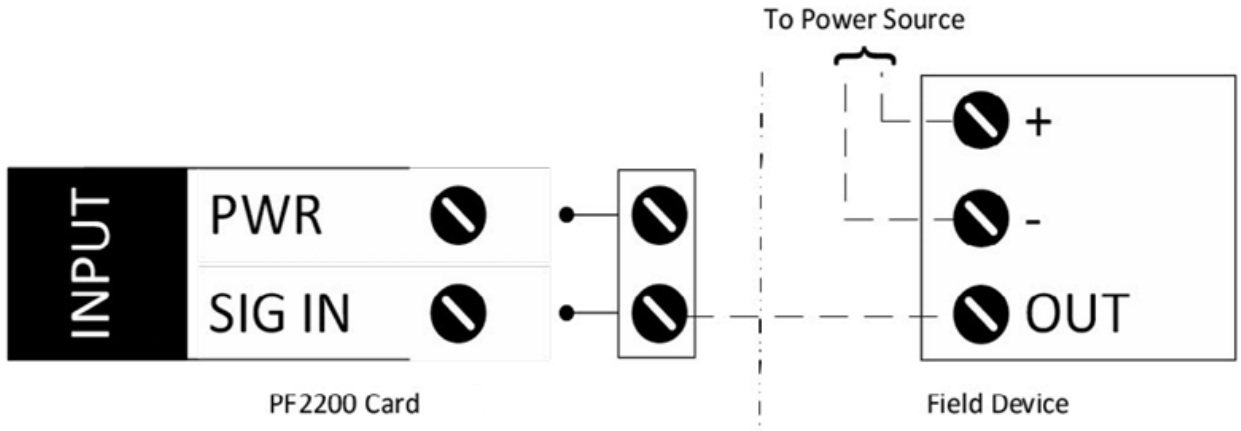


The diagram shows connections between the "PF2200 Control Card" and a "Field Device" (switch with C, NO, NC terminals). PWR terminal on the control card connects to the C (Common) terminal; SIG IN connects to NO (Normally Open). The NC terminal is unconnected.

Installation Notes:

1. The control card uses energized-to-run logic for all digital inputs.
2. PWR terminal output matches system voltage input up to 13.5V.

6.2.2 DIGITAL INPUT – WET CONTACT

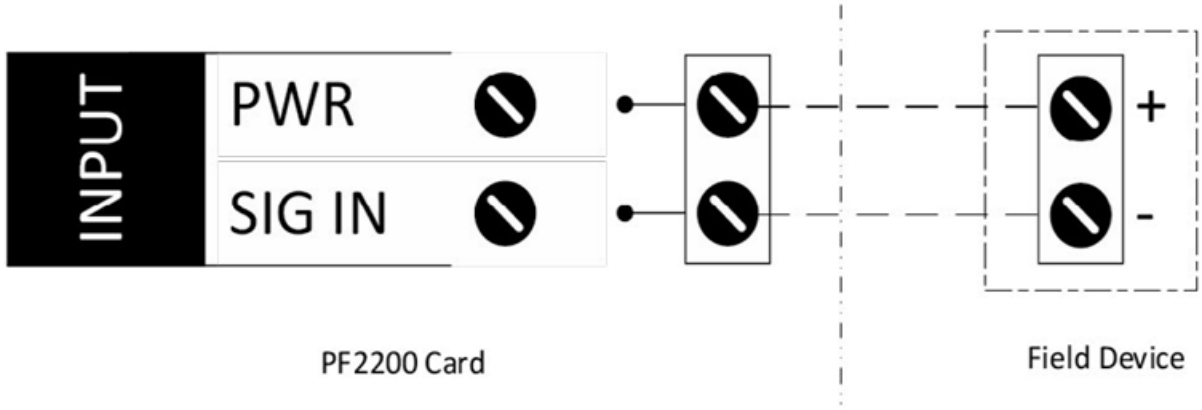


The diagram shows connections between the "PF2200 Control Card" and a "Field Device" with an external power source. SIG IN connects to the device output. The PWR terminal on the control card is unconnected.

Installation Notes:

1. The control card uses energized-to-run logic for all digital inputs.
2. External power source must be referenced about the control card Power In (−) terminal such that the supplied voltage (1) does not exceed $30V_{DC}$ with reference to Power In −, and (2) does not drop below −0.5V with reference to Power In −.

6.2.3 ANALOG INPUT – LOOP POWERED 4-20 MA TRANSMITTER

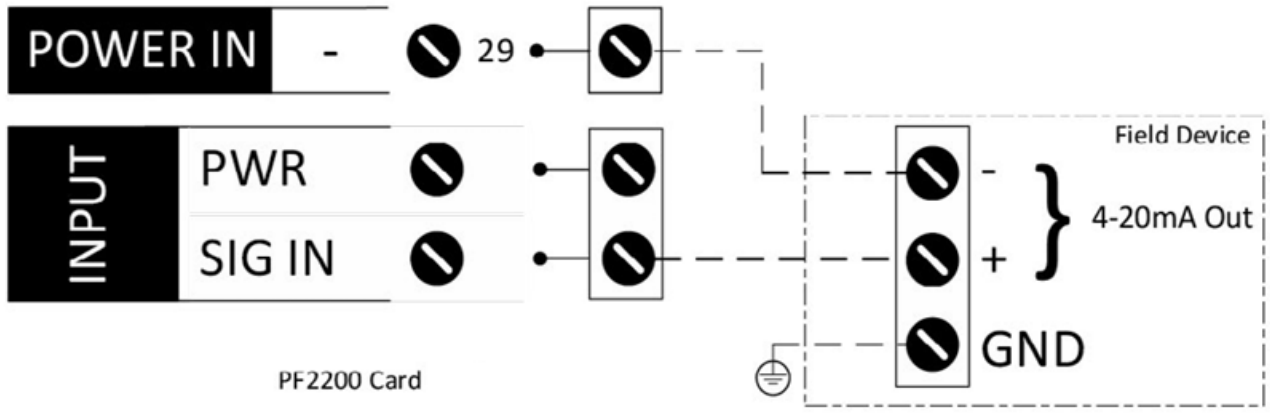


The diagram shows connections between the "PF2200 Control Card" and a "Field Device" transmitter. PWR connects to the transmitter (+); SIG IN connects to transmitter (−).

Installation Notes:

1. PWR terminal output matches system voltage input up to 13.5V.
2. Use the following formula to determine the required minimum transmitter operating voltage: $V_{IN} - V_{DROP}$ where V_{IN} = system input voltage up to a maximum of 13.5V; V_{DROP} = voltage drop at 20mA as specified in the ratings table (Section 2.1.4).

6.2.4 ANALOG INPUT – SELF-POWERED 4-20 MA TRANSMITTER

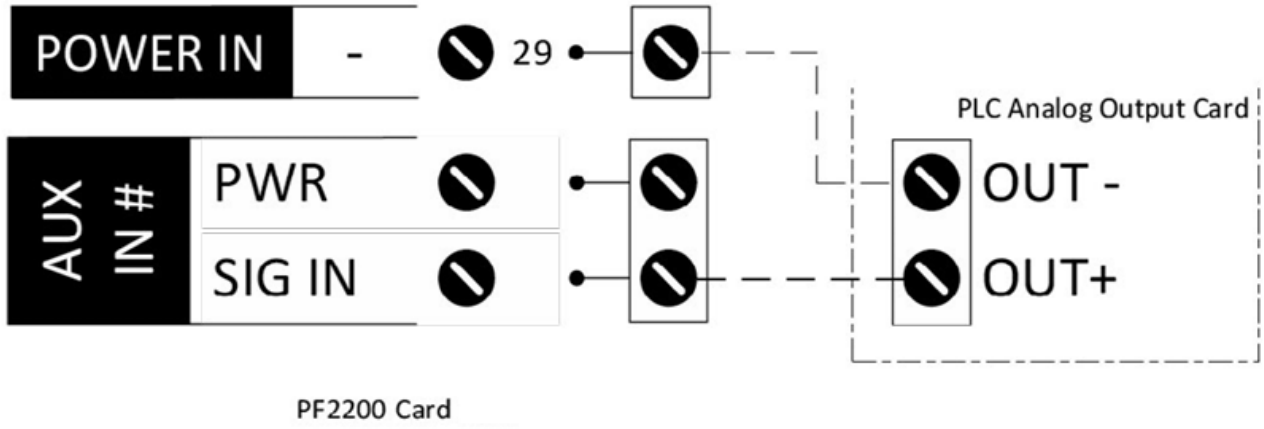


SIG IN connects to the transmitter 4-20 mA output. The transmitter has its own power source.

Installation Notes:

1. Power source must be referenced about the control card Power In (−) terminal such that the supplied voltage does not exceed $30V_{DC}$ and does not drop below −0.5V with reference to Power In −.

6.2.5 ANALOG INPUT – INPUT FROM PLC

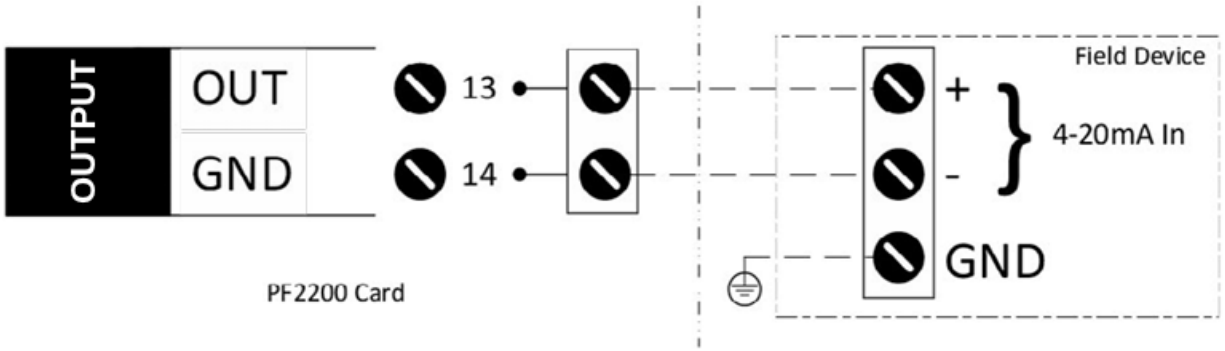


SIG IN connects to the PLC Analog Output Card OUT+. The PLC power source references the control card Power In (−).

Installation Notes:

1. PLC power source must be referenced about the control card Power In (−) terminal such that the supplied voltage does not exceed $30V_{DC}$ and does not drop below −0.5V with reference to Power In −.

6.2.6 ANALOG OUTPUT – 4-20 MA PUMP SPEED



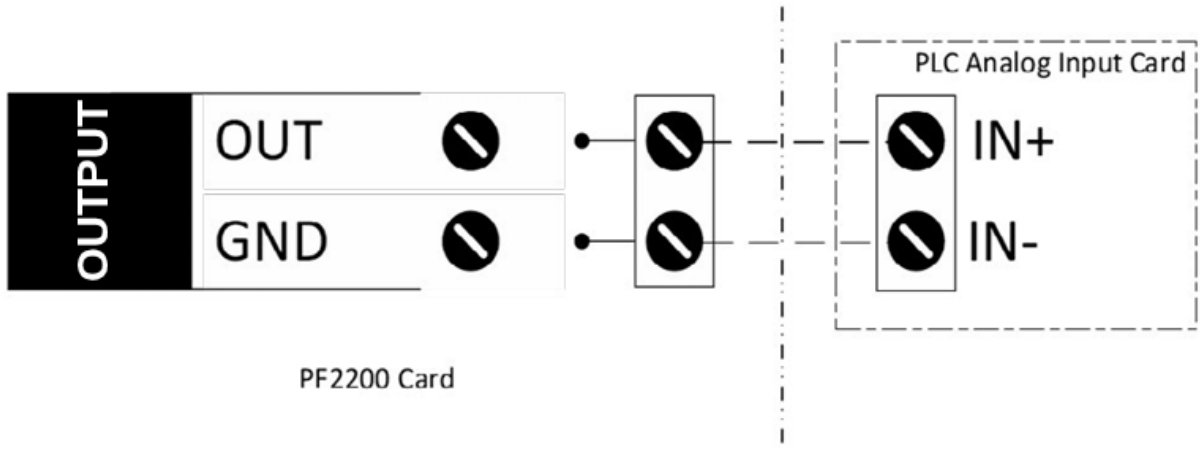
PUMP 1 SPEED OUT (terminal 37) connects to the VFD or pump controller 4-20 mA input (+). PUMP 1 SPEED GND (terminal 38) connects to the VFD or pump controller 4-20 mA return (−) and is also connected back to the control card Power In (−) rail.

PUMP 2 SPEED OUT (terminal 39) connects to the VFD or pump controller 4-20 mA input (+). PUMP 2 SPEED GND (terminal 40) connects to the VFD or pump controller 4-20 mA return (−) and is also connected back to the control card Power In (−) rail.

Installation Notes:

1. The 4-20 mA GND terminal must be run back to the control card Power In (−) terminal (local ground) to ensure proper output functionality.

6.2.7 ANALOG OUTPUT – 4-20 MA ECHO TO PLC



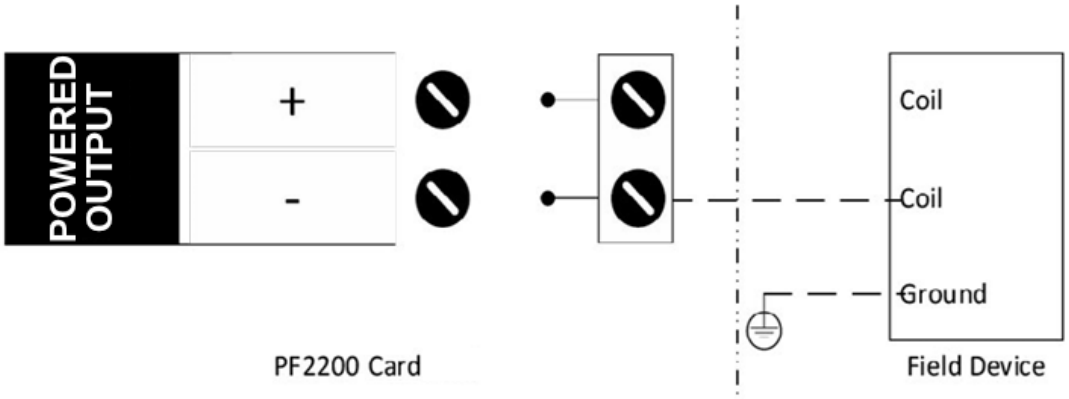
FLASH BP OUT (terminal 13) and FLASH BP OUT GND (terminal 14) are connected in series through the PLC analog input channel. GND must be connected to local ground.

Installation Notes:

1. The 4-20 mA GND terminal must be run back to the control card Power In (−) terminal (local ground) to ensure proper output functionality.

6.2.8 DISCRETE OUTPUT – PUMP ENABLE

Caution: Do not connect the discrete output minus (–) terminal to ground. The minus (–) terminals are not grounded.



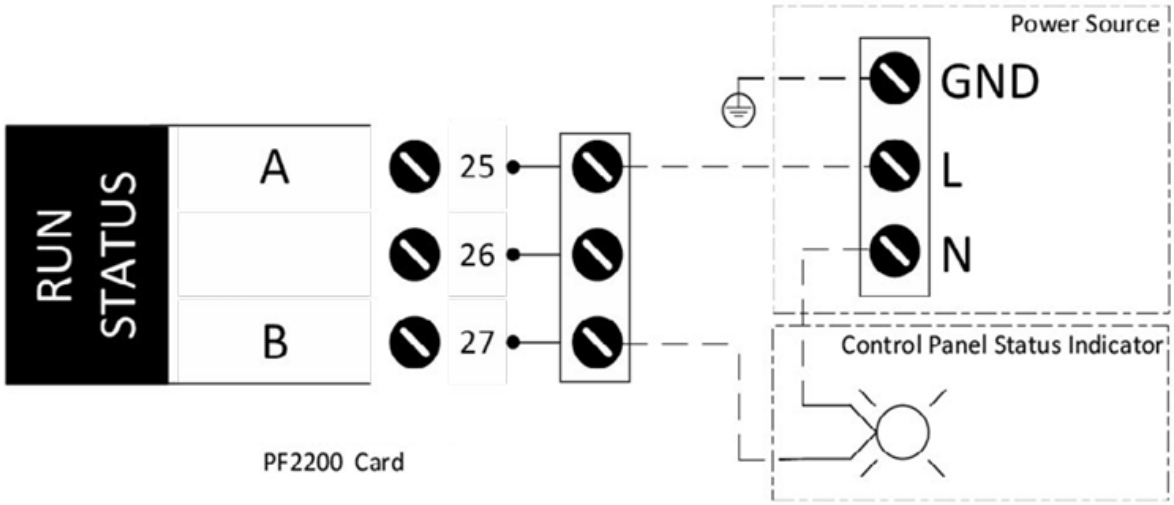
PUMP 1 discrete output terminals 19 (+) and 20 (–) connect to the pump coil, relay input, or drive enable terminals. For Pump 2, use terminals 21 (+) and 22 (–) with the same wiring method.

Installation Notes:

1. A relay must be used when driving high-current motor loads directly.
2. Configure Output PWM to 100% for resistive/inductive loads. Reduce PWM only for peak-and-hold type devices per their specification.

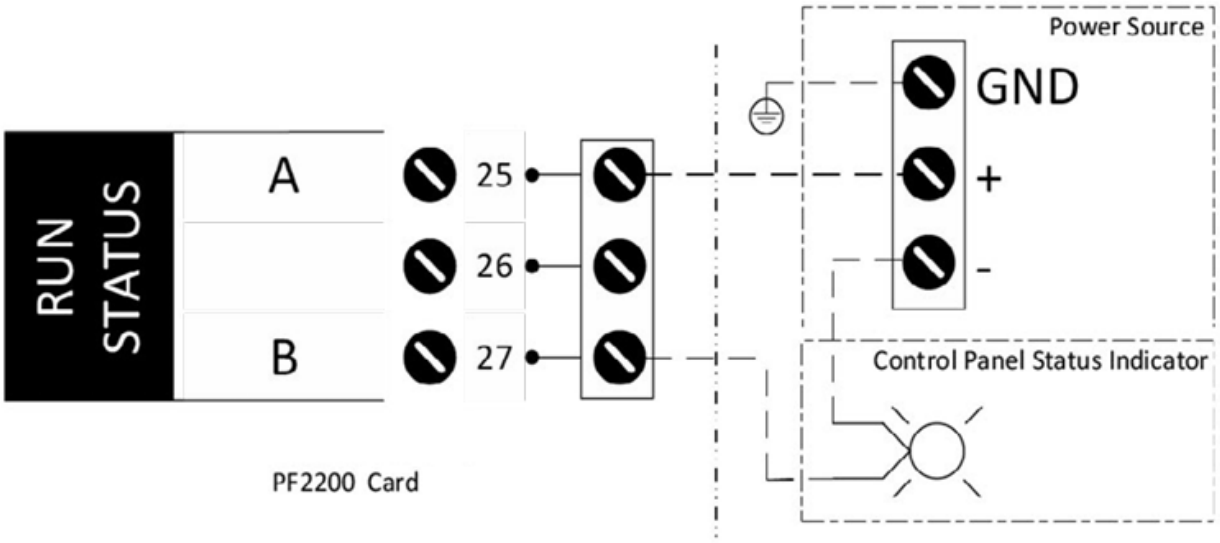
6.2.9 RUN STATUS – EXTERNAL AC SOURCE

Warning: 120VAC wiring should be installed by a qualified electrician.



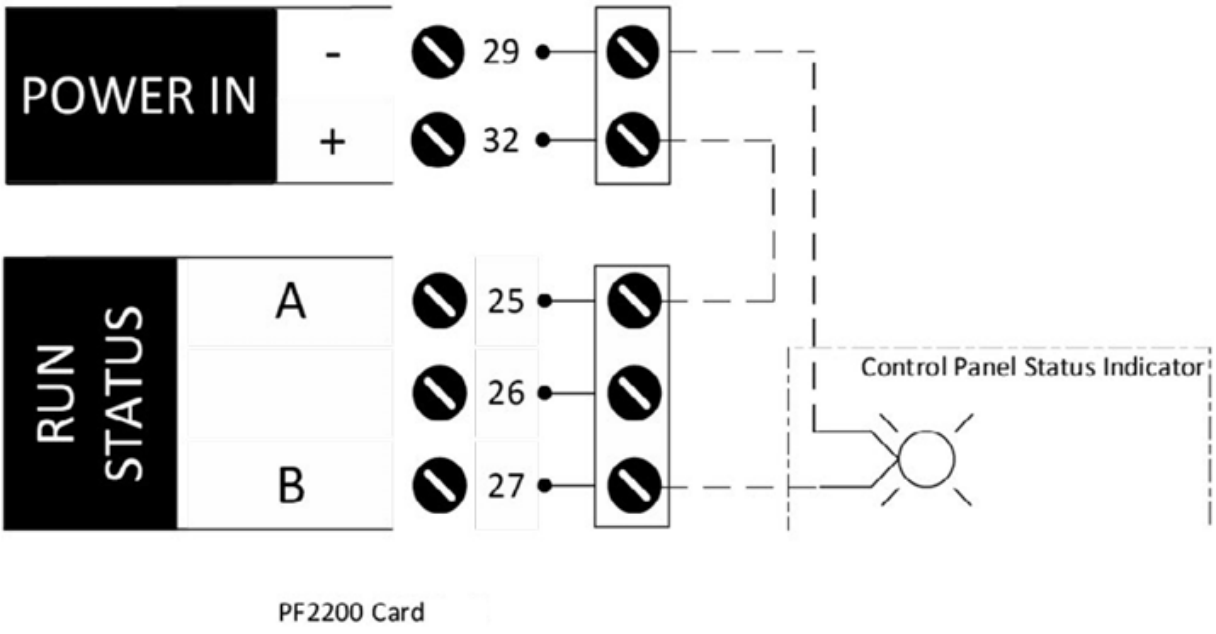
Run Status terminals A (25) and B (27) are wired in series with an external AC power source and status indicator lamp.

6.2.10 RUN STATUS – EXTERNAL DC SOURCE



Run Status terminals A (25) and B (27) are wired in series with an external DC power source and status indicator.

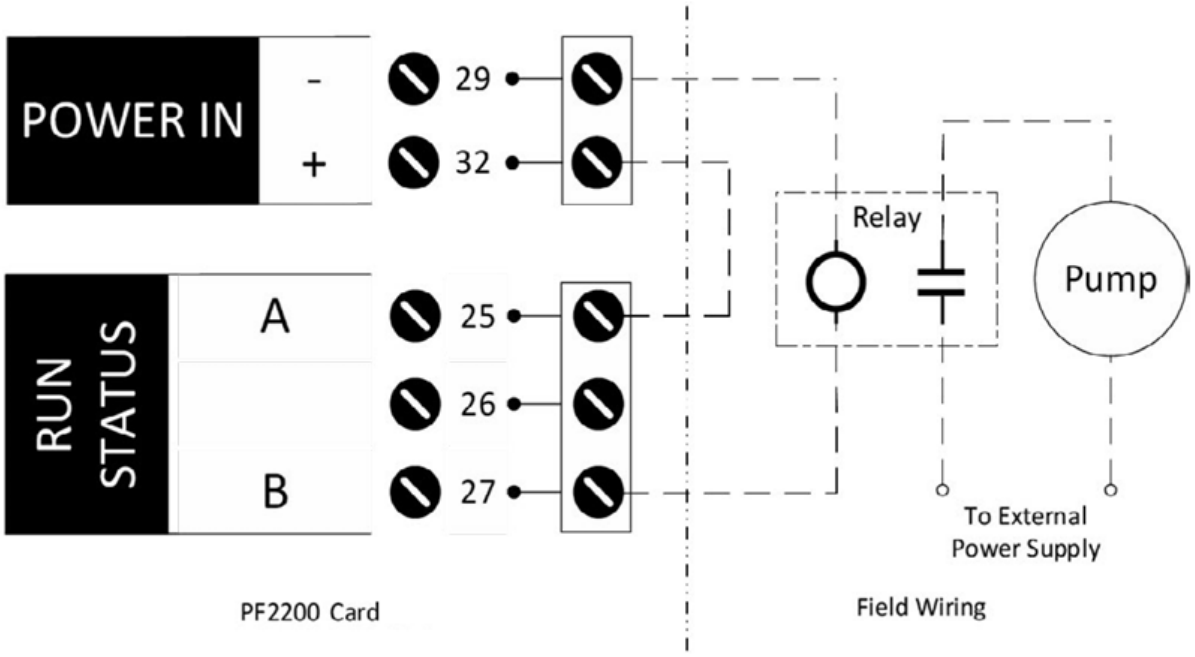
6.2.11 RUN STATUS – CONTROLLER POWER



Power In (+) connects to Run Status terminal A (25); Run Status terminal B (27) connects through the indicator back to Power In (−).

6.2.12 RUN STATUS – PUMP CONTROL

Warning: 120VAC wiring should be installed by a qualified electrician.

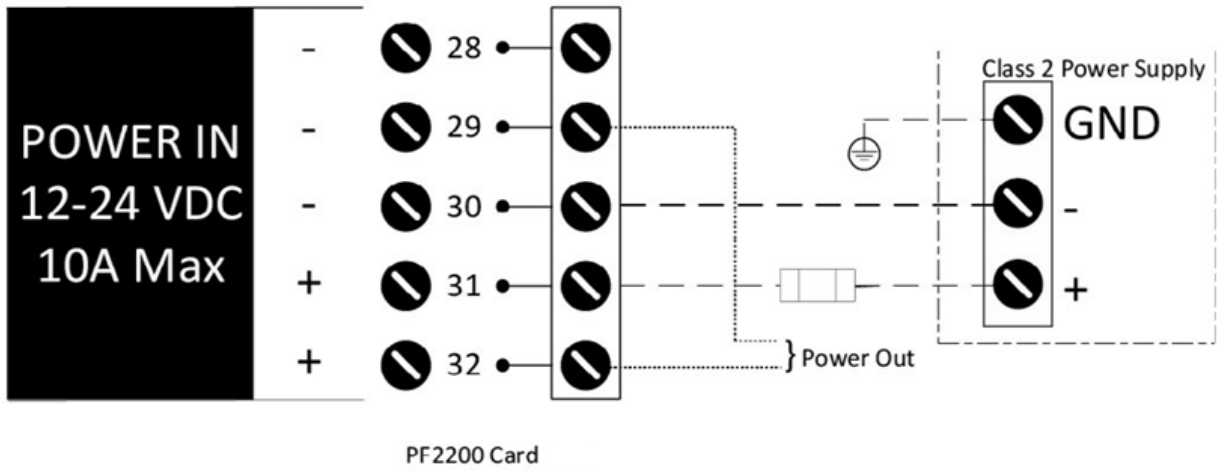


Run Status terminals are wired to an external relay that controls an AC pump and power supply.

Installation Notes:

1. A relay must be used to isolate the Run Status contact from high-transient currents associated with motors and pumps.

6.2.13 POWER INPUT WIRING

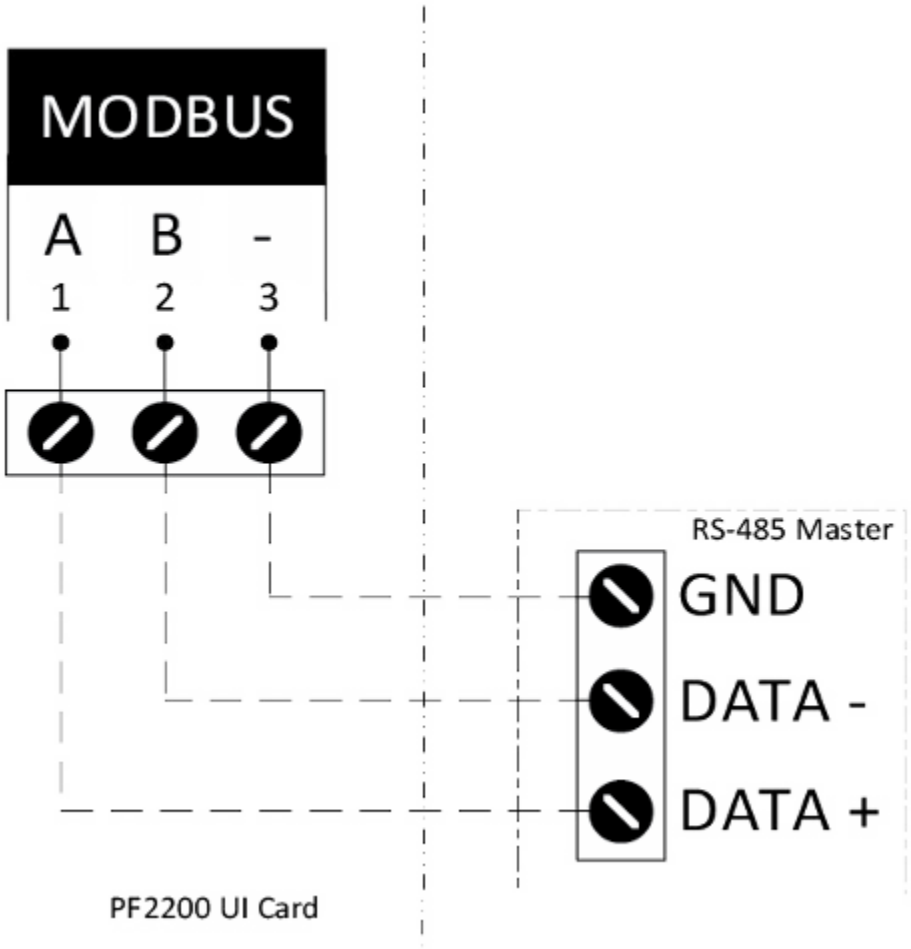


Power In (+) (terminal 31) and Power In (−) (terminal 30) connect to the 12VDC or 24VDC Class 2 power supply output terminals. Earth ground connects to the enclosure chassis.

Installation Notes:

1. The PF2200 must be powered from a Class 2 power supply as defined in the Canadian Electrical Code (CSA 22.2 No 1-15) or US National Electrical Code (NFPA 70).

6.2.14 MODBUS INPUT WIRING

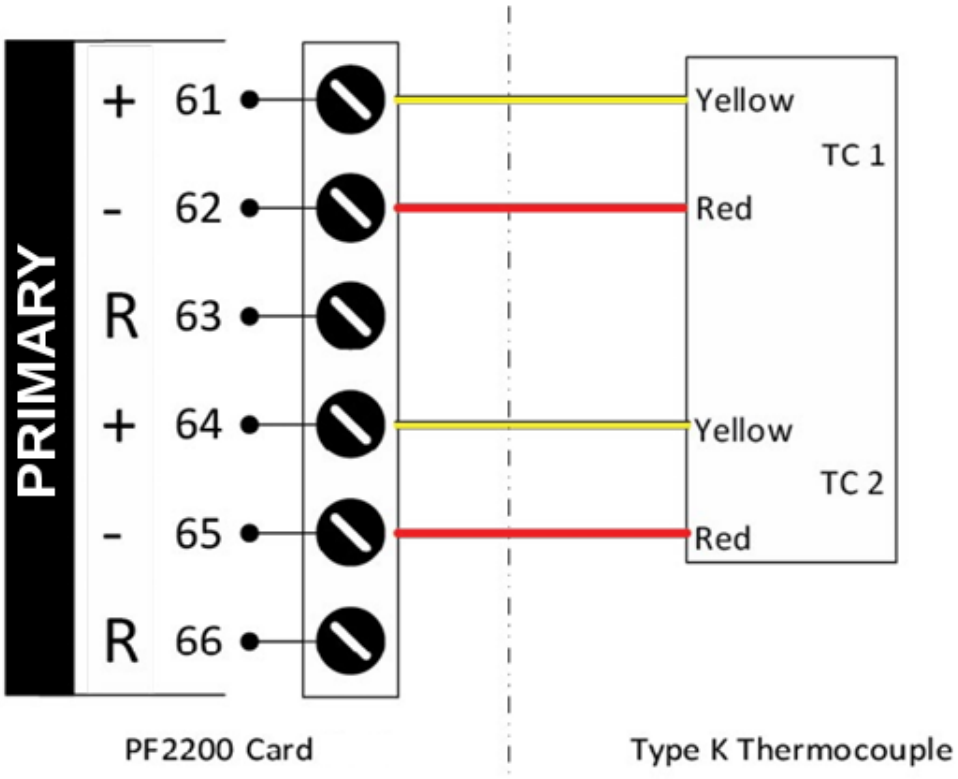


UI Card Modbus terminals: A (terminal 1, +), B (terminal 2, −), and − (terminal 3, reference). Wired to the Modbus master device A, B, and signal reference terminals respectively using shielded twisted-pair cable.

Installation Notes:

1. Use shielded twisted-pair cable rated for RS-485 communication (e.g., Belden 3106A or equivalent).
2. Terminate the RS-485 bus at both physical ends using 120Ω resistors. Enable termination via the Modbus Termination setting if the PF2200 is at a bus endpoint.
3. Maximum RS-485 bus length is 1200m (4000ft) at 9600 baud.

6.2.15 TEMPERATURE INPUT – DUAL TYPE K THERMOCOUPLE

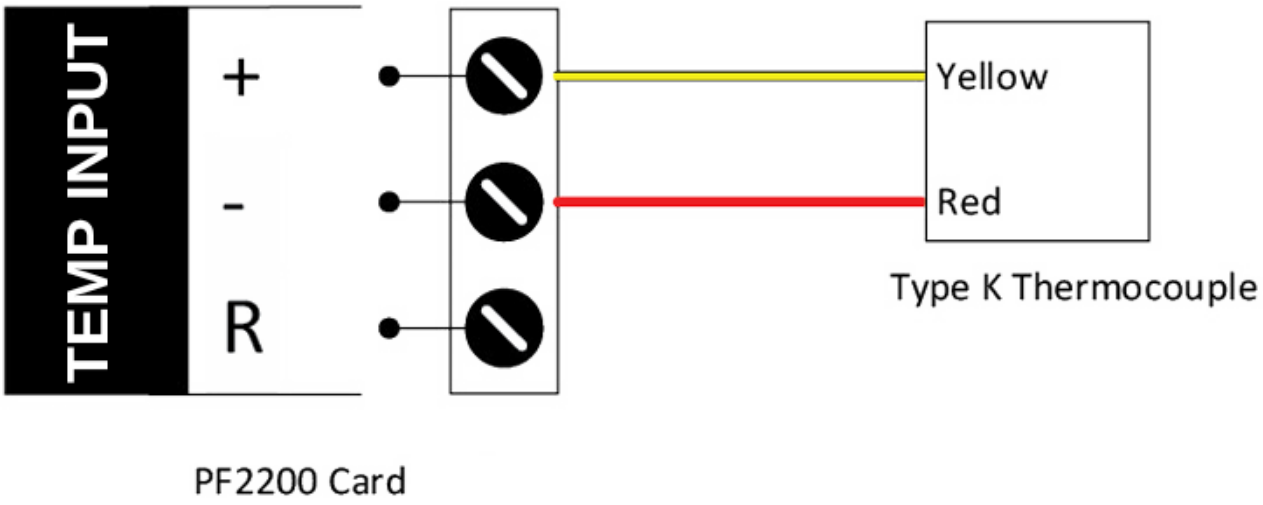


Primary Temp terminals: 61 (+), 62 (−) — Element 1; 64 (+), 65 (−) — Element 2. Thermocouple extension wire of matching alloy (Type K) must be used from the sensor to the controller terminals.

Installation Notes:

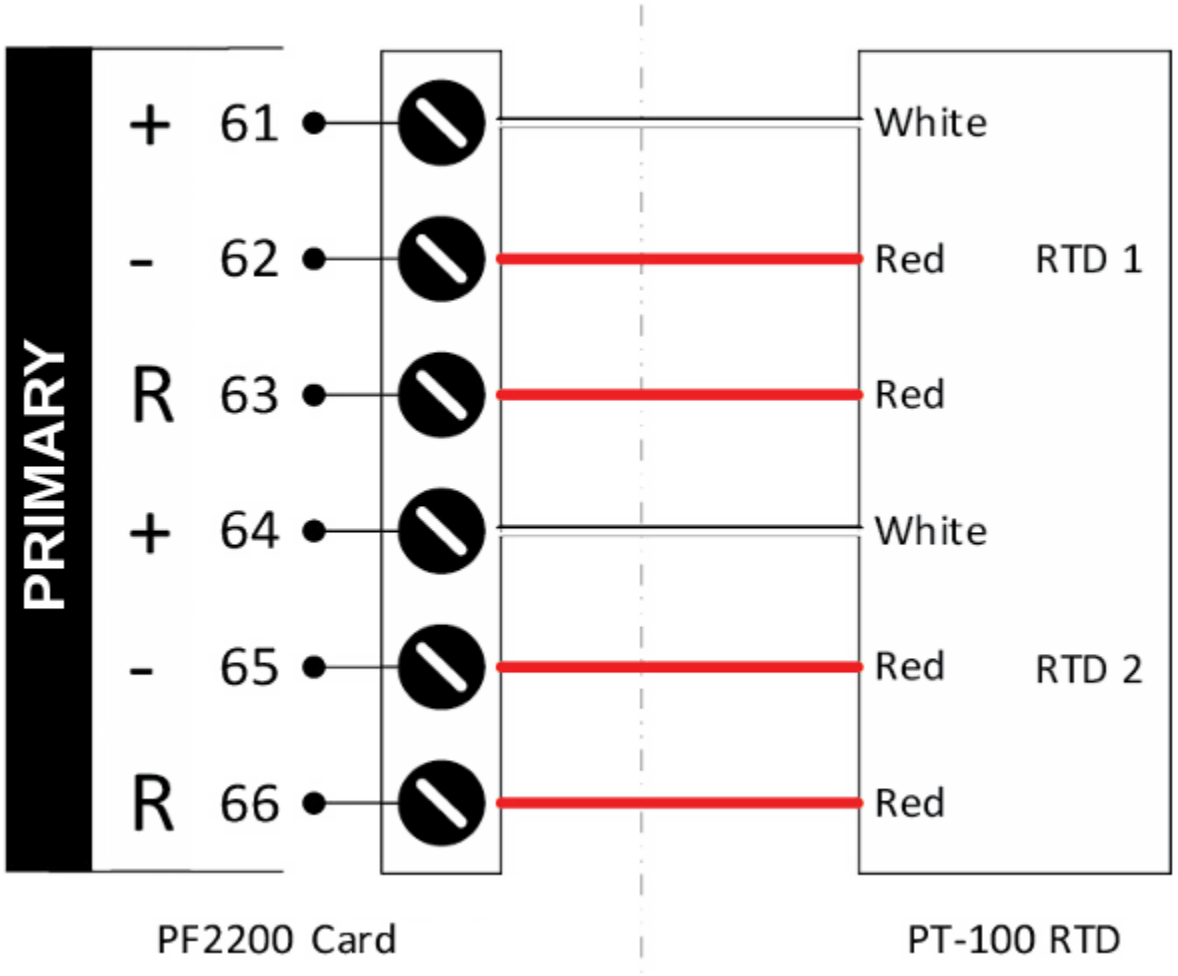
1. Use Type K thermocouple extension wire throughout the connection run. Do not substitute copper wire.
2. Thermocouple connections are polarity-sensitive; observe (+/−) markings.
3. Grounded thermocouples should not share a common ground with other field devices.

6.2.16 TEMPERATURE INPUT – SINGLE TYPE K THERMOCOUPLE



Primary Temp terminals: 61 (+), 62 (−) — Element 1 only. Element 2 terminals left unconnected.

6.2.17 TEMPERATURE INPUT – DUAL 3-WIRE RTD

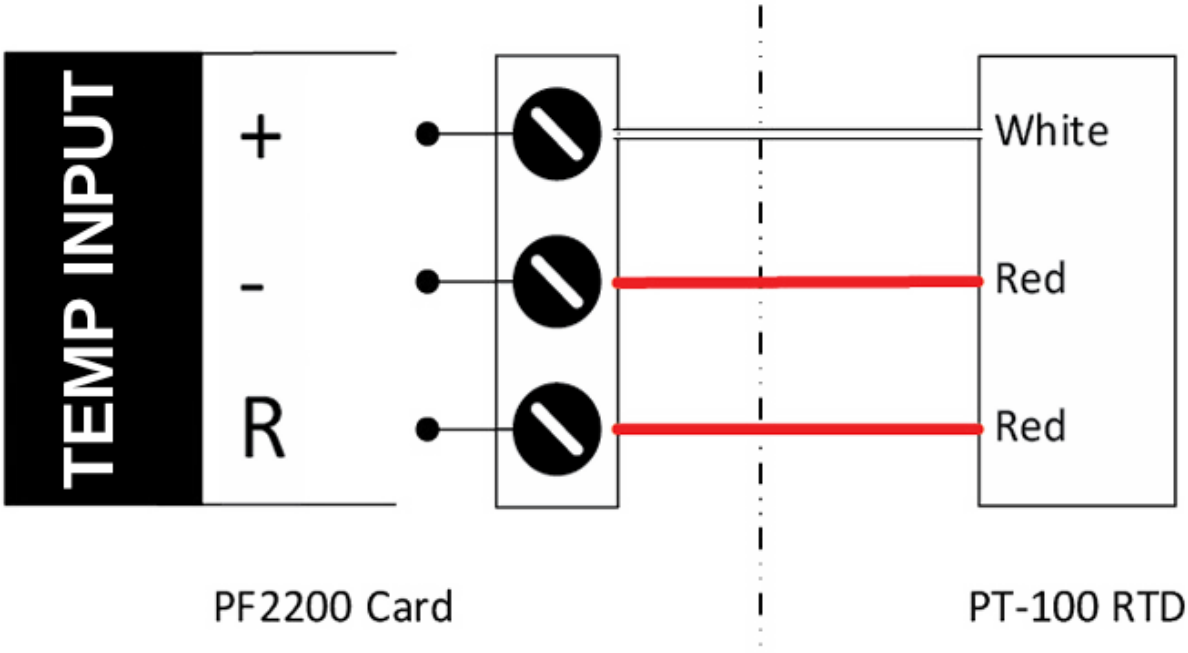


Primary Temp terminals: 61 (+), 62 (−), 63 (R) — Element 1; 64 (+), 65 (−), 66 (R) — Element 2.

Installation Notes:

1. Use matched-resistance lead wire for all three leads of each RTD element to preserve measurement accuracy.

6.2.18 TEMPERATURE INPUT – SINGLE 3-WIRE RTD



Primary Temp terminals: 61 (+), 62 (−), 63 (R) — Element 1 only.

7 SYSTEM CONFIGURATION

The System Configuration section describes all configurable settings available on the PF2200-GP. Settings are organized by functional group and are accessible via the Settings screen on the User Interface.

Each setting table includes the following columns:

- **Name:** Setting name as displayed in the UI.
- **Min / Max:** Minimum and maximum allowed values.
- **Default:** Factory default value.
- **Units:** Engineering units or enumeration options.
- **Security:** L1 (operator-accessible) or L2 (commissioning-only).

Settings marked L2 are only visible and modifiable in Commissioning Mode. Settings marked L1 are visible in Operator Mode and can be modified with the L1 password (if L1 Password Enable is set to Enabled).

7.1 TEMPERATURES

7.1.1 PRIMARY TEMPERATURE (TC/RTD)

The Primary Temperature group configures the contactor temperature sensor used for water content estimation. This input is ignored if the **Primary Aux Temp Override** is enabled.

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Primary Temp Type	0	1	0	0=TC, 1=RTD	L2
Primary Temp Enable	0	1	1	0=Disabled, 1=Enabled	L2
Primary Temp Input	0	1	0	0=Dual, 1=Single	L2
Primary Temp Fail Safe Mode	0	3	1	0=Stop, 1=Hold Last, 2=Drive to Min, 3=Drive to Max	L2
Primary Low Temp Setpoint	−40	1350	0	°C (°F)	L2
Primary High Temp Setpoint	−40	1350	90	°C (°F)	L2
Primary Temp Deadband	0	100	2	°C (°F)	L1
Primary Temp Offset	−100	100	0	°C (°F)	L1
Primary Temp Fail Safe Delay	2	20	2	Seconds	L2

7.1.2 AUXILIARY TEMPERATURE (4-20 MA)

The Auxiliary Temperature group configures the 4-20 mA temperature input. This group is active when **Primary Aux Temp Override** is set to Enabled and abides by the **Primary Temp Fail Safe Mode**, **Primary Low Temp Setpoint**, **Primary High Temp Setpoint**, **Primary Temp Deadband**, **Primary Temp Offset**, and **Primary Temp Fail Safe Delay** of 7.1.1. When enabled the Primary Temperature TC/RTD input is ignored.

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Primary Aux Temp Override	0	1	0	0=Disabled, 1=Enabled	L2
Primary Aux Temp Span Min	−100	1350	0	°C (°F)	L2
Primary Aux Temp Span Max	−100	1350	1350	°C (°F)	L2

Primary Aux Temp Span Min must be less than **Primary Aux Temp Span Max**. These values define the temperature corresponding to 4 mA and 20 mA of the transmitter signal respectively.

7.1.3 SECONDARY TEMPERATURE

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Secondary Temp Type	0	1	0	0=TC, 1=RTD	L2
Secondary Temp Enable	0	1	0	0=Disabled, 1=Enabled	L2
Secondary Temp Fail Safe Mode	0	4	1	0=Stop, 1=Hold Last, 2=Drive to Min, 3=Drive to Max, 4=Warning	L2
Secondary High Temp Setpoint	−40	1350	90	°C (°F)	L2
Secondary Low Temp Setpoint	−40	1350	0	°C (°F)	L2
Secondary Temp Deadband	0	100	2	°C (°F)	L1
Secondary Temp Fail Safe Delay	2	20	2	Seconds	L2

7.1.4 TERTIARY TEMPERATURE

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Tertiary Temp Type	0	1	0	0=TC, 1=RTD	L2
Tertiary Temp Enable	0	1	0	0=Disabled, 1=Enabled	L2
Tertiary Temp Fail Safe Mode	0	4	1	0=Stop, 1=Hold Last, 2=Drive to Min, 3=Drive to Max, 4=Warning	L2
Tertiary High Temp Setpoint	−40	1350	90	°C (°F)	L2
Tertiary Low Temp Setpoint	−40	1350	0	°C (°F)	L2
Tertiary Temp Deadband	0	100	2	°C (°F)	L1

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Tertiary Temp Fail Safe Delay	2	20	2	Seconds	L2

7.2 INPUTS

7.2.1 GAS PRESSURE

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Pressure Type	0	2	2	0=Disabled, 2=4-20 mA	L2
Pressure Fail Safe Mode	0	3	1	0=Stop, 1=Hold Last, 2=Drive to Min, 3=Drive to Max	L2
Pressure Span Min	0	100000	0	Pressure units (×10 in Modbus register)	L2
Pressure Span Max	0	100000	3000	Pressure units (×10 in Modbus register)	L2
Pressure Low Trip	4	20	4	mA (converted to pressure units for display)	L2
Pressure High Trip	4	20	20	mA (converted to pressure units for display)	L2
Pressure Deadband	0	16	0.2	Pressure units (×10 in Modbus register)	L2
Pressure Fail Safe Delay	2	20	2	Seconds	L2

Span Min must be less than Span Max. Low Trip must be less than High Trip minus Deadband. Values in the Modbus register are multiplied by 10 (e.g., 145.6 psi is stored as 1456).

7.2.2 GAS FLOW RATE

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Gas Flow Rate Type	0	2	2	0=Disabled, 2=4-20 mA	L2
Gas Flow Fail Safe Mode	0	3	1	0=Stop, 1=Hold Last, 2=Drive to Min, 3=Drive to Max	L2
Gas Flow Rate Span Min	0	100000	0	Gas flow units (×10 in Modbus register)	L2
Gas Flow Rate Span Max	0	100000	6.5	Gas flow units (×10 in Modbus register)	L2
Gas Flow Rate Low Trip	4	20	4	mA (converted to gas flow units for display)	L1
Gas Flow Rate High Trip	4	20	20	mA (converted to gas flow units for display)	L1
Gas Flow Rate Deadband	0	16	0.2	Gas flow units (×10 in Modbus register)	L2
Gas Flow Rate Fail Safe Delay	2	20	2	Seconds	L2

7.2.3 GLYCOL FLOW RATE

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Glycol Flow Rate Type	0	2	2	0=Disabled, 2=4-20 mA	L2
Glycol Flow Fail Safe Mode	0	3	1	0=Stop, 1=Hold Last, 2=Drive to Min, 3=Drive to Max	L2
Glycol Flow Rate Span Min	0	100000	0	Glycol flow units (×10 in Modbus register)	L2
Glycol Flow Rate Span Max	0	100000	210	Glycol flow units (×10 in Modbus register)	L2
Glycol Flow Rate Low Trip	4	20	4	mA (converted to glycol flow units for display)	L1
Glycol Flow Rate High Trip	4	20	20	mA (converted to glycol flow units for display)	L1
Glycol Flow Rate Deadband	0	16	0.2	Glycol flow units (×10 in Modbus register)	L2
Glycol Flow Fail Safe Delay	2	20	2	Seconds	L2
Glycol Flow Input Averaging Time	0	60	0	Seconds (0 = no averaging)	L2

Set **Glycol Flow Input Averaging Time** to a non-zero value to apply a moving-average filter to the glycol flow measurement. A value of 0 disables averaging (instantaneous reading).

7.2.4 HP FILTER DIFFERENTIAL PRESSURE

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
HP Filter DP Type	0	2	0	0=Disabled, 1=Digital, 2=4-20 mA	L2
HP Filter DP Fail Safe Mode	0	4	0	0=Stop, 1=Hold Last, 2=Drive to Min, 3=Drive to Max, 4=Warning	L2
HP Filter DP Span Min	0	100000	0	HP Filter DP units (×10 in Modbus register)	L2
HP Filter DP Span Max	0	100000	1000	HP Filter DP units (×10 in Modbus register)	L2
HP Filter DP Low Trip	4	20	4	mA (converted for display)	L1
HP Filter DP High Trip	4	20	20	mA (converted for display)	L1
HP Filter DP Deadband	0	16	0.2	HP Filter DP units (×10 in Modbus register)	L2
HP Filter DP Fail Safe Delay	2	20	2	Seconds	L2

7.2.5 LP FILTER DIFFERENTIAL PRESSURE

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
LP Filter DP Type	0	2	0	0=Disabled, 1=Digital, 2=4-20 mA	L2
LP Filter DP Fail Safe Mode	0	4	0	0=Stop, 1=Hold Last, 2=Drive to Min, 3=Drive to Max, 4=Warning	L2
LP Filter DP Span Min	0	100000	0	Pressure units (×10 in Modbus register)	L2
LP Filter DP Span Max	0	100000	1000	Pressure units (×10 in Modbus register)	L2
LP Filter DP Low Trip	4	20	4	mA (converted for display)	L1
LP Filter DP High Trip	4	20	20	mA (converted for display)	L1
LP Filter DP Deadband	0	16	0.2	Pressure units (×10 in Modbus register)	L2
LP Filter DP Fail Safe Delay	2	20	2	Seconds	L2

7.2.6 FLASH TANK PRESSURE

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Flash Pressure Type	0	2	0	0=Disabled, 1=Digital, 2=4-20 mA	L2
Flash Pressure Fail Safe Mode	0	4	1	0=Stop, 1=Hold Last, 2=Drive to Min, 3=Drive to Max, 4=Warning	L2
Flash Pressure Span Min	0	100000	0	Pressure units (×10 in Modbus register)	L2
Flash Pressure Span Max	0	100000	1000	Pressure units (×10 in Modbus register)	L2
Flash Pressure Low Trip	4	20	4	mA (converted for display)	L1
Flash Pressure High Trip	4	20	20	mA (converted for display)	L1
Flash Pressure Deadband	0	16	0.2	Pressure units (×10 in Modbus register)	L2
Flash Pressure Fail Safe Delay	2	20	2	Seconds	L2

7.2.7 LEVEL LOW

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Level Low Enable	0	1	0	0=Disabled, 1=Enabled	L2

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Level Low Fail Safe Mode	0	4	0	0=Stop, 1=Hold Last, 2=Drive to Min, 3=Drive to Max, 4=Warning	L2
Level Low Fail Safe Delay	2	20	2	Seconds	L2

7.2.8 PUMP 1 STATUS

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Pump 1 Status Enable	0	1	0	0=Disabled, 1=Enabled	L2
Pump 1 Status Fail Safe Mode	0	4	0	0=Stop, 1=Hold Last, 2=Drive to Min, 3=Drive to Max, 4=Warning	L2
Pump 1 Status Fail Safe Delay	2	20	2	Seconds	L2

7.2.9 PUMP 2 STATUS

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Pump 2 Status Enable	0	1	0	0=Disabled, 1=Enabled	L2
Pump 2 Status Fail Safe Mode	0	4	0	0=Stop, 1=Hold Last, 2=Drive to Min, 3=Drive to Max, 4=Warning	L2
Pump 2 Status Fail Safe Delay	2	20	2	Seconds	L2

7.2.10 REMOTE START

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Remote Start	0	1	0	0=Disabled, 1=Enabled	L2

7.3 CONTROL ALGORITHM

7.3.1 OUTPUTS

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Pump 2 Enable	0	1	0	0=Disabled, 1=Enabled	L2
Pump Flow Rate Span Min	0	100000	0	Glycol flow units (×10 in Modbus register)	L2
Pump Flow Rate Span Max	0	100000	500	Glycol flow units (×10 in Modbus register)	L2

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Pump Flow Rate Min	4	20	4	mA — corresponds to minimum pump speed	L1
Pump Flow Rate Max	4	20	20	mA — corresponds to maximum pump speed	L1
Output PWM	1	100	100	% — duty cycle for Pump 2 Enable discrete output	L2
Manual Pump Flow Rate	4	20	12	mA (converted to glycol flow units for display)	L2
Pump Output Offset	−100	100	0	% — added to calculated output	L2
Glycol To Water Ratio	0	100000	3	Unitless (×10 in Modbus register)	L2
Target Outlet Water Vapor Content	0	100000	0	lb/MMCF (×10 in Modbus register)	L2
Manual Mode Enable	0	1	0	0=Disabled, 1=Enabled	L2

Pump Flow Rate Span Min/Max define the glycol flow rates (in configured flow units) that correspond to 4 mA and 20 mA respectively. These values establish the scaling between pump output mA and flow rate.

Glycol To Water Ratio is the desiccant-to-water circulation ratio used in the Auto mode calculation. A value of 3 means 3 US Gal/min of glycol per unit of water.

Manual Pump Flow Rate is the fixed target glycol flow rate used when the system is in Manual state.

Manual Mode Enable forces the system into Manual state when set to Enabled, regardless of whether Auto mode conditions are met.

7.3.2 PID CONTROL

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Glycol Process Proportional Band	0	1000	10	Glycol flow units (×10)	L2
Glycol Process Integral Time	0	1000	4	Minutes/repeat (×10)	L2
Glycol Process Derivative Time	0	1000	0	Minutes (×10)	L2
Glycol Process Integral Reset Range	0	1000	10	Glycol flow units (×10) — anti-windup clamp	L2
Glycol PID Output Rate Limit	0.1	100	100	%/second (×10)	L2
Glycol PID Ramp Time	0	255	10	Seconds	L1
Glycol PID Enable	0	1	1	0=Disabled, 1=Enabled	L2

The **Integral Reset Range** sets the range around the setpoint within which error will accumulate. Outside this range, the integral term does not accumulate. Set to a value appropriate to the expected control deviation.

Output Rate Limit restricts how quickly the output can change per second, providing smooth pump response. On startup, the effective rate limit is also constrained by the **Ramp Time** setting, which controls how quickly the output ramps up from the initial position to the PID setpoint.

7.4 SETUP

7.4.1 SYSTEM

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Voltage Setting	0	1	1	0=12V, 1=24V	L2
Voltage Restart	0	1	0	0=Disabled, 1=Enabled	L2
L1 Password Enable	0	1	0	0=Disabled, 1=Enabled	L2
Commissioning Complete	0	1	0	0=Incomplete, 1=Complete	L2

Commissioning Complete must be set to Complete (1) before the system will leave the Alarm state at startup. Setting this to Incomplete will generate alarm AL010 (Incomplete Commissioning) and prevent operation.

Voltage Restart allows the system to automatically restart after any power cycle or reset, without requiring operator intervention.

7.4.2 MODBUS

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Modbus RTU Communication	0	1	0	0=Disabled, 1=Enabled	L2
Slave Address	1	247	1	Integer (1–247)	L2
Baud Rate	0	1	0	0=9600, 1=19200	L2
Stop Bits	0	1	0	0=1 Stop Bit, 1=2 Stop Bits	L2
Parity	0	2	0	0=None, 1=Odd, 2=Even	L2
Modbus Termination	0	1	0	0=Disabled, 1=Enabled (100Ω)	L2

Modbus RTU Communication must be Enabled for any Modbus read or write action to be accepted.

7.5 UNITS

NAME	MIN	MAX	DEFAULT	UNITS / OPTIONS	SECURITY
Temperature Units	0	1	0	0=Celsius, 1=Fahrenheit	L1
LP Filter DP Units	1	7	1	1=kPa, 2=psi, 3=inch wc, 4=oz/in^2, 5=kg/cm^2, 6=Percent, 7=Milliamps	L1
HP Filter DP Units	1	7	1	1=kPa, 2=psi, 3=inch wc, 4=oz/in^2, 5=kg/cm^2, 6=Percent, 7=Milliamps	L1
Flash Pressure Units	1	7	1	1=kPa, 2=psi, 3=inch wc, 4=oz/in^2, 5=kg/cm^2, 6=Percent, 7=Milliamps	L1

8 MAINTENANCE

Warning: Do not modify any system wiring or handle the electronics while the system is powered.

Caution: Do not disassemble or modify the cards in any way. The cards are not field reparable and must be sent back to Profire for replacement if damaged.

Caution: The enclosure door must be securely closed after opening. Improper closure may result in moisture or other environmental damage and may compromise the integrity of the product.

8.1 TOOLS REQUIRED

The following tools are required for maintenance and commissioning:

- Large flat-head or #2 Phillips screwdriver to open and close enclosure.
- 2.5mm and 3.5mm terminal block screwdrivers for securing wiring to card terminal blocks.
- #2 Phillips screwdriver for control card mounting.
- 10-32 nut driver for UI card mounting.
- Digital multimeter or process calibrator for troubleshooting.

8.2 RECOMMENDED MAINTENANCE PROCEDURES

A comprehensive plan for routine maintenance should be developed in accordance with local safety codes, application requirements, and manufacturer recommendations for all equipment used. The maintenance plan should include, but not be limited to the following recommended maintenance procedures:

1. Check all wiring against site wiring diagram.
2. Check enclosures, boards, and fittings for signs of wear and replace as needed.
3. Check for moisture in enclosures and replace or recharge desiccant as needed.
4. Verify functionality of all keypad buttons.
5. Verify UI screen display functionality.
6. Verify accuracy of all settings.
7. Verify card hardware and firmware versions are up to date and compatible.
8. Verify all instrumentation is functional and undamaged.
9. Verify calibration of all 4-20 mA input devices and temperature input devices.
10. Verify that all configured interlock trips result in appropriate alert annunciation.
11. Verify that the Stop input causes an immediate pump shutdown when de-energized.
12. Back up all data log and event log files from the USB to an external storage system.

It is expected that the PF2200 temperature and analog inputs are within the stated accuracy range for the lifetime of the product. Calibration and verification frequency is to be determined in accordance with the manufacturer recommendations for the connected end devices and the applicable local safety codes.

8.3 TRANSPORTATION AND STORAGE CONDITIONS

Transportation of the product shall be in the original product packaging or equivalent. Transportation of cards without enclosure is not recommended and should be done with the utmost care utilizing an Anti-Static/ESD bag.

Storage temperature should be kept within the operating temperature listed in Section 2.1.1 in a dry area. Avoid moisture buildup inside the enclosure.

8.4 REPAIR AND REPLACEMENT

Profire does not support on-site repairs for cards. For replacement cards contact Profire customer service.

In the event replacement card(s) are used, care must be taken to ensure proper firmware is loaded on both the User Interface and Control Cards. If the User Interface and Control Cards have different software bundles loaded on them, the system will fail to operate correctly and will require a firmware update to match.

Control Cards must be securely fastened into the back of the enclosure with six #10-32 machine screws.

UI cards must not be removed from the enclosure door. Should a UI card replacement be required, an entire door assembly will be shipped.

8.5 DECOMMISSIONING

When decommissioning the system, the process should be safely shut down (i.e., all outputs are de-energized and there are no process hazards present on site). Once the process is in a safe state, the power should be disconnected from the PF2200. All cards should be treated like any other piece of electronics (e.g., be sent to a recycling depot).

8.6 USEFUL LIFE

The useful life of the PF2200 is 10 years. Prior to the expiry of that period the customer should contact Profire for a suitable replacement.

8.7 MANUFACTURER NOTIFICATION

Any detected failures that compromise the functional safety of the system must be reported to Profire customer service immediately.

9 TROUBLESHOOTING

PROBLEM	PROPOSED SOLUTIONS
System will not start; remains in Ready state	1. Verify that the Commissioning Complete setting is set to Complete. 2. Check for active alarms on the Status Screen and resolve all alarm conditions. 3. Verify that the OK keypad button, Modbus start command, or Start Discrete Input sequence is being used correctly. 4. If using Modbus start, verify that Remote Access is Enabled.
System enters Waiting state and will not proceed	1. Check the Status Screen for active Wait conditions. 2. Navigate to System > Diagnostics > Inputs to view real-time input states and mA readings. 3. Verify that all configured 4-20 mA inputs are within the 4–20 mA valid range (inputs reading < 3 mA or > 21 mA will trigger Wait conditions). 4. If Auto mode is in use, verify that configured pressure, gas flow, and glycol flow inputs are within configured trip setpoints.
Pump output is not responding as expected	1. Navigate to System > Diagnostics > Outputs to view the current pump output mA value. 2. Verify PID tuning parameters (Proportional Band, Integral Time, Derivative Time) are appropriate for the process. 3. Verify that Pump Flow Rate Min, Max, Span Min, and Span Max settings match the VFD/pump controller input range. 4. Check for active warnings that may be affecting the output.
Control card is unresponsive or will not communicate with UI card	1. Ensure the Status LEDs for both cards are functioning. If the Status LED is not functioning, cycle power (if safe to do so) and check again. 2. Check the PFN wiring between the Control Card and the User Interface Card. 3. Verify that both cards have matching firmware bundle versions (System > Firmware > Info).
Analog input reading is incorrect or shows Out of Range alarm	1. Use System > Diagnostics > Inputs to view the raw mA reading for the affected input. 2. Verify the transmitter is powered and wired correctly per the applicable connection diagram in Section 6.2. 3. Verify that the transmitter output range matches the configured Span Min and Span Max settings. 4. Verify calibration of the transmitter against a known reference.
Temperature reading is incorrect or shows sensor fault	1. Use System > Diagnostics > Temperature to view raw temperature readings. 2. Check thermocouple or RTD wiring for open circuits, shorts, or reversed polarity. 3. Verify that the sensor type (TC/RTD) matches the **Primary Temp Type** setting. 4. For dual-element sensors, verify that both elements are connected and within the mismatch tolerance.
Modbus communication is not working	1. Verify that Remote Access is Enabled and that the Modbus RTU settings (Slave Address, Baud Rate, Stop Bits, Parity) match the master device configuration. 2. Navigate to System > Diagnostics > Modbus for error count and communication statistics. 3. Verify wiring polarity (A and B) and that the bus is properly terminated at both ends. 4. Verify that only one device on the bus shares the configured slave address.

PROBLEM	PROPOSED SOLUTIONS
USB storage device not recognized or event log not saving	1. Verify that the USB device is an approved Profire USB storage device. 2. Remove and re-insert the USB device with the system powered on. 3. Check the event log for any USB-related warning messages. 4. Contact Profire for a replacement USB storage device if the problem persists.

10 ALERT CODES & RESPONSE TIMES

The PF2200-GP uses three alert types to communicate system conditions:

- **Alarms (AL):** Fault conditions that stop the system or require immediate attention. All alarms drive the system to the Alarm or Lockout state and set the pump output to its fail-safe position.
- **Waits (WT):** Conditions that put the system into its fail safe mode. When a Wait is active, the system is held in the last position, max position, or min position dependent on the configured fail safe mode. The system proceeds automatically to the configured control method when all Wait conditions clear.
- **Warnings (WN):** Advisory conditions that do not stop the system. The pump continues to operate; the warning is displayed on the Status Screen and logged to the event log.

Active alert codes are displayed on the Status Screen Alerts Pane and recorded in the Event Log. Each alert bit is accessible via Modbus (see Appendix A).

10.1 ALARMS

Alarms cause the system to enter the Alarm or Lockout state. The pump output is driven to the fail-safe position configured for the triggering input(s), or to 4 mA if the fail-safe action is Stop. To recover from an Alarm, resolve the alarm condition and issue a Stop/Reset command from the UI or Modbus.

ID	NAME	ALARM CONDITION	SET
AL001	Stop Contact Open	Stop input is de-energized (open)	1s
AL002	Ambient Temp Mismatch	Ambient temperature sensors on the Control Card do not agree within tolerance	6s
AL003	Ambient Temp 1 Invalid	Ambient temperature sensor 1 on the Control Card is reporting an invalid reading	6s
AL004	Ambient Temp 2 Invalid	Ambient temperature sensor 2 on the Control Card is reporting an invalid reading	6s
AL005	Low Voltage	System input voltage is below the minimum for the configured voltage mode	2s
AL006	High Voltage	System input voltage is above the maximum for the configured voltage mode	2s
AL007	System ADC Start Fault	Internal Control Card fault — system ADC failed to start [2]	2s
AL008	System ADC Read Fault	Internal Control Card fault — system ADC failed to read [2]	2s
AL009	System ADC Stop Fault	Internal Control Card fault — system ADC failed to stop [2]	2s
AL010	Incomplete Commissioning	Commissioning Complete setting is set to Incomplete	0
AL011	Cross Compare Failure	Internal Control Card fault — dual-processor cross-comparison failed [2]	2s
AL012	External Switch Stuck	Start/Stop switch input is stuck in an active position	5s
AL013	External Switch Invalid	Start/Stop switch input is in an invalid state	0

ID	NAME	ALARM CONDITION	SET
AL014	User Stop via External Switch	Stop was triggered by the external switch input	0
AL015	User Stop via Interface	Stop command received from the UI keypad or Modbus	0
AL016	Settings CRC Failed	Settings in non-volatile memory failed CRC verification and cannot be restored	0
AL017	State Mismatch	Internal Control Card fault — dual-processor state comparison failed [2]	1s
AL018	Gas Pressure I2C Bus Fault	Internal Control Card fault — Gas Pressure input analog circuit communication error [2]	2s
AL019	Gas Flow Rate I2C Bus Fault	Internal Control Card fault — Gas Flow Rate input analog circuit communication error [2]	2s
AL020	Glycol Flow Rate I2C Bus Fault	Internal Control Card fault — Glycol Flow Rate input analog circuit communication error [2]	2s
AL021	HP Filter DP I2C Bus Fault	Internal Control Card fault — HP Filter DP input analog circuit communication error [2]	2s
AL022	LP Filter DP I2C Bus Fault	Internal Control Card fault — LP Filter DP input analog circuit communication error [2]	2s
AL023	Flash Pressure I2C Bus Fault	Internal Control Card fault — Flash Pressure input analog circuit communication error [2]	2s
AL024	Aux Temp I2C Bus Fault	Internal Control Card fault — Auxiliary Temperature input analog circuit communication error [2]	2s
AL025	Pump 1 I2C Bus Fault	Internal Control Card fault — Pump 1 Status input analog circuit communication error [2]	2s
AL026	Pump 2 I2C Bus Fault	Internal Control Card fault — Pump 2 Status input analog circuit communication error [2]	2s
AL027	System Voltage Current I2C Bus Fault	Internal Control Card fault — system voltage/current measurement circuit communication error [2]	2s
AL028	IO Short Switch Run Fault	Internal Control Card fault — IO short detected on Run switch circuit [2]	1.5s
AL029	IO Short Switch Ignition Fault	Internal Control Card fault — IO short detected on Ignition switch circuit [2]	1.5s
AL030	IO Short Start Fault	Internal Control Card fault — IO short detected on Start input circuit [2]	1.5s
AL031	IO Short Stop Fault	Internal Control Card fault — IO short detected on Stop input circuit [2]	1.5s
AL032	Flash Failed To Read	Non-volatile memory read failure	0
AL033	Flash Failed To Write	Non-volatile memory write failure	0

ID	NAME	ALARM CONDITION	SET
AL034	Descriptor Failure	Firmware descriptor read failure at startup	0
AL035	Descriptor Mismatch	Firmware descriptor mismatch between processors at startup	0
AL036	Pump 1 Valve Output Voltage Fault	Pump 1 valve output circuit voltage is outside expected range	2s
AL037	Pump 2 Valve Output Voltage Fault	Pump 2 valve output circuit voltage is outside expected range	2s
AL038	Start Contact Out of Range	Start input circuit voltage is outside the valid measurement range	2s
AL039	Stop Contact Out of Range	Stop input circuit voltage is outside the valid measurement range	2s
AL040	Level Low Contact Out of Range	Level Low input circuit voltage is outside the valid measurement range	2s
AL041	Pump 1 Status Contact Out of Range	Pump 1 Status input circuit voltage is outside the valid measurement range	2s
AL042	Pump 2 Status Contact Out of Range	Pump 2 Status input circuit voltage is outside the valid measurement range	2s
AL043	Digital Input ADC Start Fault	Internal Control Card fault — digital input ADC failed to start [2]	2s
AL044	Digital Input ADC Read Fault	Internal Control Card fault — digital input ADC failed to read [2]	2s
AL045	Digital Input ADC Stop Fault	Internal Control Card fault — digital input ADC failed to stop [2]	2s
AL046	Processor Reset	Control Card processor experienced an unexpected reset	0
AL047	Calibration CRC Failed	Factory calibration data in non-volatile memory failed CRC verification	0
AL048	Brownout Reset Voltage Incorrect	Processor brownout detection threshold is incorrectly configured	0
AL049	Factory Calibration Error	Factory calibration data is invalid or missing	0
AL050	System Voltage Mismatch	Measured system voltage does not match the configured Voltage Setting	2s
AL051	Shutdown Failed To Set	Internal fault — system failed to set the shutdown register during a stop	0
AL052	UI Comm Loss	Communication between the UI Card and Control Card has been lost for longer than the configured threshold	Configurable [1]
AL053	High Primary Temperature	Primary Temperature input is above the High Temp Setpoint	Configurable [1]
AL054	Low Primary Temperature	Primary Temperature input is below the Low Temp Setpoint	Configurable [1]
AL055	Primary Temp Mismatch	Primary Temperature dual elements do not agree within the mismatch tolerance	2s

ID	NAME	ALARM CONDITION	SET
AL056	Primary Temp Configuration Range Error	Primary Temperature settings are invalid (setpoint out of range or ordering violation)	0
AL057	Primary Temp 1 Sensor Open	Primary Temperature element 1 has an open circuit	6s
AL058	Primary Temp 1 Sensor Short	Primary Temperature element 1 in RTD mode is measuring a short circuit	6s
AL059	Primary Temp 1 Out of Range	Primary Temperature element 1 is outside the valid TC or RTD measurement range	6s
AL060	Primary Temp 1 Stale Data	Primary Temperature element 1 is not returning valid data	6s
AL061	Primary Temp 2 Sensor Open	Primary Temperature element 2 has an open circuit	6s
AL062	Primary Temp 2 Sensor Short	Primary Temperature element 2 in RTD mode is measuring a short circuit	6s
AL063	Primary Temp 2 Out of Range	Primary Temperature element 2 is outside the valid TC or RTD measurement range	6s
AL064	Primary Temp 2 Stale Data	Primary Temperature element 2 is not returning valid data	6s
AL065	High Secondary Temperature	Secondary Temperature input is above the High Temp Setpoint	Configurable [1]
AL066	Low Secondary Temperature	Secondary Temperature input is below the Low Temp Setpoint	Configurable [1]
AL067	Secondary Temp Configuration Range Error	Secondary Temperature settings are invalid (setpoint out of range or ordering violation)	0
AL068	Secondary Temp Sensor Open	Secondary Temperature sensor has an open circuit	6s
AL069	Secondary Temp Sensor Short	Secondary Temperature sensor in RTD mode is measuring a short circuit	6s
AL070	Secondary Temp Out of Range	Secondary Temperature sensor is outside the valid measurement range	6s
AL071	Secondary Temp Stale Data	Secondary Temperature sensor is not returning valid data	6s
AL072	High Tertiary Temperature	Tertiary Temperature input is above the High Temp Setpoint	Configurable [1]
AL073	Low Tertiary Temperature	Tertiary Temperature input is below the Low Temp Setpoint	Configurable [1]
AL074	Tertiary Temp Configuration Range Error	Tertiary Temperature settings are invalid (setpoint out of range or ordering violation)	0
AL075	Tertiary Temp Sensor Open	Tertiary Temperature sensor has an open circuit	6s
AL076	Tertiary Temp Sensor Short	Tertiary Temperature sensor in RTD mode is measuring a short circuit	6s

ID	NAME	ALARM CONDITION	SET
AL077	Tertiary Temp Out of Range	Tertiary Temperature sensor is outside the valid measurement range	6s
AL078	Tertiary Temp Stale Data	Tertiary Temperature sensor is not returning valid data	6s
AL079	Aux Temp Configuration Error	Auxiliary 4-20 mA temperature input settings are invalid (e.g., Span Min ≥ Span Max)	0
AL080	Aux Temp Out of Range	Auxiliary 4-20 mA temperature input is reading less than 3 mA or greater than 21 mA	1s
AL081	Low Gas Pressure	Gas Pressure input is below the Low Trip setpoint	Configurable [1]
AL082	High Gas Pressure	Gas Pressure input is above the High Trip setpoint	Configurable [1]
AL083	Gas Pressure Out of Range	Gas Pressure 4-20 mA input is reading less than 3 mA or greater than 21 mA	1s
AL084	Gas Pressure Configuration Error	Gas Pressure settings are invalid (e.g., High Trip < Low Trip + Deadband, or Span Max ≤ Span Min)	0
AL085	Low Gas Flow Rate	Gas Flow Rate input is below the Low Trip setpoint	Configurable [1]
AL086	High Gas Flow Rate	Gas Flow Rate input is above the High Trip setpoint	Configurable [1]
AL087	Gas Flow Rate Out of Range	Gas Flow Rate 4-20 mA input is reading less than 3 mA or greater than 21 mA	1s
AL088	Gas Flow Rate Configuration Error	Gas Flow Rate settings are invalid (e.g., High Trip < Low Trip + Deadband, or Span Max ≤ Span Min)	0
AL089	Low Glycol Flow Rate	Glycol Flow Rate input is below the Low Trip setpoint while the system is running and has collected a valid glycol flow value	Configurable [1]
AL090	High Glycol Flow Rate	Glycol Flow Rate input is above the High Trip setpoint while the system is running and has collected a valid glycol flow value	Configurable [1]
AL091	Glycol Flow Rate Out of Range	Glycol Flow Rate 4-20 mA input is reading less than 3 mA or greater than 21 mA while the system is running and has collected a valid glycol flow value	1s
AL092	Glycol Flow Rate Configuration Error	Glycol Flow Rate settings are invalid (e.g., High Trip < Low Trip + Deadband, or Span Max ≤ Span Min)	0
AL093	Low HP Filter DP	HP Filter DP input is below the Low Trip setpoint	Configurable [1]
AL094	High HP Filter DP	HP Filter DP input is above the High Trip setpoint	Configurable [1]
AL095	HP Filter DP Contact Open	HP Filter DP digital input is de-energized (open)	Configurable [1]
AL096	HP Filter DP Out of Range	HP Filter DP 4-20 mA input is reading less than 3 mA or greater than 21 mA	1s
AL097	HP Filter DP Configuration Error	HP Filter DP settings are invalid (e.g., High Trip < Low Trip + Deadband, or Span Max ≤ Span Min)	0
AL098	Low LP Filter DP	LP Filter DP input is below the Low Trip setpoint	Configurable [1]

ID	NAME	ALARM CONDITION	SET
AL099	High LP Filter DP	LP Filter DP input is above the High Trip setpoint	Configurable [1]
AL100	LP Filter DP Contact Open	LP Filter DP digital input is de-energized (open)	Configurable [1]
AL101	LP Filter DP Out of Range	LP Filter DP 4-20 mA input is reading less than 3 mA or greater than 21 mA	1s
AL102	LP Filter DP Configuration Error	LP Filter DP settings are invalid (e.g., High Trip < Low Trip + Deadband, or Span Max ≤ Span Min)	0
AL103	Low Flash Pressure	Flash Tank Pressure input is below the Low Trip setpoint	Configurable [1]
AL104	High Flash Pressure	Flash Tank Pressure input is above the High Trip setpoint	Configurable [1]
AL105	Flash Pressure Contact Open	Flash Tank Pressure digital input is de-energized (open)	Configurable [1]
AL106	Flash Pressure Out of Range	Flash Tank Pressure 4-20 mA input is reading less than 3 mA or greater than 21 mA	1s
AL107	Flash Pressure Configuration Error	Flash Tank Pressure settings are invalid (e.g., High Trip < Low Trip + Deadband, or Span Max ≤ Span Min)	0
AL108	Level Low Contact Open	Level Low digital input is de-energized (open)	Configurable [1]
AL109	Pump 1 Status Contact Open	Pump 1 Status digital input is de-energized (open)	Configurable [1]
AL110	Pump 2 Status Contact Open	Pump 2 Status digital input is de-energized (open)	Configurable [1]
AL111	Conflicting Fail Safes Tripped	Two or more active fail-safe conditions specify conflicting output actions (e.g., Drive to Min and Drive to Max simultaneously)	0
AL112	Glycol PID Requires Glycol Flow Input	Glycol PID is enabled but no Glycol Flow input is configured	0
AL113	Auto Mode Requires Gas Pressure, Flow, Temp	Auto mode is active but one or more required inputs (gas pressure, gas flow rate, temperature) are not configured or are invalid	0

*[1] "Configurable" set time indicates the alarm is gated by the associated input's **Fail Safe Delay** setting (2–20 seconds, configurable per input). See Section 7.2 for individual input delay settings.*
[2] Internal fault alarms (I2C Bus Faults, ADC Faults, Cross Compare, etc.) indicate a hardware or firmware fault on the Control Card. Contact Profire technical support if these alarms occur.

10.2 WAITS

Wait conditions hold the system in the Waiting state with the pump output at 4 mA. The system automatically enters Auto or Manual mode when all Wait conditions clear. Wait conditions do not require operator acknowledgement.

ID	NAME	WAIT CONDITION	SET
WT001	High Primary Temperature	Primary Temperature is above the High Temp Setpoint AND fail-safe action is configured as Wait	Configurable

ID	NAME	WAIT CONDITION	SET
WT002	Low Primary Temperature	Primary Temperature is below the Low Temp Setpoint AND fail-safe action is configured as Wait	Configurable
WT003	Primary Temp Mismatch	Primary Temperature dual elements do not agree AND fail-safe is configured as Wait	2s
WT004	Primary Temp 1 Sensor Open	Primary Temperature element 1 has an open circuit AND fail-safe is configured as Wait	6s
WT005	Primary Temp 1 Sensor Short	Primary Temperature element 1 in RTD mode has a short circuit AND fail-safe is configured as Wait	6s
WT006	Primary Temp 1 Out of Range	Primary Temperature element 1 is outside the valid measurement range AND fail-safe is configured as Wait	6s
WT007	Primary Temp 1 Stale Data	Primary Temperature element 1 is not returning valid data AND fail-safe is configured as Wait	6s
WT008	Primary Temp 2 Sensor Open	Primary Temperature element 2 has an open circuit AND fail-safe is configured as Wait	6s
WT009	Primary Temp 2 Sensor Short	Primary Temperature element 2 in RTD mode has a short circuit AND fail-safe is configured as Wait	6s
WT010	Primary Temp 2 Out of Range	Primary Temperature element 2 is outside the valid measurement range AND fail-safe is configured as Wait	6s
WT011	Primary Temp 2 Stale Data	Primary Temperature element 2 is not returning valid data AND fail-safe is configured as Wait	6s
WT012	High Secondary Temperature	Secondary Temperature is above the High Temp Setpoint AND fail-safe is configured as Wait	Configurable
WT013	Low Secondary Temperature	Secondary Temperature is below the Low Temp Setpoint AND fail-safe is configured as Wait	Configurable
WT014	Secondary Temp Sensor Open	Secondary Temperature sensor has an open circuit AND fail-safe is configured as Wait	6s
WT015	Secondary Temp Sensor Short	Secondary Temperature sensor in RTD mode has a short circuit AND fail-safe is configured as Wait	6s
WT016	Secondary Temp Out of Range	Secondary Temperature sensor is outside the valid measurement range AND fail-safe is configured as Wait	6s
WT017	Secondary Temp Stale Data	Secondary Temperature sensor is not returning valid data AND fail-safe is configured as Wait	6s
WT018	High Tertiary Temperature	Tertiary Temperature is above the High Temp Setpoint AND fail-safe is configured as Wait	Configurable
WT019	Low Tertiary Temperature	Tertiary Temperature is below the Low Temp Setpoint AND fail-safe is configured as Wait	Configurable
WT020	Tertiary Temp Sensor Open	Tertiary Temperature sensor has an open circuit AND fail-safe is configured as Wait	6s

ID	NAME	WAIT CONDITION	SET
WT021	Tertiary Temp Sensor Short	Tertiary Temperature sensor in RTD mode has a short circuit AND fail-safe is configured as Wait	6s
WT022	Tertiary Temp Out of Range	Tertiary Temperature sensor is outside the valid measurement range AND fail-safe is configured as Wait	6s
WT023	Tertiary Temp Stale Data	Tertiary Temperature sensor is not returning valid data AND fail-safe is configured as Wait	6s
WT024	Aux Temp Out of Range	Auxiliary 4-20 mA temperature input is less than 3 mA or greater than 21 mA AND fail-safe is configured as Wait	1s
WT025	Low Gas Pressure	Gas Pressure input is below the Low Trip setpoint AND fail-safe is configured as Wait	Configurable
WT026	High Gas Pressure	Gas Pressure input is above the High Trip setpoint AND fail-safe is configured as Wait	Configurable
WT027	Gas Pressure Out of Range	Gas Pressure 4-20 mA input is less than 3 mA or greater than 21 mA AND fail-safe is configured as Wait	1s
WT028	Low Gas Flow Rate	Gas Flow Rate input is below the Low Trip setpoint AND fail-safe is configured as Wait	Configurable
WT029	High Gas Flow Rate	Gas Flow Rate input is above the High Trip setpoint AND fail-safe is configured as Wait	Configurable
WT030	Gas Flow Rate Out of Range	Gas Flow Rate 4-20 mA input is less than 3 mA or greater than 21 mA AND fail-safe is configured as Wait	1s
WT031	Low Glycol Flow Rate	Glycol Flow Rate input is below the Low Trip setpoint AND fail-safe is configured as Wait while the system is running and has collected a valid glycol flow value	Configurable
WT032	High Glycol Flow Rate	Glycol Flow Rate input is above the High Trip setpoint AND fail-safe is configured as Wait while the system is running and has collected a valid glycol flow value	Configurable
WT033	Glycol Flow Rate Out of Range	Glycol Flow Rate 4-20 mA input is less than 3 mA or greater than 21 mA AND fail-safe is configured as Wait while the system is running and has collected a valid glycol flow value	1s
WT034	Low HP Filter DP	HP Filter DP input is below the Low Trip setpoint AND fail-safe is configured as Wait	Configurable
WT035	High HP Filter DP	HP Filter DP input is above the High Trip setpoint AND fail-safe is configured as Wait	Configurable
WT036	HP Filter DP Contact Open	HP Filter DP digital input is de-energized AND fail-safe is configured as Wait	Configurable
WT037	HP Filter DP Out of Range	HP Filter DP 4-20 mA input is less than 3 mA or greater than 21 mA AND fail-safe is configured as Wait	1s
WT038	Low LP Filter DP	LP Filter DP input is below the Low Trip setpoint AND fail-safe is configured as Wait	Configurable

ID	NAME	WAIT CONDITION	SET
WT039	High LP Filter DP	LP Filter DP input is above the High Trip setpoint AND fail-safe is configured as Wait	Configurable
WT040	LP Filter DP Contact Open	LP Filter DP digital input is de-energized AND fail-safe is configured as Wait	Configurable
WT041	LP Filter DP Out of Range	LP Filter DP 4-20 mA input is less than 3 mA or greater than 21 mA AND fail-safe is configured as Wait	1s
WT042	Low Flash Pressure	Flash Tank Pressure input is below the Low Trip setpoint AND fail-safe is configured as Wait	Configurable
WT043	High Flash Pressure	Flash Tank Pressure input is above the High Trip setpoint AND fail-safe is configured as Wait	Configurable
WT044	Flash Pressure Contact Open	Flash Tank Pressure digital input is de-energized AND fail-safe is configured as Wait	Configurable
WT045	Flash Pressure Out of Range	Flash Tank Pressure 4-20 mA input is less than 3 mA or greater than 21 mA AND fail-safe is configured as Wait	1s
WT046	Level Low Contact Open	Level Low digital input is de-energized AND fail-safe is configured as Wait	Configurable
WT047	Level Low Contact Out of Range	Level Low 4-20 mA input is less than 3 mA or greater than 21 mA AND fail-safe is configured as Wait	1s
WT048	Pump 1 Status Contact Open	Pump 1 Status digital input is de-energized AND fail-safe is configured as Wait	Configurable
WT049	Pump 1 Status Contact Out of Range	Pump 1 Status 4-20 mA input is less than 3 mA or greater than 21 mA AND fail-safe is configured as Wait	1s
WT050	Pump 2 Status Contact Open	Pump 2 Status digital input is de-energized AND fail-safe is configured as Wait	Configurable
WT051	Pump 2 Status Contact Out of Range	Pump 2 Status 4-20 mA input is less than 3 mA or greater than 21 mA AND fail-safe is configured as Wait	1s

*[1] "Configurable" set time indicates the wait is gated by the associated input's **Fail Safe Delay** setting (2–20 seconds, configurable per input). See Section 7.2 for individual input delay settings.*

10.3 WARNINGS

Warnings are advisory conditions that do not stop the system. The pump continues to operate while warnings are active. Warnings are displayed on the Status Screen and logged to the event log. The Status LED changes from Green to Amber while any warning is active.

ID	NAME	WARNING CONDITION	SET
WN001	Low Voltage	System input voltage is below the warning threshold for the configured voltage mode	2s
WN002	High Voltage	System input voltage is above the warning threshold for the configured voltage mode	2s

ID	NAME	WARNING CONDITION	SET
WN003	Measuring Glycol Flow Sample	The system is actively averaging the glycol flow input (Glycol Flow Input Averaging Time > 0)	—
WN004	UI to BMS Firmware Mismatch	The UI Card and Control Card have different firmware bundle versions installed	0
WN005	BMS Comm Loss	Communication from the Control Card to the UI Card has been lost	0
WN006	Hardware Descriptor Error	Hardware descriptor information could not be read at startup	0
WN007	Product Variant Descriptor Error	Product variant descriptor does not match expected value at startup	0
WN008	Firmware Descriptor Error	Firmware descriptor information is invalid at startup	0
WN009	Bootloader Descriptor Error	Bootloader descriptor information is invalid at startup	0
WN010	UI Descriptor Error	UI Card descriptor information is invalid at startup	0
WN011	Failed to Read Diagnostic Descriptor	Diagnostic descriptor information could not be read from the Control Card	0
WN012	Failed to Write Diagnostic Descriptor	Diagnostic descriptor information could not be written to the Control Card	0
WN013	High Secondary Temperature	Secondary Temperature is above the High Temp Setpoint AND fail-safe is configured as Warning	Configurable
WN014	Low Secondary Temperature	Secondary Temperature is below the Low Temp Setpoint AND fail-safe is configured as Warning	Configurable
WN015	Secondary Temp Sensor Open	Secondary Temperature sensor has an open circuit AND fail-safe is configured as Warning	6s
WN016	Secondary Temp Sensor Short	Secondary Temperature sensor in RTD mode has a short circuit AND fail-safe is configured as Warning	6s
WN017	Secondary Temp Out of Range	Secondary Temperature sensor is outside the valid measurement range AND fail-safe is Warning	6s
WN018	Secondary Temp Stale Data	Secondary Temperature sensor is not returning valid data AND fail-safe is configured as Warning	6s
WN019	High Tertiary Temperature	Tertiary Temperature is above the High Temp Setpoint AND fail-safe is configured as Warning	Configurable
WN020	Low Tertiary Temperature	Tertiary Temperature is below the Low Temp Setpoint AND fail-safe is configured as Warning	Configurable
WN021	Tertiary Temp Sensor Open	Tertiary Temperature sensor has an open circuit AND fail-safe is configured as Warning	6s
WN022	Tertiary Temp Sensor Short	Tertiary Temperature sensor in RTD mode has a short circuit AND fail-safe is configured as Warning	6s

ID	NAME	WARNING CONDITION	SET
WN023	Tertiary Temp Out of Range	Tertiary Temperature sensor is outside the valid measurement range AND fail-safe is configured as Warning	6s
WN024	Tertiary Temp Stale Data	Tertiary Temperature sensor is not returning valid data AND fail-safe is configured as Warning	6s
WN025	Low HP Filter DP	HP Filter DP is below the Low Trip setpoint AND fail-safe is configured as Warning	Configurable
WN026	High HP Filter DP	HP Filter DP is above the High Trip setpoint AND fail-safe is configured as Warning	Configurable
WN027	HP Filter DP Contact Open	HP Filter DP digital input is open AND fail-safe is configured as Warning	Configurable
WN028	HP Filter DP Out of Range	HP Filter DP 4-20 mA input is less than 3 mA or greater than 21 mA AND fail-safe is Warning	1s
WN029	Low LP Filter DP	LP Filter DP is below the Low Trip setpoint AND fail-safe is configured as Warning	Configurable
WN030	High LP Filter DP	LP Filter DP is above the High Trip setpoint AND fail-safe is configured as Warning	Configurable
WN031	LP Filter DP Contact Open	LP Filter DP digital input is open AND fail-safe is configured as Warning	Configurable
WN032	LP Filter DP Out of Range	LP Filter DP 4-20 mA input is less than 3 mA or greater than 21 mA AND fail-safe is Warning	1s
WN033	Low Flash Pressure	Flash Tank Pressure is below the Low Trip setpoint AND fail-safe is configured as Warning	Configurable
WN034	High Flash Pressure	Flash Tank Pressure is above the High Trip setpoint AND fail-safe is configured as Warning	Configurable
WN035	Flash Pressure Contact Open	Flash Tank Pressure digital input is open AND fail-safe is configured as Warning	Configurable
WN036	Flash Pressure Out of Range	Flash Tank Pressure 4-20 mA input is less than 3 mA or greater than 21 mA AND fail-safe is Warning	1s
WN037	Level Low Contact Open	Level Low digital input is open AND fail-safe is configured as Warning	Configurable
WN038	Level Low Contact Out of Range	Level Low input is out of valid range AND fail-safe is configured as Warning	1s
WN039	Pump 1 Status Contact Open	Pump 1 Status digital input is open AND fail-safe is configured as Warning	Configurable
WN040	Pump 1 Status Contact Out of Range	Pump 1 Status input is out of valid range AND fail-safe is configured as Warning	1s
WN041	Pump 2 Status Contact Open	Pump 2 Status digital input is open AND fail-safe is configured as Warning	Configurable

ID	NAME	WARNING CONDITION	SET
WN042	Pump 2 Status Contact Out of Range	Pump 2 Status input is out of valid range AND fail-safe is configured as Warning	1s

11 GLOSSARY

TERM	DEFINITION
Anti-Windup	A PID control technique that prevents the integral term from accumulating beyond a defined range, avoiding excessive overshoot when the output is saturated.
Auto Mode	Operating mode in which the glycol circulation rate setpoint is automatically calculated from the measured gas temperature, pressure, gas flow rate, and configured Glycol To Water Ratio.
Contactor	The gas-glycol contact tower where water is absorbed from the gas stream into the lean glycol.
Desiccant	The water-absorbing fluid used in gas dehydration, typically triethylene glycol (TEG).
Dew Point	The temperature at which water vapor in a gas begins to condense into liquid.
Stop Input	A hardwired normally-energized discrete input. When de-energized (open), the system immediately stops. Always active regardless of run state.
Fail-Safe	The configured action taken by an input when it detects a fault or trip condition. Options are Stop, Hold Last, Drive to Min, Drive to Max, or Warning.
Flash Tank	A vessel where absorbed water and light hydrocarbons are removed from rich glycol by reducing pressure, allowing the components to "flash" off as vapor.
Glycol To Water Ratio	The configured ratio of desiccant circulation rate to water removal rate; a key parameter in the Auto mode target calculation.
Hold Last	A fail-safe action that freezes the pump output at the last valid output value when a fault is detected.
HP Filter DP	High-pressure filter differential pressure input on the high-pressure gas stream.
LP Filter	Low-pressure filter in the glycol regeneration circuit, upstream of the still column.
Manual Mode	Operating mode in which the operator directly specifies the target pump flow rate via the Manual Pump Flow Rate setting.
PID	Proportional-Integral-Derivative. A closed-loop control algorithm that minimizes the error between a measured process variable and a setpoint.
Ramp Time	The startup ramp time, in seconds, over which the pump output ramps from its initial position to the PID-calculated target when the system enters Auto mode.
Rich Glycol	Glycol that has absorbed water from the gas stream and is being directed to the regeneration system for reconditioning.
Wait Condition	A system condition that allows the system to be started but prevents the pump from operating until the condition clears.
Water Content	The amount of water vapor present in the gas stream, typically expressed in lbs/MMSCF or kg/MMm^3.

12 ACRONYMS

ACRONYM	MEANING
4-20 mA	4 to 20 milliamp analog signal standard
ADC	Analog-to-Digital Converter
BMS	Burner Management System (platform card name, shared with SB variant)
CRC	Cyclic Redundancy Check
DP	Differential Pressure
ESD	Emergency Shutdown (legacy terminal label; relabeled STOP on current hardware)
GP	Glycol Pump (product variant)
HP	High Pressure
HMI	Human-Machine Interface
I2C	Inter-Integrated Circuit (internal communications bus)
LP	Low Pressure
mA	Milliampere
MMSCFD	Million Standard Cubic Feet per Day
PFN	Profire Network (proprietary RS-485 communication protocol between UI and Control cards)
PID	Proportional-Integral-Derivative
PT-100	Platinum Resistance Temperature Detector, 100Ω at 0°C
RTD	Resistance Temperature Detector
SCADA	Supervisory Control and Data Acquisition
TC	Thermocouple
TEG	Triethylene Glycol
UI	User Interface
USB	Universal Serial Bus
VFD	Variable Frequency Drive

APPENDIX A — MODBUS REGISTER REFERENCE

This appendix describes the Modbus RTU interface of the PF2200-GP Glycol Pump Controller. It covers communication configuration, register addressing conventions, data formats, and a complete register map organized by function.

A.1 CONFIGURATION

A.1.1 MODBUS CONFIGURATION SETTINGS

All settings are accessible from the controller keypad at **Settings > System Configuration > Communications**.

PARAMETER	RANGE	DEFAULT	DESCRIPTION
Baud Rate	9600, 19200	9600	Serial communication baud rate
Stop Bits	1, 2	1	Number of stop bits per character
Parity	None, Odd, Even	None	Parity bit configuration
Slave Address	1 – 247	1	Modbus device address
Modbus Termination	Disabled, Enabled	Disabled	Enables internal 100 Ω RS-485 line termination resistor
Remote Access	Disabled, Enabled	Disabled	Enables writing to settings registers via Modbus

NOTE: Remote Access must be Enabled before the Modbus master can write to any setting register. The PF2200-GP will accept writes to the Start/Stop register (40100) regardless of the Remote Access setting.

A.1.2 MODBUS MASTER CONFIGURATION REQUIREMENTS

Configure the Modbus master (PLC, SCADA, or RTU) with the following parameters to communicate with the PF2200-GP:

PARAMETER	REQUIRED VALUE	NOTES
Protocol	Modbus RTU	ASCII mode is not supported
Baud Rate	Match PF2200-GP setting	Default 9600 bps
Data Bits	8	Fixed
Stop Bits	Match PF2200-GP setting	Default 1
Parity	Match PF2200-GP setting	Default None
Slave Address	Match PF2200-GP setting	Default 1
Inter-packet Delay	≥ 20 ms	Minimum silent gap between frames
Response Timeout	≥ 500 ms	Time to wait before declaring a timeout

PARAMETER	REQUIRED VALUE	NOTES
Min. Time Between Writes	≥ 5 s	Applies to all setting registers
Min. Time Between Reads	≥ 1 s	Recommended polling interval

A.1.3 TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
No response from PF2200-GP	Slave address mismatch	Verify the master address matches the GP Slave Address setting
No response from PF2200-GP	Baud rate, parity, or stop bits mismatch	Match all serial parameters between master and GP
No response from PF2200-GP	RS-485 wiring fault	Check A/B polarity, cable continuity, and shield grounding
No response from PF2200-GP	Missing termination	Enable Modbus Termination if the GP is the last device on the bus, or use an external 120 Ω resistor
CRC errors / garbled data	Signal reflection	Verify proper termination at both ends of the RS-485 bus
CRC errors / garbled data	Inter-packet delay too short	Increase master inter-packet delay to ≥ 20 ms
All registers return zero	PFN communication error	Read register 30015 (Communication Error). If = 1, a fault exists between the Modbus Card and the Control Card. Cycle power and check PFN wiring
Write command accepted but setting unchanged	Remote Access disabled	Enable Remote Access at **Settings > System Configuration > Communications > Remote Access**
Write command accepted but setting unchanged	Security level too low	L2 (Commissioning) settings cannot be written remotely if the controller is not in Commissioning mode

MODBUS DIAGNOSTICS

The following read-only registers provide communication diagnostic information.

REGISTER (OFFSET)	REGISTER (ADDRESS)	NAME	DESCRIPTION
30015	40015	Communication Error	0 = No Error; 1 = PFN Communication Error. All other Modbus registers return 0 when this bit is set.
30016	40016	Comm Error Counter	Counts consecutive PFN timeouts while register 30015 = 1. Resets to 0 when error clears.

A.1.4 MODBUS COMMANDS

The PF2200-GP supports the following Modbus function codes:

FUNCTION CODE	NAME	DESCRIPTION
0x01 (1)	Read Coils	Read discrete output coils
0x02 (2)	Read Discrete Inputs	Read discrete input status
0x03 (3)	Read Holding Registers	Read read/write registers (4xxxx addresses)
0x04 (4)	Read Input Registers	Read read-only registers (3xxxx addresses)
0x06 (6)	Write Single Register	Write one holding register
0x10 (16)	Write Multiple Registers	Write a block of holding registers

Function codes 0x05 (Write Single Coil) and 0x0F (Write Multiple Coils) are not supported.

A.1.5 REGISTER ADDRESS VS REGISTER OFFSET

Modbus registers are addressed two ways depending on the software tool used:

- **Register Address (Offset):** The value used directly in the Modbus frame. This guide uses the offset (e.g., address 3000 maps to offset 3000 in the frame).
- **Register Number (1-based):** Some SCADA tools display registers as 1-based numbers prefixed by type: 3xxxx for input registers, 4xxxx for holding registers. Subtract 1 from the display number to obtain the frame offset.

Example:

REGISTER TYPE	REGISTER NUMBER	FRAME OFFSET	FUNCTION CODE
Input Register	33001	3000	0x04
Holding Register	41000	999	0x03 or 0x06

All register addresses in this guide are **frame offsets** (0-based). Add 30001 or 40001 respectively when using 1-based register number notation.

A.1.6 REGISTER DATA FORMAT

DATA TYPE	STATUS INFORMATION (HEXADECIMAL)	MODBUS REPRESENTATION	ENDIANNESS
int16/ uint16	0x0A0B	0x0A0B in a single 16-bit register	Big-endian
int32/ uint32	0x0A0B0C0D	0x0A0B0C0D in two sequential 16-bit registers • 0x0A0B in first register • 0x0C0D in second register	Big-endian
Float (IEEE 754)	0x0A0B0C0D	0x0A0B0C0D in two sequential 16-bit registers (high word first) • 0x0A0B in first register • 0x0C0D in second register	Big-endian

DATA TYPE	STATUS INFORMATION (HEXADECIMAL)	MODBUS REPRESENTATION	ENDIANNESS
Bitset	0x0000	0x0000 in a single 16-bit register where each binary digit represents separate status information • Bit 0: 0b0000 0000 0000 0000 • Bit 1: 0b0000 0000 0000 0000 • ... • Bit 14: 0b0000 0000 0000 0000 • Bit 15: 0b0000 0000 0000 0000	Big-endian
Array	0x0A0B0C0D0E0F	0x0F0E0D0C0B0A held in consecutive 16-bit registers • 0x0F0E in first register • 0x0D0C in second register • 0x0B0A in third register	Little-endian

A.1.7 LATCHED VS UNLATCHED REGISTERS

- **Unlatched:** The register value reflects the current real-time state. Alarm, Wait, and Warning bitset registers are unlatched — they clear automatically when the condition that caused them clears.
- **Latched:** The Shutdown Code register (3003/33004) holds the code that caused the most recent Lockout state. It retains its value until the lockout is acknowledged by writing 1 to register 40143 (Clear Shutdown Code).

A.1.8 SYSTEM UNITS

Analog values transmitted via Modbus use SI base units unless otherwise noted in the register description:

QUANTITY	SI UNIT STORED	NOTES
Temperature	Degrees Celsius (°C)	Values are multiplied by 10 and stored as Int16. Example: 45.2 °C = 452.
Pressure	kPa	Values are multiplied by 10 and stored as Int32. Example: 1456.0 kPa = 14560.
Flow Rate	Litres/min	Values are multiplied by 10 and stored as Int32.
Differential Pressure	kPa	Values are multiplied by 10 and stored as Int32.
Voltage	V × 10	System Voltage register stores value multiplied by 10. Example: 12.4 V = 124.
Pump Output	mA × 10	Pump output setpoints stored as 4–20 mA scaled by 10. Example: 12.0 mA = 120.
Time	Seconds	

A.1.9 COMMUNICATION LOSS

The PF2200-GP user interface communicates with the control card via a proprietary protocol called PFN. Modbus data is transferred from the control card to the user interface over the PFN link. When the user interface loses communication with the control card, all Modbus registers return a value of 0 except for the Communication Error register (30015) and the Communication Error Counter register (30016).

A.2 REGISTER MAP

A.2.1 READ-ONLY COILS AND DISCRETE INPUTS [FUNCTION CODE 0X01 OR 0X02]

Reading a single coil returns a single byte with the coil value in its least significant bit. Reading multiple coils returns a bit-packed vector of the requested values (LSB first).

SYSTEM STATUS COILS

ADDRESS (OFFSET)	NAME	0	1
10001/20001 (0)	Run	System not in a running state	System in a running state

ALERT COILS

Individual alert condition bits are accessible as discrete coil registers. Each alert bit corresponds to a single coil address.

ADDRESS RANGE	NAME	0	1
10101/20101 (100) to 10357/20357 (356)	Alarm Bit AL000 to AL256	Alarm not set	Alarm set
10501/20501 (500) to 10565/20565 (564)	Wait Bit WT000 to WT064	Wait not set	Wait set
10601/20601 (600) to 10665/20665 (664)	Warning Bit WN000 to WN064	Warning not set	Warning set

Note: The packed-word equivalents of these alert bits are available as holding registers at addresses 33101–33404 (see Alert Bitsets). Either method may be used to read alert status; the coil interface allows polling individual bits without word-masking.

A.2.2 DIAGNOSTIC AND CONTROL REGISTERS

These registers are accessible as Modbus holding registers (function codes 0x03/0x04/0x06). Addresses below 1000 use function code 0x04 (input register) for reads and 0x06/0x10 for writes where noted.

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	NAME	DESCRIPTION
14	30015	Read	UInt16	Communication Error	0 = No Error; 1 = PFN Comm Error. All registers return 0 when set.
15	30016	Read	UInt16	Comm Error Counter	Consecutive timeout count. Resets when error clears.
17	30018	Read	Int16	Ambient Board Temp	Control Card ambient temperature in °C. Range: −100 to 1350 °C.
20	30021	Read	UInt16	Clock Seconds	Current clock second (0–59).
21	30022	Read	UInt16	Clock Minutes	Current clock minute (0–59).
22	30023	Read	UInt16	Clock Hours	Current clock hour (0–23).

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	NAME	DESCRIPTION
23	30024	Read	UInt16	Clock Day	Current clock day (1–31).
24	30025	Read	UInt16	Clock Month	Current clock month (1–12).
25	30026	Read	UInt16	Clock Year	Current clock year (2000–2099).
29	30030	Read	UInt16	System Bundle Firmware Version	Byte 1 = Major, Byte 2 = Minor release.
99	40100	Read/Write	UInt16	Start / Stop	Write 1234 to start. Write 4321 to stop. Clears when command is accepted.
109	40110	Read/Write	UInt16	Set Clock Seconds	Write to set clock second (0–59).
110	40111	Read/Write	UInt16	Set Clock Minutes	Write to set clock minute (0–59).
111	40112	Read/Write	UInt16	Set Clock Hours	Write to set clock hour (0–23).
112	40113	Read/Write	UInt16	Set Clock Day	Write to set clock day (1–31).
113	40114	Read/Write	UInt16	Set Clock Month	Write to set clock month (1–12).
114	40115	Read/Write	UInt16	Set Clock Year	Write to set clock year (2000–2099).
115	40116	Read/Write	UInt16	Apply Clock Changes	Deprecated placeholder. Reads and writes have no effect.
122	30123	Read	UInt16	Test Read Unsigned	Always returns 1234. Use to verify unsigned Modbus reads are correctly formatted.
123	30124	Read	Int16	Test Read Signed	Always returns −1234. Use to verify signed Modbus reads are correctly formatted.
142	40143	Read/Write	UInt16	Clear Shutdown Code	Write 1 to acknowledge the current lockout and clear the Shutdown Code.

A.2.3 READ-ONLY STATUS REGISTERS

Status registers are read-only input registers (function code 0x04) at addresses 3000–3788.

CONTROLLER STATE

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3000	33001	Int16	Controller State	Current system state. See state codes below. −1 = Invalid.
3001	33002	Int16	Primary Next Controller State	Next state calculated by primary processor.

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3002	33003	Int16	Secondary Next Controller State	Next state calculated by secondary processor.
3003	33004	UInt16	Shutdown Code	Code for most recent lockout. 0 if no lockout. Cleared by register 40143.
3005	33006	UInt16	State Timer	Time elapsed in current state, in seconds.
3007	33008	UInt16	Delta Time	Control loop cycle time in milliseconds.
3505	33506	Int16	Transition Status	Active transition state during state changes.

Controller State Codes:

CODE	STATE NAME
0	Lockout
1	Alarm
2	Power On
3	Ready
4	Confirm Start
5	Waiting
6	Auto
7	Manual
−1	Invalid

ALERT BITSETS

Alert registers are packed bit arrays. Each alert condition corresponds to one bit. See Section 10 for alert definitions.

OFFSET	ADDRESS (1-BASED)	SIZE (WORDS)	NAME	DESCRIPTION
3100	33101	16	Alarm Bits	Alarm conditions. Bit N corresponds to alarm AL(N). Up to 256 bits.
3200	33201	4	Wait Bits	Wait conditions. Bit N corresponds to wait WT(N). Up to 64 bits.
3300	33301	4	Warning Bits	Warning conditions. Bit N corresponds to warning WN(N). Up to 64 bits.
3400	33401	4	Main Permissive Bits	Permissive status bits. Bit 0 is not used (reserved).

Reading Bitset Registers: Each word contains 16 bits. To read bit N, read the word at offset (BaseAddress + N/16), then check bit (N mod 16) of that word. Example: to read alarm bit 25 (AL25), read the word at offset 3101 (3100 + 25/16 = 3100 + 1), then test bit 9 (25 mod 16).

SYSTEM MEASUREMENTS

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3500	33501	Int16	System Voltage	Input voltage × 10. Example: 124 = 12.4 V.
3501	33502	UInt16	Authentication Level	0=None, 1=Remote, 2=L1 Operator, 3=L2 Commissioning, 4=System
3502	33503	UInt16	Is Running	0 = Stopped (states 0–5); 1 = Running (states 6–7).
3503	33504	UInt32	Sync Count	Processor synchronization count. Two consecutive words (high word first).

DESCRIPTOR REGISTERS

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3506	33507	UInt32	Hardware Model Number	BMS hardware identifier. PF2200 BMS = 0x220002. Two words (high first).
3508	33509	UInt16	Firmware Product Variant	Firmware variant code (0–9).
3509	33510	UInt16	Region Code	0=Dev, 1=North America, 2=EU, 3=Australia, 4=World.
3510	33511	UInt32	Bundle Version	Firmware bundle version. Bytes: [Variant][Major][Minor][Release]. Two words.
3512	33513	UInt32	Firmware Version	BMS firmware version. Bytes: [Major][Minor][Release Hi][Release Lo]. Two words.
3514	33515	UInt32	Bootloader Version	BMS bootloader version. Same format as Firmware Version. Two words.
3516	33517	UInt32	BOM Version	BMS bill-of-materials version. Two words.
3518	33519	Array (6 bytes)	Manufacturer Serial Number	6-byte unique serial number. Three consecutive words.
3521	33522	UInt32	Manufacture Date	Bytes: [Year−2000][Month][Day]. Two words.
3523	33524	UInt32	Manufacture Test Date	Test completion date. Same format as Manufacture Date. Two words.
3525	33526	UInt32	PFN Version	Inter-card communication protocol version. Two words.

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3779	33780	UInt16	Hardware Product Variant	Hardware product type code (0–9).
3788	33789	Bitset (16 bits)	Software Options	Software feature enable bits.

FACTORY CALIBRATION (3527–3602)

Factory calibration registers contain board-level slope and offset corrections applied to hardware measurements. These values are set during manufacturing and are read-only.

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3527	33528	UInt16	Calibration Format Number	Factory calibration data format version.
3528	33529	Float (IEEE 754)	Analog Output 1 Slope	Factory slope correction for analog output 1. IEEE 754, two words.
3530	33531	Float (IEEE 754)	Analog Output 1 Offset	Factory offset correction for analog output 1. IEEE 754, two words.
3532	33533	Float (IEEE 754)	Analog Output 2 Slope	Factory slope correction for analog output 2. IEEE 754, two words.
3534	33535	Float (IEEE 754)	Analog Output 2 Offset	Factory offset correction for analog output 2. IEEE 754, two words.
3536	33537	Float (IEEE 754)	Analog Output 3 Slope	Factory slope correction for analog output 3. IEEE 754, two words.
3538	33539	Float (IEEE 754)	Analog Output 3 Offset	Factory offset correction for analog output 3. IEEE 754, two words.
3540	33541	Float (IEEE 754)	Analog Input 1 Slope	Factory slope correction for analog input 1. IEEE 754, two words.
3542	33543	Float (IEEE 754)	Analog Input 1 Offset	Factory offset correction for analog input 1. IEEE 754, two words.
3544	33545	Float (IEEE 754)	Analog Input 2 Slope	Factory slope correction for analog input 2. IEEE 754, two words.
3546	33547	Float (IEEE 754)	Analog Input 2 Offset	Factory offset correction for analog input 2. IEEE 754, two words.
3548	33549	Float (IEEE 754)	Analog Input 3 Slope	Factory slope correction for analog input 3. IEEE 754, two words.
3550	33551	Float (IEEE 754)	Analog Input 3 Offset	Factory offset correction for analog input 3. IEEE 754, two words.

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3552	33553	Float (IEEE 754)	Analog Input 4 Slope	Factory slope correction for analog input 4. IEEE 754, two words.
3554	33555	Float (IEEE 754)	Analog Input 4 Offset	Factory offset correction for analog input 4. IEEE 754, two words.
3556	33557	Float (IEEE 754)	Analog Input 5 Slope	Factory slope correction for analog input 5. IEEE 754, two words.
3558	33559	Float (IEEE 754)	Analog Input 5 Offset	Factory offset correction for analog input 5. IEEE 754, two words.
3560	33561	Float (IEEE 754)	Analog Input 6 Slope	Factory slope correction for analog input 6. IEEE 754, two words.
3562	33563	Float (IEEE 754)	Analog Input 6 Offset	Factory offset correction for analog input 6. IEEE 754, two words.
3564	33565	Float (IEEE 754)	Analog Input 7 Slope	Factory slope correction for analog input 7. IEEE 754, two words.
3566	33567	Float (IEEE 754)	Analog Input 7 Offset	Factory offset correction for analog input 7. IEEE 754, two words.
3568	33569	Float (IEEE 754)	RTD 1A Slope	Factory slope correction for RTD 1A. IEEE 754, two words.
3570	33571	Float (IEEE 754)	RTD 1A Offset	Factory offset correction for RTD 1A. IEEE 754, two words.
3572	33573	Float (IEEE 754)	RTD 1B Slope	Factory slope correction for RTD 1B. IEEE 754, two words.
3574	33575	Float (IEEE 754)	RTD 1B Offset	Factory offset correction for RTD 1B. IEEE 754, two words.
3576	33577	Float (IEEE 754)	RTD 2 Slope	Factory slope correction for RTD 2. IEEE 754, two words.
3578	33579	Float (IEEE 754)	RTD 2 Offset	Factory offset correction for RTD 2. IEEE 754, two words.
3580	33581	Float (IEEE 754)	RTD 3 Slope	Factory slope correction for RTD 3. IEEE 754, two words.
3582	33583	Float (IEEE 754)	RTD 3 Offset	Factory offset correction for RTD 3. IEEE 754, two words.
3584	33585	Float (IEEE 754)	TC 1A Slope	Factory slope correction for TC 1A. IEEE 754, two words.
3586	33587	Float (IEEE 754)	TC 1A Offset	Factory offset correction for TC 1A. IEEE 754, two words.

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3588	33589	Float (IEEE 754)	TC 1B Slope	Factory slope correction for TC 1B. IEEE 754, two words.
3590	33591	Float (IEEE 754)	TC 1B Offset	Factory offset correction for TC 1B. IEEE 754, two words.
3592	33593	Float (IEEE 754)	TC 2 Slope	Factory slope correction for TC 2. IEEE 754, two words.
3594	33595	Float (IEEE 754)	TC 2 Offset	Factory offset correction for TC 2. IEEE 754, two words.
3596	33597	Float (IEEE 754)	TC 3 Slope	Factory slope correction for TC 3. IEEE 754, two words.
3598	33599	Float (IEEE 754)	TC 3 Offset	Factory offset correction for TC 3. IEEE 754, two words.
3600	33601	Float (IEEE 754)	ADC Slope	Factory slope correction for ADC. IEEE 754, two words.
3602	33603	Float (IEEE 754)	ADC Offset	Factory offset correction for ADC. IEEE 754, two words.

TEMPERATURE READINGS (3604–3661)

Temperature value registers return the current measured temperature in the configured display units (see Section A.2.4.15). Fault bitset registers indicate sensor-level error conditions; a bit value of 1 indicates a fault.

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3604	33605	Int16	Primary Temp	Primary contactor temperature in configured units.
3605	33606	Int16	Primary 2 Temp	Primary temperature element 2 in configured units.
3606	33607	Int16	Secondary Temp	Secondary temperature in configured units.
3607	33608	Int16	Tertiary Temp	Tertiary temperature in configured units.
3608	33609	Int16	Aux Temp	Auxiliary temperature (4-20 mA) in configured units.
3609	33610	Int16	Ambient Temp 1	Control card ambient temperature sensor 1 in °C.
3610	33611	Int16	Ambient Temp 2	Control card ambient temperature sensor 2 in °C.

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3611	33612	Bitset (5 bits)	Primary Temp Faults	Primary temp sensor fault bits. Bits: 0=TC Open, 1=RTD Open, 2=RTD Short, 3=Out of Range, 4=Stale Data.
3621	33622	Bitset (5 bits)	Primary Temp 2 Faults	Primary temp element 2 fault bits. Same bit mapping as offset 3611.
3631	33632	Bitset (5 bits)	Secondary Temp Faults	Secondary temp fault bits. Same bit mapping as offset 3611.
3641	33642	Bitset (5 bits)	Tertiary Temp Faults	Tertiary temp fault bits. Same bit mapping as offset 3611.
3651	33652	Bitset (5 bits)	Ambient Temp 1 Faults	Ambient temp 1 fault bits. Only bits 3 (Out of Range) and 4 (Stale Data) apply.
3661	33662	Bitset (5 bits)	Ambient Temp 2 Faults	Ambient temp 2 fault bits. Only bits 3 (Out of Range) and 4 (Stale Data) apply.

INPUT STATUS (3684–3720)

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3684	33685	Bitset (13 bits)	Interlock Input Contact Status	Input contact states. 1 = energized. Bits: 0=Level Low, 1=Stop, 2=Start, 3=Gas Pressure, 4=Gas Flow Rate, 5=LP Filter DP, 6=Glycol Flow Rate, 7=HP Filter DP, 8=Flash Pressure, 9=Aux Temp, 10=Pump 1 Status, 11=Pump 2 Status, 12=Unused.
3689	33690	Bitset (7 bits)	IO Short Faults	Input short-circuit fault bits. 1 = fault. Bits: 0=Switch Run, 1=Switch Ignition, 2=DIN1, 3=DIN2, 4=DIN3, 5=Pump 1 Status, 6=Stop.
3694	33695	Int16	Pump 1 Status Voltage	Pump 1 status input voltage × 10 (V).
3695	33696	Int16	Pump 2 Status Voltage	Pump 2 status input voltage × 10 (V).
3697	33698	Int16	Stop Voltage	Stop input voltage × 10 (V).
3698	33699	Int16	Start Voltage	Start input voltage × 10 (V).
3699	33700	Int16	Level Low Voltage	Level low input voltage × 10 (V).
3700	33701	Int32	4-20 Glycol Flow Rate	Raw glycol flow rate input in mA × 10. Two words (high word first).
3702	33703	Int32	Averaged 4-20 Glycol Flow Rate	Averaged glycol flow rate input in mA × 10. Two words.
3704	33705	Int32	4-20 Gas Pressure	Raw gas pressure input in mA × 10. Two words.

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3706	33707	Int32	4-20 Gas Flow Rate	Raw gas flow rate input in mA × 10. Two words.
3708	33709	Int16	4-20 LP Filter DP	Raw LP filter differential pressure input in mA × 10.
3710	33711	Int16	4-20 Aux Temp	Raw auxiliary temperature input in mA × 10.
3712	33713	Int16	4-20 HP Filter DP	Raw HP filter differential pressure input in mA × 10.
3714	33715	Int16	4-20 Flash Pressure	Raw flash tank pressure input in mA × 10.
3716	33717	UInt16	External Switch State	External mode switch position.
3717	33718	UInt16	System Voltage Fault	1 = system voltage fault active; 0 = normal.
3718	33719	Bitset (13 bits)	I2C Bus Faults	Internal I2C communication bus faults. 1 = fault. Bits: 0=AIN7, 1=AIN6, 2=AIN5, 3=AIN1, 4=AIN2, 5=AIN3, 6=AIN4, 7=Pilot 1, 8=Pilot 2, 9=SSV1, 10=SSV2, 11=Aux Valve, 12=System Voltage Current.
3720	33721	Bitset (9 bits)	ADC Faults	Internal ADC fault bits. 1 = fault. Bits: 0=Pilot Start, 1=Pilot Read, 2=Pilot Stop, 3=System Start, 4=System Read, 5=System Stop, 6=Digital Input Start, 7=Digital Input Read, 8=Digital Input Stop.

OUTPUT AND PROCESS STATUS (3724–3758)

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3724	33725	Bitset (5 bits)	Valve Driver Status	Output energized state. 1 = energized. Bits: 2=Pump 1, 3=Pump 2 (bits 0, 1, 4 unused).
3729	33730	UInt16	Status Contact State	Current state of the status contact output.
3731	33732	UInt16	Pump 1 Output Fault	1 = Pump 1 output fault active; 0 = normal.
3732	33733	UInt16	Pump 2 Output Fault	1 = Pump 2 output fault active; 0 = normal.
3733	33734	UInt16	Flash BP Output Fault	1 = Flash BP output fault active; 0 = normal. Post-MVP — reserved.
3734	33735	UInt16	Pump 1 Output Percent	Current Pump 1 output level × 10 (%).
3735	33736	UInt16	Pump 2 Output Percent	Current Pump 2 output level × 10 (%).
3736	33737	UInt16	Flash BP Output Percent	Current Flash BP output level × 10 (%). Post-MVP — reserved.

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3737	33738	UInt16	Calculated Target Glycol Flow Rate	PID-calculated target flow rate in glycol flow units × 10.
3740	33741	UInt16	Requested Pump Position	Current pump position command × 10 (%).
3741	33742	UInt16	PID Status	PID controller internal status code.
3742	33743	UInt16	Glycol Flow Rate Sample Ready	1 = averaged glycol flow rate sample is valid; 0 = averaging in progress.
3758	33759	UInt16	Pump Output State	Current pump output control mode. 0=Off (states 0–6), 1=Fixed (state 7), 2=Partial (state 8), 3=Full (state 9).

DIAGNOSTICS (3745–3757)

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DESCRIPTION
3745	33746	Int16	Pump 1 Voltage	Pump 1 output voltage × 10 (V).
3746	33747	Int16	Pump 1 Current	Pump 1 output current × 10 (mA).
3747	33748	Int16	Pump 2 Voltage	Pump 2 output voltage × 10 (V).
3748	33749	Int16	Pump 2 Current	Pump 2 output current × 10 (mA).
3749	33750	Int16	System Current	Total system current × 10 (mA).
3750	33751	Int16	System Power	Total system power × 10 (W).
3751	33752	Bitset (5 bits)	Valve Power Status	Output power-good bits. 1 = output energized without fault. Bits: 2=Pump 1, 3=Pump 2 (bits 0, 1, 4 unused).
3752	33753	UInt16	System Up Time	Total system up time in seconds.
3753	33754	UInt16	Average Hourly Energy Consumption	Average hourly energy consumption in Wh.
3754	33755	UInt16	Pump 1 Run Time	Pump 1 cumulative run time in seconds.
3755	33756	UInt16	Pump 2 Run Time	Pump 2 cumulative run time in seconds.
3756	33757	UInt16	Average Pump 1 Position	Average Pump 1 output position × 10 (%).
3757	33758	UInt16	Average Pump 2 Position	Average Pump 2 output position × 10 (%).

A.2.4 SETTING REGISTERS

Setting registers are holding registers accessible at addresses 1000–20026. All setting registers support read access (function code 0x04 as input registers or 0x03 as holding registers). Write access (function codes 0x06 / 0x10) is available only for registers marked **R/W**, and only when **Remote Access** is enabled at **Settings > System Configuration > Communications > Remote Access**.

Security Levels:

- **L1** — Operator level. Writable when Remote Access is enabled.
- **L2** — Commissioning level. Read via Modbus only; changes require direct keypad access unless the controller is in Commissioning mode.

PRIMARY TEMPERATURE SETTINGS (1000–1012)

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1000	41001	R	UInt16	0	Primary Temp Type	0 = TC; 1 = RTD
1001	41002	R	UInt16	1	Primary Temp Enable	0 = Disabled; 1 = Enabled
1002	41003	R	UInt16	0	Primary Temp Input	0 = Dual; 1 = Single
1003	41004	R	UInt16	1	Primary Temp Fail Safe Mode	0=Stop, 1=Hold Last, 2=Drive Min, 3=Drive Max
1004	41005	R	Int16	0	Primary Low Temp Setpoint	°C × 1. Range: −40 to 1350 °C.
1005	41006	R	Int16	90	Primary High Temp Setpoint	°C × 1. Range: −40 to 1350 °C.
1006	41007	**R/W**	UInt16	2	Primary Temp Deadband	°C × 1. Range: 0–100 °C. L1.
1007	41008	R	UInt16	0	Primary Aux Temp Override	0 = Disabled; 1 = Enabled
1008	41009	R	UInt16	2	Primary Aux Temp Type	2=4-20 mA
1009	41010	R	Int16	0	Primary Aux Temp Span Min	4-20 mA span min in °C.
1010	41011	R	Int16	1350	Primary Aux Temp Span Max	4-20 mA span max in °C.
1011	41012	**R/W**	Int16	0	Primary Temp Offset	Calibration offset in °C. Range: −100 to 100 °C. L1.

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1012	41013	R	UInt16	2	Primary Temp Fail Safe Delay	Trip delay in seconds (2–20 s).

SECONDARY TEMPERATURE SETTINGS (1020–1026)

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1020	41021	R	UInt16	0	Secondary Temp Type	0 = TC; 1 = RTD
1021	41022	R	UInt16	0	Secondary Temp Enable	0 = Disabled; 1 = Enabled
1022	41023	R	UInt16	1	Secondary Temp Fail Safe Mode	0=Stop, 1=Hold Last, 2=Drive Min, 3=Drive Max, 4=Warning
1023	41024	R	Int16	90	Secondary High Temp Setpoint	°C × 1. Range: −40 to 1350 °C.
1024	41025	R	Int16	0	Secondary Low Temp Setpoint	°C × 1. Range: −40 to 1350 °C.
1025	41026	**R/W**	UInt16	2	Secondary Temp Deadband	°C × 1. Range: 0–100 °C. L1.
1026	41027	R	UInt16	2	Secondary Temp Fail Safe Delay	Trip delay in seconds (2–20 s).

TERTIARY TEMPERATURE SETTINGS (1030–1036)

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1030	41031	R	UInt16	0	Tertiary Temp Type	0 = TC; 1 = RTD
1031	41032	R	UInt16	0	Tertiary Temp Enable	0 = Disabled; 1 = Enabled
1032	41033	R	UInt16	1	Tertiary Temp Fail Safe Mode	0=Stop, 1=Hold Last, 2=Drive Min, 3=Drive Max, 4=Warning
1033	41034	R	Int16	90	Tertiary High Temp Setpoint	°C × 1. Range: −40 to 1350 °C.

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1034	41035	R	Int16	0	Tertiary Low Temp Setpoint	°C × 1. Range: −40 to 1350 °C.
1035	41036	**R/W**	UInt16	2	Tertiary Temp Deadband	°C × 1. Range: 0–100 °C. L1.
1036	41037	R	UInt16	2	Tertiary Temp Fail Safe Delay	Trip delay in seconds (2–20 s).

GAS PRESSURE SETTINGS (1040–1052)

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1040	41041	R	UInt16	2	Pressure Type	0=Disabled, 2=4-20 mA
1041	41042	R	UInt16	1	Pressure Fail Safe Mode	0=Stop, 1=Hold Last, 2=Drive Min, 3=Drive Max
1042	41043	R	Int32	0	Pressure Span Min	4-20 mA span min. kPa × 10. Two words.
1044	41045	R	Int32	3000	Pressure Span Max	4-20 mA span max. kPa × 10. Two words.
1046	41047	R	Int32	4	Pressure Low Trip	Low trip setpoint. mA × 10. Two words.
1048	41049	R	Int32	20	Pressure High Trip	High trip setpoint. mA × 10. Two words.
1050	41051	R	UInt16	2	Pressure Deadband	Deadband. mA × 10.
1052	41053	R	UInt16	2	Pressure Fail Safe Delay	Trip delay in seconds (2–20 s).

GAS FLOW RATE SETTINGS (1060–1072)

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1060	41061	R	UInt16	2	Gas Flow Rate Type	0=Disabled, 2=4-20 mA
1061	41062	R	UInt16	1	Gas Flow Fail Safe Mode	0=Stop, 1=Hold Last, 2=Drive Min, 3=Drive Max
1062	41063	R	Int32	0	Gas Flow Rate Span Min	4-20 mA span min. Units × 10. Two words.

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1064	41065	R	Int32	6.5	Gas Flow Rate Span Max	4-20 mA span max. Units × 10. Two words.
1066	41067	R	Int32	4	Gas Flow Rate Low Trip	Low trip setpoint. mA × 10. Two words. L1.
1068	41069	R	Int32	20	Gas Flow Rate High Trip	High trip setpoint. mA × 10. Two words. L1.
1070	41071	R	UInt16	2	Gas Flow Rate Deadband	Deadband. mA × 10.
1072	41073	R	UInt16	2	Gas Flow Rate Fail Safe Delay	Trip delay in seconds (2–20 s).

GLYCOL FLOW RATE SETTINGS (1080–1093)

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1080	41081	R	UInt16	2	Glycol Flow Rate Type	0=Disabled, 2=4-20 mA
1081	41082	R	UInt16	1	Glycol Flow Fail Safe Mode	0=Stop, 1=Hold Last, 2=Drive Min, 3=Drive Max
1082	41083	R	Int32	0	Glycol Flow Rate Span Min	4-20 mA span min. Units × 10. Two words.
1084	41085	R	Int32	210	Glycol Flow Rate Span Max	4-20 mA span max. Units × 10. Two words.
1086	41087	R	Int32	4	Glycol Flow Rate Low Trip	Low trip. mA × 10. Two words. L1.
1088	41089	R	Int32	20	Glycol Flow Rate High Trip	High trip. mA × 10. Two words. L1.
1090	41091	R	UInt16	2	Glycol Flow Rate Deadband	Deadband. mA × 10.
1092	41093	R	UInt16	2	Glycol Flow Fail Safe Delay	Trip delay in seconds (2–20 s).
1093	41094	R	UInt16	0	Glycol Flow Input Averaging Time	Averaging window in seconds (0–60 s).

HP FILTER DIFFERENTIAL PRESSURE SETTINGS (1100–1112)

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1100	41101	R	UInt16	0	HP Filter DP Type	0=Disabled, 1=Digital, 2=4-20 mA
1101	41102	R	UInt16	0	HP Filter DP Fail Safe Mode	0=Stop, 1=Hold Last, 2=Drive Min, 3=Drive Max, 4=Warning
1102	41103	R	Int32	0	HP Filter DP Span Min	4-20 mA span min. Units × 10. Two words.
1104	41105	R	Int32	1000	HP Filter DP Span Max	4-20 mA span max. Units × 10. Two words.
1106	41107	R	Int32	4	HP Filter DP Low Trip	Low trip. mA × 10. Two words. L1.
1108	41109	R	Int32	20	HP Filter DP High Trip	High trip. mA × 10. Two words. L1.
1110	41111	R	UInt16	2	HP Filter DP Deadband	Deadband. mA × 10.
1112	41113	R	UInt16	2	HP Filter DP Fail Safe Delay	Trip delay in seconds (2–20 s).

LP FILTER DIFFERENTIAL PRESSURE SETTINGS (1120–1132)

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1120	41121	R	UInt16	0	LP Filter DP Type	0=Disabled, 1=Digital, 2=4-20 mA
1121	41122	R	UInt16	0	LP Filter DP Fail Safe Mode	0=Stop, 1=Hold Last, 2=Drive Min, 3=Drive Max, 4=Warning
1122	41123	R	Int32	0	LP Filter DP Span Min	4-20 mA span min. Units × 10. Two words.
1124	41125	R	Int32	1000	LP Filter DP Span Max	4-20 mA span max. Units × 10. Two words.
1126	41127	R	Int32	4	LP Filter DP Low Trip	Low trip. mA × 10. Two words. L1.
1128	41129	R	Int32	20	LP Filter DP High Trip	High trip. mA × 10. Two words. L1.
1130	41131	R	UInt16	2	LP Filter DP Deadband	Deadband. mA × 10.

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1132	41133	R	UInt16	2	LP Filter DP Fail Safe Delay	Trip delay in seconds (2–20 s).

FLASH TANK PRESSURE SETTINGS (1140–1152)

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1140	41141	R	UInt16	0	Flash Pressure Type	0=Disabled, 1=Digital, 2=4-20 mA
1141	41142	R	UInt16	1	Flash Pressure Fail Safe Mode	0=Stop, 1=Hold Last, 2=Drive Min, 3=Drive Max, 4=Warning
1142	41143	R	Int32	0	Flash Pressure Span Min	4-20 mA span min. Units × 10. Two words.
1144	41145	R	Int32	1000	Flash Pressure Span Max	4-20 mA span max. Units × 10. Two words.
1146	41147	R	Int32	4	Flash Pressure Low Trip	Low trip. mA × 10. Two words. L1.
1148	41149	R	Int32	20	Flash Pressure High Trip	High trip. mA × 10. Two words. L1.
1150	41151	R	UInt16	2	Flash Pressure Deadband	Deadband. mA × 10.
1152	41153	R	UInt16	2	Flash Pressure Fail Safe Delay	Trip delay in seconds (2–20 s).

DISCRETE INPUT SETTINGS (1160–1177)

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1160	41161	R	UInt16	0	Remote Start	0 = Disabled; 1 = Enabled. Enables 3-step discrete start sequence.
1165	41166	R	UInt16	0	Level Low Enable	0 = Disabled; 1 = Enabled.

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1166	41167	R	UInt16	0	Level Low Fail Safe Mode	0=Stop, 1=Hold Last, 2=Drive Min, 3=Drive Max, 4=Warning
1167	41168	R	UInt16	2	Level Low Fail Safe Delay	Trip delay in seconds (2–20 s).
1170	41171	R	UInt16	0	Pump 1 Status Enable	0 = Disabled; 1 = Enabled.
1171	41172	R	UInt16	0	Pump 1 Status Fail Safe Mode	0=Stop, 1=Hold Last, 2=Drive Min, 3=Drive Max, 4=Warning
1172	41173	R	UInt16	2	Pump 1 Status Fail Safe Delay	Trip delay in seconds (2–20 s).
1175	41176	R	UInt16	0	Pump 2 Status Enable	0 = Disabled; 1 = Enabled.
1176	41177	R	UInt16	0	Pump 2 Status Fail Safe Mode	0=Stop, 1=Hold Last, 2=Drive Min, 3=Drive Max, 4=Warning
1177	41178	R	UInt16	2	Pump 2 Status Fail Safe Delay	Trip delay in seconds (2–20 s).

OUTPUT SETTINGS (1181–1200)

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1181	41182	R	UInt16	0	Pump 2 Enable	0 = Disabled; 1 = Enabled. Enables Pump 2 discrete output.
1182	41183	R	Int32	0	Pump Flow Rate Span Min	Output 4-20 mA span min. Units × 10. Two words.
1184	41185	R	Int32	500	Pump Flow Rate Span Max	Output 4-20 mA span max. Units × 10. Two words.
1186	41187	R	Int32	4	Pump Flow Rate Min	Minimum pump output. mA × 10. Two words. L1.
1188	41189	R	Int32	20	Pump Flow Rate Max	Maximum pump output. mA × 10. Two words. L1.
1190	41191	R	UInt16	100	Output PWM	Discrete output PWM duty cycle. Range: 1–100 %.

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1192	41193	**R/W**	Int32	12	Manual Pump Flow Rate	Manual pump output in Manual mode. mA × 10. Two words. L2.
1194	41195	**R/W**	Int32	0	Pump Output Offset	Buffer added to calculated output. Percentage × 10. Two words. L2.
1196	41197	**R/W**	Int32	3	Glycol To Water Ratio	Ratio multiplied by 10. Example: 3.0 = 30. L2.
1198	41199	**R/W**	Int32	0	Target Outlet Water Vapor Content	Target outlet water vapor content in lb/MMCF. Value is 10x. Two words. L2.
1200	41201	**R/W**	UInt16	0	Manual Mode Enable	0 = Disabled; 1 = Enabled. Forces controller to Manual mode. L2.

PID CONTROL SETTINGS (1225–1231)

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1225	41226	**R/W**	UInt16	10	Glycol Process Proportional Band	PID proportional band × 10 (flow units). L2.
1226	41227	**R/W**	UInt16	4	Glycol Process Integral Time	PID integral time × 10 (min/repeat). L2.
1227	41228	**R/W**	UInt16	0	Glycol Process Derivative Time	PID derivative time × 10 (minutes). L2.
1228	41229	**R/W**	UInt16	10	Glycol Process Integral Reset Range	Anti-windup range × 10 (flow units). L2.
1229	41230	**R/W**	UInt16	100	Glycol PID Output Rate Limit	Output rate limit × 10 (%/second). L2.
1230	41231	**R/W**	UInt16	10	Glycol PID Ramp Time	Startup ramp time in seconds (0–255 s). L1.
1231	41232	**R/W**	UInt16	1	Glycol PID Enable	0 = Disabled; 1 = Enabled. L2.

SYSTEM CONFIGURATION SETTINGS (1250–1259)

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1250	41251	R	UInt16	1	Voltage Setting	0 = 12 V; 1 = 24 V.
1251	41252	R	UInt16	0	Voltage Restart	0 = Disabled; 1 = Enabled. Auto-restart after voltage fault.
1252	41253	R	UInt16	0	L1 Password Enable	0 = Disabled; 1 = Enabled.
1253	41254	R	UInt16	0	Commissioning Complete	0 = Incomplete; 1 = Complete.
1254	41255	R	UInt16	1	Slave Address	Modbus slave address (1–247).
1255	41256	R	UInt16	0	Baud Rate	0 = 9600 bps; 1 = 19200 bps.
1256	41257	R	UInt16	0	Stop Bits	0 = 1 stop bit; 1 = 2 stop bits.
1257	41258	R	UInt16	0	Parity	0 = None; 1 = Odd; 2 = Even.
1258	41259	R	UInt16	0	Modbus Termination	0 = Disabled; 1 = Enabled (100 Ω).
1259	41260	R	UInt16	0	Remote Access	0 = Disabled; 1 = Enabled. Enables write access to settings via Modbus.

CALIBRATION SETTINGS (20000–20026)

Calibration registers store field-trim slope and offset corrections for each analog input channel. All registers are read-only via Modbus. Changes require direct keypad access.

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DEFAULT	DESCRIPTION
20000	60001	Float (IEEE 754)	AIN 1 Field Slope	1.0	Analog input 1 slope correction (0.9375–1.0625). IEEE 754, two words.
20002	60003	Float (IEEE 754)	AIN 1 Field Offset	0.0	Analog input 1 offset correction (−1.0 to 1.0). IEEE 754, two words.
20004	60005	Float (IEEE 754)	AIN 2 Field Slope	1.0	Analog input 2 slope correction.
20006	60007	Float (IEEE 754)	AIN 2 Field Offset	0.0	Analog input 2 offset correction.
20008	60009	Float (IEEE 754)	AIN 3 Field Slope	1.0	Analog input 3 slope correction.

OFFSET	ADDRESS (1-BASED)	DATA TYPE	NAME	DEFAULT	DESCRIPTION
20010	60011	Float (IEEE 754)	AIN 3 Field Offset	0.0	Analog input 3 offset correction.
20012	60013	Float (IEEE 754)	AIN 4 Field Slope	1.0	Analog input 4 slope correction.
20014	60015	Float (IEEE 754)	AIN 4 Field Offset	0.0	Analog input 4 offset correction.
20016	60017	Float (IEEE 754)	AIN 5 Field Slope	1.0	Analog input 5 slope correction.
20018	60019	Float (IEEE 754)	AIN 5 Field Offset	0.0	Analog input 5 offset correction.
20020	60021	Float (IEEE 754)	AIN 6 Field Slope	1.0	Analog input 6 slope correction.
20022	60023	Float (IEEE 754)	AIN 6 Field Offset	0.0	Analog input 6 offset correction.
20024	60025	Float (IEEE 754)	AIN 7 Field Slope	1.0	Analog input 7 slope correction.
20026	60027	Float (IEEE 754)	AIN 7 Field Offset	0.0	Analog input 7 offset correction.

UNITS CONFIGURATION SETTINGS (1300–1303)

Units settings configure the engineering units used for display and Modbus reporting of process values. All units settings are L1 security and read-only via Modbus; changes require keypad access.

OFFSET	ADDRESS (1-BASED)	ACCESS	DATA TYPE	DEFAULT	NAME	DESCRIPTION
1300	41301	R	UInt16	0	Temperature Units	0=Celsius, 1=Fahrenheit
1301	41302	R	UInt16	1	LP Filter DP Units	1=kPa, 2=psi, 3=inch wc, 4=oz/in^2, 5=kg/cm^2, 6=Percent, 7=Milliamps
1302	41303	R	UInt16	1	HP Filter DP Units	1=kPa, 2=psi, 3=inch wc, 4=oz/in^2, 5=kg/cm^2, 6=Percent, 7=Milliamps
1303	41304	R	UInt16	1	Flash Pressure Units	1=kPa, 2=psi, 3=inch wc, 4=oz/in^2, 5=kg/cm^2, 6=Percent, 7=Milliamps

End of Appendix A

DOCUMENT REVISION HISTORY

1.0 — 2026-06-01

Applies to:

- **Controller Hardware:** v2.4.3
- **UI Hardware:** v3.4.3
- **Firmware:** GP 0.3.x

Initial release.

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