PROFIRE

PF2150-E SERIES BMS CONTROLLER

PF2150-E | PF2150-EMD

PRODUCT MANUAL

DOC-001175
v4.0 WEB

PROFIRE

Warning:

All PF2150 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 PF2150 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 disconnect while the circuit is live or unless the area is free of ignitible concentrations.

Explosion hazard. Do not remove or replace fuses unless power has been disconnected or the area is free of ignitible concentrations.

All safety functions must be end-to-end proven following commissioning of the system.

This equipment is suitable for use in Class I, Division 2, Groups A,B,C and D or non-hazardous locations only.

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

Avertissement:

Toutes les installations PF2150 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 PF2150 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 débrancher pendant que le circuit est sous tension ou à moins que l'emplacement ne soit exempt de concentrations inflammables.

Risque d'explosion. Ne pas retirer ni remplacer les fusibles ni à moins que l'alimentation n'ait été coupée ou que l'emplacement ne soit exempt de concentrations inflammables.

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

Cet équipement convient à une utilisation en Classe I, Division 2, Groupes A, B, C et D ou uniquement dans des emplacement non dangereux.

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

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1 SCOPE

The PF2150-E Burner Management System is an automated safety controller designed to monitor and control industrial heating processes that utilize single burner natural draft appliances. It provides safe burner ignition, ionization flame detection, temperature control and peripheral input device monitoring. The user interface provides real-time system status and state information as well as detailed alert annunciation, system diagnostics and data logging.

This document provides detailed descriptions of the PF2150-E inputs, outputs and operating sequence as well as installation, maintenance and commissioning instructions. This document is applicable for all PF2150-E series controllers (e.g., PF2150-E00, PF2150-EMD) with the following hardware and firmware versions:

BMS CARD HARDWARE VERSION	UI CARD HARDWARE VERSION	PF2150-E FIRMWARE VERSION
v1.2	v1.1	E 1.3.2

2 APPROVALS AND RATINGS

2.1 CERTIFICATIONS

The PF2150-E is certified to the following standards:

C UL US
LISTED
E517794

UL 60730-2-5/ ANSI Z21.20:22 • CSA C22.2 No. 60730-2-5:22
UL 121201 • CSA-C22.2 No. 213
Class I Div 2 Group ABCD; T4A
Class I, Zone 2, Group IIC T4 – US Only

C ETL LISTED US
Intertek
5004922

UL 50; UL 50E; CSA C22.2 #94.1; CSA C22.2. #94.2; CSA C22.2 #60529
Type 4/4X Enclosure

2.2 PRODUCT DECLARATIONS

SYSTEM PARAMETER	VALUE
Maximum Flame Detector Response Time	50ms
Minimum Flame Detector Self-Checking Rate	1Hz
Maximum Flame Failure Response Time	4s
Maximum Ignition Time	20.5s
Maximum Pilot-Flame Establishing Period	10s
Maximum Post-Ignition Time	2.5s
Minimum Pre-Ignition Time	300ms
Maximum Pre-Ignition Time – Auto Mode	600ms
Maximum Pre-Ignition Time – Manual Mode	10.5s
Minimum Post-Purge Time	10s
Minimum Recycle Time	10s
Minimum Waiting Time	5s
Maximum Trial For Ignition Period	10s
Maximum Valve Sequence Period	30s
Pollution Degree	Pollution Degree 1 when enclosure door securely closed
Signal For Presence of Flame	Flame signal DC offset of less than -2.54V
Signal For Absence of Flame	Flame signal DC offset of -2.54V or greater
High Voltage Spark Gap Range	2mm To 8mm
Purpose	Burner Control System
Type of Burners	Operation: Natural Draft Fuel: Gas
Type of Control	Incorporated Control
Type of Ignition	Interrupted Ignition
Type of Pilot	Continuous Pilot
Types of Action	2.V - Non-Volatile Lock-Out (when both Modbus Enable setting and Start Input Mode setting are disabled) 2.W - Volatile Lock-Out (Soft Lockout) when either Modbus Enable setting or Start Input Mode setting are enabled 2.Y - Electronic Disconnection 2.AD - Permanent Operation

2.3 PRODUCT RATINGS

SYSTEM PARAMETER	VALUE
Operating Temperature	-40°C to 55°C (-40°F to 131°F)
Storage Temperature	-40°C to 55°C (-40°F to 131°F)
Input Voltage	$12V_{DC}$, 8.0A max $24V_{DC}$, 4.2A max For use with a Class 2 power supply

2.4 ENCLOSURE RATINGS

SYSTEM PARAMETER	VALUE
Material	Polycarbonate
Type Rating	Type 4/4X
Ingress Protection Rating	IP66
Dimensions	291mm x 243mm x 178mm (11.5” x 9.6” x 7.0”)
Weight	2.6 kg / 5.8 lbs

2.5 POWER CONSUMPTION

	12V MODE	24V MODE
Running • Screen Off • No USB	0.7W	1.0W
Running • Screen Off • USB installed	1.1W	1.4W
Running • Screen On • USB installed	1.2W	1.5W

2.6 UI CARD TERMINAL RATINGS

TERMINAL	NAME	RATING
1	BMS +	BMS+ and - Power In: 10.2 - $32.4V_{DC}$, 500mA Max BMS A and B Communication: -7V – 7V common mode range
2	BMS A	
3	BMS B	
4	BMS -	
5	MODBUS -	RS-485, -7V – 7V common mode range with reference to terminal 5 (-)
6	MODBUS A	
7	MODBUS B	
8	MODBUS -	
-	USB	$5V_{DC}$, 200mA Max
-	KEYPAD	$3V_{DC}$, 4.75 kΩ Source Impedance

2.7 BMS CARD TERMINAL RATINGS

TERMINAL	NAME	RATING
1	UI +	Power Out: 10.2 - 32.4V_{DC}, 500mA Max PFN: -7V – 7V Common Mode Range
2	UI A	
3	UI B	
4	UI -	
5	4-20mA OUT OUT	20mA Max Output, Expected Load: < 350Ω ±0.1 mA accuracy
6	4-20mA OUT GND	
7	PoC PWR	Current: 30mA max Voltage: matches system voltage up to a maximum of 13.5V
8	PoC SIG IN	30V_{DC} max Energized: 1.25mA or greater, De-energized: 0.5mA or less
9	PILOT +	Valve Output Rating: 12V_{DC}, 5.0A max per output; 7.8A max combined total, Pilot duty 24V_{DC}, 4.0A max per output; 4.0A max combined total, Pilot duty Pulsed Output with configurable PWM
10	PILOT -	
11	SSV1 / STAGE 1 +	
12	SSV1 / STAGE 1 -	
13	SSV2 / STAGE 2 +	
14	SSV2 / STAGE 2 -	
15	STATUS A	40 V_{DC} max 1A max
16	NOT USED	
17	STATUS B	
18/19/20	VIN –	12V Mode: 10.2 - 16.2 V_{DC} (12V_{DC} nominal) 24V Mode: 20.4 - 32.4 V_{DC} (24V nominal)
21/22	VIN +	
23	ESD PWR	Current: 30mA max Voltage: matches system voltage up to a maximum of 13.5V
24	ESD SIG IN	30V_{DC} max Energized: 1.25mA or greater, De-energized: 0.5mA or less
25	START PWR	Current: 30mA max Voltage: matches system voltage up to a maximum of 13.5V
26	START SIG IN	30V_{DC} max Energized: 1.25mA or greater, De-energized: 0.5mA or less
27	AUX TEMP +	Type K thermocouple -100°C to 1350°C ± 2°C accuracy
28	AUX TEMP -	
29	BATH A +	
30	BATH A -	
31	BATH B +	
32	BATH B -	
33	PRESSURE PWR	Current: 30mA max Voltage: matches system voltage up to a maximum of 13.5V
34	PRESSURE SIG IN	30V_{DC} max Digital Mode: Energized: 1.25mA or greater, De-energized: 0.5mA or less 4-20 Mode: 2.08V max voltage drop at 20mA (1.00V typical), ±0.1 mA accuracy
35	HIGH PRESSURE PWR	Current: 30mA max Voltage: matches system voltage up to a maximum of 13.5V
36	HIGH PRESSURE SIG IN	30V_{DC} max Energized: 1.25mA or greater, De-energized: 0.5mA or less
37	LEVEL PWR	Current: 30mA max Voltage: matches system voltage up to a maximum of 13.5V
38	LEVEL SIG IN	30V_{DC} max Digital Mode: Energized: 1.25mA or greater, De-energized: 0.5mA or less 4-20 Mode: 2.08V max voltage drop at 20mA (1.00V typical), ±0.1 mA accuracy
39	ION +	Intermittent 80-130 V_{RMS} Output
40	ION -	
41	IGNITION COIL -	Pulsed output at system input voltage Expected Load: Inductive
42	IGNITION COIL +	

[1] *All wiring must be adequately sized in accordance with local electrical codes.*

3 CONTROLLER INTERFACE

3.1 KEYPAD

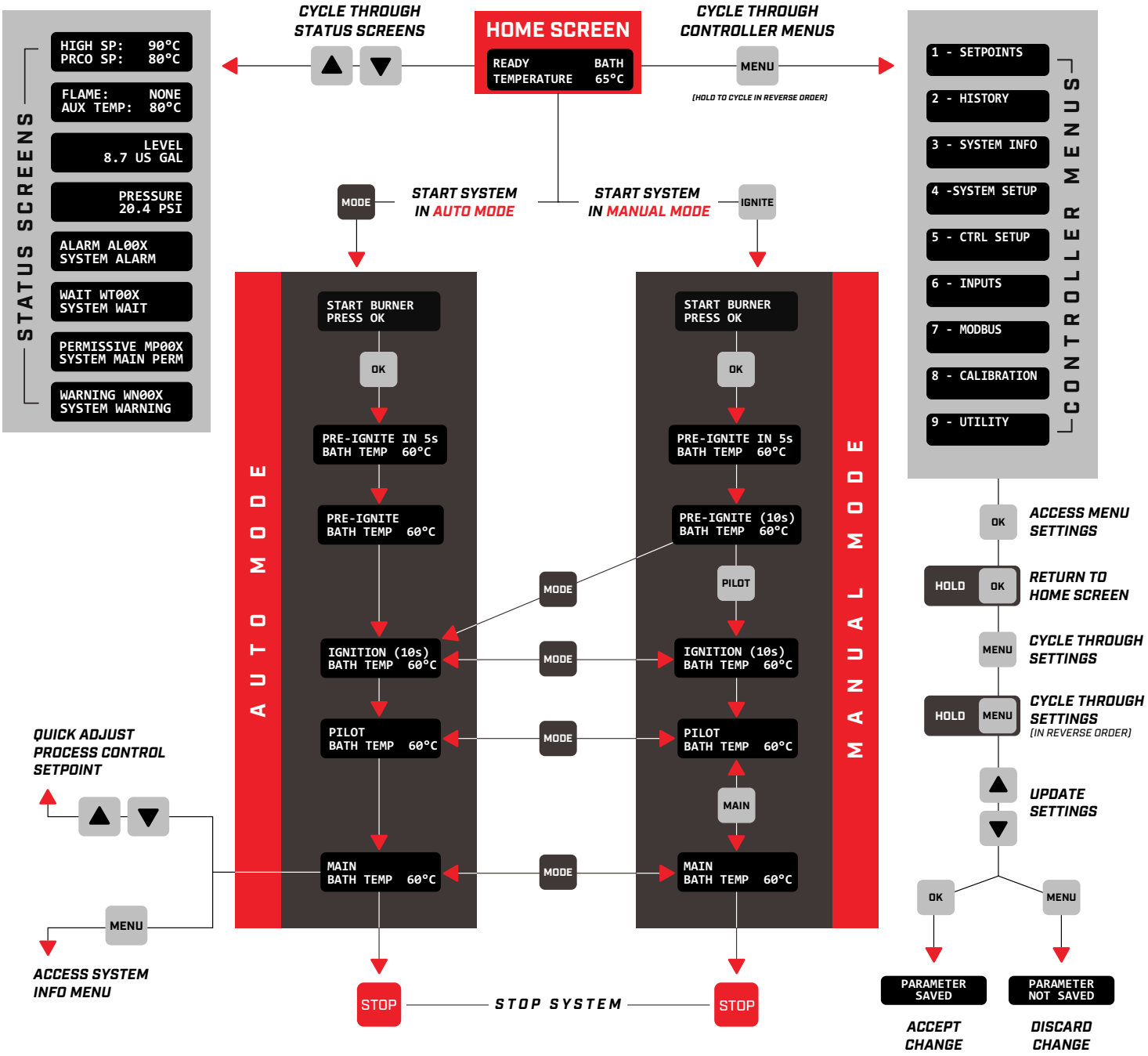
3.1.1 INDICATOR LEDS

LED	BEHAVIOR	DESCRIPTION
FLAME	On	Flame detected
	Off	No flame detected
AUTO	On	System is in Auto Mode
	Off	System is in Manual Mode
	Blinking	Wait present when running in Auto Mode
MANUAL	On	System is in Manual Mode
	Off	System is in Auto Mode
	Slow blinking	System is in Alarm state
	Fast flashing	System is in Lockout state
PILOT	On	Pilot Output energized
	Off	Pilot Output de-energized
IGNITE	On	Coil Output energized
	Off	Coil Output de-energized
MAIN	On	SSV1 Output energized
	Off	SSV1 Output de-energized
	Blinking	Main Permissive present when running in Auto Mode

3.1.2 BUTTONS

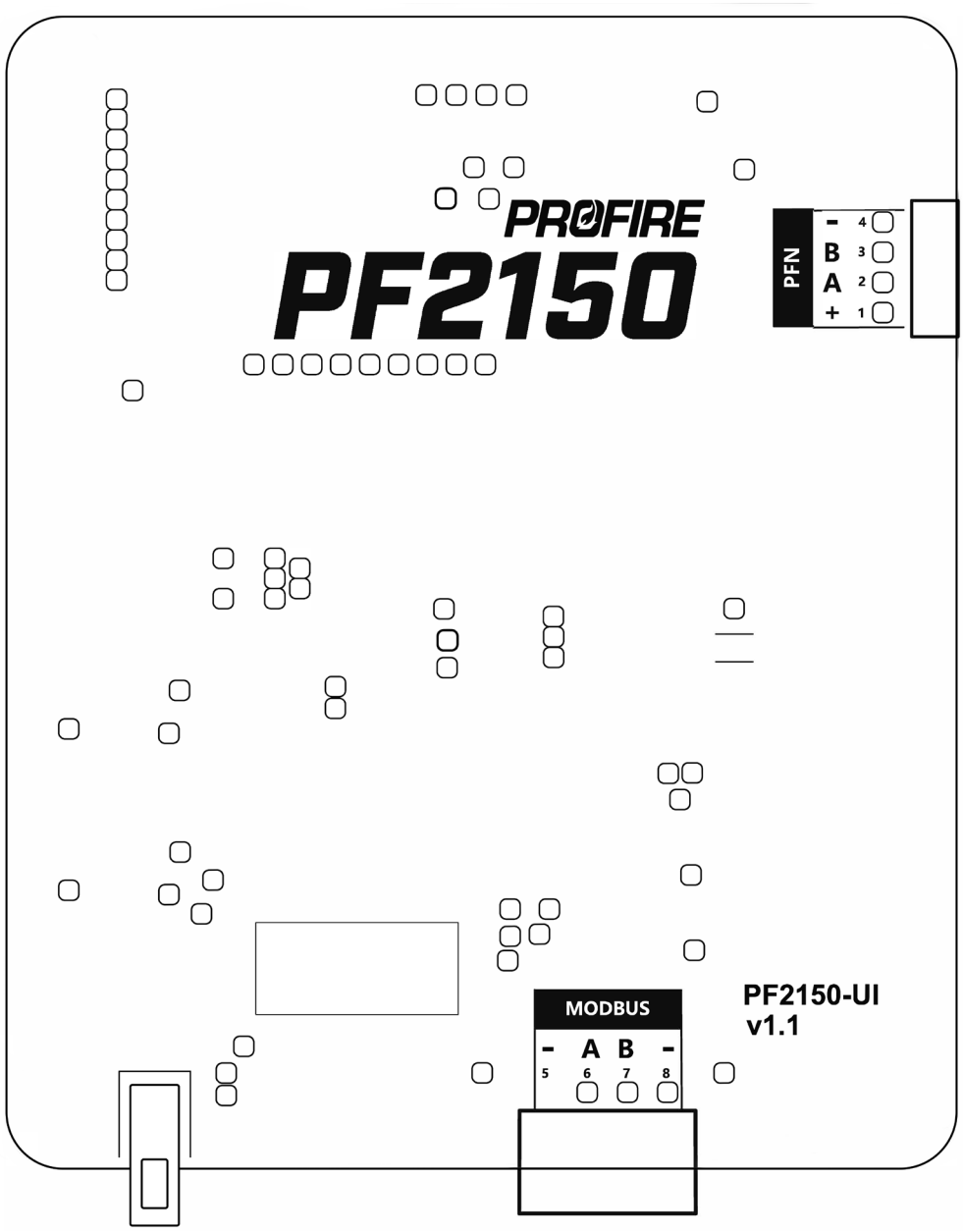
BUTTON	ACTION	FUNCTIONS
STOP	Press	Stop the system
MENU	Press	Access controller menus
		Discard settings changes
		Scroll through controller menus
	Hold	Scroll through controller menus in reverse order
▲	Press	Scroll through controller status information on the Status Screen
		Quick Setpoint Adjust: Change Process Setpoint setting while running in Auto Mode Note: Set L1 Password Enable setting (in Menu 4 - SYSTEM SETUP) to Enabled to allow Quick Setpoint Adjust only when authenticated.
▼		Change settings from controller menus
	Hold	Change settings at an accelerated rate
OK	Press	Acknowledge Lockout message
		Access controller menu contents
		Accept a request to start the system
		Accept settings changes
	Hold	Return to home screen
	Long hold	Password logout
MODE	Press	Swap between Manual Mode and Auto Mode
		Send a request to start the system in Auto Mode
PILOT	Press	Energize/de-energize Pilot Output when running in Manual Mode
	Hold	No effect
IGNITE	Press	Send a request to start the system in Manual Mode
	Hold	No effect
MAIN	Press	Energize/de-energize SSV Outputs when running in Manual Mode
	Hold	No effect

3.2 SCREEN NAVIGATION



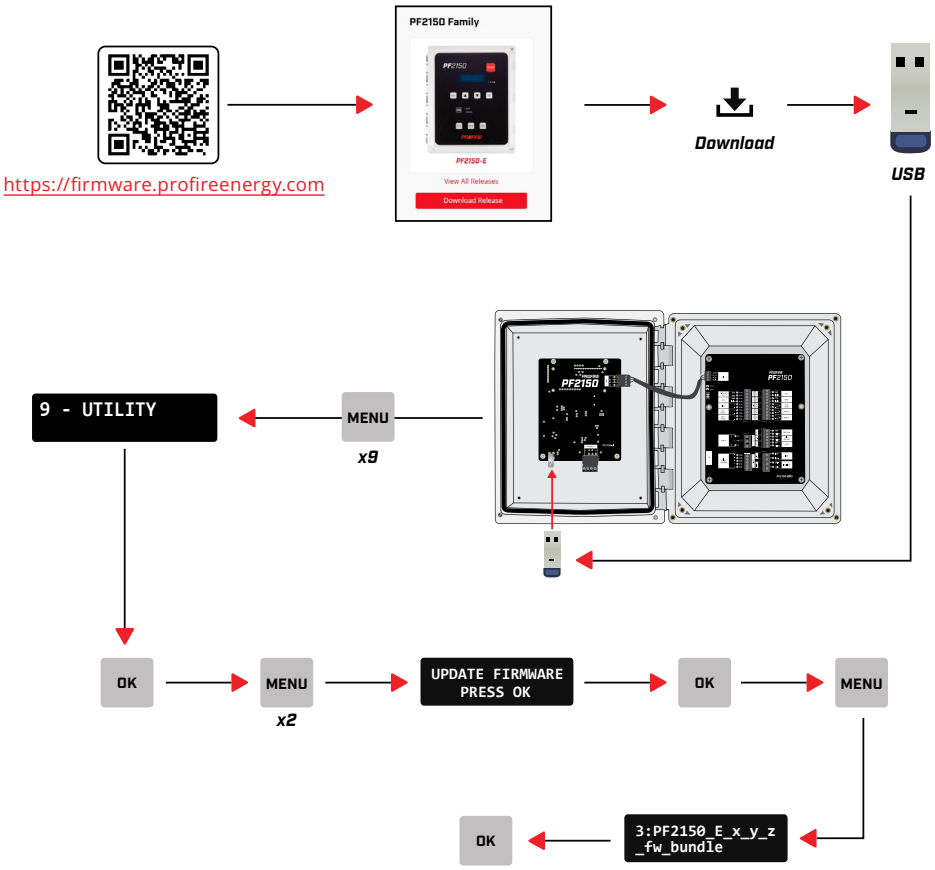
3.3 USER INTERFACE CARD

The User Interface (UI) Card includes a 2-line display and connections to the keypad and BMS card. There is a USB port for settings backup/restore, firmware update, and data logging as well as additional terminals to connect to a Modbus client.



3.4 SOFTWARE UTILITIES

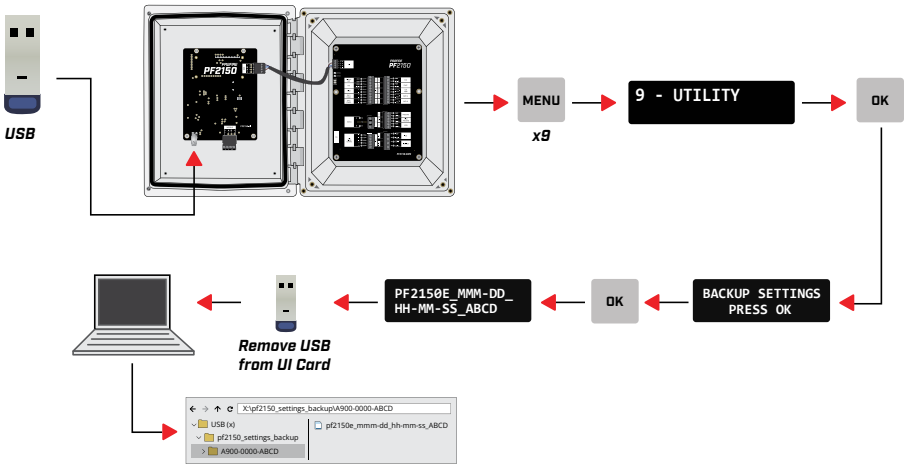
3.4.1 FIRMWARE UPDATE



1. Navigate to the Profire firmware website: https://firmware.profireenergy.com
2. Select appropriate firmware bundle and download it to a USB storage device
   Note: save compressed PF2150_E_x_y_z_fw_bundle.tar file to the USB (i.e., do not unzip the bundle file)
3. Insert USB into PF2150 system
4. Navigate to Menu 9 - Utility and select Update Firmware
5. Select appropriate firmware bundle to begin update. System will automatically perform a Settings Backup prior to beginning the update, and will return to the Home Screen once firmware update is complete.

   System will return to the Home Screen once firmware update is complete
6. Perform a Settings Restore and configure any new settings appropriately.
7. Perform all site commissioning checks prior to starting the system

3.4.2 SETTINGS BACKUP

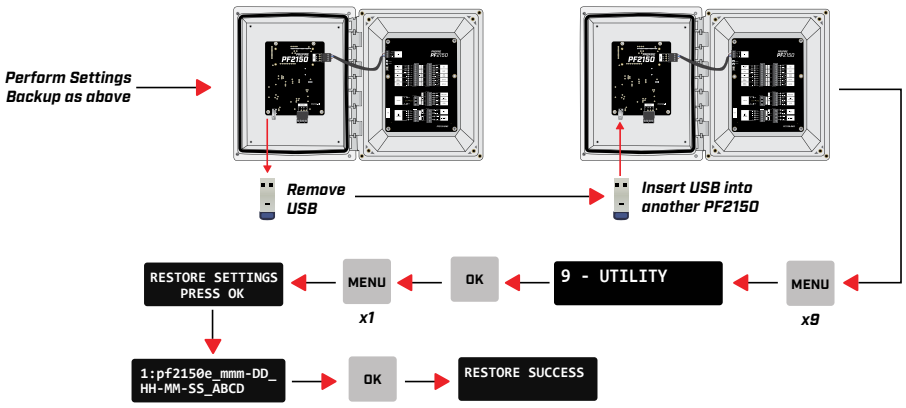


1. Insert USB into PF2150 system
2. Navigate to Menu 9 - Utility and select Backup Settings
3. Settings file will be saved to the USB in the form: pf2150e_mmm-dd_HH-MM-SS_ABCD

   where:
   mmm-dd = date of backup
   HH-MM-SS = time of backup
   ABCD = last 4 digits of BMS serial number

3.4.3 SETTINGS RESTORE

Settings Restore can be used to load saved settings files onto a PF2150 – The steps below outline the procedure for transferring settings from a commissioned PF2150 to an uncommissioned PF2150, but the same procedure can be used to restore settings following a firmware update or settings reset.



1. Perform Settings Backup (as in previous section) on the commissioned PF2150 to save desired settings file to a USB.
2. Transfer USB to uncommissioned PF2150
3. Navigate to Menu 9 - Utility and select Restore Settings
4. Select desired settings file and press OK

   Note: file must be located in a folder on the USB named "pf2150_settings_backup" in order for it to be shown on the screen for selection.

3.4.4 DATA LOGGING

Data Logging is only available on PF2150-EMD models with a USB storage device installed. The following items are saved to the USB at an interval specified by the Data Logging Period setting (MENU 7 – MODBUS):

- Date
- Time
- Run Status
- Pilot Output Status
- SSV1 Output Status
- SSV2 Output Status
- Pilot Output Voltage
- SSV1 Output Voltage
- SSV2 Output Voltage
- POC Input Status
- ESD Input Status
- Start Input Status
- Pressure Input Status (Digital)
- Level Input Status (Digital)
- High Pressure Input Status
- Pressure Input Reading (4–20)
- Level Input Reading (4–20)
- Flame Status
- Bath Temp Input Reading
- Aux Temp Input Reading
- Ambient Temp Reading
- Bath Process Setpoint
- Bath High Temp Setpoint
- Bath Main Off Setpoint
- Bath Pilot Off Setpoint
- Aux High Temp Setpoint
- Aux Process Setpoint
- Aux Main Off Setpoint
- Aux Pilot Off Setpoint
- System Voltage

3.5 CONTROLLER SETTINGS

3.5.1 SETPOINTS MENU

SETTING [SECURITY LEVEL]	DEFAULT	RANGE	DESCRIPTION
Bath Pilot Off Setpoint L1	185°F 85°C	-40°F to 2462°F -40°C to 1350°C	Bath temperature at which Pilot Output is de-energized to avoid overheating (when enabled).
Bath Main Off Setpoint L1	185°F 85°C	-40°F to 2462°F -40°C to 1350°C	Bath temperature at which SSV1 Output and SSV2 Output are de-energized to avoid overheating (when enabled).
Bath Process Setpoint L1	176°F 80°C	-40°F to 2462°F -40°C to 1350°C	Target Bath temperature when configured as a process control input.
Bath Low Temp Setpoint L2	32°F 0°C	-40°F to 2462°F -40°C to 1350°C	Bath temperature at which a low temperature warning is displayed on screen.
Bath Deadband L1	3.6°F 2°C	0°F to 180°F 0°C to 100°C	Tolerance applied around Bath setpoints under certain state re-entry conditions to prevent excessive valve wear.
Aux Temp Pilot Off Setpoint L1	185°F 85°C	-40°F to 2462°F -40°C to 1350°C	Aux temperature at which Pilot Output is de-energized to avoid overheating (when enabled).
Aux Temp Main Off Setpoint L1	185°F 85°C	-40°F to 2462°F -40°C to 1350°C	Aux temperature at which SSV1 Output and SSV2 Output are de-energized to avoid overheating (when enabled).
Aux Temp Process Setpoint L1	176°F 80°C	-40°F to 2462°F -40°C to 1350°C	Target Aux temperature when configured as a process control input.
Aux Temp Low Temp Setpoint L2	32°F 0°C	-40°F to 2462°F -40°C to 1350°C	Aux temperature at which a low temperature warning is displayed on screen.
Aux Temp Deadband L1	3.6°F 2°C	0°F to 180°F 0°C to 100°C	Tolerance applied around Aux setpoints under certain state re-entry conditions to prevent excessive valve wear.
Process Proportional Band L2	18°F 10°C	0°F to 1800°F 0°C to 1000°C	Proportional band used by PID control algorithm.
Process Integral Time L2	4 mins /rep	0 mins/rep to 1000 mins/rep	Integral time used by PID control algorithm.
Process Derivative Time L2	0 mins	0 minutes to 1000 minutes	Derivative time used by PID control algorithm.
Process Integral Reset Range L2	18°F 10°C	0°F to 1800°F 0°C to 1000°C	Tolerance outside which the PID control algorithm resets integral error accumulation.
PID Output Rate Limit L2	100%/sec	0.1%/sec to 100%/sec	Limit on the maximum rate of change of the 4-20mA Output when configured for Valve Control.
PID Ramp Time L2	10 sec	0 seconds to 255 seconds	Time to ramp to 100% firing rate upon startup.

3.5.2 HISTORY MENU

ITEM	DESCRIPTION
Flame Fail Count	Displays the number of flame failures since last power cycle
Relights Left	Displays the number of relights remaining before a flame fail will result in a shutdown
Event Log	Displays the event log on screen
Clear Event Log	Resets the event log
Export Event Log	Saves the event log to USB

3.5.3 SYSTEM INFO MENU

ITEM	DESCRIPTION
Bath Temp	Displays the current Bath Input temperature measurement
TCV Output %	Displays the current 4-20mA Output position
Ambient Temp	Displays the current Ambient Temperature
Level	Displays the Level Input reading
Pressure	Displays the Pressure Input reading
System Voltage	Displays the current Power Input voltage
Date	Displays the current date
Time	Displays the current time
Location	Displays the configured Location of the controller
Current State	Displays the current state of the system
Bootloader Version	Displays the bootloader version of the system
BMS Bundle	Displays the firmware bundle version of the BMS card
UI Bundle	Displays the firmware bundle version of the UI card
Hardware Variant	Displays the system product variant

3.5.4 SYSTEM SETUP MENU

SETTING (SECURITY LEVEL)	DEFAULT	RANGE	DESCRIPTION
Voltage Restart L2	Disabled	Disabled	Controller must be manually restarted following power up.
		Enabled	Controller will automatically restart if it was running at last power loss.
Purge Time L2	60 seconds	10 seconds to 900 seconds	Time for which a Purging wait will be present following power up or a stop of gas flow.
Pilot Startup Delay Time L2	15 seconds	5 seconds to 600 seconds	Time held in Pilot state upon initial startup.
Main Startup Delay Time L2	30 seconds	30 seconds to 600 seconds	Time held with 4-20 Output in Main Light Off Position before ramping to high heat demand configuration.
Relight Attempts L2	3 relights	0 relights to 3 relights	Number of allowable relight attempts following a flame loss. Note: Initial ignition is allowed 3 attempts regardless of this setting.
Low Pressure Delay L2	2 seconds	2 seconds to 20 seconds	Time for which a low-pressure event must persist for the system to act upon it.
Level Delay L2	2 seconds	2 seconds to 20 seconds	Time for which a low-level event must persist for the system to act upon it.
Status Contact Mode L2	Run Status	Run Status	Configures the Status Contact to indicate running status.
		Heating Status	Configures the Status Contact to indicate heating status.
		Low Temp Warning	Configures the Status Contact to indicate Low Temperature Status.
		Level Control	Configures the Status Contact to indicate Level Control Status.
L1 Password Enable L2	Disabled	Disabled	L2 Password is required for all setting adjustments except Quick Setpoint Adjust while running.
		Enabled	L1 Password must be used to access L1-protected settings.
Display Sleep L1	Never	Never	Time of inactivity after which the UI screen turns off to limit power consumption.
		5 minutes	
		10 minutes	
		15 minutes	

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SETTING [SECURITY LEVEL]	DEFAULT	RANGE	DESCRIPTION
Pilot Valve PWM L2	60%	1% to 100%	Duty cycle of Pilot Output signal
SSV PWM L2	60%	1% to 100%	Duty cycle of SSV1 Output and SSV2 Output signals.
Input Voltage L2	12V	12V 24V	Voltage expected to be applied to controller Power Input.
UI Comm Loss Alarm L1	Disabled	Disabled	System continues to run when communication is lost between BMS card and UI card.
		Enabled	System shuts down when communication is lost between BMS card and UI card.
Temperature Units L2	Fahrenheit	Celsius Fahrenheit	Units for all temperature measurements and settings shown on screen.
Date	–	–	User-configurable date.
Time	–	–	User-configurable date system time.
Location L2	Blank	Alphanumeric string between 0 to 16 characters	The location of the controller.
Reset Settings	–	–	Resets all settings to their default values.

3.5.5 CONTROL SETUP MENU

SETTING [SECURITY LEVEL]	DEFAULT	RANGE	DESCRIPTION
Bath Type L2	Dual	Dual	Bath input is wired to a dual-element thermocouple.
		Single	Bath Input is wired to a single-element thermocouple. Note: Bath Input is safety rated ONLY if the input is configured as Dual. If configured as Single the input is NOT safety rated.
Bath Mode L2	Process Control	Process Control	The system uses Bath Input temperature to make process control decisions.
		High Temp ESD	The system uses Bath Input temperature for high temperature shutdown only.
Bath High Temp Setpoint L2	194°F 90°C	-40°F to 2462°F -40°C to 1350°C	Temperature at which the system shuts down to avoid overheating.
Process Control Mode L2	On/Off Control	On/Off Control	Configures the system for single stage heating.
		Staged Heating	Configures the system for two-stage heating.
		Bath PID Control	Configures the system for temperature modulation based on Bath Input measurement.
		Aux Temp PID Control	Configures the system for temperature modulation based on Aux Temp Input measurement.
Pilot Off Mode L1	Disabled	Disabled	Pilot Output remains energized until process temperature reaches its configured High Temp Setpoint.
		Off At Pilot Off Setpoint	Pilot Output remains energized until process temperature reaches its configured Pilot Off Setpoint.
		Off At Main Off Setpoint	Pilot Output remains energized until process temperature reaches its configured Main Off Setpoint.

SETTING [SECURITY LEVEL]	DEFAULT	RANGE	DESCRIPTION
Aux Temp Mode L2	Disabled	Disabled	Aux Temp Input is ignored by the system.
		Process Control	The system uses Aux Temp Input to make process control decisions.
		High Temp ESD	The system uses Aux Temp Input for high temperature shutdown only.
		Display Only	The system displays Aux Temp Input measurements, but they have no effect on system behavior.
Aux Temp High Temp Setpoint L2	194°F 90°C	-40°F to 2462°F -40°C to 1350°C	Temperature at which the system shuts down to avoid overheating when Aux Temp is enabled.
Analog Output Mode L2	Valve Control	Valve Control	Configures the 4-20mA Output for use with a temperature control valve installed in the main fuel train.
		Bath Temp Echo	Configures the 4-20mA Output to echo Bath Input measurement as a 4-20mA signal.
		Aux Temp Echo	Configures the 4-20mA Output to echo Aux Temp Input measurement as a 4-20mA signal.
		Level Echo	Configures the 4-20mA Output to echo Level Input measurement as a 4-20mA signal.
TCV Min Position L2	40%	0% to 70%	Configures the minimum position of 4-20mA Output when configured for use with a temperature control valve.
TCV Purge Position L2	100%	0% to 100%	Configures the purge position of 4-20mA Output when configured for use with a temperature control valve.
TCV Pilot Position L2	40%	0% to 100%	Configures the pilot position of 4-20mA Output when configured for use with a temperature control valve.
TCV Main Light Off Position L2	40%	0% to 100%	Configures the light off position of 4-20mA Output when configured for use with a temperature control valve.
Temp Echo Span Min L2	32°F 0°C	-148°F to 2462°F -100°C to 1350°C	Specifies the temperature corresponding to a 4mA echoed signal on 4-20mA Output when configured for temperature echo.
Temp Echo Span Max L2	2462°F 1350°C	-148°F to 2462°F -100°C to 1350°C	Specifies the temperature corresponding to a 20mA echoed signal on 4-20mA Output when configured for temperature echo.

3.5.6 INPUTS MENU

SETTING [SECURITY LEVEL]	DEFAULT	RANGE	
Level Type L2	Digital	Disabled	Level Input is ignored.
		Digital	Configures Level input for use with a level switch.
		4-20	Configures Level Input for use with a level transmitter.
Level Units L2	US Gallons	Litres	Units for all level measurements and settings shown on screen.
		m3	
		US Gallons	
		Bbl	
		ft3	
		Percent	
		Milliamps	
Level Digital Mode L2	Alarm	Alarm	A digital level trip results in an alarm.
		Wait	A digital level trip results in a wait.
Level High Trip Mode L2	Alarm	Alarm	A high-level event results in an alarm.
		Wait	A high-level event results in a wait.
Level Low Trip Mode L2	Alarm	Alarm	A low-level event results in an alarm.
		Wait	A low-level event results in a wait.
Level Span Max L2	31.7 gal 120 L	0 to 2,641,720 gal 0 to 10,000,000 L	Level Input measurement corresponding to a 20mA level transmitter input signal.
Level Span Min L2	0 gal 0 L	0 to 2,641,720 gal 0 to 10,000,000 L	Level Input measurement corresponding to a 4mA level transmitter input signal.
Level High Trip L2	30.9 gal 117 L	0 to Span Max	Level at which the system recognizes a high-level event.
Level Low Trip L2	15.9 gal 60 L	0 to Span Max	Level at which the system recognizes a low-level event.
Level Control Setpoint L2	27.7 gal 105 L	0 to Span Max	Level measurement determining behavior of Status Contact when configured for Level Control Status.
Level Deadband L2	0.4 gal 1.5 L	0% to 6.25% of span	Tolerance applied around Level setpoints under certain conditions to prevent excessive bouncing between system states.
Pressure Type L2	Digital	Disabled	Pressure Input is ignored.
		Digital	Configures Pressure Input for use with a low pressure switch.
		4-20	Configures Pressure Input for use with a pressure transmitter.
Pressure Units L2	psi	kPa	Units for all pressure measurements and settings shown on screen.
		psi	
		inch wc	
		oz/in2	
		kg/cm2	
		Percent	
		Milliamps	
Low Pressure Mode L2	Alarm	Alarm	A low-pressure event results in an alarm.
		Wait	A low-pressure event results in a wait.
		Warning	A low-pressure event results in a warning.
		Main Permissive	A low-pressure event results in a main permissive.

SETTING [SECURITY LEVEL]	DEFAULT	RANGE	DESCRIPTION
Pressure Span Max L2	30 psi 207 kPa	0 to 14504 psi 0 to 100,000 kPa	Pressure Input measurement corresponding to a 20mA pressure transmitter input signal.
Pressure Span Min L2	0 psi 0 kPa	0 to 14504 psi 0 to 100,000 kPa	Pressure Input measurement corresponding to a 4mA pressure transmitter input signal.
Pressure High Trip L2	25.7 psi 177 kPa	0 to Span Max	Pressure at which the system recognizes a high-pressure event.
Pressure Low Trip L2	0 psi 0 kPa	0 to Span Max	Pressure at which the system recognizes a low-pressure event.
Pressure Deadband L2	0.4 psi 2.6 kPa	0% to 6.25% of span	Tolerance applied around Pressure setpoints under certain conditions to prevent excessive bouncing between system states.
High Press Input L2	Enabled	Disabled	High Pressure Input is ignored.
		Enabled	High Pressure alarms, waits, and warnings are enabled.
POC Input L2	Enabled	Disabled	PoC Input is ignored.
		Enabled	PoC Input alarms, waits and warnings are enabled.
Start Input L2	Disabled	Disabled	Start Input is ignored.
		Enabled	Start Input can be used to start the system and acknowledge lockouts.

3.5.7 MODBUS MENU (ONLY AVAILABLE ON PF2150-EMD)

SETTING [SECURITY LEVEL]	DEFAULT	RANGE	DESCRIPTION
Modbus Enable L2	Disabled	Disabled	Disables Modbus communication.
		Enabled	Enables Modbus communication.
Server Address L2	1	1 to 247	Specifies the Modbus server address of the controller.
Baud Rate L2	9600	9600	Specifies the Modbus communication Baud Rate configuration.
		19200	
Stop Bits L2	1	1	Specifies the Modbus Communication Stop Bits configuration.
		2	
Parity L2	None	None	Specifies the Modbus Communication Parity configuration.
		Odd	
		Even	
Modbus Termination L2	Disabled	Disabled	Disables Modbus termination resistor.
		Enabled	Enabled Modbus termination resistor.
Data Logging Period L1	5 seconds	5 seconds to 300 seconds	Interval at which the system data is logged to USB.

3.5.8 CALIBRATION MENU

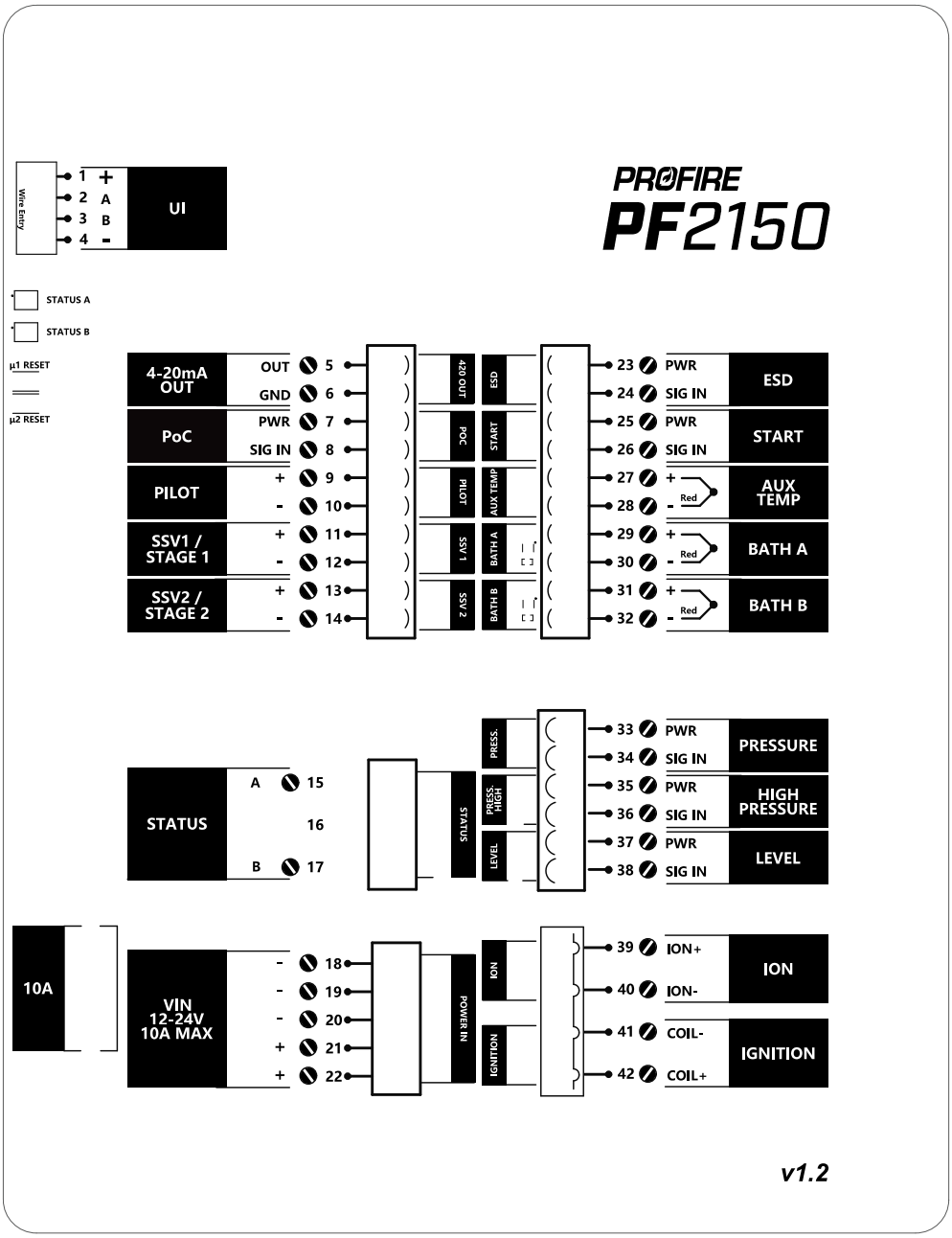
Follow on-screen instruction to field-calibrate level and pressure inputs.

3.5.9 UTILITY MENU

ITEM	DESCRIPTION
Backup Settings	Saves current settings to USB
Restore Settings	Loads a settings file from USB. Note: Settings file must be located in a folder on the USB named "pf2150_settings_backup"
Update Firmware	Updates system firmware with approved Profire PF2150-E firmware bundles saved to USB **Note:** Firmware update can only be performed when the system is not running.
Keypad Test	Tests keypad/screen/LED functionality

4 BMS CARD

The BMS card provides the necessary inputs and outputs to safely control a burner as well as additional inputs and outputs to reliably accommodate a variety of single burner applications. The following section outlines the behavior and intended device connections for each BMS input and output and provides brief configuration instructions and links to the appropriate Connection Diagrams (pg 42).



4.1 4-20mA OUTPUT

4.1.1 DETAILS

ITEM	
Terminals	5 & 6
Name	4-20mA OUT
Type	4-20mA Output

4.1.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Control of 4-20mA proportional fuel gas valve	5 – CONTROL SETUP > 4-20 Output Mode = Valve Control 5 – CONTROL SETUP > TCV Min Position = as desired* 5 – CONTROL SETUP > TCV Purge Position = as desired* 5 – CONTROL SETUP > TCV Pilot Position = as desired* 5 – CONTROL SETUP > TCV Main Light Off Position = as desired* **Per appliance manufacturer recommendations and burner tuning.*	4-20mA Output Wiring – TCV (pg 43)
BMS temperature input echo to PLC	5 – CONTROL SETUP > 4-20 Output Mode = Bath Temp Echo 5 – CONTROL SETUP > Temp Echo Span Min and Temp Echo Span Max = As desired	4-20mA Output Wiring – Echo (pg 43)
BMS level input echo to PLC	5 – CONTROL SETUP > 4-20 Output Mode = Level Echo	4-20mA Output Wiring – Echo (pg 43)

4.1.3 SYSTEM BEHAVIOR

4-20 OUTPUT MODE SETTING	STATE	OUTPUT
Valve Control	Power On	TCV Purge Position
	Lockout	TCV Purge Position
	Alarm	TCV Purge Position
	Ready	TCV Purge Position
	Waiting	TCV Purge Position
	Pre-Ignition	TCV Purge Position
	Ignition	TCV Pilot Position setting
	Pilot	TCV Pilot Position setting
	Process Control – Main Delay	TCV Main Light Off Position setting
	Process Control – Main	100%
	Process Control – PID Control	Modulated in accordance with PID configuration settings
	Process Control – Stage 1	50%
	Process Control – Stage 2	100%
Bath Temp Echo **Aux Temp Echo**	Any	Temperature input measurement is echoed out as a 4-20mA signal mapped between the Temp Echo Span Min and Temp Echo Span Max setting values. Input values below the Min Span setting are echoed out as 4mA signals and input values above the Max Span setting are echoed out as 20mA signals.
Level Echo	Any	Level input measurement echoed out as an identical 4-20mA signal

4.2 PROOF OF CLOSURE INPUT

4.2.1 DETAILS

ITEM	
Terminals	7 & 8
Name	PoC
Type	Digital input

4.2.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Connection to main valve (SSV) proof of closure switch	6 – INPUTS > Proof of Closure = Enabled	Digital Input – Dry Contact (pg 42) Digital Input – Wet Contact (pg 42)

4.2.3 SYSTEM BEHAVIOR

	SCENARIO			
CONFIGURATION DETAILS	SSV OUTPUT STATE	POC INPUT STATE	STATE TRANSITION IF RUNNING	ALERTS
PROOF CLOSURE: ENABLED	De-energized	De-energized	Lockout	POC Input Open Alarm
	Energized	Energized	No effect	POC Still Closed Warning
	De-energized	Energized	No effect	N/A
	Energized	De-energized	No effect	N/A
PROOF CLOSURE: DISABLED	Any	Any	No effect	N/A

4.3 PILOT VALVE OUTPUT

4.3.1 DETAILS

ITEM	
Terminals	9 & 10
Name	Pilot
Type	Powered solenoid output with configurable PWM

4.3.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Connection to normally closed pilot gas shutoff valve – Peak and hold	4 – SYSTEM SETUP > Pilot Valve PWM = per valve manufacturer recommendations	Solenoid Output – 12V/24V (pg 44)
Connection to normally closed pilot gas shutoff valve – Constant current	4 – SYSTEM SETUP > Pilot Valve PWM = 100%	Solenoid Output – 12V/24V (pg 44)

4.3.3 SYSTEM BEHAVIOR

SYSTEM STATE	PILOT OUTPUT
POWER ON	De-energized
LOCKOUT	De-energized
ALARM	De-energized
READY	De-energized
WAITING	De-energized
PRE-IGNITION	De-energized
IGNITION	Energized
PILOT	Energized
PROCESS CONTROL	Energized

4.4 SSV1 MAIN VALVE OUTPUT

4.4.1 DETAILS

ITEM	
Terminals	11 & 12
Name	SSV1 / STAGE 1
Type	Powered solenoid output with configurable PWM

4.4.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Connection to normally closed main gas shutoff valve – Peak and hold	4 – SYSTEM SETUP > SSV PWM = per valve manufacturer recommendations	Solenoid Output – 12V/24V (pg 44)
Connection to normally closed main gas shutoff valve – Constant current	4 – SYSTEM SETUP > SSV PWM = 100%	Solenoid Output – 12V/24V (pg 44)

4.4.3 SYSTEM BEHAVIOR

SYSTEM STATE	SSV1 OUTPUT
POWER ON	De-energized
LOCKOUT	De-energized
ALARM	De-energized
READY	De-energized
WAITING	De-energized
PRE-IGNITION	De-energized
IGNITION	De-energized
PILOT	De-energized
PROCESS CONTROL	Energized

4.5 SSV2 MAIN VALVE OUTPUT

4.5.1 DETAILS

ITEM	
Terminals	13 & 14
Name	SSV2 / STAGE 2
Type	Powered solenoid output with configurable PWM

4.5.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Connection to normally closed main gas shutoff valve – Peak and hold	4 – SYSTEM SETUP > SSV PWM = per valve manufacturer recommendations	Solenoid Output – 12V/24V (pg 44)
Connection to normally closed main gas shutoff valve – Constant current	4 – SYSTEM SETUP > SSV PWM = 100%	Solenoid Output – 12V/24V (pg 44)

4.5.3 SYSTEM BEHAVIOR

SYSTEM STATE	SSV2 OUTPUT
POWER ON	De-energized
LOCKOUT	De-energized
ALARM	De-energized
READY	De-energized
WAITING	De-energized
PRE-IGNITION	De-energized
IGNITION	De-energized
PILOT	De-energized
PROCESS CONTROL - MAIN DELAY	De-energized when Process Control Mode setting is configured as Staged Heating. Energized otherwise.
PROCESS CONTROL - MAIN	Energized
PROCESS CONTROL - PID CONTROL	Energized
PROCESS CONTROL - STAGE 1	De-energized
PROCESS CONTROL - STAGE 2	Energized

4.6 STATUS

4.6.1 DETAILS

ITEM	
Terminals	15 & 17
Name	STATUS
Type	N.O. dry contact

4.6.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Connection to site equipment status panel	4 – SYSTEM SETUP > Status Contact Mode = Run Status or Heating Status or Low Temp Warning	Run Status – External DC Source (pg 44) Run Status – BMS Power (pg 44)
Connection to tank pump motor enable via relay	4 – SYSTEM SETUP > Status Contact Mode = Level Control	Run Status – Pump Control (pg 45)

4.6.3 STATUS CONTACT BEHAVIOR

			LOW TEMP WARNING MODE		LEVEL CONTROL MODE	
SYSTEM STATE	RUN STATUS MODE	HEATING STATUS MODE	PROCESS TEMP BELOW LOW TEMP SETPOINT	PROCESS TEMP ABOVE LOW TEMP SETPOINT	LEVEL INPUT BELOW LEVEL CONTROL SETPOINT	LEVEL INPUT ABOVE LEVEL CONTROL SETPOINT
POWER ON	OPEN	OPEN	OPEN	OPEN	CLOSED	OPEN
LOCKOUT	OPEN	OPEN	OPEN	OPEN	CLOSED	OPEN
ALARM	OPEN	OPEN	OPEN	OPEN	CLOSED	OPEN
READY	OPEN	OPEN	OPEN	OPEN	CLOSED	OPEN
WAITING	CLOSED	OPEN	OPEN	CLOSED	CLOSED	OPEN
PRE-IGNITION	CLOSED	OPEN	OPEN	CLOSED	CLOSED	OPEN
IGNITION	CLOSED	CLOSED	OPEN	CLOSED	CLOSED	OPEN
PILOT	CLOSED	CLOSED	OPEN	CLOSED	CLOSED	OPEN
PROCESS CONTROL	CLOSED	CLOSED	OPEN	CLOSED	CLOSED	OPEN

4.7 POWER INPUT

4.7.1 DETAILS

ITEM	
Terminals	18 - 22
Name	VIN
Type	12/24V Power Input

4.7.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Power input connection from 12V Class 2 Power Supply	4 – SYSTEM SETUP > Input Voltage = 12V	Power Input Wiring (pg 45)
Power input connection from 24V Class 2 Power Supply	4 – SYSTEM SETUP > Input Voltage = 24V	Power Input Wiring (pg 45)

4.7.3 SYSTEM BEHAVIOR – 12V MODE

SCENARIO			
SYSTEM VOLTAGE	VOLTAGE RESTART SETTING	STATE TRANSITION IF RUNNING	ALERTS
BELOW 9.5V	Enabled	Waiting	Low Voltage Wait
	Disabled	Lockout	Low Voltage Alarm
BETWEEN 9.5V AND 10.2V	Any	No effect	Low Voltage Warning
BETWEEN 10.2V AND 16.2V	Any	No effect	N/A
BETWEEN 16.2V AND 16.8V	Any	No effect	High Voltage Warning
ABOVE 16.8V	Enabled	Waiting	High Voltage Wait
	Disabled	Lockout	High Voltage Alarm

4.7.4 SYSTEM BEHAVIOR – 24V MODE

SCENARIO			
SYSTEM VOLTAGE	VOLTAGE RESTART	STATE TRANSITION IF RUNNING	ALERTS
BELOW 19.0V	Enabled	Waiting	Low Voltage Wait
	Disabled	Lockout	Low Voltage Alarm
BETWEEN 19.0V AND 20.4V	Any	No effect	Low Voltage Warning
BETWEEN 20.4V AND 32.4V	Any	No effect	N/A
BETWEEN 32.4V AND 33.6V	Any	No effect	High Voltage Warning
ABOVE 33.6V	Enabled	Waiting	High Voltage Wait
	Disabled	Lockout	High Voltage Alarm

4.8 ESD INPUT

4.8.1 DETAILS

ITEM	
Terminals	23 & 24
Name	ESD
Type	Digital input

4.8.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Connection to external emergency stop push button or PLC	N/A	Digital Input – Dry Contact (pg 42) Digital Input – Wet Contact (pg 46)

4.8.3 SYSTEM BEHAVIOR

ESD INPUT STATE	STATE TRANSITION IF RUNNING	STATE TRANSITION IF STOPPED	ALERTS
DE-ENERGIZED	Lockout	Alarm	ESD Input Open Alarm
ENERGIZED	No effect	No effect	N/A

4.9 START INPUT

4.9.1 DETAILS

ITEM	
Terminals	25 & 26
Name	START
Type	Digital input

4.9.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Connection to digital start switch or PLC	6 – INPUTS > Remote Start = Enabled	Digital Input – Dry Contact (pg 42) Digital Input – Wet Contact (pg 42)

4.9.3 SYSTEM BEHAVIOR

	EVENT			
CONFIGURATION DETAILS	INITIAL SYSTEM STATE	START INPUT STATE	STATE TRANSITION	ALERTS
REMOTE START: ENABLED	Any	Energized	No effect	N/A
	Any Stopped	De-energized	No effect	Start Input Open Wait
	Any Running	De-energized	Waiting	Start Input Open Wait
	Lockout	Energized to de-energized to energized[1]	Ready/Alarm[2]	N/A
	Ready	Energized to de-energized to energized[1]	Startup	N/A
REMOTE START: DISABLED	Any	Any	No effect	N/A

[1]The system registers a double-action Start Input toggle only when it transitions from energized to de-energized to energized within 30 seconds.

[2]The Start Input can be used to acknowledge a lockout message only when the system has performed fewer than 5 remote lockout acknowledgements (i.e., lockout acknowledgements initiated via Modbus or Start Input) within the last 15 minutes. A further attempt to acknowledge a lockout message using the Start Input will be rejected unless it is initiated after the 15-minute window elapses. Lockout messages can always be acknowledged locally using the Ok button.

4.10 TEMPERATURE INPUTS

4.10.1 DETAILS

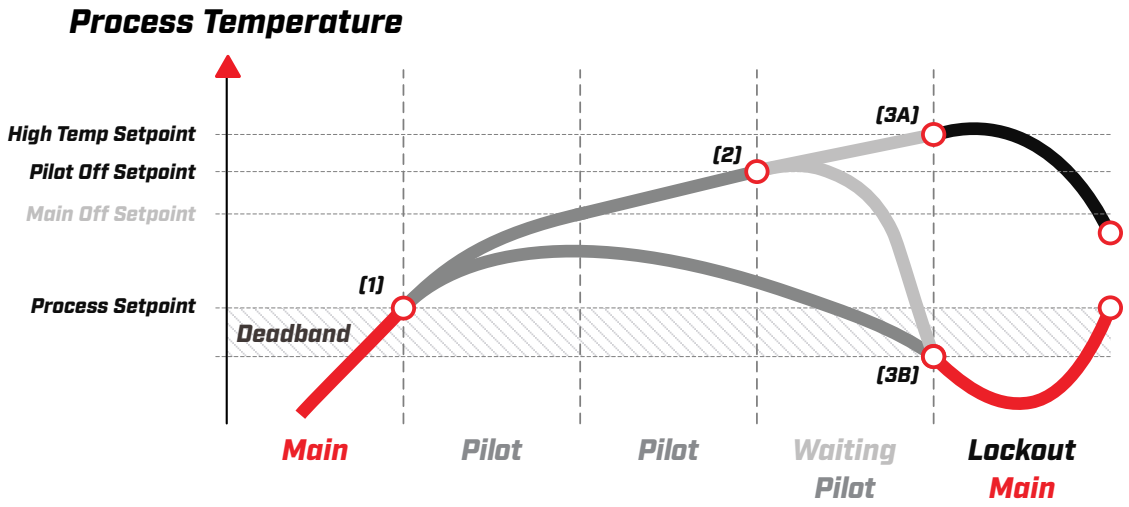
ITEM	
Terminals & Names	27 & 28: AUX TEMP 29 & 30: BATH A 31 & 32: BATH B
Type	Type K thermocouple input

4.10.2 INTENDED FIELD DEVICE CONNECTIONS

INPUT	FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
AUX TEMP	Connection to auxiliary thermocouple for process control and high temperature shutdown.	5 – CONTROL SETUP > Aux Temp Mode = Process Control	Temperature Input – Single Type K Thermocouple (pg 46)
	Connection to auxiliary thermocouple for high temperature shutdown only.	5 – CONTROL SETUP > Aux Temp Mode = High Temp ESD	Temperature Input – Single Type K Thermocouple (pg 46)
	Connection to auxiliary thermocouple for display only.	5 – CONTROL SETUP > Aux Temp Mode = Display Only	Temperature Input – Single Type K Thermocouple (pg 46)
BATH A	Connection to thermocouple installed in appliance bath for process control and high temperature shutdown.	5 – CONTROL SETUP > Bath Mode = Process Control	Temperature Input – Dual Type K Thermocouple (pg 46) Temperature Input – Single Type K Thermocouple (pg 46)
	Connection to thermocouple installed in appliance bath for high temperature shutdown only.	5 – CONTROL SETUP > Bath Mode = High Temp ESD	Temperature Input – Dual Type K Thermocouple (pg 46) Temperature Input – Single Type K Thermocouple (pg 46)
BATH B	Connection to second element of dual thermocouple installed in appliance bath.	5 – CONTROL SETUP > Bath Type = Dual	Temperature Input – Dual Type K Thermocouple (pg 46)

4.10.3 ON/OFF CONTROL BEHAVIOR

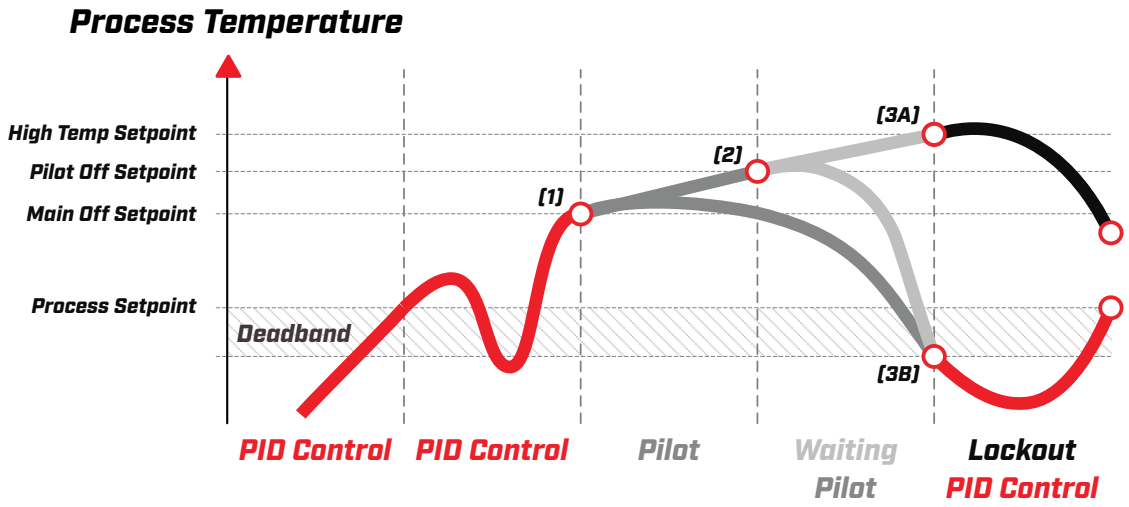
The following graphic outlines system behavior with respect to process temperature when Process Control Mode setting is configured as On/Off Control:



	DESCRIPTION	SCENARIO	SYSTEM STATE BEHAVIOR
1	Temperature rises above Process Setpoint	Any	Transitions to Pilot state
		Pilot Off Mode setting is configured as Off at Main Off Setpoint	Transitions to Waiting state (not shown in graphic above)
2	Temperature rises above Pilot Off Setpoint	Pilot Off Mode setting is configured as Off at Pilot Off Setpoint	Transitions from Pilot state to Waiting state
		Pilot Off Mode setting is configured as Off at Main Off Setpoint	Remains in Pilot state (not shown in graphic above)
		Pilot Off Mode setting is configured as Disabled	
3A	Temperature rises above High Temp Setpoint	Any	Transitions to Lockout state
3B	Temperature drops below Process Setpoint minus Deadband.	System is in Pilot state	Transitions to Main state
		System is in Waiting state	Transitions through Ignition and Pilot to Main state

4.10.4 PID CONTROL BEHAVIOR

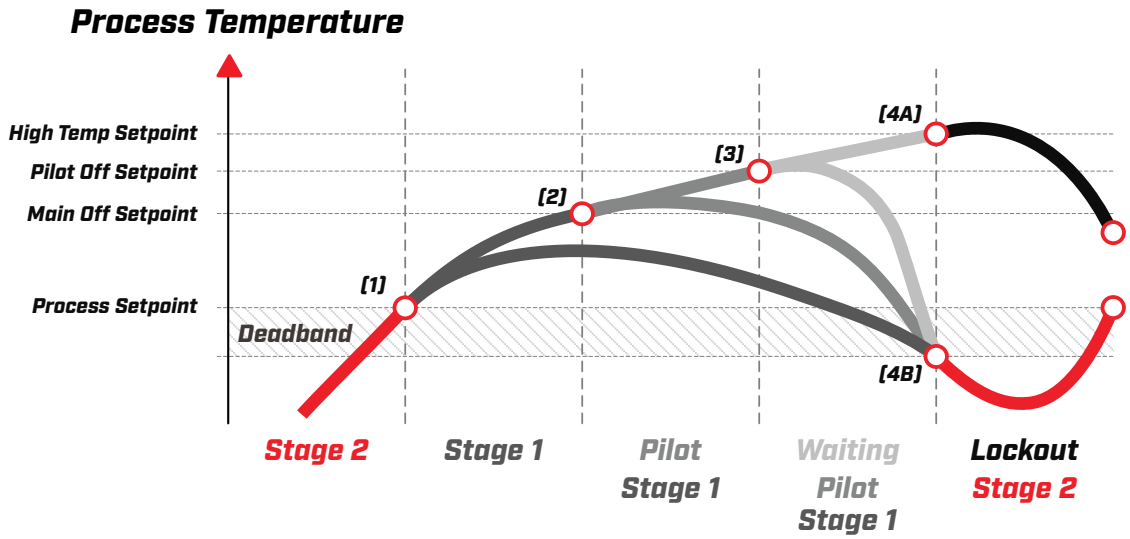
The following graphic outlines system behavior with respect to process temperature when Process Control Mode setting is configured as Bath PID Control or Aux PID Control:



	DESCRIPTION	SCENARIO	SYSTEM STATE BEHAVIOR
1	Temperature rises above Main Off Setpoint	Pilot Off Mode setting is configured as Off at Pilot Off Setpoint	Transitions to Pilot state
		Pilot Off Mode setting is configured as Off at Main Off Setpoint	Transitions to Waiting state (not shown in graphic above)
		Pilot Off Mode setting is configured as Disabled	Transitions to Pilot state
2	Temperature rises above Pilot Off Setpoint	Pilot Off Mode setting is configured as Off at Pilot Off Setpoint	Transitions to Waiting state
		Pilot Off Mode setting is configured as Disabled	Remains in Pilot state (not shown in graphic above)
3A	Temperature rises above High Temp Setpoint	Any	Transitions to Lockout state
3B	Temperature falls below Process Setpoint minus Deadband	System is in Waiting state	Transitions through Ignition and Pilot to PID Control state
		System is in Pilot state	Transitions to PID Control state

4.10.5 STAGED HEATING BEHAVIOR

The following graphic outlines system behavior with respect to process temperature when Process Control Mode setting is configured as Staged Heating:



	DESCRIPTION	SCENARIO	SYSTEM STATE BEHAVIOR
1	Temperature rises above Process Setpoint	Any	Transitions to Stage 1 state
2	Temperature rises above Main Off Setpoint	Pilot Off Mode setting is configured as Off at Pilot Off Setpoint	Transitions to Pilot state
		Pilot Off Mode setting is configured as Off at Main Off Setpoint	Transitions to Waiting state (not shown in graphic above)
		Pilot Off Mode setting is configured as Disabled	Transitions to Pilot state
3	Temperature rises above Pilot Off Setpoint	Pilot Off Mode setting is configured as Off at Pilot Off Setpoint	Transitions to Waiting state
		Pilot Off Mode setting is configured as Disabled	Remains in Pilot state (not shown in graphic above)
4A	Temperature rises above High Temp Setpoint	Any	Transitions to Lockout state
4B	Temperature drops below Process Setpoint minus Deadband	System is in Waiting state	Transitions through Ignition, Pilot and Stage 1 to Stage 2 state
		System is in Pilot state	Transitions through Stage 1 to Stage 2 state
		System is in Stage 1 state	Transitions to Stage 2 state

4.10.6 HIGH TEMP ESD BEHAVIOR

DESCRIPTION	SCENARIO	SYSTEM STATE BEHAVIOR
Temperature rises above High Temp Setpoint	Any	Transitions to Lockout state

4.11 PRESSURE INPUT

4.11.1 DETAILS

ITEM	
Terminals	33 & 34
Name	PRESSURE
Type	Configurable digital or 4-20mA input

4.11.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Digital low-pressure switch	6 – INPUTS > Pressure Type = Digital	Digital Input – Dry Contact (pg 46) Digital Input – Wet Contact (pg 46)
Digital high-pressure switch	Not supported	N/A
4-20mA pressure transmitter	6 – INPUTS > Pressure Type = 4-20	Analog Input – Loop Powered 4-20mA Transmitter (pg 43) Analog Input – Self Powered 4-20mA Transmitter (pg 43)

4.11.3 SYSTEM BEHAVIOR

		SCENARIO			
CONFIGURATION DETAILS		PRESSURE INPUT STATE	SSV OUTPUT STATE	STATE TRANSITION IF RUNNING	ALERTS
TYPE: DIGITAL	Low Pressure Mode: Alarm	De-energized	Any	Lockout	Low Pressure Alarm
	Low Pressure Mode: Wait	De-energized	Any	Waiting	Low Pressure Wait
	Low Pressure Mode: Warning	De-energized	Any	No effect	Low Pressure Warning
	Low Pressure Mode: Main Permissive	De-energized	Any	Pilot [1]	Low Pressure Main Permissive
	Any	Energized	Any	No effect	N/A
TYPE: 4-20	Any	Out of Range	Any	Lockout	Pressure Invalid Alarm
	Any	High Trip	De-energized	No effect	High Pressure Warning
	Any	High Trip	Energized	Lockout	High Pressure Alarm
	Low Pressure Mode: Alarm	Low Trip	Any	Lockout	Low Pressure Alarm
	Low Pressure Mode: Wait	Low Trip	Any	Waiting	Low Pressure Wait
	Low Pressure Mode: Warning	Low Trip	Any	No effect	Low Pressure Warning
	Low Pressure Mode: Main Permissive	Low Trip	Any	Pilot [1]	Low Pressure Main Permissive

[1] *No effect if running in the Waiting state*

4.12 HIGH PRESSURE INPUT

4.12.1 DETAILS

ITEM	
Terminals	35 & 36
Name	HIGH PRESSURE
Type	Digital input

4.12.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
High-pressure switch	6 – INPUTS > High Pressure = Enabled	Digital Input – Dry Contact (pg 42) Digital Input – Wet Contact (pg 46)

4.12.3 SYSTEM BEHAVIOR

CONFIGURATION DETAILS	PRESSURE HIGH INPUT STATE	STATE TRANSITION IF RUNNING	ALERTS
PRESSURE HIGH: ENABLED	De-energized	Lockout	High Pressure Alarm
	Energized	No effect	N/A
PRESSURE HIGH: DISABLED	Any	No effect	N/A

4.13 LEVEL INPUT

4.13.1 DETAILS

ITEM	
Terminals	37 & 38
Name	LEVEL
Type	Configurable digital or 4-20mA input

4.13.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Level switch	6 – INPUTS > Level Type = Digital	Digital Input – Dry Contact (pg 42) Digital Input – Wet Contact (pg 42)
4-20mA level transmitter	6 – INPUTS > Level Type = 4-20	Analog Input – Loop Powered 4-20mA Transmitter (pg 43) Analog Input – Self Powered 4-20mA Transmitter (pg 43)

4.13.3 SYSTEM BEHAVIOR

CONFIGURATION DETAILS		LEVEL INPUT STATE	STATE TRANSITION IF RUNNING	ALERTS
TYPE: DIGITAL	Digital Mode: Alarm	De-energized	Lockout	Low Level Alarm
	Digital Mode: Wait	De-energized	Waiting	Low Level Wait
	Digital Mode: Any	Energized	No effect	N/A
TYPE: 4-20	Any	Out of Range	Lockout	Level Invalid Alarm
	High Trip Mode: Alarm	High	Lockout	High Level Alarm
	High Trip Mode: Wait	High	Waiting	High Level Wait
	Low Trip Mode: Alarm	Low	Lockout	Low Level Alarm
	Low Trip Mode: Wait	Low	Waiting	Low Level Wait
	Any	Valid Range	No effect	N/A

4.14 FLAME DETECTION

4.14.1 DETAILS

ITEM	
Terminals	39 & 40
Name	ION
Type	Ionization flame detection signal

4.14.2 INTENDED FIELD DEVICE CONNECTIONS

FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Connection to Profire ignition coil or flame detection rod per application.	N/A	Single Rod Ignition Wiring (pg 45) Dual Rod Ignition Wiring (pg 46)

4.15 IGNITION OUTPUT

4.15.1 DETAILS

ITEM	
Terminals	41 & 42
Name	IGNITION
Type	Powered ignition output

4.15.2 INTENDED FIELD DEVICE CONNECTIONS

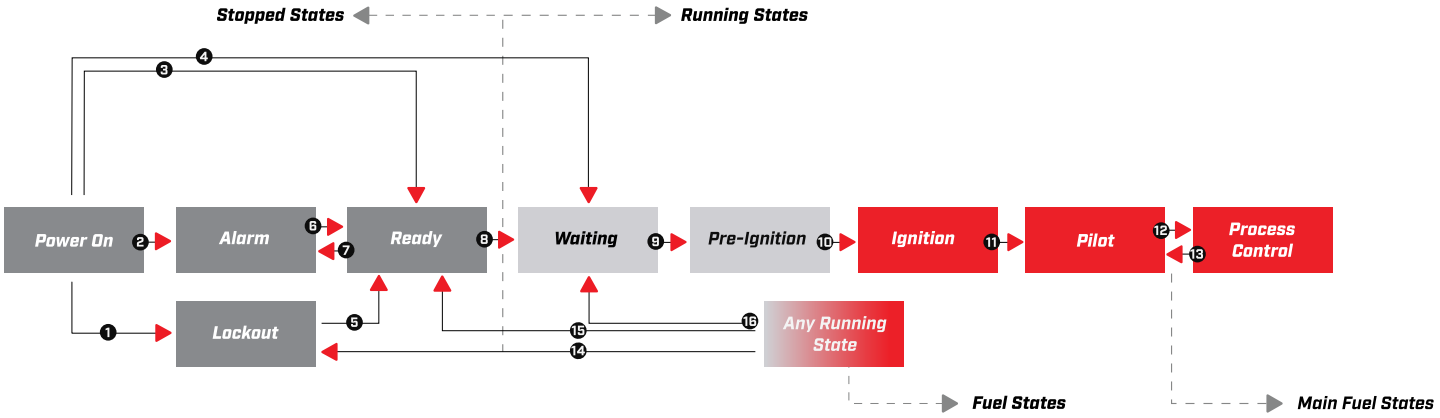
FIELD DEVICE	CONFIGURATION REQUIREMENTS	CONNECTION DIAGRAMS
Connection to Profire ignition coil.	N/A	Single Rod Ignition Wiring (pg 45) Dual Rod Ignition Wiring (pg 46)

4.15.3 SYSTEM BEHAVIOR - COIL OUTPUT

SYSTEM STATE	COIL OUTPUT
Ignition	Energized (Pulsed)
Any Other State	De-energized

5 OPERATING SEQUENCE

The PF2150-E uses a state-based control scheme to safely control a heating appliance. Each system state has specific entry and exit requirements and output behavior as indicated below



	SAFETY OUTPUTS			
STATE NAME	**COIL**	**PILOT**	**SSV 1**	**SSV 2**
Power On	De-energized	De-energized	De-energized	De-energized
Lockout	De-energized	De-energized	De-energized	De-energized
Alarm	De-energized	De-energized	De-energized	De-energized
Ready	De-energized	De-energized	De-energized	De-energized
Waiting	De-energized	De-energized	De-energized	De-energized
Pre-Ignition	Energized	De-energized	De-energized	De-energized
Ignition	Energized	Energized	De-energized	De-energized
Pilot	De-energized	Energized	De-energized	De-energized
Process Control – Main Delay	De-energized	Energized	Energized	Energized*
Process Control – Main	De-energized	Energized	Energized	Energized
Process Control – PID Control	De-energized	Energized	Energized	Energized
Process Control – Stage 1	De-energized	Energized	Energized	De-energized
Process Control – Stage 2	De-energized	Energized	Energized	Energized

** Unless Process Control Mode setting is configured as Staged Heating.*

	FROM	TO	DESCRIPTION	APPLICABLE MODE
1	Power On	Lockout	Lockout present at last power down	Auto and Manual
2	Power On	Alarm	Alarm present upon power up	Auto and Manual
3	Power On	Ready	No alarms present upon power up	Auto and Manual
4	Power On	Waiting	System was running at last power down and relights remaining > 0	Auto and Manual
5	Lockout	Ready	Ok button pressed	Auto and Manual
			Start Input toggled	Auto and Manual
			Modbus Acknowledge command received	Auto and Manual
6	Alarm	Ready	No alarms present	Auto and Manual
7	Ready	Alarm	Alarm present	Auto and Manual
8	Ready	Waiting	Modbus Start Command received	Auto and Manual
			Start Input toggled	Auto and Manual
			MODE button then OK button pressed	Auto only
			Ignite button then OK button pressed	Manual only
9	Waiting	Pre-Ignition	No waits present	Auto and Manual
10	Pre-Ignition	Ignition	Pilot button pressed	Manual only
			Mode button pressed	Manual only
			500ms elapsed	Auto only
11	Ignition	Pilot	Flame detected	Auto and Manual
12	Pilot	Process Control	Appliance needs more heat	Auto only
			Main button pressed	Manual only
13	Process Control	Pilot	Main permissive present	Auto and Manual
			Main button pressed	Manual only
			Appliance needs less heat	Auto and Manual
14	Waiting	Lockout	Alarm present	Auto and Manual
	Pre-Ignition	Lockout	Alarm present	Auto and Manual
	Ignition	Lockout	Alarm present	Auto and Manual
			No flame detected with relights remaining with relights remaining = 0	Auto only
			No flame detected	Manual only
	Pilot/ Process Control	Lockout	Alarm present	Auto and Manual
			Flame fail with relights remaining = 0	Auto only
			Flame fail	Manual only
15	Waiting	Ready	Wait present	Manual only
	Pre-Ignition	Ready	10s elapsed	Manual only
			Wait present	Manual only*
	Ignition	Ready	Wait present	Manual only*
	Pilot/ Process Control	Ready	Pilot button pressed	Manual only
			Wait present	Manual only*
16	Pre-Ignition	Waiting	Wait present	Auto only
	Ignition	Waiting	Wait present	Auto only
			No flame detected with relights remaining > 0	Auto Only
	Pilot/ Process Control	Waiting	Wait present	Auto only
			Flame fail with relights remaining > 0	Auto only

** The system transitions through Waiting into Ready when a wait is present in manual mode.*

6 INSTALLATION

Warning:
Failure to provide a low-impedance path from the burner assembly to the PF2150-E may result in electric shock, product damage, failure to ignite the pilot, or failure to detect flame.

Installers and commissioners of the PF2150-E system must:

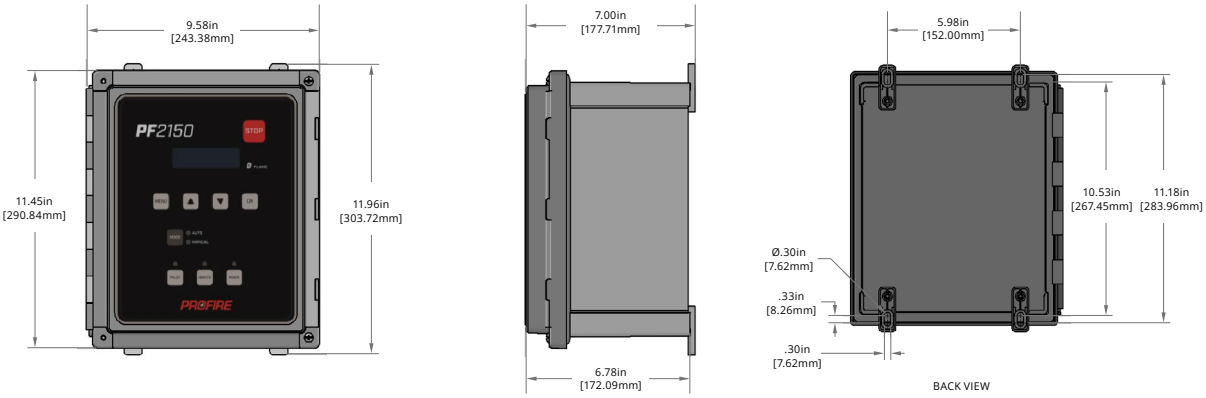
- Understand local codes and how they apply to the installation (for both electrical and mechanical aspects of the installation).
- Understand the electrical and mechanical limitations of the product and how that relates to the installation.
- Understand the safety and operational effects of modifying system settings or wiring.
- Verify all required safety functions prior to completing the commissioning of the appliance.
- Be fluent in the English language (the only language this product supports).
- Be familiar with navigating the product menus and modifying settings.

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 appliance being controlled in order to minimize cable run lengths to the valve train (solenoids), burner assembly (ignition coil and flame rod) and thermocouple elements.
- 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 PF2150-E ENCLOSURE DIMENSIONS



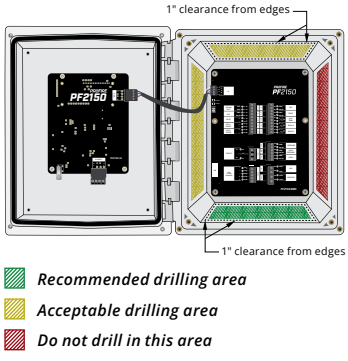
6.1.2 CONDUIT ENTRIES

Conduit entries should be drilled in the bottom of the enclosure while maintaining all of the following:

- 1" clearance from edges
- 2" maximum hole size
- 1/2" minimum hole spacing

All fittings must be Type 4X rated to maintain product Type rating.

Note: The BMS Card should be removed from the enclosure while drilling conduit entries.



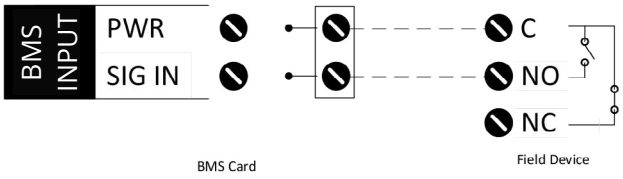
6.2 CONNECTION DIAGRAMS

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.

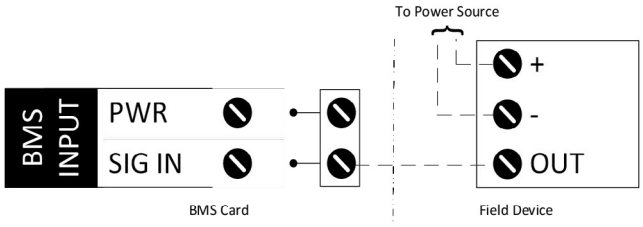
6.2.1 DIGITAL INPUT - DRY CONTACT



Installation Notes:

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

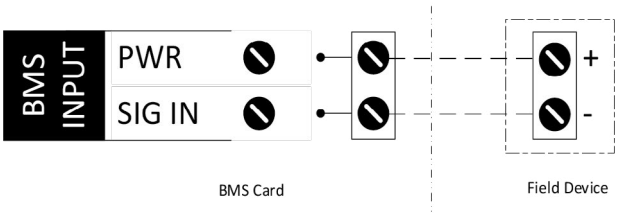
6.2.2 DIGITAL INPUT - WET CONTACT



Installation Notes:

1. The BMS uses energized-to-run logic for all digital inputs.
2. External power source must be Earth grounded.
3. External power source must be referenced about BMS card terminal 18 (VIN-) such that the supplied voltage (1) does not exceed 30V_{DC} with reference to VIN-, and (2) does not drop below -0.5V with reference to VIN-.

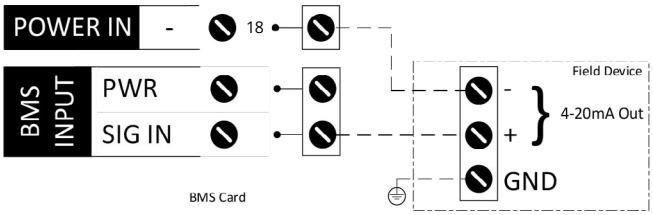
6.2.3 ANALOG INPUT - LOOP POWERED 4-20MA TRANSMITTER



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: $V_{OUT} - V_{DROP}$
   Where V_{OUT} matches system input voltage (VIN) up to a maximum of 13.5V (i.e., VIN = 12V → V_{OUT} = 12V and VIN = 24V → V_{OUT} = 13.5V) and V_{DROP} is the voltage drop at 20mA specified for terminals 34 and 38 in the ratings table of Section 2.7. (pg 7).

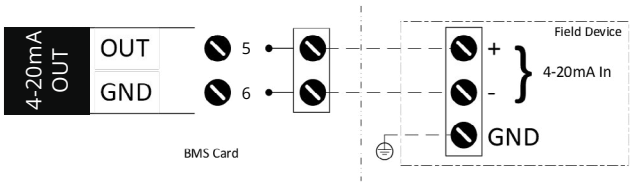
6.2.4 ANALOG INPUT – SELF POWERED 4-20MA TRANSMITTER



Installation Notes:

1. Field Device must be Earth grounded.
2. Power source must be referenced about BMS card terminal 18 (VIN-) such that the supplied voltage (1) does not exceed 30V_{DC} with reference to VIN–, and (2) does not drop below -0.5V with reference to VIN-.

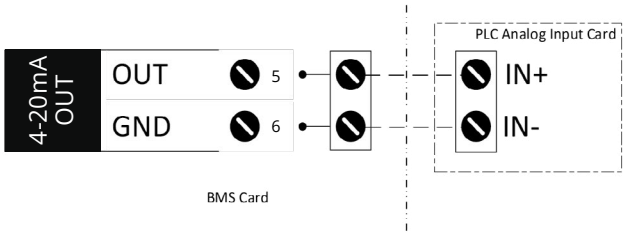
6.2.5 4-20MA OUTPUT WIRING – TCV



Installation Notes:

1. 4-20mA Input – terminal must be run back to BMS terminal 6 (Local ground) to ensure proper output functionality.

6.2.6 4-20MA OUTPUT WIRING – SIGNAL ECHO



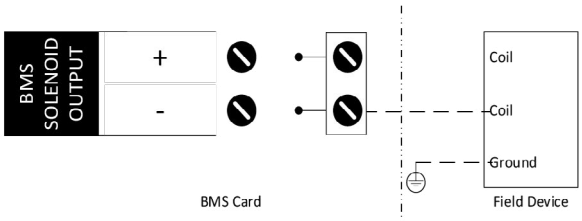
Installation Notes:

1. 4-20mA Input IN – terminal must be run back to BMS Input GND terminal 6 (Local ground) to ensure proper output functionality.

6.2.7 SOLENOID OUTPUT – 12V/24V

Caution:
Do not connect solenoid device minus (-) terminals to ground, as the BMS solenoid output minus (-) terminals are not grounded.

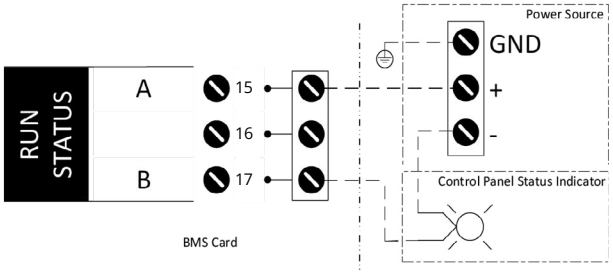
Caution:
Do not jumper solenoid minus terminals together under any circumstance, as this will compromise the safety integrity of the system.



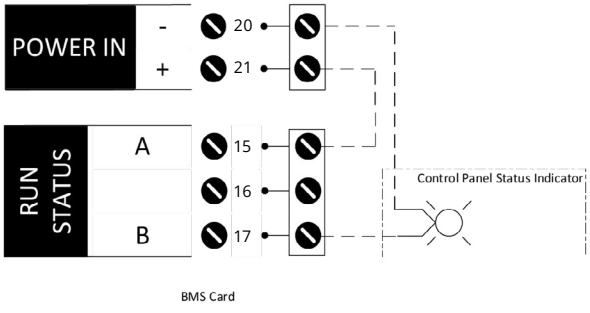
Installation Notes:

1. Solenoid powered outputs are rated to 5A max individually, however care must be taken when using multiple high-powered solenoid so as to not exceed the 8.3A maximum current rating for the product as a whole.
2. Solenoid valve outputs are assumed to be in safe state when de-energized. Normally closed valves must be used such that gas-flow to the burner is stopped when the output is in the de-energized state. Solenoid valve outputs can also be connected to normally open bleed valves when utilizing a double block and bleed configuration.

6.2.8 RUN STATUS – EXTERNAL DC SOURCE

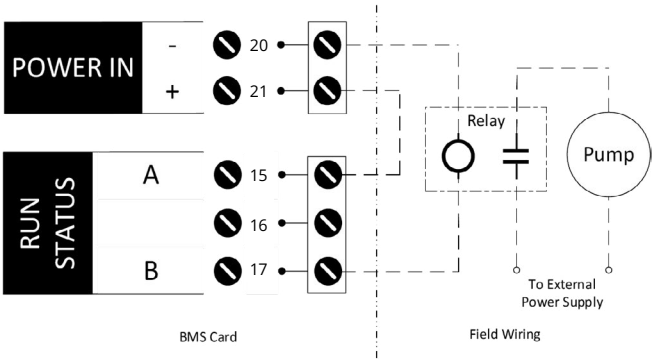


6.2.9 RUN STATUS – BMS POWER



6.2.10 RUN STATUS – PUMP CONTROL

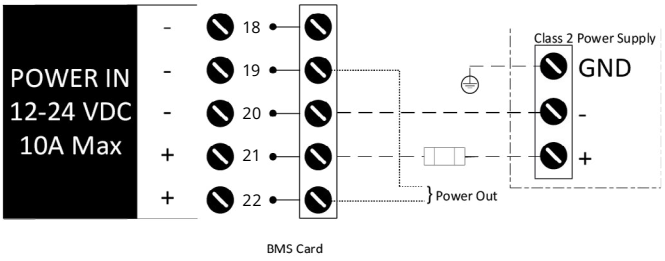
Warning:
120VAC wiring should be installed by a qualified electrician.



Installation Notes:

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

6.2.11 POWER INPUT WIRING

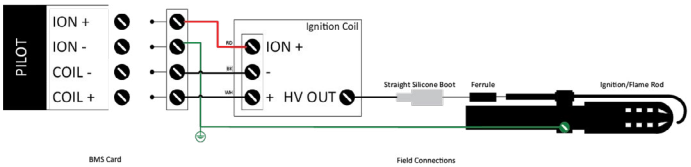


Installation Notes:

1. The PF2150 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).

6.2.12 SINGLE ROD IGNITION WIRING

Warning:
Failure to provide a low-impedance path from the burner assembly to the PF2150-E may result in electric shock, product damage, failure to ignite the pilot, or failure to detect flame.

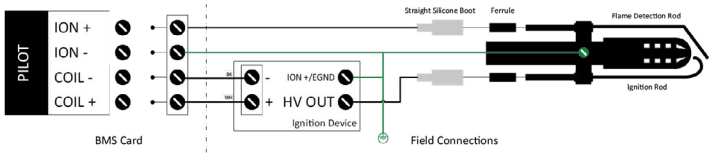


Installation Notes:

1. The wire length between the ignition coil and pilot should be no more than 5m (15ft).
2. For long run lengths of ION+, the connection should be made with 7mm ignition wire to help minimize ground-loading of the flame signal.

6.2.13 DUAL ROD IGNITION WIRING

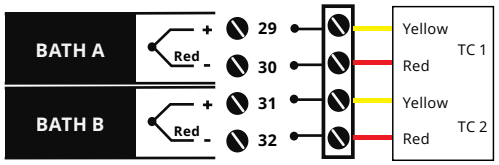
Warning:
Failure to provide a low-impedance path from the burner assembly to the PF2150-E may result in electric shock, product damage, failure to ignite the pilot, or failure to detect flame.



Installation Notes:

1. The wire length between the ignition coil and pilot should be no more than 5m (15ft).
2. For long run lengths of ION+, the connection should be made with 7mm ignition wire to help minimize ground-loading of the flame signal.

6.2.14 TEMPERATURE INPUT – DUAL TYPE K THERMOCOUPLE

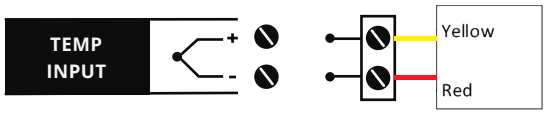


BMS Card Type K Thermocouple

Installation Notes:

1. Thermocouple must be grounded or ungrounded Type K.
2. Thermocouple wire run lengths should be minimized where possible.
3. Thermocouple wires should not be run in the same conduit as high-noise signals (e.g. valve wires, motor wires, etc.)

6.2.15 TEMPERATURE INPUT – SINGLE TYPE K THERMOCOUPLE

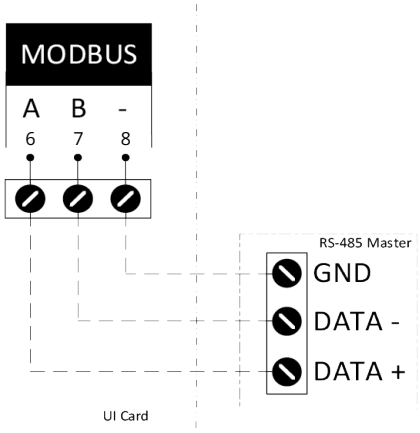


BMS Card

Installation Notes:

1. Thermocouple must be grounded or ungrounded Type K.
2. Thermocouple wire run lengths should be minimized where possible.
3. Thermocouple wires should not be run in the same conduit as high-noise signals (e.g. valve wires, motor wires, etc.)

6.2.16 MODBUS INPUT WIRING



Installation Notes:

1. Modbus wires should not be run in the same conduit as high-noise signals (e.g. valve wires, motor wires, etc.)

7 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.

7.1 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 BMS card mounting.
- 10-32 nut driver for UI card mounting.
- Digital multimeter or process calibrator for troubleshooting.

7.2 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 and fuel train components are functional and undamaged.
9. Verify all heater components are functional and undamaged.
10. Verify that all configured interlock trips result in appropriate alert annunciation.
11. Verify calibration of all 4-20mA input devices and temperature input devices
12. Back up all data log and event log files from the USB to an external storage system.

It is expected that the PF2150-E 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.

7.3 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 rated operating temperature in a dry area. Avoid moisture buildup inside the enclosure.

7.4 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 BMS cards. If the User Interface and BMS cards have different software bundles loaded on them, the system will fail to operate correctly and will require a firmware update to match.

BMS cards must be securely fastened into the back of the enclosure with four #10-32 machine screws.

7.5 DECOMMISSIONING

When decommissioning the system, the appliance should be safely shut down (i.e. all safety outputs are turned off and there are no gas leaks on site). Once the appliance is in a safe state, the power should be disconnected from the PF2150-E. All cards should be treated like any other piece of electronics (e.g. be sent to a recycling depot).

7.6 USEFUL LIFE

The useful life of the PF2150-E is 10 years. Prior to the expiry of that period the customer should contact Profire for a suitable replacement.

7.7 MANUFACTURER NOTIFICATION

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

8 ALERT CODES & RESPONSE TIMES

8.1 ALARMS

ID	NAME	ALARM CONDITION	SET
AL001	POC INPUT OPEN	On/Off Control and PID Control: POC Input is de-energized when either SSV1 or SSV2 Output is de-energized. Staged Heating: POC Input is de-energized when SSV1 Output is de-energized.	2 s
AL002	ESD INPUT OPEN	ESD Input is de-energized.	1 s
AL003	PRESSURE INVALID	4-20 Mode: Pressure Input signal is less than or equal to 3mA or greater than or equal to 20mA. Digital Mode: Pressure Input current is below -0.5mA or above 10mA.	1 s
AL004	LOW PRESSURE	4-20 Mode: Pressure Input signal is less than or equal to configured Pressure Low Trip setting. Digital Mode: Pressure Input in de-energized.	Pressure Delay
AL005	4-20 HIGH PRESS	4-20 Mode: Pressure Input signal is greater than or equal to configured Pressure High Trip. setting when the system is in a main fuel state. Digital Mode: This alarm cannot be set.	2 s
AL006	HIGH PRESS OPEN	High Pressure Input is de-energized.	2 s
AL007	PRESSURE CONFIG	Pressure High Trip setting is too close to Pressure Low Trip setting, or Pressure Span Max setting is less than Pressure Span Min setting.	0 s
AL008	LEVEL INVALID	4-20 Mode: Level Input signal is less than or equal to 3mA or greater than or equal to 20mA. Digital Mode: Level Input current is below -0.5mA or above 10mA.	1 s
AL009	LOW LEVEL	4-20 Mode: Level Input signal is less than or equal to configured Level Low Trip setting. Digital Mode: Level Input in de-energized.	Level Delay
AL010	HIGH LEVEL	4-20 Mode: Level Input signal is greater than or equal to configured Level High Trip setting. Digital Mode: This alarm cannot be set.	Level Delay
AL011	LEVEL CONFIG	Level High Trip setting is too close to Level Low Trip setting, or Level Span Max setting is less than Level Span Min setting.	0 s
AL012	HIGH BATH TEMP	Bath Input temperature is greater than or equal to configured Bath High Temp ESD setting.	2 s
AL013	BATH MISMATCH	Bath A temperature does not match Bath B temperature.	2 s
AL014	BATH CONFIG	Bath temperature settings are invalid.	0 s
AL015	BATH A OPEN	Bath A Input is open.	6 s
AL016	BATH A INVALID	Bath A Input temperature is below -100°C (-148°F) or above 1350°C (2462°F).	6 s
AL017	BATH A STALE	Hardware fault - contact Profire.	6 s
AL018	BATH B OPEN	Bath B Input is open.	6 s
AL019	BATH B INVALID	Bath B Input temperature is below -100°C (-148°F) or above 1350°C (2462°F).	6 s
AL020	BATH B STALE	Hardware fault - contact Profire.	6 s
AL021	HIGH AUX TEMP	Aux Temp Input temperature is greater than or equal to configured Aux High Temp ESD setting.	2 s
AL022	AUX TEMP CONFIG	Aux Temp settings are invalid.	0 s
AL023	AUX TEMP OPEN	Aux Temp Input is open.	6 s
AL024	AUX TEMP INVALID	Aux Temp Input temperature is below -100°C (-148°F) or above 1350°C (2462°F).	6 s
AL025	AUX TEMP STALE	Hardware fault - contact Profire.	6 s
AL026	AMBIENT MISMATCH	Hardware fault - contact Profire.	6 s
AL027	AMBIENT1 INVALID	Hardware fault - contact Profire.	6 s
AL028	AMBIENT2 INVALID	Hardware fault - contact Profire.	6 s
AL029	NO PROCESS TEMP	Neither Bath Mode setting nor Aux Temp Mode setting is configured as Process Control.	0 s
AL030	FLAME FAILURE	No flame has been detected and there are no automatic relights remaining.	0 s
AL031	FLAME WHILE OFF	Flame is detected prior to the system admitting fuel to the appliance.	0 s
AL032	ION+ WIRING	Flame signal is too low to reliably detect flame.	3 s
AL033	ADC1 START FAULT	Hardware fault - contact Profire.	2 s
AL034	ADC1 READ FAULT	Hardware fault - contact Profire.	2 s
AL035	ADC1 STOP FAULT	Hardware fault - contact Profire.	2 s
AL036	FLAME VOLTAGE	Hardware fault - contact Profire.	3 s
AL037	LOW VOLTAGE	System voltage is too low.	2 s
AL038	HIGH VOLTAGE	System voltage is too high.	2 s
AL039	ADC2 START FAULT	Hardware fault - contact Profire.	2 s

ID	NAME	ALARM CONDITION	SET
AL040	ADC2 READ FAULT	Hardware fault - contact Profire.	2 s
AL041	ADC2 STOP FAULT	Hardware fault - contact Profire.	2 s
AL042	XCOMPARE FAULT	Hardware fault - contact Profire.	2 s
AL043	USER STOP	System has stopped due to either the keypad STOP button being pressed or receipt of a Stop Command over Modbus.	0 s
AL044	SETTINGS CRC	Settings cannot be verified - Power cycle BMS.	0 s
AL045	STATE MISMATCH	Hardware fault - contact Profire.	1 s
AL046	PRESSURE I2C	Hardware fault - contact Profire.	2 s
AL047	LEVEL I2C	Hardware fault - contact Profire.	2 s
AL048	ESD IO SHORT	Hardware fault - contact Profire.	5 s
AL049	START IO SHORT	Hardware fault - contact Profire.	5 s
AL050	PILOT IO SHORT	Hardware fault - contact Profire.	5 s
AL051	HIPRESS IO SHORT	Hardware fault - contact Profire.	5 s
AL052	VIN ADC IO SHORT	Hardware fault - contact Profire.	5 s
AL053	POC IO SHORT	Hardware fault - contact Profire.	5 s
AL054	RESERVED	N/A	N/A
AL055	FLASH READ FAULT	Hardware fault - contact Profire.	0 s
AL056	FLSH WRITE FAULT	Hardware fault - contact Profire.	0 s
AL057	DESCRIPTOR FAULT	Hardware fault - contact Profire.	0 s
AL058	DESCR MISMATCH	Hardware fault - contact Profire.	0 s
AL059	PILOT VOLTAGE	Hardware fault - contact Profire.	10 s
AL060	SSV1 VOLTAGE	Hardware fault - contact Profire.	10 s
AL061	SSV2 VOLTAGE	Hardware fault - contact Profire.	10 s
AL062	START INVALID	Negative voltage on SIG IN terminal.	2 s
AL063	POC INVALID	Negative voltage on SIG IN terminal.	2 s
AL064	ESD INVALID	Negative voltage on SIG IN terminal.	2 s
AL065	HI PRESS INVALID	Negative voltage on SIG IN terminal.	2 s
AL066	ADC3 START FAULT	Hardware fault - contact Profire.	2 s
AL067	ADC3 READ FAULT	Hardware fault - contact Profire.	2 s
AL068	ADC3 STOP FAULT	Hardware fault - contact Profire.	2 s
AL069	OUTPUT MISMATCH	Hardware fault - contact Profire.	2 s
AL070	PROCESSOR RESET	Hardware fault - contact Profire.	0 s
AL071	CAL CRC FAILED	Hardware fault - contact Profire.	0 s
AL072	BROWNOUT INVALID	Hardware fault - contact Profire.	0 s
AL073	FLAME DC OPEN	Hardware fault - contact Profire.	3 s
AL074	FACTORY CAL DESC	Hardware fault - contact Profire.	0 s
AL075	SHUTDOWN FAILED	Hardware fault - contact Profire.	0 s
AL076	STATUS CONFIG	Run Status Level Control setting is outside Level Low and High Trip setpoints.	0 s
AL077	UI COMM LOSS	UI Comm Loss setting is configured as enabled and communication has been lost between UI Card and BMS Card.	1 s
AL078	PID CONFIG	Process Control Mode is configured as Bath PID Control but Bath Mode setting is not configured as Process Control, or Process Control Mode is configured as Aux PID Control but Aux Temp Mode setting is not configured as Process Control.	0 s
AL079	STATUS CNFG 4-20	Run Status Mode is configured as Level Control but Level Type is not configured as 4-20.	0 s
AL080	PID NEEDS TCV	Process Control Mode is configured for PID Control but 4-20 Output Mode is not configured as Valve Control.	0 s

8.2 WAITS

ID	NAME	WAIT CONDITION	SET
WT001	LOW VOLTAGE	System voltage is too low AND Voltage Restart setting is enabled.	2 s
WT002	HIGH VOLTAGE	System voltage is too high AND Voltage Restart setting is enabled.	2 s
WT003	LOW PRESSURE	4-20 Mode: Pressure Input signal is less than or equal to configured Pressure Low Trip setting AND Low Pressure Mode setting is Wait. Digital Mode: Pressure Input in de-energized AND Low Pressure Mode setting is Wait..	Pressure Delay
WT004	LOW LEVEL	4-20 Mode: Level Input signal is less than or equal to configured Level Low Trip setting AND Level Low Trip Mode setting is Wait. Digital Mode: Level Input in de-energized AND Level Digital Mode is Wait.	Level Delay
WT005	HIGH LEVEL	4-20 Mode: Level Input signal is greater than or equal to configured Level High Trip setting AND Level High Trip Mode setting is Wait. Digital Mode: This wait cannot be set.	Level Delay
WT006	HIGH BATH TEMP	Bath temperature is too high.	2 s
WT007	HIGH AUX TEMP	Aux temperature is too high.	2 s
WT008	START CONTACT OPEN	Start Input is open.	1 s
WT009	PURGING	The system is purging. Note: The Proof of Closure Input must be energized (if enabled) in order for the purge timer to count down.	N/A

8.3 MAIN PERMISSIVES

ID	NAME	MAIN PERMISSIVE CONDITION	SET
MP001	LOW PRESSURE	4-20 Mode: Pressure Input signal is less than or equal to configured Pressure Low Trip setting AND Low Pressure Mode setting is Main Permissive. Digital Mode: Pressure Input is de-energized AND Low Pressure Mode setting is Main Permissive.	Pressure Delay

8.4 WARNINGS

ID	NAME	WARNING CONDITION	SET
WN001	LOW VOLTAGE	System voltage is approaching low voltage alarm threshold.	2 s
WN002	HIGH VOLTAGE	System voltage is approaching high voltage alarm threshold.	2 s
WN003	LOW BATH TEMP	Bath Input temperature is below its configured Low Temp Setpoint setting.	2 s
WN004	LOW AUX TEMP	Aux Input temperature is below its configured Low Temp Setpoint setting.	2 s
WN005	HIGH PRESSURE	4-20 Mode: Pressure Input signal is greater than or equal to configured Pressure High Trip AND system is not in a main fuel state. Digital Mode: This alarm cannot be set.	2 s
WN006	POC STILL CLOSED	POC Input is energized while in a main fuel state.	10 s
WN007	UI/BMS MISMATCH	UI Card and BMS Card are not running matching firmware.	N/A
WN008	BMS COMM LOSS	UI Card and BMS Card have lost communication with each other.	N/A
WN009	HW DESC ERROR	Hardware fault - contact Profire.	N/A
WN010	PV DESC ERROR	Hardware fault - contact Profire.	N/A
WN011	FW DESC ERROR	Hardware fault - contact Profire.	N/A
WN012	BOOT DESC ERROR	Hardware fault - contact Profire.	N/A
WN013	UI DESC ERROR	Hardware fault - contact Profire.	N/A
WN014	AUX TEMP OPEN	Aux Temp Input is open AND Aux Temp Mode is Display Only.	6 s
WN015	AUX TEMP INVALID	Aux Temp Input is out of range AND Aux Temp Mode is Display Only.	6 s
WN016	AUX TEMP STALE	Hardware fault - contact Profire.	6 s
WN017	TCV WIRING FAULT	4-20mA Aux Out wiring fault.	2 s
WN018	LOW PRESSURE	4-20 Mode: Pressure Input signal is less than or equal to configured Pressure Low Trip setting AND Low Pressure Mode setting is Warning. Digital Mode: Pressure Input in de-energized AND Low Pressure Mode setting is Warning.	Pressure Delay

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