PF2100F MANUAL REV 1.0

FLARE IGNITION SYSTEM

WARNING

THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS 1, DIVISION 2, GROUPS ABCD OR NON-HAZARDOUS LOCATIONS ONLY.

WARNING: EXPLOSION HAZARD
DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS OR EQUIVALENT

WARNING: EXPLOSION HAZARD
SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.

MUST CONFORM TO THE DIRECTIONS IN THIS MANUAL

THE UNIT MUST BE PROPERLY CONNECTED TO EARTH-GROUND FOR EFFECTIVE IONIZATION OPERATION

ELECTRICAL DEVICES CONNECTED TO THE CONTROLLER MUST MEET ELECTRICAL STANDARDS AND BE WITHIN VOLTAGE LIMITS

DO NOT SERVICE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS

DO NOT OPEN WHEN ENERGIZED

SUBSTITUTION OF COMPONENTS MAY IMPAIR THE SUITABILITY FOR USE IN CLASS 1, DIVISION 2

REPLACEMENT FUSES MUST BE CERAMIC

FOR ANY QUESTIONS PLEASE CALL	1 855 PRO FIRE *(776-3473)*

APPROVALS

Class 1, Division 2, Grp ABCD
IEC Ex nA IIC
IP54
NEMA Type 4x

CSA C22.2 No. 0-M91
CSA C22.2 No. 0.4-04
CSA C22.2 No. 94-91
CSA C22.2 No. 142-M1987
CSA C22.2 No. 213-M1987
CSA E60079-0:2007
CSA E60079-15:2005
UL 508, 17th Edition
ANSI-ISA-12.12.01-2007
UL 60079-0:2005
UL 60079-15:2002

C US

MC#248705

GENERAL FEATURES

- Designed for the natural draft-fire, tube heater industry
- Meets or exceeds all relevant codes and standards
- Easy installation with clearly marked component I/O
- Easily accessible removable terminal connections
- Rapid 3 second shut-down on flame-out
- DC voltage spark ignition
- Low-power design to accommodate solar panel or TEG applications
- Auto-relight or manual operation
- Transient protected and fail-safe circuits

ENCLOSURE

Polyester
309 x 234 x 134 mm (12.15" x 9.23" x 5.28")
overall dimensions 2.3 kg (5 lb)
CSA and UL compliant for Class 1, Division 2 locations
Enclosure type 4, 4X, 12, 13

CIRCUT BOARDS

All solid state
CSA compliant for Class 1, Division 2 locations
Certified for use on B.149 compliant valve trains

IGNITION BASE AND COIL

For non-hazardous mounting area only
Ignition coil mounted in the 2100 is optionally available.

TEMPERATURE RATING

-40°C to +55°C (Tested to -60°C)
-40˚F to +130°F (Tested to -76°F)

INPUTS & OUTPUTS

(6) Digital inputs for safety interlock device connections
(5) Digital outputs
(1) 4-20mA output
(1) Flame-rod input
(3) Thermocouple inputs
See Section 1.3 for thermocouple inputs

FUSE

Only equivalent fuse should be used to replace a blown fuse.
Factory fuse: LittleFuse 0314005.HXP
(5A, 250V Ceramic, Fast Blow)

POWER REQUIREMENTS

10VDC to 28VDC (voltage must match solenoid rating) 5A MAX

POWER COMSUMPTION	*12V*	*24V*
Controller only, display ON	2.6 W	2.8 W
Controller only, display OFF	1.1 W	1.4 W

1.1 Mounting Locations

- The control panel can be mounted on the unit skid or on a building wall providing it does not infringe on a Class 1, Division 1 area.
- Use control panel mounting tabs to mount in a location that faces away from the burner housing so the operator is facing both the enclosure and the burner housing while operating. Other considerations may include panel access, traffic, wire-runs and visibility.

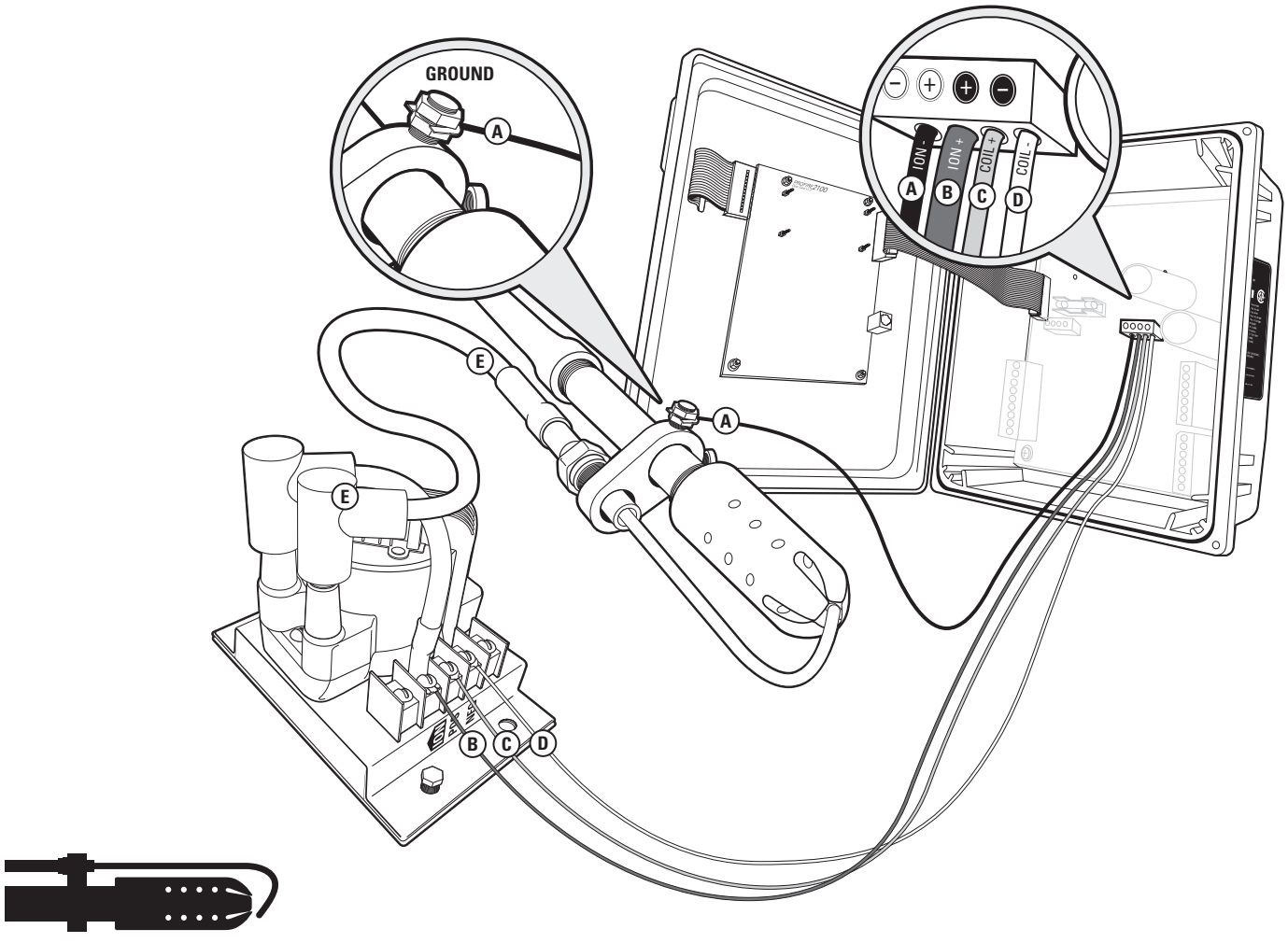
- The control panel should be mounted about 1.5m (5') above ground level.
- If an external ignition coil is used, it must be mounted in a Class 1, Division 2 enclosure or a non-hazardous location, ideally inside the burner housing.

1.2 P&ID and Wiring Diagram

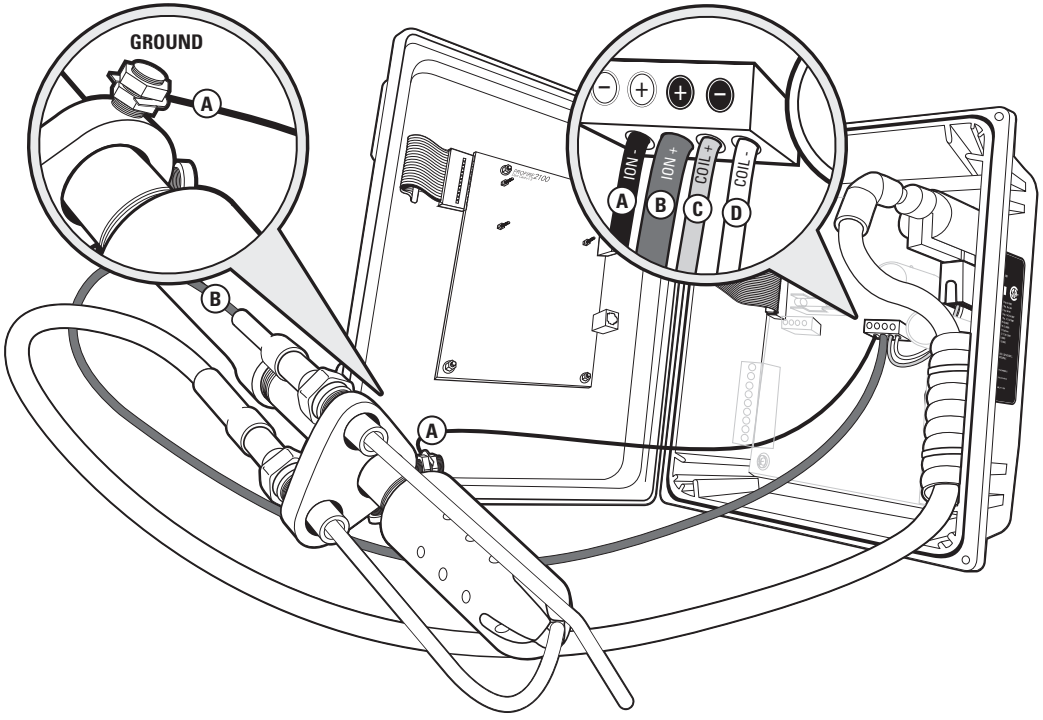
Any design used, should be approved by a qualified inspector and approved by the gas authority having jurisdiction at the site where the system is to be installed.

Additional P&ID and wiring diagrams are provided in a separate application note.

1.3.1 External Coil



1.3.2 Internal Coil



1.4 Terminal Description

CONNECTION	DESCRIPTION	EXPECTED CONNECTIONS	RATINGS
12/24VDC	Input power 10VDC - 28VDC, 5A MAX	Input power from a DC source	10VDC - 28VDC Internally fused at 5A
Common	Common	Ground from DC source	Internally connected to EGND
EGND	Earth Ground	Earth or Chassis ground	Internally connected to Common
4-20mA Out +	4-20mA output intended to drive a proportional control valve. This output will be connected to a Current to Pressure converter which will drive a proportional control valve. A software control loop is implimented to tune the flame to match the demand. Proportional control is optional.	A resistance of 120Ω to 250Ω is expected.	
4-20mA Out -	Ground	Ground return for the 4-20mA output	
HighTemp_TC + (YELLOW)	Thermocouple input. High Temp shutdown thermocouple.	"*TYPE K*" thermocouple must be connected between the "+" and "-" terminals and must not be electrically connected to ground. An uninterrupted connection using "*TYPE K*" thermocouple wire is required for an accurate reading.	
HighTemp_TC - (RED)	Thermocouple Input. Negative terminal of High Temp Shutdown thermocouple.		
Process_TC + (YELLOW)	Thermocouple input. Process thermocouple.	"*TYPE K*" thermocouple must be connected between the "+" and "-" terminals and must not be electrically connected to ground. An uninterrupted connection using "*TYPE K*" thermocouple wire is required for an accurate reading.	
Process_TC - (RED)	Thermocouple Input. Negative terminal of Process thermocouple.		

1.4 Terminal Description Continued...

CONNECTION	DESCRIPTION	EXPECTED CONNECTIONS	RATINGS
AUX_TC + (YELLOW)	Thermocouple Input Pilot Thermocouple.	A "*TYPE K*" thermocouple must be connected between the "+" and "-" terminals and must not be electrically connected to ground. An uninterrupted connection using "*TYPE K*" thermocouple wire is required for an accurate reading.	
AUX_TC - (RED)	Thermocouple Input. Negative terminal of Auxiliary thermocouple.		
High Fire/Main +	Positive terminal of the High Fire / Main valve	Solenoid valves must be connected between the "+" and "-" terminals. The negative terminal is not directly connected to ground so a common return wire for the High Fire, Low Fire and Pilot valves cannot be used.	Maximum continuous current is 2A. If "Low Power" mode is enabled, a peak load of 4A is permitted.
High Fire/Main -	Negative terminal of the High Fire / Main valve		
Low Fire +	Positive terminal of the Low Fire valve	Solenoid valves must be connected between the "+" and "-" terminals. The negative terminal is not directly connected to ground so a common return wire for the High Fire, Low Fire and Pilot valves cannot be used.	
Low Fire -	Negative terminal of the Low Fire valve		
Pilot +	Positive terminal of the Pilot valve	Solenoid valves must be connected between the "+" and "-" terminals. The negative terminal is not directly connected to ground so a common return wire for the High Fire, Low Fire and Pilot valves cannot be used.	
Pilot -	Negative terminal of the Pilot valve		
Ion +	Flame Detection Input. Connected to a Flame-rod.	A Kanthal rod should be placed directly in the pilot flame and connected to this input. The pilot assembly must be grounded for the flame detection to function properly. Input is protected from high voltage and can be connected in series with the high voltage terminals of an external ignition coil, allowing a single flame-rod to be used for both ignition and flame detection.	A 65VAC signal is applied to the flame rod. The source impedance is very high so there is no danger of sparking.
Ion -	Ground	Ground return for flame detection. Must be connected to the burner housing.	

1.4 Terminal Description Continued...

CONNECTION	DESCRIPTION	EXPECTED CONNECTIONS	RATINGS
Coil +	Driver for the low voltage primary of the ignition coil.	The primary of the ignition coil should be connected to this terminal. The 12/24VDC input power will be applied for 1 ms and turned off for 50 ms while sparking.	This output is protected by a 250mA thermal fuse.
Coil -	Ground	Ground return for the ignition coil.	
Status +	The status "+" and "-" contacts will be closed when the system is running and opened when the system is shutdown.	Dry contact output to indicate system status to an external device. ie. PLC.	250VAC/DC, 200mA, 15Ω
Status -			
Start +	Remote start input from an external device. ie. PLC.	Dry contact switch is expected. The input is internally pulled up to 9VDC via a 3.75kΩ resistance. Jumper "+" and "-" if not used.	
Start -	Ground	Ground return for switch. All switches can use a single common ground return.	
ESD +	External Shutdown input.	Dry contact switch is expected. The input is internally pulled up to 9VDC via a 3.75kΩ resistance. Jumper "+" and "-" if not used.	
ESD -	Ground	Ground return for switch. All switches can use a single common ground return.	
Proof of Closure +	Proof of Closure from main valve(s).	Dry contact switch is expected. The input is internally pulled up to 9VDC via a 3.75kΩ resistance. Jumper "+" and "-" if not used.	
Proof of Closure -	Ground	Ground return for switch. All switches can use a single common ground return.	
High Pressure +	Input from a mechanical pressure switch.	Dry contact switch is expected. The input is internally pulled up to 9VDC via a 3.75kΩ resistance. Jumper "+" and "-" if not used.	

1.4 Terminal Description Continued...

CONNECTION	DESCRIPTION	EXPECTED CONNECTIONS	RATINGS
High Pressure -	Ground	Ground return for switch. All switches can use a single common ground return.	
Low Pressure +	Input from a mechanical pressure switch.	Dry contact switch is expected. The input is internally pulled up to 9VDC via a 3.75kΩ resistance. Jumper "+" and "-" if not used.	
Low Pressure -	Ground	Ground return for switch. All switches can use a single common ground return.	
Level +	Input from a float-switch mounted in the bath.	Dry contact switch is expected. The input is internally pulled up to 9VDC via a 3.75kΩ resistance. Jumper "+" and "-" if not used.	
Level -	Ground	Ground return for switch. All switches can use a single common ground return.	

1.5 Thermocouples

ALL THERMOCOUPLES MUST BE ISOLATED FROM THE GROUND

PROCESS THERMOCOUPLE
"TYPE K"

Primary temperature control device provides high-temp shut-down. 20 AWG or larger "*TYPE K*" extension wire must be used. System will shutdown if an open circuit or short circuit is detected. Should be placed in the same thermowell as *HIGH TEMPERATURE THERMOCOUPLE.*

HIGH TEMPERATURE THERMOCOUPLE
"TYPE K"

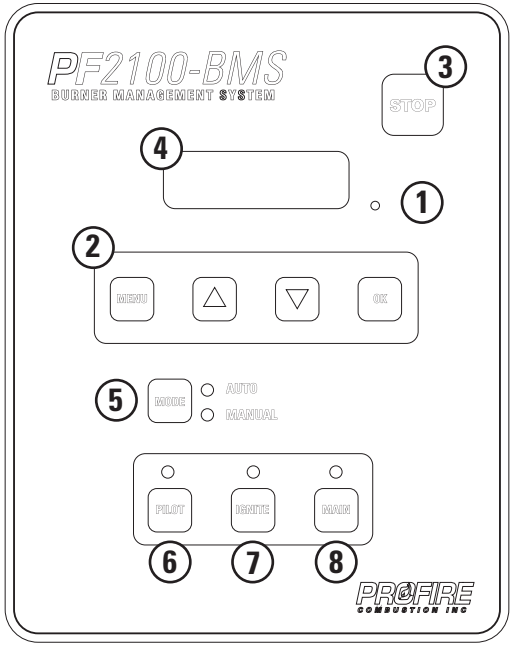
Provides high-temp shutdown. 20 AWG or larger "*TYPE K*" extension wire must be used. System will shutdown if an open circuit, short-circuit or short-to-ground is detected. Should be placed in the same thermowell as *PROCESS THERMOCOUPLE.*

PILOT THERMOCOUPLE (AUX)
"TYPE K"

Provides a flame detection indication based on the temperature of the pilot. The system will shutdown if an open circuit is detected.

* TE101 and TE102 may be different elements in the same head of a "*TYPE K*" thermocouple
* For all thermocouples, avoid locating extension wire near high-voltage lines. Shield if necessary.

2.1 Keypad Layout



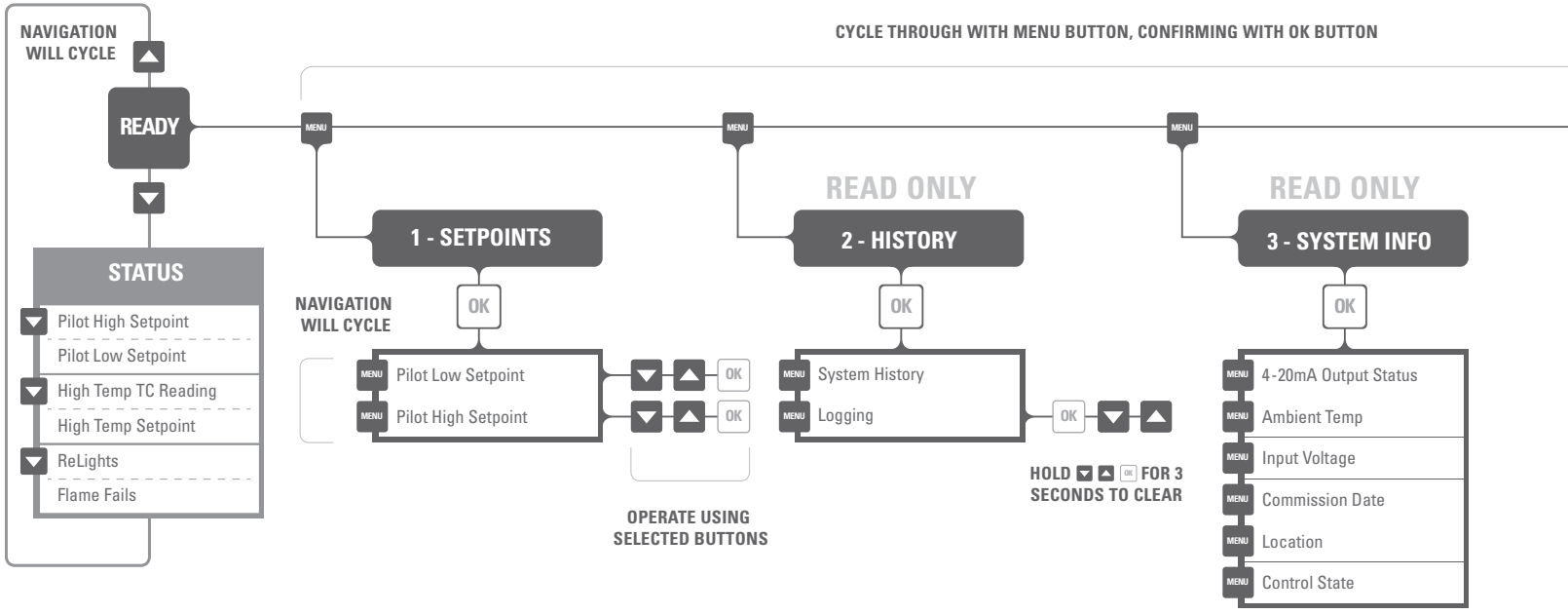
1. RUN LIGHT
2. MENU NAVIGATION
3. STOP BUTTON
4. DISPLAY WINDOW
5. MODE BUTTON
6. PILOT BUTTON
7. IGNITE BUTTON
8. MAIN BUTTON

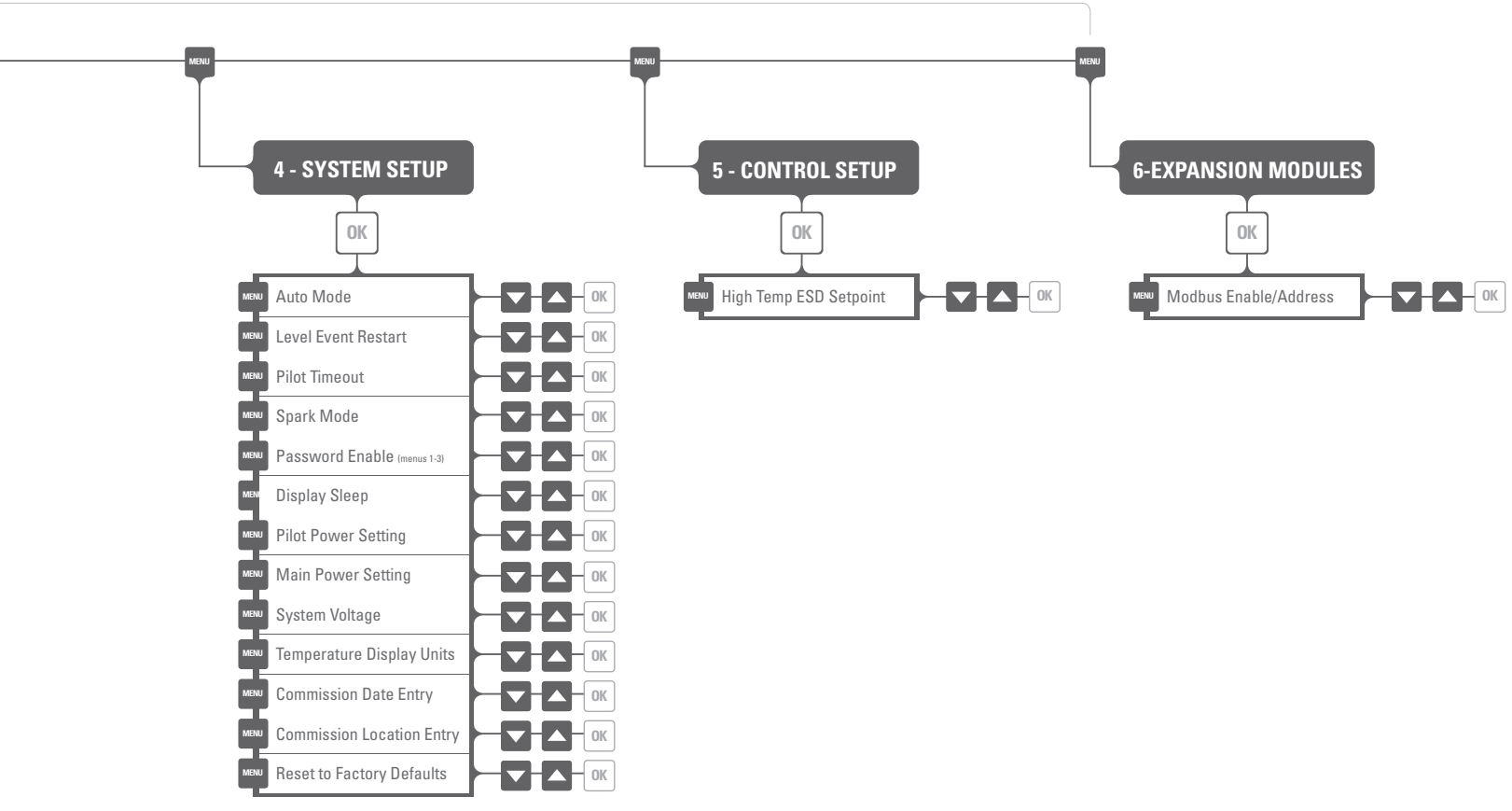
2.2 Menu Operation

The system must be in manual mode in order to access the menus. Press the "MENU" button to step through the menus. When the desired menu is displayed, press the "OK" button to enter that menu. Once in the menu, the "MENU" button will step through the parameters.

While viewing the desired parameter use the △ and ▽ buttons to adjust the setting and "OK" to accept the change. To exit back to the "Ready" screen, press the "OK" button without making any changes. From the "Ready" screen, the △ and ▽ buttons will scroll through the current system status.

2.3 Menu Map


NAVIGATION WILL CYCLE
READY
STATUS
Pilot High Setpoint
Pilot Low Setpoint
High Temp TC Reading
High Temp Setpoint
ReLights
Flame Fails
CYCLE THROUGH WITH MENU BUTTON, CONFIRMING WITH OK BUTTON
MENU
1 - SETPOINTS
NAVIGATION WILL CYCLE
OK
Pilot Low Setpoint
Pilot High Setpoint
OPERATE USING SELECTED BUTTONS
READ ONLY
2 - HISTORY
System History
Logging
HOLD FOR 3 SECONDS TO CLEAR
READ ONLY
3 - SYSTEM INFO
4-20mA Output Status
Ambient Temp
Input Voltage
Commission Date
Location
Control State


MENU
4 - SYSTEM SETUP
OK
MENU
Auto Mode
OK
MENU
Level Event Restart
OK
MENU
Pilot Timeout
OK
MENU
Spark Mode
OK
MENU
Password Enable (menus 1-3)
OK
MENU
Display Sleep
OK
MENU
Pilot Power Setting
OK
MENU
Main Power Setting
OK
MENU
System Voltage
OK
MENU
Temperature Display Units
OK
MENU
Commission Date Entry
OK
MENU
Commission Location Entry
OK
MENU
Reset to Factory Defaults
OK
MENU
5 - CONTROL SETUP
OK
MENU
High Temp ESD Setpoint
OK
MENU
6-EXPANSION MODULES
OK
MENU
Modbus Enable/Address
OK

2.4.1 (MENU 1) Setpoints

Can only be accessed in manual mode. High Temp Setpoint is adjusted in MENU 5 - Control Setup (level 2 password)

ON SCREEN	DESCRIPTION	FUNCTION	RANGE	DEFAULT SETTING	USER SETTING
Pilot Low Setpoint 200˚C	Low setpoint for pilot thermocouple.	When the Pilot temperature rises above this setpoint, the status contacts will close and the flame light will come on.	0 to 1350˚C (32 to 2462˚F)	200˚C (392˚F)	
Pilot High Setpoint 600˚C	High setpoint for pilot thermocouple.	When the pilot temperature is above this setpoint and the Spark Mode is set to "Spark Only <PHI" the system will stop sparking. The "Pilot Timeout" timer will start counting down when the pilot temperature drops below this setpoint.	0 to 1350˚C (32 to 2462˚F)	600˚C (1,112˚F)	

2.4.2 (MENU 2) History

No adjustments are available in the History menu; the items are display only. Hold △ ▽ + OK to reset history.

ON SCREEN	DESCRIPTION	FUNCTION	RANGE	DEFAULT SETTING	USER SETTING
ReLight = x	Displays the number of relights	Incremented when an automatic ignition attempt is made.	0 to 1000	0	
FlmFails = x	Displays the number of flame fails	When all retries attempts have failed, the unit shuts down and increments the Flame Fail counter	0 to 1000	0	
Resets = x	Displays the number of resets.	This number will increment every time the board is reset by a power loss or by pressing the reset button	0 to 1000	0	

2.4.2 (MENU 2) History Continued...

ON SCREEN	DESCRIPTION	FUNCTION	RANGE	DEFAULT SETTING	USER SETTING
ESDs = x	Displays the total number of ESDs	This number will increment any time a fault causes the system to shutdown.	0 to 1000	0	
HPR ESDs = x	Displays the total number of High Pressure ESDs	This number will increment any time the system is shutdown due to High Pressure contact opening.	0 to 1000	0	
LPR ESDs = x	Displays the total number of Low Pressure ESDs	This number will increment any time the system is shutdown due to Low Pressure contact opening.	0 to 1000	0	
LVL ESDs = x	Displays the total number of Level ESDs	This number will increment any time the system is shutdown due to Level contact opening.	0 to 1000	0	
Open TC = x	Displays the total number of Thermocouple ESDs	This number will increment any time the system is shutdown due to a thermocouple fault.	0 to 1000	0	
TERMCRD = x	Displays the total number of Terminal Card ESDs	This number will increment any time the system is shutdown due to a fault from the Terminal Card.	0 to 1000	0	
Sys ERR = x	Displays the total number of System Error ESDs	This number will increment any time the system is shutdown due to a communication failure between the Door and Terminal Cards.	0 to 1000	0	
Logging	Event Log	This is a log of recent events. Press OK to enter the log and use the up and down keys to navigate through the log. Press OK again to exit. To clear the history and log press and hold Up, Down, OK and Menu for 5 seconds	N/A	N/A	

2.4.3 (MENU 3) System Info

No adjustments are available in the System Info menu; the items are display only.

ON SCREEN	DESCRIPTION	FUNCTION	RANGE	DEFAULT SETTING	USER SETTING
4-20mA Output x%	Current status of the 4-20mA Output	0% = 4mA 100% = 20mA	N/A	N/A	
Ambient Temp xC (xF)	Displays the ambient temperature	This is the ambient temperature sampled on the board at the point where the thermocouples connect and is used for cold junction compensation of the thermocouples	-55˚C to 65˚C (-70˚F to 150˚F)	N/A	
System Voltage xx.x V	Displays the voltage applied to the system	Measures the input voltage to the system.	8V to 35V	N/A	
Commission Date: 01-JAN-2010	Date that the system was commissioned (if entered by user)	Data entry is done in menu 4.	DD-MON-YYYY	01-JAN-2010	
Location:	Displays the installed location of the system (if entered by user)	Data entry is done in menu 4.	N/A	N/A	
CONTROL STATE IDLE	Shows the current state of the firmware control system	Used in troubleshooting.	N/A	N/A	

2.4.4 (MENU 4) System Setup

This menu always is password protected. The password is △ ▽ △ △ ▽ △ OK Cannot be accessed while BMS is running.

ON SCREEN	DESCRIPTION	FUNCTION	RANGE	DEFAULT SETTING	USER SETTING
Auto Mode = OFF	Enables unit to recover from a power cycle, low pressure or high voltage event.	ON : Remain in auto mode after and re-start after a power cycle, low pressure, low voltage or high voltage event. OFF : Unit will switch to manual mode and shutdown after a power cycle, low pressure, low voltage or high voltage event.	ON or OFF	Off	
Level Restart	Enables the unit to recover from a Level event.	ON : Remain in auto mode after and restart after a Level event. OFF : Unit will switch to manual mode and shutdown after a Level event.	ON or OFF	OFF	
Pilot Timeout 2 minutes	Flame Fail Timer.	Adjusts the time between the pilot temperature dropping below the high setpoint and shutdown.	2 to 120 minutes	2 minutes	
Spark Mode Spark Only < PHI	Sets Spark Mode	Spark Only < PHI : The systme will spark any time the temperature drops below the pilot high setpoint and the system is in Auto mode. Always Sparking : When the system is in Auto mode it will spark continually in a set pattern of 2 seconds on and 8 seconds off.	Spark Only < PHI, Always Sparking	Spark Only < PHI	
Alarm Type No Alm when OFF	Status contact operation.	Alarm When OFF : The status contacts will open when the unit is remote stopped. No Alarm When OFF : The status contacts will remain closed when the unit is remote stopped.	Alarm When Off or No Alm When OFF	No Alm When OFF	

2.4.4 (MENU 4) System Setup Continued...

ON SCREEN	DESCRIPTION	FUNCTION	RANGE	DEFAULT SETTING	USER SETTING
Password = OFF	Password - when ON Menu 1, 2 and 3 become password protected. **NOTE:** Menu 4, 5 and 6 are always password protected.	ON = Menu 1,2,3 access restricted OFF = Menu 1.2.3 access open The Level 1 password is △ ▽ △ △	ON or OFF	OFF	
Display Always ON	Sleep Mode for the Display.	Allows the Display to turn off after 10 min to save power.	Always ON/ OFF after 10 min	Always ON	
Pilot Solenoid PWM 60%	Enables the Low Power mode for the Pilot solenoid.	Indicates the percentage of ON time for the solenoid drive circuits. 20% is the lowest power setting.	OFF, 80%, 60%, 40%, 20%	60%	
Main Solenoid PWM 60%	Enables the Low Power mode for the Main solenoid	Indicates the percentage of ON time for the solenoid drive circuits. 20% is the lowest power setting.	OFF, 80%, 60%, 40%, 20%	60%	
System Voltage =24V	Configures the expected input voltage for the system	Used by the system to determine the over and under voltage lockout points. At 12V the valid input range is 9.5V to 17V. At 24V the valid input range is 19V to 34V.	12V or 24V	24V	
Temp Display = Celsius	Configures the temperature units used by the system	All display temperatures will be converted to the chosen unit.	Fahrenheit or Celsius	Celsius	
Commission Date: 01-JAN-2010	Date that the system was commissioned	This is a user modified parameter.	DD-MON-YYYY	01-JAN-2010	
Commission Loc:	Displays the installed location of the system	This is a user modified parameter.		N/A	
Restore Factory Defaults = NO	Restore all settings to the factory default	All parameters will be reset to the default settings.	YES or NO	NO	

2.4.5 (MENU 5) Control Setup

This menu always is password protected. The password is △ ▽ △ △ ▽ △ OK Cannot be accessed while BMS is running.

ON SCREEN	DESCRIPTION	FUNCTION	RANGE	DEFAULT SETTING	USER SETTING
Change ProcH ESD Setpoint x˚C	Adjusts the High Temperature shutdown setpoint	If process temperature reaches this setpoint, the system will shutdown and alarm.	0 to 1350˚C (32 to 2462˚F)	65˚C (149˚F)	

2.4.6 (MENU 6) Expansion Modules

ON SCREEN	DESCRIPTION	FUNCTION	RANGE	DEFAULT SETTING	USER SETTING
Comm Exp Card Disabled	Enable control and address for the Modbus Module	To enable the Modbus card press the up button to select the desired Modbus address	Disabled, 1-128	Disabled	

3.1 Operational Description

The PF2100F is intended for use in flares or other applications requiring a reliable ignition source.

When the system is set for "Spark only < PHI" and put into auto mode it will start sparking and continue to spark until the Pilot High setpoint is reached. The Status contacts will close when the temperature rises above the Pilot Low setpoint. If the temperature drops below the Pilot High setpoint the system will start sparking again and will continue to spark until either the temperature rises back above the pilot high setpoint or the pilot timeout timer expires.

If the temperature drops below the Pilot Low setpoint the status contacts will open. When the system is set up for "Always Sparking" and put into auto mode the system will spark continuously in a 2 seconds on/8 seconds off pattern regardless of the temperature. The status contacts will close when the temperature is above the Pilot Low setpoint. The pilot high setpoint is not used in this mode.

4.1 Normal Operation

SYSTEM STATUS	RESPONSE
System off and there is a flame	The system is in Power Save mode. Press any button to wake.
System off and there is no flame	The system is in Power Save mode. Press any button to wake. If still no response, check power.
Ready	Unit is in manual mode • Press MODE button to return unit to AUTO mode

4.2 Typical I/O Readings

CONNECTION	EQUIPMENT	CONDITION	EXPECTED READING
Thermocouple Inputs • High Temp • Process • AUX	Volt Meter with mV range: Set to measure DC voltage	System powered up no thermocouple connected	TC+ terminal should read approximately 140mVDC with reference to ground. TC- Terminal should read 70mVDC with reference to ground.
		System powered up with thermocouple connected	Both terminals should read approximately 110mV with reference to ground.
Contact Inputs • Start • ESD • PoC • High Pressure • Low Pressure • Level	Volt Meter: Set to measure DC voltage	System powered up with switch open	The meter should read approximately 8VDC between the "+" and "–" inputs.
		System powered up with switch closed	Both "+" and "–" terminal should read 0VDC with reference to ground.

4.2 Typical I/O Readings Continued...

CONNECTION	EQUIPMENT	CONDITION	EXPECTED READING
Ion+ (Ion- is internally connected to ground)	Volt Meter: Set to measure AC voltage	System powered up with flame rod connected. No flame present	Ion+ should measure between 12VAC and 65VAC with reference to Ion- (ground).
	Volt Meter: Set to measure DC voltage		Ion+ should measure approximately 5VDC with reference to Ion- (ground).
	Volt Meter: Set to measure DC voltage	System powered up with flame rod connected. Flame present	Ion+ should drop from the 5VDC measured with no flame and cross below ground. With a good flame it should read -2VDC to -5VDC. **NOTE:** If your meter cannot read negative voltages then reverse the leads and put the positive lead on Ion- (ground) and look for a reading of 2VDC to 5VDC.
Coil + and -	Volt Meter: Set to measure DC voltage	System powered up with coil disconnected	The Coil+ terminal is disconnected from power when not sparking. When sparking it is pulsed on for a couple of milliseconds, turned off again, then repeated. The Coil + terminal should measure 0VDC with reference to Coil- (ground).
	Multi-Meter: Set to measure resistance	System powered down with coil disconnected	The resistance should measure in the MΩ range or may read OL (out of range) on your meter.
	Multi-Meter: Set to measure resistance	System powered down with coil connected	The resistance between the Coil + and Coil- (ground) should be very low, in the 1Ω to 5Ω range.

4.2 Typical I/O Readings Continued...

CONNECTION	EQUIPMENT	CONDITION	EXPECTED READING
Solenoid outputs • High Fire/Main • Low Fire • Pilot	Volt Meter: Set to measure DC voltage	System powered up. Solenoid outputs off	Both the "+" and "–" terminals of the coil are switched so no power or ground connection should be present. Both terminals should measure 0VDC.
	Volt Meter: Set to measure continuity	System powered up. Solenoid outputs off	Both the "+" and "–" terminals should measure open circuit

4.3 Error Messages

When there is more than one alarm, the abbreviated on-screen display will be shown. When a shutdown occurs, the system will enter a "lock-out" state with all outputs off. Selecting the "OK" button, toggling the "Start" contacts, or a power cycle, will be required to clear any of the following errors once the problem has been corrected.

ON SCREEN	DESCRIPTION	CAUSE	CORRECTIVE ACTION
Proc Thermocouple Error Or Proc TC	Thermocouple error	Process thermocouple is open or value is out of range	• Check thermocouple wiring • Replace thermocouple
HH Thermocouple Error Or ProH TC	Thermocouple error	High Temp thermocouple is open or value is out of range	• Check thermocouple wiring • Replace thermocouple
Aux Thermocouple Error Or Aux TC	Thermocouple error	AUX thermocouple is open or value is out of range	• Check thermocouple wiring • Replace thermocouple

4.3 Error Messages Continued...

ON SCREEN	DESCRIPTION	CAUSE	CORRECTIVE ACTION
ESD Input Or ESD Inp	Emergency Shut Down	ESD input open	• Check contact
Flame Fail Or Flame	Flame Fail	Pilot not detected, retry limit expired	• Check fuel, air & ignition • Return to auto mode and try again • Check flame detection during ignition trial
Proof Of Closure Open Or POC Inp	Proof of Closure input is open	Proof of Closure contacts open before main energized	• Check wiring • Jumper contacts if no proof of closure is present
Start Input Open Or St Inp	Remote Start input is open	Start contacts open	• Close START contacts • Check wiring
High Pressure Or HighPR	High Pressure Switch open	High Pressure switch input open	• Check pressure switch wiring • Check fuel pressure • Check wiring
Low Pressure Or LowPR	Low Pressure Switch open	Low Pressure switch input open	• Check pressure switch wiring • Check fuel pressure • Check wiring
Level Input Or Lvl Inp	Level switch open	Level switch has opened	• Check level switch wiring • Check bath level • Check wiring
High Temp Or Hi Temp	High Temperature Shutdown	Process or High Temp thermocouple has reached the High Temp ESD setpoint	• Verify setpoints • Allow bath to cool • Calibrate Process and High Temp

4.3 Error Messages Continued...

ON SCREEN	DESCRIPTION	CAUSE	CORRECTIVE ACTION
AUX High Temp Or AUX HT	High Temperature Shutdown	AUX thermocouple is confirmed for High Temp ESD and has reached the AUX setpoint	• Calibrate AUX Thermocouple • Allow the AUX to cool • Verify setpoints
High Voltage Or Hi Volt	High Voltage	Voltage input to the board is too high	• Reduce the input voltage • If the system is running off of 2V, ensure that the system setting is correct in menu 4
Low Voltage Or Lo Volt	Low Voltage	Voltage input to the board is too low	• Increase the input voltage • If the system is running off of 24V, ensure that the system setting is correct in menu 4
Flame Detected Before Start	Flame detected before start	Flame detected when trying to ignite the burner	• Ensure valves are closed • If the distance from the pilot valve to the nozzle is long then try increasing the purge time • Check for other sources of flame
Unit Stopped Via Start Input	Start contacts open	Remote start has been opened	• Check wiring
Solenoid Feedback Error	Solenoid power error	A solenoid output is detected as being on when it should be off, or off when it should be on	• Check for shorted ouputs • Check solenoid wiring
Master Power not Detected	Master power error	Master power switch is not turning on, or is on when it should be off	• Check for shorted ouputs
Error xx Or Sys Err	Internal system error	Internal error detected in the system	• Reset both boards or cycle power • Replace terminal card
EEPROM Error	Internal system error	The Door Card micro cannot communicate with the EEPROM or there was a CRC error in the EEPROM	• Reset the Door Card or cycle power • Replace the door card

4.3 Error Messages Continued...

ON SCREEN	DESCRIPTION	CAUSE	CORRECTIVE ACTION
Pilot Timeout	Key held	Pilot button held down for more than 30 seconds	• Do not hold the pilot button for > 30 seconds • Replace the door card • Check for a stuck key by running the following key test: Hold △ and ▽ buttons, then press MAIN to run the test
Spark Timeout	Key held	Ignite button held down for more than 30 seconds	• Do not hold the pilot button for > 30 seconds • Replace the door card • Check for a stuck key by running the following key test: Hold △ and ▽ buttons, then press MAIN to run the test
Flame Test	Internal System Error	Fault in the flame detection circuit.	• Move the flame rod further into the flame • Check the grounding from the pilot nozzle to the PF2100 • Replace the ribbon cable • Replace terminal card
TCs Not Equal	Thermocouple error	The High Temp Thermocouple reading on the door and terminal cards is not the same, or "High Temp" and "Process" readings are greater than 10˚C (50˚F) apart. The three temperatures will be shown. DC High Temp, TC High Temp, Proc Temp	• Reset both, or cycle power • Check the thermocouple wiring • Verify that the "Process" and "High Temp" thermocouples are reading the same temperature
Ambient Temps Not Equal	Internal System Error	The ambient (cold injunction) temperature as read on the door card and terminal card are more than 10˚C (50˚F) apart	• Verify the thermocouple wiring • Calibrate the thermocouples

4.3 Error Messages Continued...

ON SCREEN	DESCRIPTION	CAUSE	CORRECTIVE ACTION
Control Error	Internal System Error	Error in the control system	• Reset or cycle power • Replace the door card
Key Stuck Error "Key name"	Keypad problem	Key shorted at startup	• Reset or cycle power • Inspect ribbon cable connection • Replace the keypad
Stopped	Stopped	The stop key has been pressed	• Press OK key
Comparison "error"	Internal System Error		• Reset or cycle power • Reverse ribbon • Replace the ribbon cable • Replace terminal
Terminal Card Communications	Communication error	Communication error between the door card and terminal card	• Reset or cycle power • Check ribbon cable connection • Reverse ribbon • Replace ribbon • Replace the terminal card
Terminal Card Command Refused	Internal system error	The terminal card has rejected a command sent by the door card	• Check the solenoid wiring, if there are crossed wires or if a common wire is used for the negative return this error can result. • Reset or cycle power • Reverse ribbon • Replace the ribbon cable • Replace one or both cards
Terminal Card Output Feeback	Solenoid power error	A solenoid output is detected as being on when it should be off, or off when it should be on	• Reset or cycle power • Check for shorted outputs

ON SCREEN	DESCRIPTION	CAUSE	CORRECTIVE ACTION
Terminal Card Reciprocal Comp	Internal system error	The reciprocal comparison between the cards does not agree	• Reset or cycle power • Reverse ribbon • Replace the ribbon cable • Replace one or both cards
Terminal Card Shutdown Detect	External system error	Contact input detected open by the terminal card: ESD, High Pressure, Low Pressure, Level	• Reset or cycle power • Check wiring • Reverse ribbon • Replace the ribbon cable
Terminal Card Invalid Command	Internal system error	The terminal card has received an invalid command from the door card.	• Reset or cycle power • Reverse ribbon • Replace the ribbon cable • Replace the door card
Terminal Card High Temp Alarm	High Temperature Shutdown	Process or High Temp Thermocouple has reached the High Temp ESD setpoint. This is detected by the terminal card first.	• Reset or cycle power • Allow bath to cool
Terminal Card HH TC Grounded	Thermocouple error	High Temp Thermocouple is shorted to ground.	• Check for wiring faults with the thermocouples • Check for a short to ground on the high temp thermocouple.

4.4 Calibration

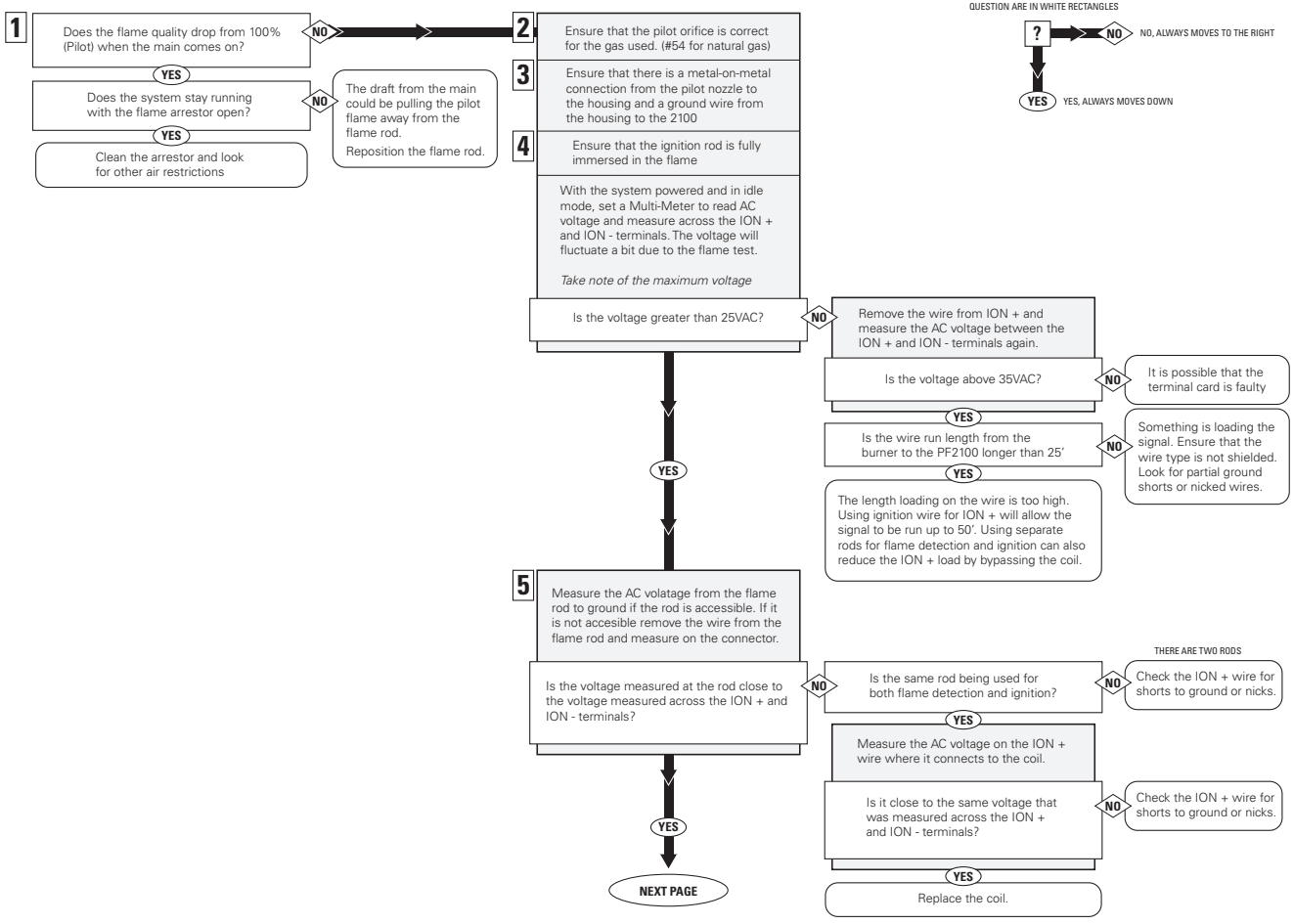
Factory calibration has been performed.

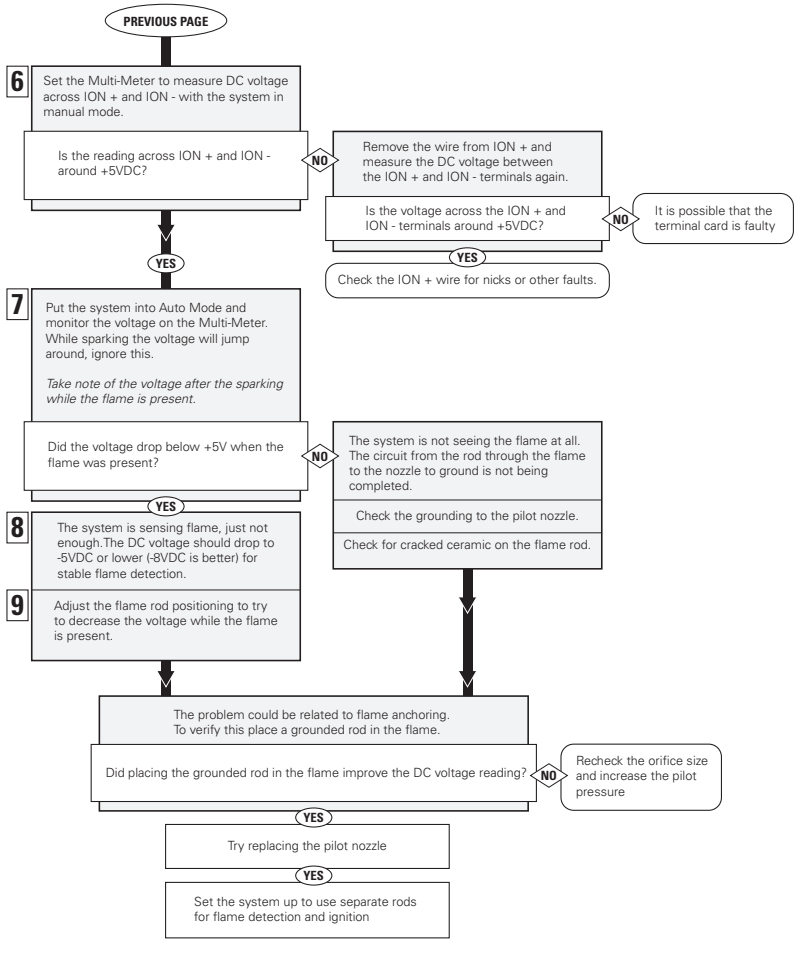
ON SCREEN	DESCRIPTION	FUNCTION	RANGE	DEFAULT SETTING	USER SETTING
Cal: Proc TC Zero = No	Process thermocouple zero calibration	Short the Proc "+" and "-" contacts and select Yes	N/A	N/A	
Cal: ProcH TC Zero = No	High Temp thermocouple zero calibration	Short the ProH "+" and "-" contacts and select Yes	N/A	N/A	
Cal: AUX TC Disabled	AUX thermocouple zero calibration	Short the AUX "+" and "-" contacts and select Yes	N/A	N/A	
Cal: Proc TC = xxC	Process thermocouple span calibration	Provide a calibrated 212˚F signal (from thermocouple in a block or meter) to the Process TC input and adjust the reading to match the applied temperature.	N/A	N/A	
Cal: High Temp TC = xxC	High Temperature thermocouple calibration	Provide a calibrated 212˚F signal (from thermocouple in a block or meter) to the High Temp TC input and adjust the reading to match the applied temperature.	N/A	N/A	
Cal: AUX TC = xxC	AUX thermocouple calibration	Provide a calibrated 212˚F signal (from thermocouple in a block or meter) to the AUX TC input and adjust the reading to match the applied temperature.	N/A	N/A	

ON SCREEN	DESCRIPTION	FUNCTION	RANGE	DEFAULT SETTING	USER SETTING
Cal: 4-20 Low Adj for 4mA	Calibration for 4mA output	Insert a current meter inline with the 4-20mA output and use the △ and ▽ keys to adjust the output until the current meter reads 4mA.	N/A	N/A	
Cal: 4-20 High Adj for 20mA	Calibration for 20mA output	Insert a current meter inline with the 4-20mA output and use the △ and ▽ keys to adjust the output until the current meter reads 20mA.	N/A	N/A	

4.5 Flame Detection Troubleshooting

System is not detecting flame.

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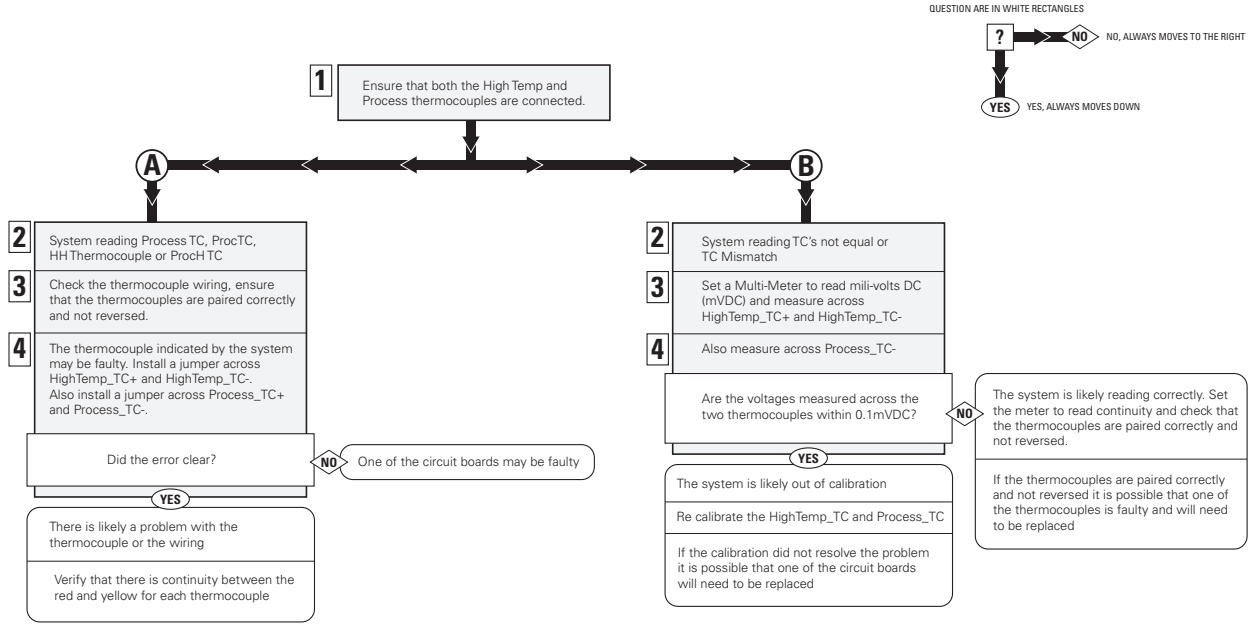
6
Set the Multi-Meter to measure DC voltage across ION + and ION - with the system in manual mode.
Is the reading across ION + and ION - around +5VDC?
NO
Remove the wire from ION + and measure the DC voltage between the ION + and ION - terminals again.
Is the voltage across the ION + and ION - terminals around +5VDC?
NO
It is possible that the terminal card is faulty
YES
Check the ION + wire for nicks or other faults.
YES
7
Put the system into Auto Mode and monitor the voltage on the Multi-Meter. While sparking the voltage will jump around, ignore this.
Take note of the voltage after the sparking while the flame is present.
Did the voltage drop below +5V when the flame was present?
NO
The system is not seeing the flame at all. The circuit from the rod through the flame to the nozzle to ground is not being completed.
Check the grounding to the pilot nozzle.
Check for cracked ceramic on the flame rod.
YES
8
The system is sensing flame, just not enough.The DC voltage should drop to -5VDC or lower (-8VDC is better) for stable flame detection.
9
Adjust the flame rod positioning to try to decrease the voltage while the flame is present.
The problem could be related to flame anchoring. To verify this place a grounded rod in the flame.
Did placing the grounded rod in the flame improve the DC voltage reading?
NO
Recheck the orifice size and increase the pilot pressure
YES
Try replacing the pilot nozzle
YES
Set the system up to use separate rods for flame detection and ignition

4.6 Thermocouple Troubleshooting

Problem with Thermocouples.



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