


# Eclipse PulsePak Burner

Model PB  
Version 1




Innovative Thermal Solutions  
[www.eclipsenet.com](http://www.eclipsenet.com)

## PulsePak

**T400 Phase Codes**

PHASE	SYMBOL	DESCRIPTION
OFF	▷ □	Standby
P01	⊙ ↓	Undervoltage
P04	⚠ ▷	Improper Flame
P21	⚠ ⊙ →	POC Test
P40	⚡	Ignition, Pilot On
P42	⊙ ▷	Flame Detect
P44	⊙ ▷	Wait to Main On
P50	⊙ ⊙	Main Safety Time
oP1	▷ ⊙	Operate
P10	↓ ▷	Shutdown



10048776

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## **Document Conventions**

There are several special symbols in this document. You must know their meaning and importance.

The explanation of these symbols follows below. Please read it thoroughly.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

***NOTICE***

Is used to address practices not related to personal injury.

**NOTE**

Indicates an important part of text. Read thoroughly.



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# Introduction

1

## Product Description

The Eclipse PulsePak offers a modular and scalable approach to pulse-fire control applications. With integrated flame safeguard, temperature control, and pulse-firing of burners in each zone; the PulsePak is the most complete and scalable pulse solution available for your application.

The PulsePak Burner panels can be ordered for use in a zone system with the PulsePak Zone panel, see Installation Guide 862-1. Then each temperature zone on your furnace is controlled with independent, closed-loop, auto-tuned PID temperature control with integrated pulse firing for up to eight (8) burners per zone. No additional PLC or programming is required to achieve pulse control; the unit is ready “out of the box” to interface to your furnace control. Up to seven (7) PulsePak Burner panels communicate to the PulsePak Zone panel through a CANopen communication protocol.

The PulsePak Burner panels can also be ordered for use in a zone system controlled by your own pulse algorithm residing in your PLC for the furnace. In this case, the PulsePak Zone panel is not used and your PLC sends start and stop commands over a communication buss. The PulsePak Burner panel can be specified for DeviceNet, Modbus TCP, or Profibus DP communication protocols.

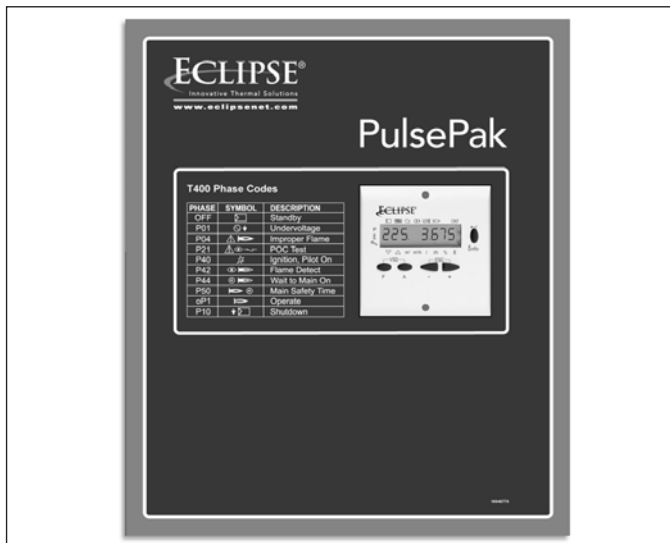


Figure 1.1. PulsePak Burner

## Audience

This manual has been written for people who are already familiar with all aspects of a burner system and its add-on components, also referred to as “the burner system”.

These aspects are:

- Design/Selection
- Use
- Maintenance

The audience is expected to have previous experience with this type of equipment.

## PulsePak Documents

### Installation Guide No. 862

- This document

### Datasheet, Series No. 862

- Available for individual PulsePak models
- Required to complete installation

### Design Guide No. 862

- Used with Datasheet to complete installation

### Worksheet No. 862

- Required to provide application information to Eclipse Engineering

## Related Documents

- EFE 825 (Combustion Engineering Guide)
- Eclipse Bulletins and Info Guides:
  - Instruction Manual 830-1 (T400)
  - Quick Guide 830 (T400)
  - Data 841
  - Drawing 10050014

## Purpose

The purpose of this manual is to ensure that you carry out the installation of a safe, effective, and trouble free combustion system.

# Safety

## 2

Important notices about safe operation will be found in this section. Read this entire manual before attempting to start the system. If any part of the information in this manual is not understood, contact Eclipse before continuing.

### Safety Warnings



**DANGER**

- **Read entire manual before attempting to start this system. If you do not understand any part of the information contained in this manual, contact Eclipse before continuing.**
- **The safety of this device is only ensured when the device is used correctly for its intended purpose within the limits and environmental conditions that have been specified. Any application beyond these limits is prohibited. Claims of any kind against the manufacturer, for damages resulting from misuse of the instrument are precluded, liability is limited to the user.**
- **The user is responsible for keeping the operating manual in the immediate vicinity of the instrument and always accessible for the operating personnel.**
- **All electrical wiring must conform to local standards. See the “Specifications” section for more details.**

### Capabilities

Adjustment, maintenance and troubleshooting of the mechanical and the electrical parts of this system should be done by qualified personnel with good mechanical aptitude and experience with combustion equipment.

### Operator Training

The best safety precaution is an alert and trained operator. Train new operators thoroughly and have them demonstrate an adequate understanding of the equipment, its operation and any related hazards. A regular retraining schedule should be administered to ensure operators maintain a high degree of proficiency.

### Replacement Parts

Order replacement parts from Eclipse only.



# Specifications

# 3

## **General Technical Data**

<b>Parameter</b>	<b>Specifications</b>
Power Supply	120 or 230 VAC, 1PH, 50/60 Hz
Power Consumption	2A (Panel with Ignition Transformer On, Refer to Valve Datasheet for Valve Train current draw)
Ambient Temperature	32°F to 122°F (0°C to 50°C)
Enclosure Rating	NEMA 12
Dimensions	14" High x 12" Wide x 6" Deep (356 x 305 x 152 mm)
Weight	35 lbs (15 kg)
Flame Monitor	No Purge
Flame Sensor	Flame rod UV Scanner Self-Check UV Scanner (North America Only)
Ignition Transformer	Included
Start Signal	120 VAC or 230 VAC (same as power supply)
Annunciation	Integral Display through window, optional door mounted Remote Display
Communication Protocols	PulsePak Zone (CANopen), Profibus DP, Modbus TCP, or DeviceNet

# Installation

# 4

In this section you will find the information and instructions that you need to install the PulsePak Burner Packaged Burner Option.

## **Handling**

- Make sure that the area is clean.
- Protect the components from the weather, damage, dirt and moisture.
- Protect the components from excessive temperatures and humidity.
- Take care not to drop or damage components.

## **Storage**

- Make sure that the components are clean and free of damage.
- Store the components in a cool, clean, dry room.
- After you have made sure that everything is present and in good condition, keep the components in the original package as long as possible.

## **NOTICE**

- **It is critical that the instructions for handling and storage are followed. The PulsePak Burner should be considered fragile; improper handling and storage will cause premature failure.**

## **Approval of Components**

### **Limit Controls & Safety Equipment**

All limit controls and safety equipment must comply with all applicable local codes and/or standards and must be listed for combustion safety by an independent testing agency. Typical application examples include:

- American: NFPA 86 with listing marks from UL, FM, CSA
- European: EN 746-2 with CE mark from TuV, Gastec, Advantica

### **Electrical Wiring**

All the electrical wiring must comply with all applicable local codes and/or standards such as:

- NFPA Standard 70
- IEC60364
- CSA C22
- BS7671

## **Gas Piping**

All the gas piping must comply with all applicable local codes and/or standards such as:

- NFPA Standard 54
- ANSI Z223
- EN 746-2

### **Where to Get the Standards:**

#### **The NFPA Standards are available from:**

National Fire Protection Agency  
Batterymarch Park  
Quincy, MA 02269  
[www.nfpa.org](http://www.nfpa.org)

#### **The ANSI Standards are available from:**

American National Standard Institute  
1430 Broadway  
New York, NY 10018  
[www.ansi.org](http://www.ansi.org)

#### **The UL Standards are available from:**

333 Pfingsten Road  
Northbrook, IL 60062  
[www.ul.com](http://www.ul.com)

#### **The FM Standards are available from:**

1151 Boston-Providence Turnpike  
PO Box 9102  
Norwood, MA 02062  
[www.fmglobal.com/approvals](http://www.fmglobal.com/approvals)

#### **Information on the EN standards and where to get them is available from:**

Comité Européen de Normalisation  
Stassartstraat 36  
B-1050 Brussels  
Phone: +32-25196811  
Fax: +32-25196819  
[www.cen.eu](http://www.cen.eu)

Comité Européen de Normalisation Electronique  
Stassartstraat 36  
B-1050 Brussels  
Phone: +32-25196871  
Fax: +32-25196919  
[www.cenelec.org](http://www.cenelec.org)



# PulsePak Burner Panel Mounting

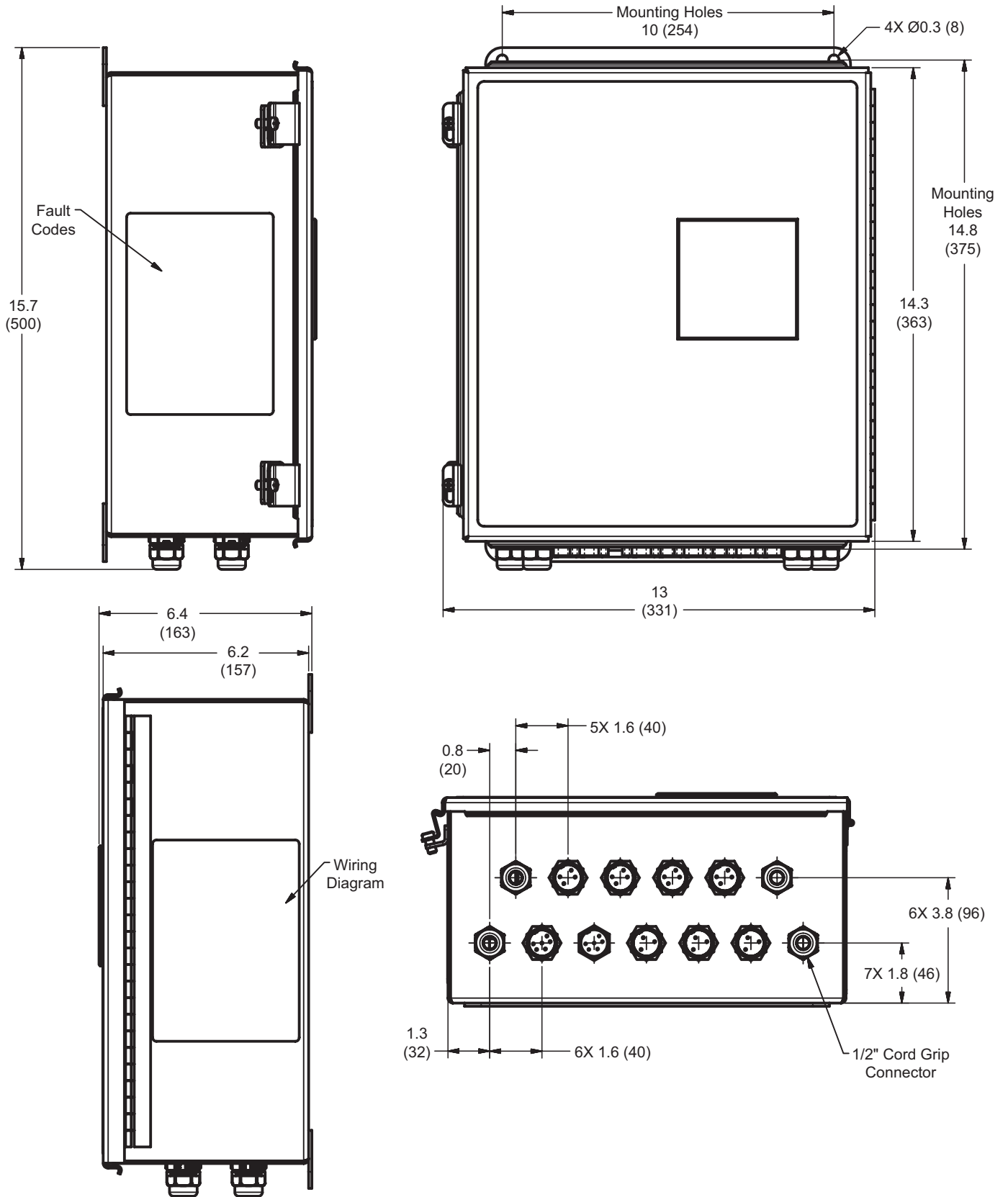
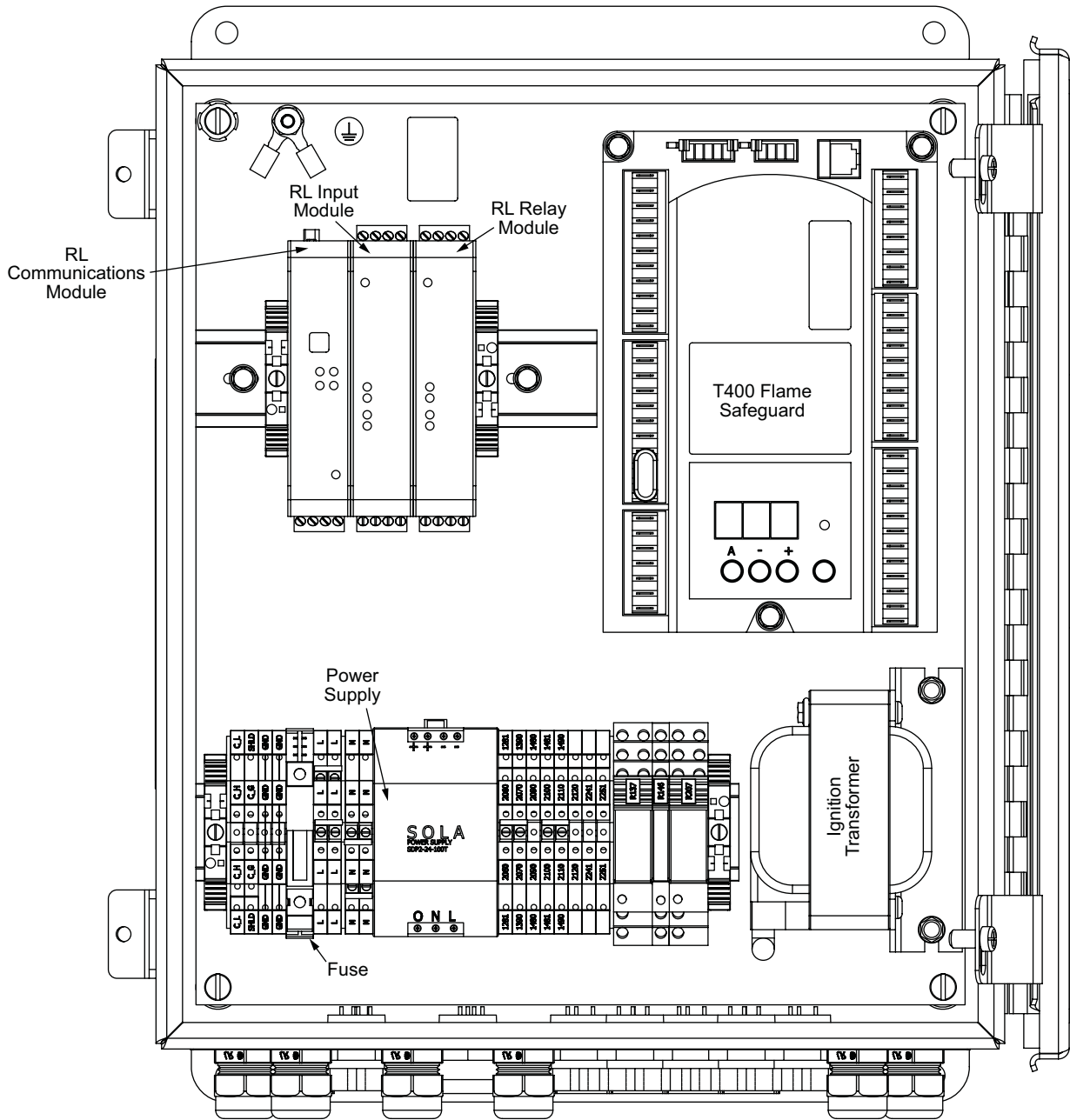
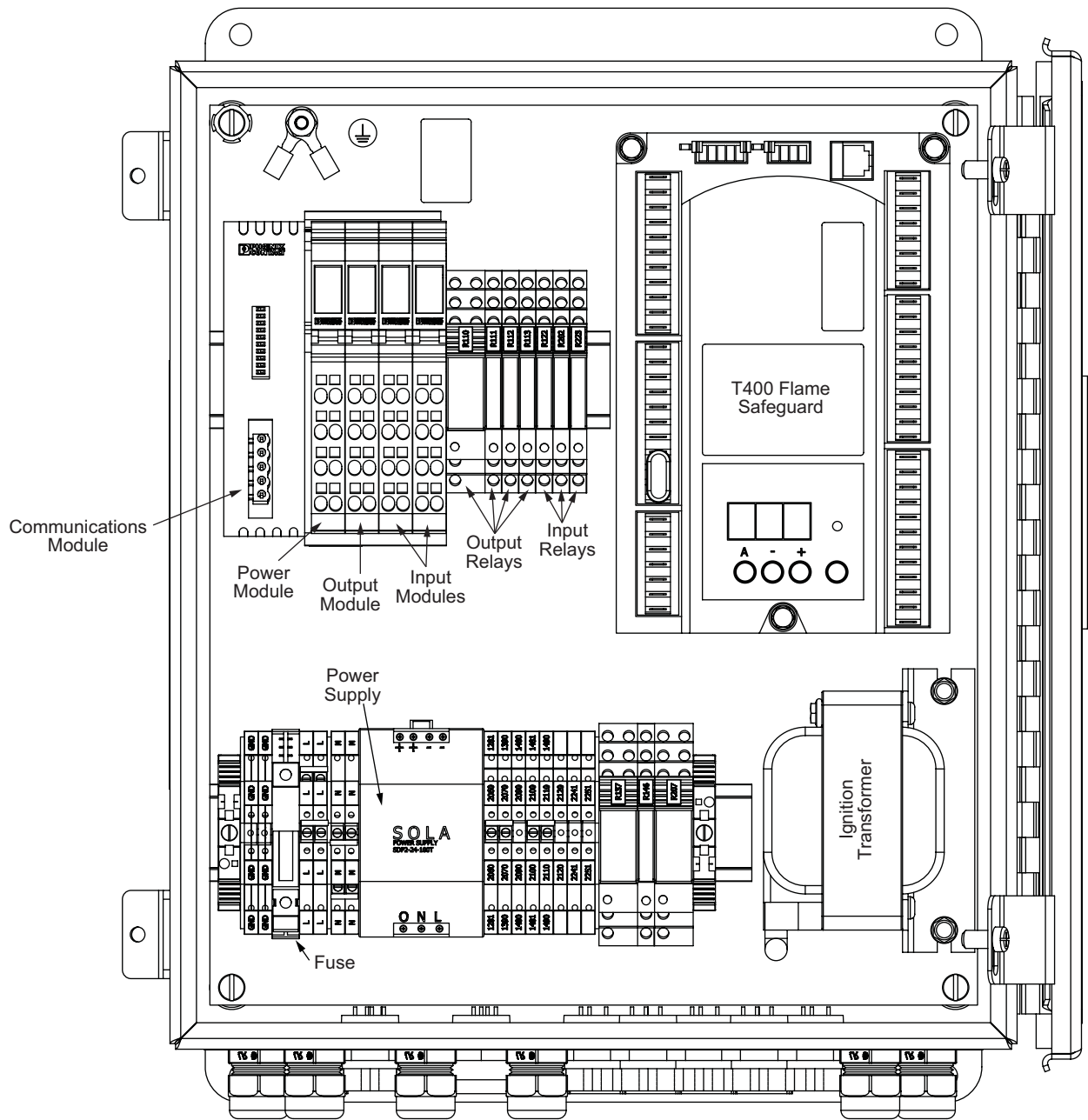


Figure 4.1.

# PulsePak Burner Components



**Figure 4.2. Layout for Profibus DP, Modbus TCP and PulsePak Zone Communication**



**Figure 4.3. Layout for DeviceNet Communication**

**T400 Flame Safeguard**

Eclipse PN:  
 10042540 (120V)  
 10042544 (230V)

For additional product information, see:  
 T410 Instruction Manual 830-1  
 Bulletin 830C  
 T400 Quick Guide 830

**Ignition Transformer**

Eclipse PN:  
 22967 (120V)  
 10005352 (230V)

For additional product information, see:  
 Data 841

## I/O Modules

Eclipse PN:

10049574 (PulsePak Zone/CANopen Module)

10050032 (Profibus DP Module)

10050033 (Modbus TCP Module)

10049575 (Input Module)

10049576 (Relay Module)

For additional product information, see:

<http://www.pma-online.de/en/products/rl400.html>

10050016 (DeviceNet Module)

For additional product information, see:

[http://www.phoenixcontact.com/automation/32123\\_31969.htm](http://www.phoenixcontact.com/automation/32123_31969.htm)

## Power Supply

Eclipse PN:

10049577

For additional product information, see:

<http://www.solahd.com/products/powersupplies/sdp.htm>

**NOTE:** To ensure correct product configuration, order replacement parts from Eclipse only.

## PulsePak Burner Panel Wiring

There are a number of wiring connections required during installation. See supplied electrical drawings for additional details regarding wiring connections. Interlocks and purge signals are handled externally.

**NOTE:** Handling of Interlock and Purge signals is to be done in accordance to local codes. See the Approval of Components section for additional information on safety codes.

**NOTE:** General wiring "Best Practices" should be followed. For example low voltage wiring (signal, communications, etc.) should not be run in the same conduit as high voltage wiring (power, ignition cables, etc.).

A general overview of required wiring connections can be seen in Figure 4.4.

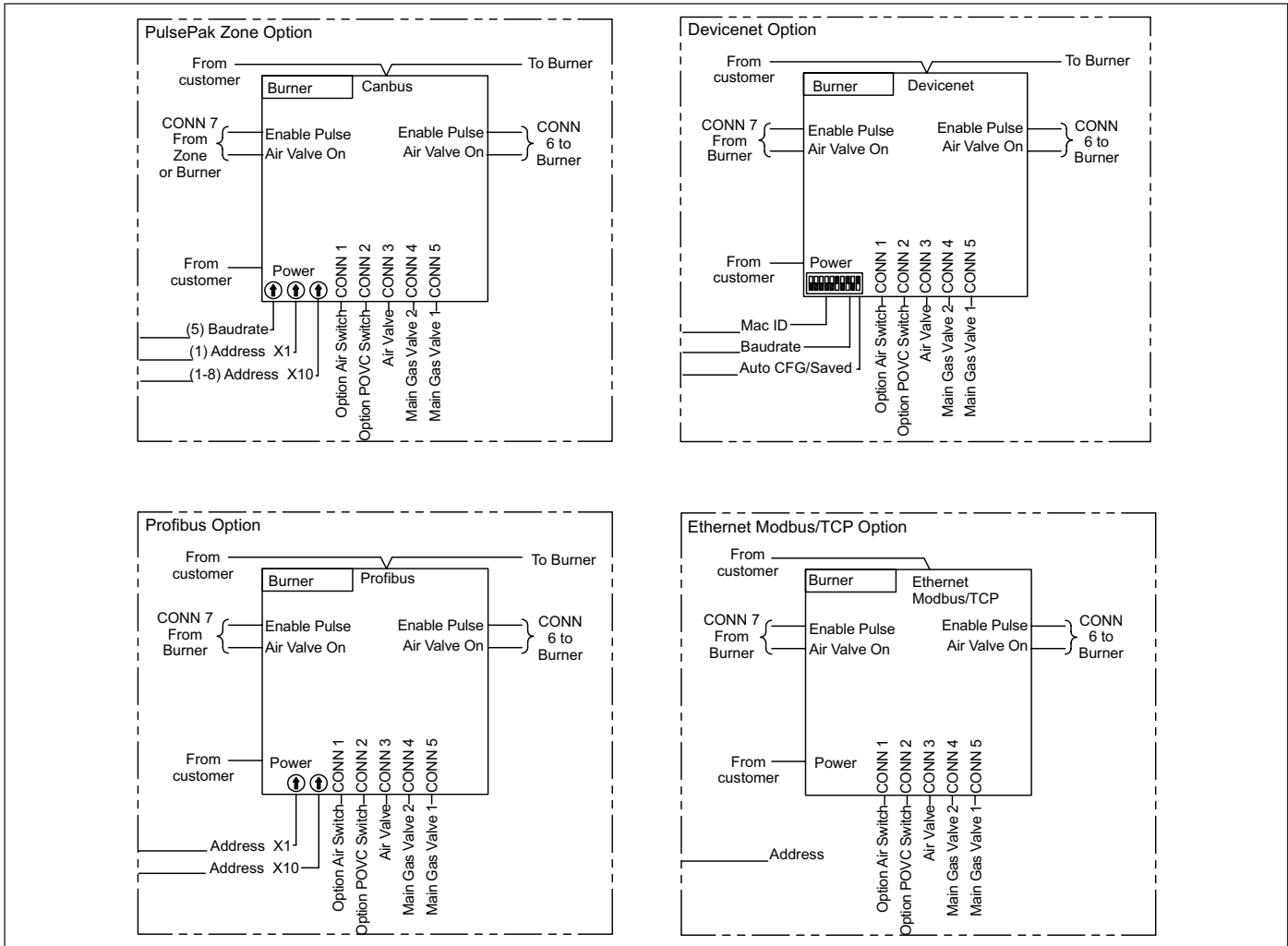


Figure 4.4.

## Connections

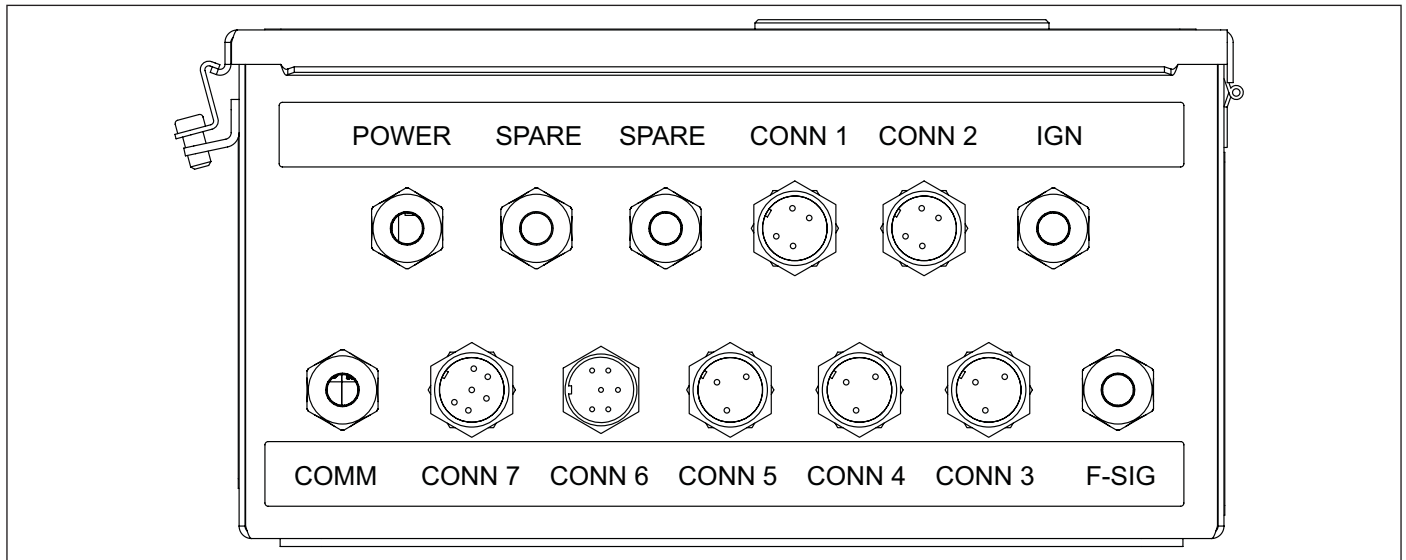


Figure 4.5.

All cable connections are located at the bottom of the panel. The diagram above identifies each cable connection location. CONN 1 through CONN 7 have connectors for Brad Harrison Cables. See Data Sheets 862-1 or 862-2 for cable ordering information. The remaining connections can be brought in to or out of the panel using the supplied cord grip connectors. If required remaining connections can be brought in to or out of the panel using the supplied cord grip connectors. If required the cord grip connectors may be replaced with conduit fittings.

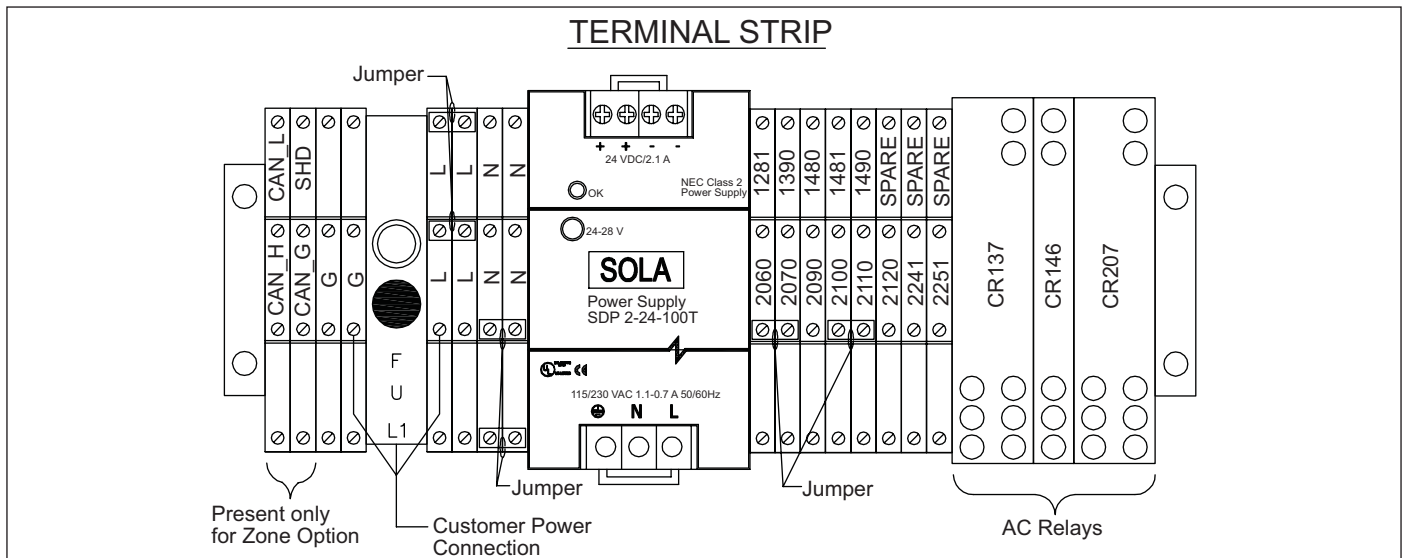


Figure 4.6.

### Power Cable

Power is supplied to the G, L1 & N terminals and must be 120 or 230 VAC, 1 Phase, 50/60 Hz as specified when ordered.

### Input Cable

There are several required input signals along with some optional signals. They are as follows:

## Pulse Enable

The pulse enable (start) signal is required to operate the burners. This signal could be fed directly from the users interlock circuit or there might be additional logic that controls the Pulse Enable signal. This is a line voltage input (120 or 230VAC) that is wired to CONN 7, white, wire 1281.

## CONN1 - COMB Air Switch

When using an air switch, a Brad Harrison cable is used to connect the panel (CONN1) to the switch. See figure 4.7. It will be necessary to remove the jumper between 2060 and 2070. See Figure 4.6.

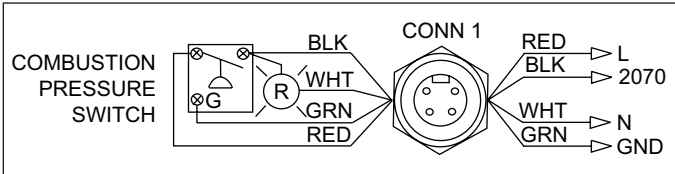


Figure 4.7.

## CONN2 -POVC Switch

When using a Proof of Valve Closure Switch (POVC), remove the jumpers between 2090 and 2100 plus 2110 and 2120. Add a jumper between 2100 and 2110. See detail in Figure 4.8.

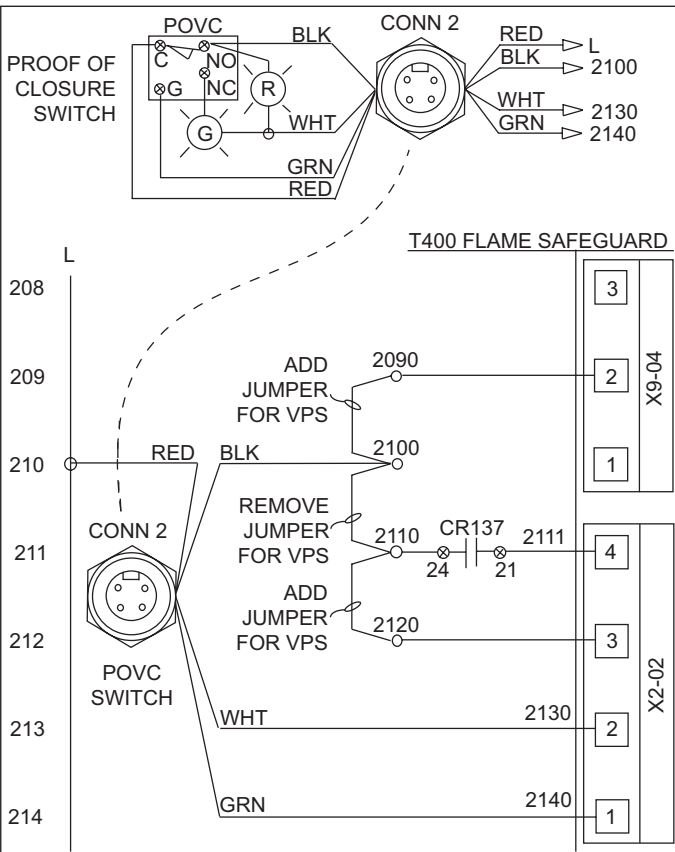


Figure 4.8.

## IGN Cable

The IGN output connection is used to run the high voltage cable from the ignition transformer to the burner ignitor. The cable plugs directly into the ignition transformer.

## F-SIG Cable

The flame rod or UV wires can be fed through the F-Sig cord grip. These are wired directly to the T410. A UV scanner is wired to X10-06 Terminals 1 & 2. A flame rod is wired to X10-5 Terminals 1 & 2. See Instruction manual 830-1 and Data 830-1 and 830-2 for additional info.

## CONN3-Air Valve; CONN4-Gas Valve 2; CONN5-Gas Valve 1:

Air and gas valves are connected to CONN 3, CONN4 and CONN 5 using Brad Harrison Cables. CONN 3 goes to the Air Valve. CONN 4 goes to gas valve 2 and CONN 5 goes to gas valve 1.

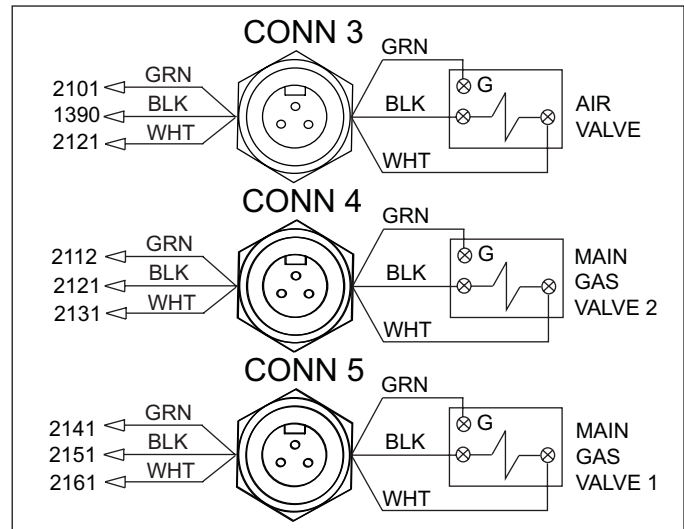


Figure 4.9.

## INTLKS/CONN6:

### Interlock Cable Input (Air Interlocks)

The air interlocks circuit gives the user the ability to monitor the air switches of all burners in the zone. The interlock loop from the customer panel should be wired directly to terminals 1480 and 1490 in the PulsePak Zone panel. If the PulsePak Zone panel is not used, connect the interlock loop to terminals 1480 and 1490 of the first PulsePak Burner panel. The signal (along with a hard wired pulse enable signal) continues out of CONN 6 to the next burner panel, CONN 7, as shown in Figure 4.4. The last burner panel (Burner 8 for an 8 burner system) should include a jumper between 1481 and 1490 to complete the circuit. See Terminal Strip, Figure 4.6. This is one possible method used to verify purge.

## COMM

The Comm input/output connection is used to run communication into and/or out of the panel. Recommended Communication Cables are as follows:

CANopen or DeviceNet: BELDEN 7896A Multi-Conductor - DeviceBus® for ODVA DeviceNet™

PROFIBUS - BELDEN 3079A Multi-Conductor - DataBus® ISA/SP-50 PROFIBUS Cable

MODBUS - BELDEN 8777 Multi-Conductor - Shielded Twisted Pair Cable

CANopen is used to communicate between the PulsePak Zone panel and the PulsePak Burner panels. The CANopen cable can be connected to the CAN\_H, CAN\_L and CAN\_G terminal blocks, refer to Figure 4.6. Refer to Installation Guide 862-1 to configure the module for communication with the PulsePak Zone panel.

When not using a PulsePak Zone panel, then the appropriate communication cable attaches directly to the port on the communication module. The Profibus DP cable can be connected with a standard DB9 connector as shown in Figure 4.10. The Modbus TCP cable can be connected with a standard Ethernet RJ45 connector, as shown in Figure 4.11. The DeviceNet cable can be connected with screw terminal plug supplied on the module, as shown in Figure 4.12. Refer to your PLC or other host communication device documentation for the settings to configure the PulsePak Burner module. See page 11 for web site links to more information on the communication modules.

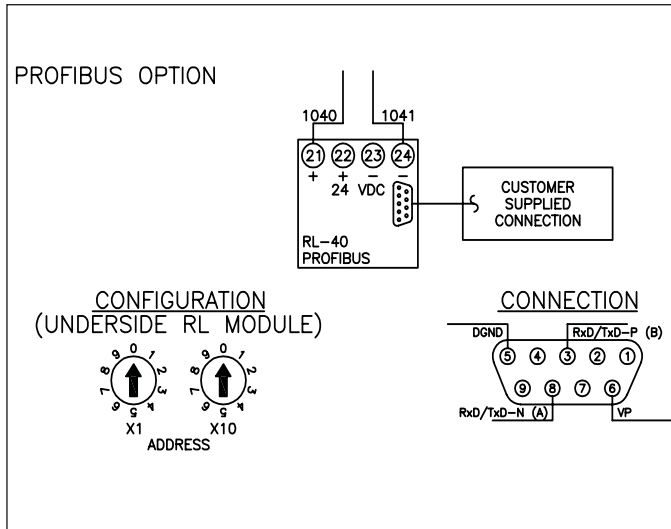


Figure 4.10.

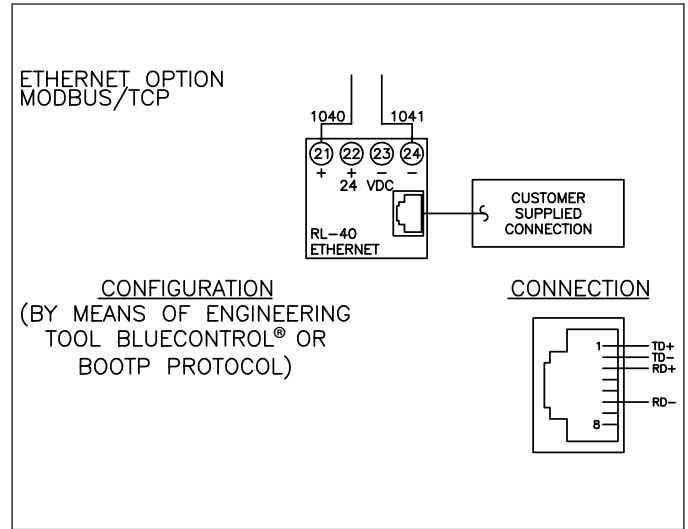
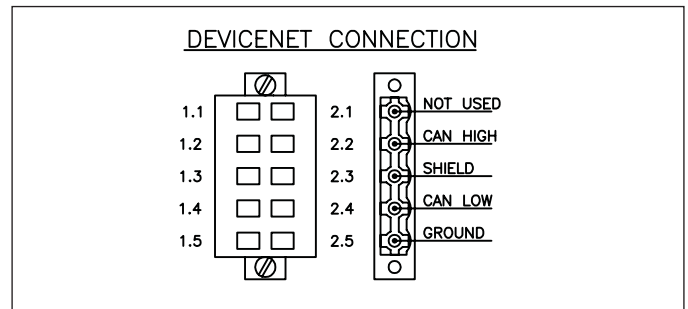


Figure 4.11.



### Valve Train Installation

For Valve Train installation, please see Installation Guide 791-2.



### WARNING

- Certain safety features are designed into the complete PulsePak system. Failure to use Eclipse PulsePak Valve Train Segments (dual valves with ratio regulator) and an upstream containment removal system (drip leg, filter, stainer) increases the risk of explosion.

# Operation

# 5

## PulsePak Zone Panel Controlled

Refer to Installation Guide 862-1 for operation of PulsePak Burner panels when used with the PulsePak Zone panels.

## Host Communication Controlled

The furnace management system must provide a hardwired, line voltage safety signal to enable the output modules in the PulsePak Burner panel. Then the host controller can communicate to turn on and off specific outputs for controlling the air valve and the T400 flame safeguard.

Output 1 resets the T400 flame safeguard when it is in a lockout condition. The output should be a pulse lasting from about 1 to 5 seconds.



- **The host logic must not automatically reset or fault to continuous cycling of the reset. Such action releases successive accumulations of fuel that create an explosion hazard and could result in serious injury, death and equipment damage.**

Output 2 starts the T400 flame safeguard. The host logic must insure that the air supply to the burner is on before turning on this output. Refer to the installation section of this manual for hardwired jumper options on monitoring an air switch at the burner.

Output 3 controls the air valve. The host logic must insure that Output 2 is not allowed on unless this output is on.

Output 4 is a spare and available for the user.

Input 1 high signals the host that the T400 flame safeguard is in an alarm and lockout state. Pulsing Output 1 or pushing the 'Info' button on the unit will reset it.

Input 2 high signals the host that the air valve is on. Refer to the installation section of this manual for hardwired jumper options on monitoring an air switch at the burner.

Input 3 high signals the host that the ignition transformer is powered by the T400 flame safeguard.

Input 4 is a spare and available for the user.



# Start Up

# 6

Before applying power to the panel, ensure the following points have been taken into account.

## Verify Wiring/Connections

- Verify the supply voltage corresponds to the specifications
- Confirm that all required external signals are wired and connected to the proper terminals - at a minimum, the panel needs to have power and an external pulse enable line voltage signal input that is wired to CONN 7 or terminal 1281
- For each PulsePak burner panel in the zone, determine that a cable is connected from CONN 6 of the previous panel to CONN 7 of the next panel to supply the hard wired pulse enable and air interlock signal (if used) between all panels in the zone
- Make sure that the jumpers are properly installed or removed to meet the application requirements: 1481-1490, 2060-2070; 2090-2100; 2100-2110; 2110-2120
- Check that all terminals are properly tightened
- Ensure that the communication module is properly configured with the correct address and baud rates for the burner location
- Verify all gas and air valves are connected to the proper connectors and that the connectors are tightened

## Verify Communications

Once wiring has been verified, apply power to the zone and burner panels. Verify communication between panels is taking place by LEDs.

## Setup Flame Safeties

In each zone and/or burner panel, verify flame safety settings are correct. Typically, the settings of concern are trial for ignition and flame failure response time. See Instruction Manual 830-1 for detailed information on initial settings for the flame safety.

## Verify Purge

Once the system is ready to start, verify the purge timer is set to the appropriate amount of time for the furnace. Purge time is typically determined by the volume of the furnace and the flow rate through the air valves. Four or five volume changes are often required to complete a full purge, but it is necessary to verify purge requirements from all applicable codes and regulations.

Close all burner manual gas valves and initiate the startup sequence. Verify the purge comes on before the start signal and the start signal is not triggered until the purge has completed. Once the purge has been triggered, verify that all air valves are open and flowing the correct amount of air. If flow meters are not available, this can be done using differential or static pressures supplied with the burner setup data.

Depending on the purge time and number of burners, it might be best to set the purge time longer than required to ensure enough time is allowed for verification. Otherwise, it might be necessary to restart the purge sequence several times to verify the correct amount of air is flowing through each burner.

## Adjust Burners

Once all wiring, settings and communications have been verified, adjust burner valves so that they start safely. See the setup guides for that particular burner for proper guidelines.

Set the main panel to start up and open all manual gas valves. At this point, the pulse enable signal can be applied. For convenience, put the host controller in manual mode and zero percent output. If running in High/Low mode, all burners should light and remain at low fire. Verify low fire settings for each burner and ensure all burners are operating in a safe condition. If running on On/Off mode, all burners should be off.

To properly setup each burner, drive a specific burner to high fire regardless of controller output. Best practice is to set up each burner high fire one at a time.



**CAUTION**

- **Setting a burner to MAN HI could cause the furnace to hit a high temp/high limit condition.**

Please note that depending on the type of burner, the control scheme, piping practices, etc, adjustments of individual burners might change when running multiple burners. All adjustments should later be verified when the furnace is fully operational. For a Hi/Low system, Once

high fire is set for each burners in the zone, go back to low fire and verify low fire adjustments.

### **Start Furnace Operation**

Once all burners have been properly adjusted, the host controller can start automatic temperature control to the desired setpoint. At this point, the furnace should be functional and care should be taken to ensure all burners in the furnace are operating safely and correctly. If any burners failed to ignite at any point, the burner failure can be viewed on the T400 display and then the burner can be reset.

### **T410 Flame Safeguard Parameters**

<b>Parameter</b>	<b>Set Value</b>	<b>Factory Default</b>
140 (Display Mode)		2
230 (Stabilize)		3.234
231 (Interrupt)		9.996
239 (24Hr Restart)		0
240 (Repitition)		0
247 (Pilot Stays On)		0
254 (Flame Response)		0
257 (Ignition Time)		4.116

# Maintenance & Troubleshooting

This chapter is divided into two sections:

- Maintenance procedures
- Troubleshooting guide

## Maintenance

Preventive maintenance is the key to a reliable, safe and efficient system. The core of any preventive maintenance system is a list of periodic tasks.

The following are suggestions for a monthly list and a yearly list.

**NOTE:** The monthly list and yearly lists are an average interval. If your environment is dirty, the intervals may be shorter.

## Monthly Checklist

- Inspect and tighten loose mechanical or electrical components.
- Look for signs of damage and repair as needed.
- Clean the external surfaces.

## Yearly Checklist

- Perform all monthly checklists plus;
- Check tightness of wiring connections.
- Check for gas pipe leaks.

See Valve Train Installation Guide 791-2 for details regarding valve train maintenance and troubleshooting. Gas valves in the On/Off mode and air valves in either pulse mode will accumulate cycles according to the chart below. The maintenance interval (years) is based on a valve life rating of 1 million cycles.

**Table 7.1 Maintenance for On-Off Pulse Mode**

Operating Conditions				Results	
Pulse Timings		Furnace Operation		Accumulated	Repair/Replace
Cycles / Hour	Seconds / Cycle	Hours / Day	Days / Year	Cycles / Year	Years
600	6	16	300	2,880,000	0.3
300	12			1,440,000	0.7
100	36			480,000	2
60	60			288,000	3
600	6	10	300	1,800,000	0.5
300	12			900,000	1
100	36			300,000	3
60	60			180,000	5

## Troubleshooting Guide

Problem	Possible Cause	Solution
Dead, no power	No voltage to panel	Check power is being supplied and verify wiring
	No fuse / blown fuse	Add or replace fuse
Pulse sequence won't start	No start signal	Host controller not calling for startup; Hard-wired interlocks not made, CONN 7 loose; Incorrect wiring
	Not controlling temperature	Host controller in manual mode or set point not correct; Buss communication error
Starts without purge	No purge	Purge timer not set; incorrect wiring
Burner does not ignite	No communication between host and burner packs	Incorrect wiring; incorrect address or baud rate settings
	Burner ignition failure	Incorrect burner settings; bad/wrong igniter; incorrect flame signal wiring; Ignition transformer not connected; air and gas valves not connected correctly; flame safety error
	Burner disabled	Enable burner
	Flame safety errors	Incorrect flame safety settings; flame safety alarm
Temperature overshoot	Set point set too high	Correct set point
	Incorrect tuning parameters	Adjust tuning parameters (Manual or Auto tune)
	Low fire set too high	Adjust burner low fire settings
	External high limit not set / set too high	Set external high limit to desired value
	Controller in manual mode	Put controller in auto mode
	Air valve stuck open	Clean or replace air valve



# Appendix

## Conversion Factors

### Metric to English

From	To	Multiply By
actual cubic meter/hr (am <sup>3</sup> /h)	actual cubic foot/hr (acfh)	35.31
normal cubic meter/hr (Nm <sup>3</sup> /h)	standard cubic foot /hr (scfh)	38.04
degrees Celsius (°C)	degrees Fahrenheit (°F)	(°C x 9/5) + 32
kilogram (kg)	pound (lb)	2.205
kilowatt (kW)	BTU/hr	3415
meter (m)	foot (ft)	3.281
millibar (mbar)	inches water column ("w.c.)	0.402
millibar (mbar)	pounds/sq in (psi)	14.5 x 10 <sup>-3</sup>
millimeter (mm)	inch (in)	3.94 x 10 <sup>-2</sup>
MJ/Nm <sup>3</sup>	BTU/ft <sup>3</sup> (standard)	26.86

### Metric to Metric

From	To	Multiply By
kiloPascals (kPa)	millibar (mbar)	10
meter (m)	millimeter (mm)	1000
millibar (mbar)	kiloPascals (kPa)	0.1
millimeter (mm)	meter (m)	0.001

### English to Metric

From	To	Multiply By
actual cubic foot/hr (acfh)	actual cubic meter/hr (am <sup>3</sup> /h)	2.832 x 10 <sup>-2</sup>
standard cubic foot /hr (scfh)	normal cubic meter/hr (Nm <sup>3</sup> /h)	2.629 x 10 <sup>-2</sup>
degrees Fahrenheit (°F)	degrees Celsius (°C)	(°F - 32) x 5/9
pound (lb)	kilogram (kg)	0.454
BTU/hr	kilowatt (kW)	0.293 x 10 <sup>-3</sup>
foot (ft)	meter (m)	0.3048
inches water column ("w.c.)	millibar (mbar)	2.489
pounds/sq in (psi)	millibar (mbar)	68.95
inch (in)	millimeter (mm)	25.4
BTU/ft <sup>3</sup> (standard)	MJ/Nm <sup>3</sup>	37.2 x 10 <sup>-3</sup>



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