# Integrated Burner Control Circuit Boards

# Product Specification

## 1. General Description

The integrated burner control circuit board is designed to eliminate much of the wiring necessary to connect a Honeywell 7800 series burner control to a packaged gas, oil or combination gas/oil burner. It is available with a range of control features including on/off control, modulation control, low-high-low control, fuel select, low fire hold, and auto/manual select. Each version will be customizable to fit a variety of configurations. System information will be displayed via LED's.

### 1.1 Basic Requirements

There will be multiple versions of the circuit board assemblies each consisting of: a main circuit board, a light and switch circuit board with LED's, a 9-connection cable assembly, a nameplate and switch frames. All modulating versions will have a manual potentiometer as standard.

## 2. General Description of the Product

The main circuit board will provide a sub-base for the mounting of a 7800 Series control and screw terminals for wiring components external to the burner. These include the fuel valves, pilot valve, limits, interlocks, burner motor, and others.

It will use SPDT switches for on/off, fuel select, low fire hold, and auto/manual modulation. These switches will control relays located on the main circuit board. The switches will be accessible from the outside of the burner control enclosure on the panel top.

It will use LED's to display system information so that it is visible outside of the burner control enclosure.

### 2.1 Application

The two printed wiring assemblies (main circuit board and light and switch circuit board) will be mounted and enclosed in an appropriate panel by PFI.

The main circuit board will be installed in a metal panel using metal standoffs and metal screws to ensure that the circuit board is grounded to the enclosure. The enclosure must have a low impedance connection to earth ground. A fuse of appropriate current rating for the application, but no larger than 15A, will be placed into the on board fuse clips. All versions will have a number of jumpers that must be clipped to properly configure the main circuit board for the application. PFI will determine which jumpers must be clipped and that task will be performed at the factory.

The light and switch circuit board will mount to the panel top using metal standoffs and screws. After mounting the light and switch circuit board, the nameplate is applied and the switch frames and colored LED domes snapped into place. For modulating models, the potentiometer knob will be attached.

The light and switch circuit board will be connected to the main circuit board using a 24" long 9-terminal cable assembly. Most versions will have additional wires coming from the light and switch circuit board that will be factory connected to screw terminals on the main circuit board. All additional factory wiring will be done with size 16 AWG minimum, 90°C minimum wire. The field wiring of the L1 main power input and the L2 connection to the sub-base must be done with size 14 AWG minimum, 90°C minimum wire.

## 2.2 Performance

### 2.2.1 Operational Characteristics

The integrated burner control circuit board will perform the signal routing functions of a burner control panel, including limit string and valve routings for fuel changeover, while maintaining safety. It will display system information using LED's.

### 2.2.2 Operational Environment

The integrated burner control circuit board will be defined to work in the same operational environment as the 7800 SERIES relay module with which it is used.

**Ambient Temperature**

Operating: -40°F to +140°F
Storage: -40°F to +150°F

**Humidity**

Storage: 90% RH at 90°F for 30 days without noticeable performance degradation.
Operating: 85% RH continuous.
Condensation: This device is not intended for operation with condensation on its surfaces; but it must not operate in an unsafe manner under this condition.

**Voltage/Frequency**

The integrated burner control circuit board will operate with 120Vac (+10/-15%), 50 or 60 Hz (±10%).

**Vibration**

The integrated burner control circuit board will operate in an environment from 0 to ½ g up to 60 Hz (K-standard level V2).

**Life Expectancy**

The integrated burner control circuit board shall remain operative for 10 years or 100,000 burner cycles.

**Wire Ratings**

The integrated burner control circuit board must be wired using minimum 90°C copper wire with minimum size of 16 AWG. The field wiring for the L1 main power input terminal and the L2 connection to the sub-base must be wired with minimum 90°C 14 AWG copper wire.

### 2.2.3 Terminal/Component Ratings

All terminals blocks are rated for 120 Vac, up to 12 AWG wire, and have an additional wire rating of two No. 16 AWG stranded wires.

The rating of the two additional L1 terminal outputs is dependent on the current rating of the fuse being used.

The specifications of the potentiometer used for manual modulation are 1/8" shaft diameter, 270° ±15° rotation, 1.5W at 70°C, 200 Ω ±10%, cermet resistive element, metal shaft and bushing.

The integral relays are rated for 500,000 operations minimum at their rated load of 10A.

The selection/on-off switches are rated for 40,000 make-and-break cycles at their rated load of 7.5A.

The relays and switches have also been qualified under the 6,000 cycle 7800 Series safety relay qualification program.

The brightness of the white LED's used will be 2300 mcd, the red LED's will be 2800 mcd.

### 2.3 Listing Agency Approvals Required

All versions of the integrated burner control circuit board have approvals by the following approval bodies:

- Underwriters Laboratories (UL)
- Canadian Standards Association (CSA)

### 2.4 Number of Operating System (O.S.) Identities

The integrated burner control circuit board will have eight operating system identities as described below. The main circuit board assemblies include the controller sub-base, relays, relay hold down clips, and 9-pin cable assembly. Light and switch circuit board assemblies include switches, nameplate, switch frames, LED lights and manual potentiometer knob:

- Single fuel, on/off
- Dual fuel, on/off
- Dual fuel modulating for RM7800
- Dual fuel modulating for RM7895
- Single fuel, low-hi-off
- Dual fuel, low-hi-low
- Single fuel modulating for RM7800
- Single fuel modulating for RM7895

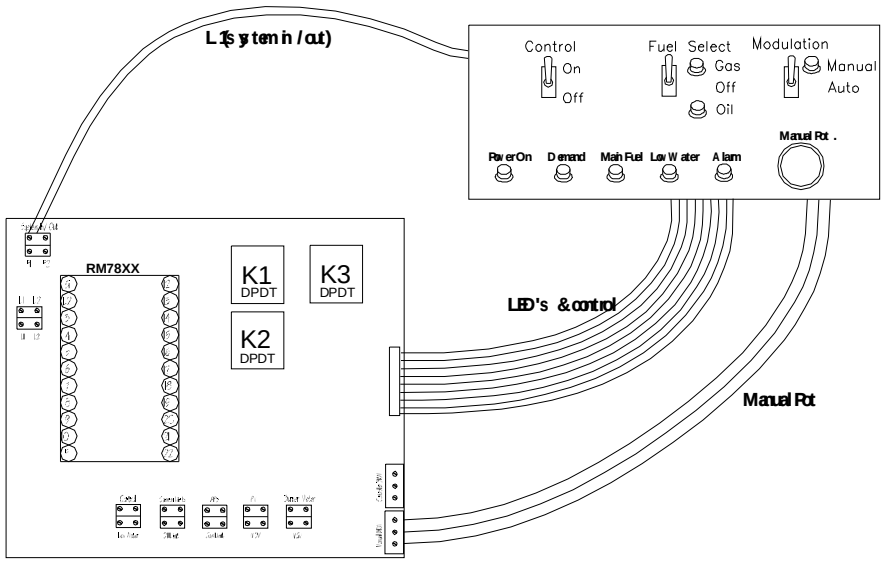
### 2.5 Shipping Information

#### 2.5.1 Description

The integrated burner control circuit board will be shipped as an integral component of the burner panel assembly. All replacement circuit boards will be available for separate purchase as replacement parts. The jumpers will be clipped at the factory for the specific application configuration. Replacement boards will be available from the factory and shipped via overnight delivery (inclusive of the parts price).

**Functional Requirements**

### 3.1 System Level Block Diagram




The above diagram is a general system overview only. The main circuit board is in the lower left; the light and switch circuit board is in the upper right. Actual configurations will use more or less components.

### 3.1 Required Functions

The integrated burner control circuit board will handle the signal routing functions for a given application. These functions include on/off, fuel changeover, low fire hold, and auto/manual modulation select. These functions must be done in such a way that the burner will not be able to enter an unsafe condition. This is accomplished with relay logic that does not allow two fuel valves to be energized and does not allow a fuel valve to be powered without the appropriate limits in place.

System status information will be displayed using LED's and plastic colored domes. The number of LED's will vary with the configuration.

#### 3.2.1 Control Switch

All versions of the integrated burner control circuit board will have a control switch. The burner demand can be turned on and off via this single-pole, double-throw switch located on the switch panel. When the bottom of this switch is pressed down it will interrupt the limit string input to sub-base terminal 6, creating a no demand situation. When the top of this switch is pressed down it will supply power to the rest of the limit string allowing a demand to be created. In this position, the control switch also supplies line voltage to the common terminals of the fuel changeover switch (in dual fuel models) and to the auto/manual select switch or low fire hold switch (when available).

### 3.2.2 Fuel Changeover Switch

In dual fuel models, the fuel changeover is accomplished with a single-pole double-throw switch with center off position located on the light and switch circuit board. When the top of the switch is pressed down gas will be the selected fuel, when the bottom is pressed down oil will be selected. When the switch is in the center off position neither fuel will be active. This switch applies line voltage to a delay circuit that is also located on the light and switch circuit board. The delay circuit then applies line voltage to the fuel select relays and to the fuel select signal output terminals located on the main circuit board. The delay circuit guarantees a delay of more then 2.5 line cycles in order to insure that the burner is recycled when the fuel is changed as required by UL2096, 59.7.

Two LED's will be located next to the fuel changeover switch to indicate which fuel is active.

### 3.2.3 Auto/Manual Modulation Select Switch

In modulating models the source of modulation is selected with a single-pole, double-throw switch located on the light and switch circuit board. When the top of the switch is pressed down manual modulation will be selected, when the bottom is pressed down automatic modulation will be selected. This switch provides line voltage to the auto/manual relay on the main circuit board when in the manual position. When powered this relay changes the system to manual modulation by connecting the W and R inputs of the manual terminal block to sub-base terminals 14 and 15. A potentiometer on the switch panel controls the burner modulation when in manual modulation mode. An LED located next to the switch lights up when in manual modulation mode.

### 3.2.4 Low Fire Hold Switch

The low fire hold switch activates a relay when the top of the switch is pressed down. This forces the system into low fire by connecting main oil valve terminal MF3 to terminal MF1 and main gas valve terminal GV2 to terminal GV3. When the bottom of the switch is pressed down the terminals are disconnected.

### 3.2.5 Light and Switch Circuit Board

The light and switch circuit boards of all models of the integrated burner control circuit board will include the following standard LED's. The terms in quotes is how the LED will be identified on the nameplate:

- "Power On": Powered by L1 input to controller sub-base
- "Demand": Powered by terminal 6 of controller sub-base
- "Main Fuel": Powered by main fuel valve output of controller sub-base
- "FSG Alarm": Powered by terminal 3 of controller sub-base
- (no label): Powered by screw terminal input on sub-base panel

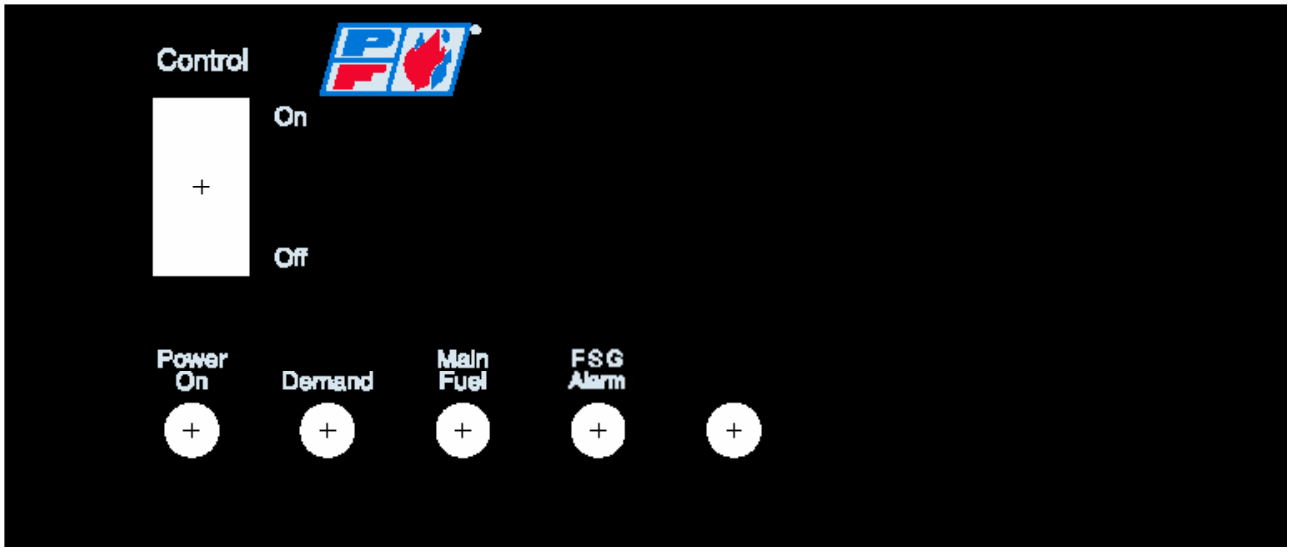
Additional components included on the light and switch circuit board for the different versions are described in the "Model Specific Feature Breakdown".

### 3.2.6 Model Specific Feature Breakdown

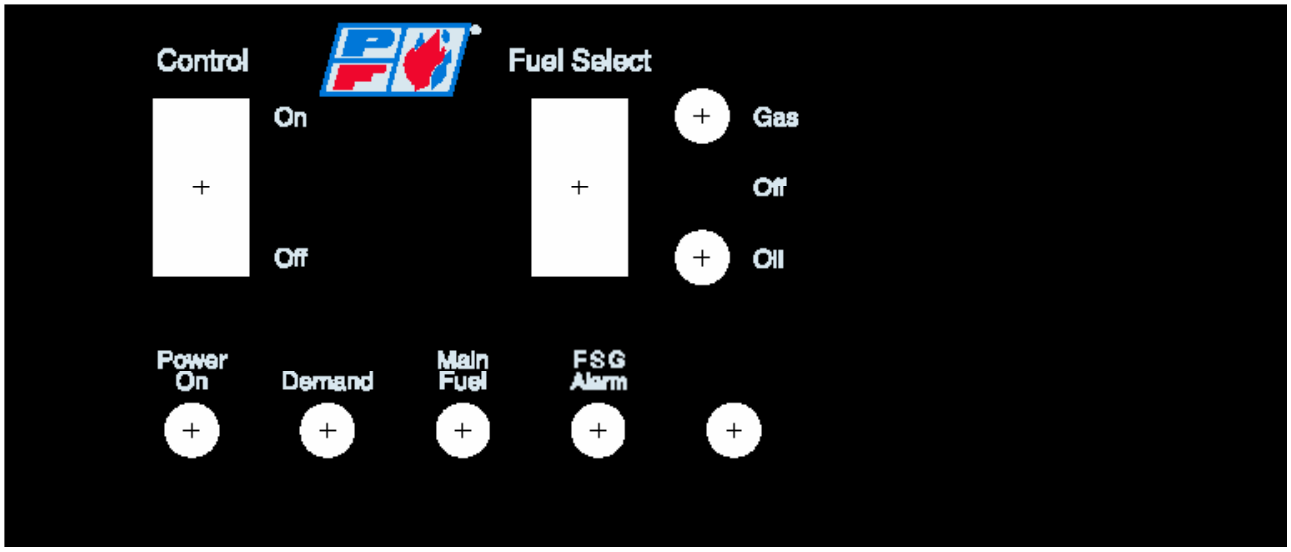
The corresponding nameplates for each model can be found in Appendix A.

Appendix A - Nameplates:
All nameplates measure 8.75” by 3.70”.

**SINGLE FUEL ON-OFF:**




**DUAL FUEL ON-OFF:**

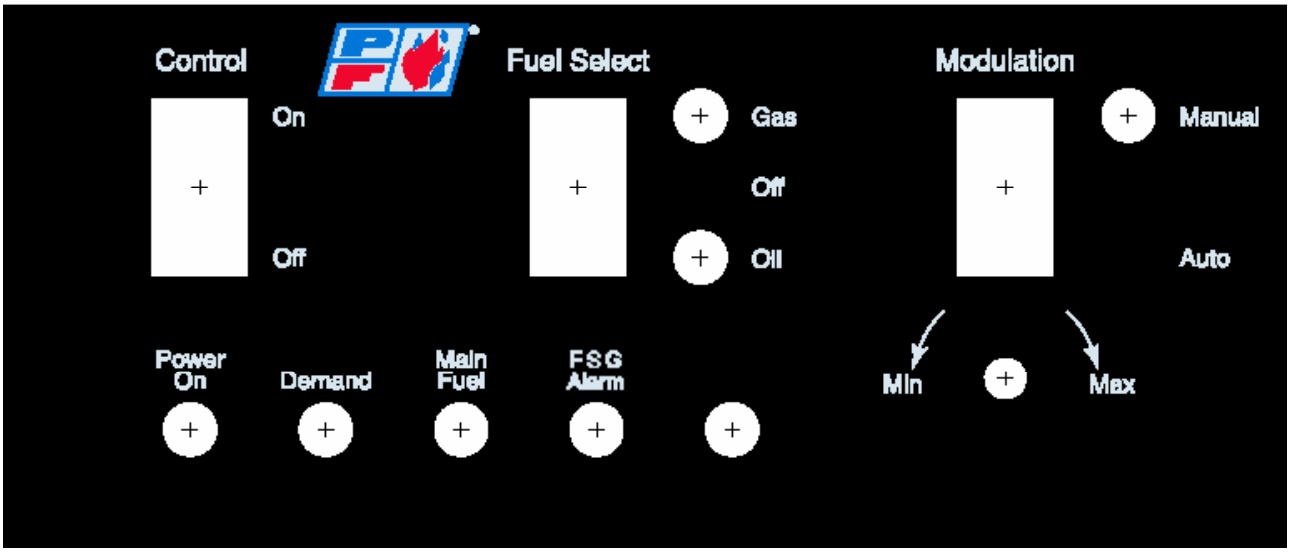


**SINGLE FUEL MODULATION:**

This nameplate is used for both versions of the single fuel modulating systems.


**DUAL FUEL MODULATION:**

This nameplate is used for both versions of the dual fuel modulating systems.



**SINGLE FUEL LOW-HIGH-LOW:**


**DUAL FUEL LOW-HIGH-LOW:**

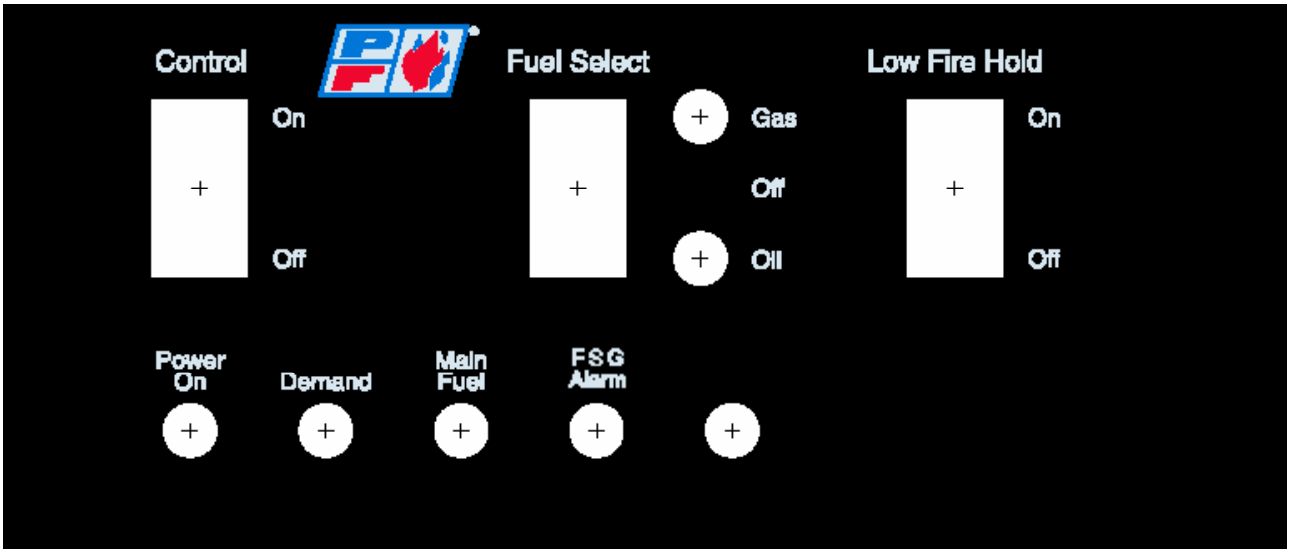


**Table 1. Q7800C Terminal Ratings.**

| Terminal Label | Description | Ratings |
|---|---|---|
| MF or MF1 | Main fuel valve power | 120 Vac[a] |
| GV1 | Main gas valve power | 120 Vac[a] |
| MF2 and MF3 | Secondary fuel valve connections | 120 Vac[a] |
| GV2 and GV3 | Secondary gas valve connections | 120 Vac[a] |
| PV1 | Gas/Single fuel pilot valve | 120 Vac[a] |
| PV2 | Oil pilot valve | 120 Vac[a] |
| OIG or GIG | Ignition output | 4.5A ignition. |
| CL1 and CL2 | Operation control/Common limit string connections | 120 Vac, 8A run, 43A inrush. |
| OL1 and OL2 | Oil/Single fuel limit string connections | 120 Vac, 8A run, 43A inrush. |
| GL1 and GL2 | Gas limit string connections | 120 Vac, 8A run, 43A inrush. |
| A1 and A2 | Air Flow Switch connections | 120 Vac, 8A run, 43A inrush. |
| OI1 and OI2 | Oil interlock connections | 120 Vac, 8A run, 43A inrush. |
| PC1 and PC2 | Proof of closure connections | 120 Vac, 8A run, 43A inrush. |
| E1 and E2 | Low fire start interlock connections | 120 Vac, 8A run, 43A inrush. |
| CS_B and CS_Y | System control switch connections | 120 Vac, 8A run, 43A inrush. |
| BM | Burner motor power | 120 Vac, 9.8 AFL, 58.8 ALR inrush[b]. |
| OP | Oil pump power | 120 Vac, 9.8 AFL, 58.8 ALR inrush[b]. |
| L1 MAIN | Main power supply input | 120 Vac (+10%/-15%), 50/60 Hz (±10%)[c]. |
| L1 | Additional power inputs | 120 Vac, limited by selected fuse and overall system load. |
| L2 | Additional L2 connections | — |
| X ALARM | External alarm LED input | 120 Vac, 30 mA. |
| HF1 and HF2 | High fire switch connections | 120 Vac, 20 mA. |
| OIL | Oil select signal output | 120 Vac, 60 mA. |
| GAS | Gas select signal output | 120 Vac, 60 mA. |
| B, R, and W | Modulation controller connections | 120 Vac, 75 VA pilot duty. |
| BLU, RED, WHT | Inputs for manual modulation controller (potentiometer) | 30 Vac, 120 Vac[d] |

[a] See Tables 2 and 3. These terminals can be connected to the 7800 SERIES subbase terminals 8, 9, 10, or 21, depending on the configuration.

[b] When terminal OP is in use this represents the combined rating of terminals BM and OP.

[c] 2000 VA maximum connected load to relay module assembly.

[d] DUAL RATING: When connected to the red, white, and blue potentiometer leads from a supplied Q7800C switch panel, these terminals are rated for 30 Vac. When connected to an outside manual modulation control, these terminals are rated for 120 Vac, 75 VA pilot duty.

**Table 2. Combinations for Terminals 8, 9, 10, and 21.**

| Combination Number | Pilot Fuel 8 | Int. Pilot Valve 21 | Ignition 10 | Main 9 |
|---|---|---|---|---|
| 1 | C | No Load | No Load | F |
| 2 | B | No Load | No Load | F |
| 3 | No Load | B | No Load | F |
| 4 | F | No Load | A | F |
| 5 | No Load | F | A | F |

**Table 2. Combinations for Terminals 8, 9, 10, and 21. (Continued)**

| Combination Number | Pilot Fuel 8 | Int. Pilot Valve 21 | Ignition 10 | Main 9 |
|---|---|---|---|---|
| 6 | D | No Load | A | F |
| 7 | No Load | D | A | F |
| 8 | D | No Load | A | D |
| 9 | No Load | D | A | D |

**Table 3. Explanation of Each Combination.**

| A | B | C | D | F |
|---|---|---|---|---|
| 4.5A ignition | 50 VA Pilot Duty plus 4.5A ignition. | 180 VA ignition plus motor valves with: 660 VA inrush, 360 VA open, 240 VA hold. | 2A Pilot Duty. | 65 VA Pilot Duty plus motor valves with: 3850 VA inrush, 700 VA open, 250 VA hold. |