APPLICATION

The Honeywell RM7800/L/40G,L and EC7840L Relay Modules are microprocessor-based integrated burner controls for automatically fired gas, oil, or combination fuel single burner applications. The RM7800L/40G,L and EC7840L Relay Modules are used for UL/CSA Modulating and FM/IRI Modulating burner applications. The RM7800L/40G,L, EC7840L system consists of a Relay Module, Keyboard Display Modules (standard with RM7800), Dust Cover (standard with RM7840/EC7840L), Subbase, Amplifier, and Purge Card. Options include DATA CONTROLBUS MODULE™, Remote Display Mounting, First-Out Expanded Annunciator and Modbus™ communications capable.

Functions provided by the RM7800L/40G,L, EC7840L include automatic burner sequencing, flame supervision, system status indication, system or self-diagnostics and troubleshooting.

RM7840L1091 has a 4 second main flame establishing period.

Using the S7800A1142 Keyboard Display (standard on RM7800L1087) the following features can be set up:

- **Post Purge time**—Up to 60 minutes—Device shipped with 15 seconds Post purge.
- **Valve Proving features including:**
  - **VPS test time**
  - **When** (Never, Before, After, Split or Both)
- **See S7800A1142 Instructions (65-0288). Series 5 can be programmed for Modbus communication.**

At commissioning time, the Valve Proving System may be scheduled to occur at one of five different times:

- **Never**—Device default as received—Valve proving does not occur.
- **Before**—Valve proving before run concurrent with Pre-Purge.
- **After**—Valve proving occurs after the Run state, before the device goes to Standby (Concurrent with Post-Purge, if selected.)
- **Both**—Valve proving occurs at both times Before and After, noted above.
- **Split**—The main valve 2 (MV2) (high pressure) seat test is performed at the Before time and the main valve 1 (MV1) (low pressure) seat test is performed during the After time.

SPECIFICATIONS

**Electrical Ratings, see Table 3:**

- **Voltage and Frequency:**
  - RM78xx—120 Vac (+10/-15%), 50 or 60 Hz (±10%).
  - EC78xx—220–240 Vac (+10/-15%), 50 or 60 Hz (±10%).
- **Power Dissipation:** RM7800/RM7840/EC7840L: 10W maximum in the Run mode.
Maximum Total Connected Load: 2000 VA.

Fusing: 15A maximum, Type SC or equivalent Fast Blow.

Environmental Ratings:
Ambient Temperature:
   Operating: -40°F to +140°F (-40°C to +60°C).
   Storage: -40°F to +150°F (-40°C to +66°C).
Humidity: 85% relative humidity continuous, noncondensing.
Vibration: 0.5G environment.

SIL 3 Capable:
RM7800/RM7840E, G, L, M are now SIL 3 Capable in a properly designed Safety Instrumented system. See form number 65-0312 for Certificate Agreement.

Approvals: RM7800L/40GL:
Underwriters Laboratories Inc. Listed: File No. MP268, Guide No. MCCZ.
Canadian Standards Association Certified: LR9S329-3.
Factory Mutual Approved: Report No. 1V9A0.AF.
Swiss Re (formerly IRI): Acceptable.
Approvals: EC7840L:
Factory Mutual Approved: Report No.1V9A0.AF.
Swiss Re (formerly IRI): Acceptable.

This document provides installation and static checkout instructions. Other applicable publications are:

<table>
<thead>
<tr>
<th>Publication No.</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-0084</td>
<td>Q7800A,B 22-Terminal Wiring Subbase Product Data</td>
</tr>
<tr>
<td>65-0288</td>
<td>S7800A1142 Keyboard Display Module Product Data</td>
</tr>
<tr>
<td>65-0091</td>
<td>S7810A Data ControlBus™ Module Product Data</td>
</tr>
<tr>
<td>65-0095</td>
<td>S7820 Remote Reset Module Product Data</td>
</tr>
<tr>
<td>65-0097</td>
<td>221729C Dust Cover Installation Instructions</td>
</tr>
<tr>
<td>65-0101</td>
<td>S7830 Expanded Annunciator Product Data</td>
</tr>
<tr>
<td>65-0109</td>
<td>R7824, R7847, R7848, R7849, R7851, R7852, R7861, R7886 Flame Amplifiers for the 7800 SERIES Product Data</td>
</tr>
<tr>
<td>65-0131</td>
<td>221818A Extension Cable Assembly Product Data</td>
</tr>
<tr>
<td>65-0229</td>
<td>7800 SERIES Relay Modules Checkout and Troubleshooting Product Data</td>
</tr>
<tr>
<td>65-0249</td>
<td>S7810M ModBus Module</td>
</tr>
</tbody>
</table>

INSTALLATION

When Installing this Product...
1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and marked on the product to make sure the product is suitable for the application.
3. Installer must be a trained, experienced, flame safeguard service technician.
4. After installation is complete, check out the product operation as provided in these instructions.

⚠️ WARNING
Fire or Explosion Hazard.
Can cause property damage, severe injury, or death.
To prevent possible hazardous burner operation, verify safety requirements each time a control is installed on a burner.

⚠️ WARNING
Electrical Shock Hazard.
Can cause serious injury or death.
Disconnect the power supply before beginning installation. More than one power supply disconnect may be required.

IMPORTANT
1. Wiring connections for the relay modules are unique; therefore, refer to Figs. 3, 4, 6, 7, or Appendix B for proper subbase wiring.
2. Wiring must comply with all applicable codes, ordinances and regulations.
3. Wiring must comply with NEC Class 1 (Line Voltage) wiring.
4. Loads connected to the RM7800L/40GL, EC7940L must not exceed those listed on the RM7800L/40GL, EC7940L label or the Specifications, see Table 3.
5. Limits and interlocks must be rated to simultaneously carry and break current to the ignition transformer, pilot valve, and main fuel valve(s).
6. All external timers must be listed or component recognized by authorities who have jurisdiction for the specific purpose for which they are used.
7. For on-off gas-fired systems, some authorities who have jurisdiction prohibit the wiring of any limit or operating contacts in series between the flame safeguard control and the main fuel valve(s).
8. Two Flame Detectors can be connected in parallel with the exception of Infrared Flame Detectors (C7015, C7915), Ultraviolet (C7927, C7961), or Visible (C7962).
9. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class B computing device of Part 15 of FCC rules which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference; in which case, the users at their own expense may be required to take whatever measures are required to correct this interference.
10. This digital apparatus does not exceed the Class B limits for radio noise for digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.
Location

Humidity
Install the relay module where the relative humidity never reaches the saturation point. The relay module is designed to operate in a maximum 85 percent relative humidity continuous, noncondensing, moisture environment. Condensing moisture may cause a safety shutdown.

Vibration
Do not install the relay module where it could be subjected to vibration in excess of 0.5G continuous maximum vibration.

Weather
The relay module is not designed to be weather tight. When installed outdoors, protect the relay module using an approved weather-tight enclosure.

Mounting Wiring Subbase

1. Mount the subbase in any position except horizontally with the bifurcated contacts pointing down. The standard vertical position is recommended. Any other position decreases the maximum ambient temperature rating.
2. Select a location on a wall, burner or electrical panel. The Q7800 can be mounted directly in the control cabinet. Be sure to allow adequate clearance for servicing, installation, access or removal of the RM7800L/40GL, EC7840L, Expanded Annunciator, Keyboard Display Module, flame amplifier, flame amplifier signal voltage probes, Run/Test Switch, electrical signal voltage probes and electrical field connections.
3. For surface mounting, use the back of the subbase as a template to mark the four screw locations. Drill the pilot holes.
4. Securely mount the subbase using four no. 6 screws.

Wiring Subbase

**WARNING**

Electrical Shock Hazard. Can cause serious injury, death or equipment damage.

Disconnect the power supply before beginning installation to prevent electrical shock, equipment and control damage. More than one power supply disconnect may be required.

1. For proper subbase wiring, refer to Figs. 3, 4, 6, 7, or Appendix B.
2. For proper remote wiring of the Keyboard Display Module, through a 203541 5-wire Connector, refer to the Specifications for the Keyboard Display Module (65-0288), Data ControlBus Module™ (65-0091) or Extension Cable Assembly (65-0131).
3. Disconnect the power supply from the main disconnect before beginning installation to prevent electrical shock and equipment damage. More than one disconnect may be required.
4. All wiring must comply with all applicable electrical codes, ordinances and regulations. Wiring, where required, must comply with NEC, Class 1 (Line Voltage) wiring.

5. Recommended wire size and type: see Table 1.
6. Recommended grounding practices: see Table 2.

The Keyboard Display Module, Data ControlBus Module™ (for remote mounting or communications), through a 203541 5-wire Connector must be wired in a daisy chain configuration, (1(a)-1(a), 2(b)-2(b), 3(c)-3(c)). The order of interconnection of all the devices listed above is not important. Be aware that modules on the closest and farthest end of the daisy chain configuration string require a 120 ohm (1/4 watt minimum) resistor termination across terminals 1 and 2 of the electrical connectors, for connections over 100 feet.

7. Recommended wire routing of leadwires:
   a. Do not run high voltage ignition transformer wires in the same conduit with the flame detector, Data Controlbus Module™, or Remote Reset Module wiring.
   b. Do not route flame detector, Data Controlbus Module™, or Remote Reset Module leadwires in conduit with line voltage circuits.
   c. Enclose flame detector leadwires without armor cable in metal cable or conduit.
   d. Follow directions in flame detector, Data ControlBus Module™, or Remote Reset Module Instructions.

8. Keyboard Display Module (KDM): Because the KDM is powered from a low voltage, energy limited source, it can be mounted outside of a control panel if it is protected from mechanical damage.

**NOTE:** A 13 Vdc power supply must be used any time more than one Keyboard Display Module is used.

9. Maximum wire lengths follow:
   a. RM7800L/40GL, EC7840L leadwires—The maximum length of leadwire is 300 feet to terminal inputs (Control, Pre-Ignition Interlock, Running/Lockout Interlock, High Fire Switch and Low Fire Switch).
   b. Flame Detector leadwires—The maximum flame sensor leadwire length is limited by the flame signal strength.
   c. Remote Reset leadwires—The maximum length of wire is 1000 feet to a Remote Reset pushbutton.
   d. Data Controlbus Module™—The maximum Data Controlbus Module™ cable length depends on the number of system modules connected, the noise conditions and the cable used. The maximum length of all Data Controlbus Module™ interconnecting wire is 1000 feet.

10. Make sure loads do not exceed the terminal ratings. Refer to the label on the RM7800/RM7840/EC7840L or to the ratings in Tables 3, 4 and 5.

Final Wiring Check

1. Check the power supply circuit. The voltage and frequency tolerance must match those of the RM7800L/40GL, EC7840L. A separate power supply circuit may be required for the RM7800/RM7840/EC7840L. Add the required disconnect means and overload protection.
2. Check all wiring circuits and complete the Static Checkout, see Table 9, before installing the RM7800L/40GL, EC7840L on the subbase.
3. Install all electrical connectors.
4. Restore power to the panel.
Table 1. Recommended Wire Sizes and Part Numbers.

<table>
<thead>
<tr>
<th>Application</th>
<th>Recommended Wire Size</th>
<th>Recommended Part Number(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line voltage terminals</td>
<td>14, 16 or 18 AWG copper conductor, 600 volt insulation, moisture-resistant wire.</td>
<td>TTW60C, THW75C, THHN90C.</td>
</tr>
<tr>
<td>Keyboard Display Module (KDM)</td>
<td>22 AWG two-wire twisted pair with ground, or five wire.</td>
<td>Beldon 8723 shielded cable or equivalent.</td>
</tr>
<tr>
<td>Data ControlBus Module™</td>
<td>22 AWG two-wire twisted pair with ground, or five wire.</td>
<td>Beldon 8723 shielded cable or equivalent.</td>
</tr>
<tr>
<td>Remote Reset Module</td>
<td>22 AWG two-wire twisted pair, insulated for low voltage.</td>
<td>—</td>
</tr>
<tr>
<td>13 Vdc full-wave rectified transformer power input.</td>
<td>18 AWG wire insulated for voltages and temperatures for given application.</td>
<td>TTW60C, THW75C, THHN90C.</td>
</tr>
</tbody>
</table>
Table 2. Recommended Grounding Practices.

<table>
<thead>
<tr>
<th>Ground Type</th>
<th>Recommended Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earth ground (subbase and relay module).</td>
<td>1. Use to provide a connection between the subbase and the control panel of the equipment. Earth ground must be capable of conducting enough current to blow the 15A fuse (or breaker) in the event of an internal short circuit. 2. Use wide straps or brackets to provide minimum length, maximum surface area ground conductors. If a leadwire must be used, use 14 AWG copper wire. 3. Make sure that mechanically tightened joints along the ground path are free of nonconductive coatings and protected against corrosion on mating surfaces.</td>
</tr>
<tr>
<td>Signal ground (KDM, Data ControlBus Module™)</td>
<td>Use the shield of the signal wire to ground the device to the signal ground terminals [3(c)] of each device. Connect the shield at both ends of the chain to earth ground.</td>
</tr>
</tbody>
</table>

Table 3. Terminal Ratings.

<table>
<thead>
<tr>
<th>Terminal No.</th>
<th>Description</th>
<th>Ratings</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>Flame Sensor Grounda</td>
<td>——</td>
</tr>
<tr>
<td>G</td>
<td>Earth Ground</td>
<td>——</td>
</tr>
<tr>
<td>L2(N)</td>
<td>Line Voltage Common</td>
<td>——</td>
</tr>
<tr>
<td>3</td>
<td>Alarm</td>
<td>1A pilot duty 120 Vac (+10%/-15%), 50 or 60 Hz (±10%)</td>
</tr>
<tr>
<td>4</td>
<td>Line Voltage Supply (L1)b</td>
<td>9.8 AFL, 58.8 ALR (inrush)</td>
</tr>
<tr>
<td>5</td>
<td>Burner Motor</td>
<td>1 mA</td>
</tr>
<tr>
<td>6</td>
<td>Burner Controller and Limits Demand (NOT Valve Proving)</td>
<td>8A run, 43A inrush</td>
</tr>
<tr>
<td>7</td>
<td>Lockout/Running Interlock 8A run, 43A inrush</td>
<td>4A at PF = 0.5, 20A Inrush</td>
</tr>
<tr>
<td>8</td>
<td>Pilot Valve/Ignition</td>
<td>4A at PF = 0.5, 20A Inrush</td>
</tr>
<tr>
<td>9</td>
<td>Main Fuel Valve</td>
<td>4A at PF = 0.5, 20A Inrush</td>
</tr>
<tr>
<td>10</td>
<td>Ignition</td>
<td>2A at PF = 0.2</td>
</tr>
<tr>
<td>F(11)</td>
<td>Flame Sensor</td>
<td>60 to 220 Vac, current limited</td>
</tr>
<tr>
<td>12</td>
<td>Firing Rate High Fire</td>
<td>75 VA pilot duty</td>
</tr>
<tr>
<td>13</td>
<td>Firing Rate Common</td>
<td>75 VA pilot duty</td>
</tr>
<tr>
<td>14</td>
<td>Firing Rate Low Fire</td>
<td>75 VA pilot duty</td>
</tr>
<tr>
<td>15</td>
<td>Firing Rate Modulate</td>
<td>75 VA pilot duty</td>
</tr>
<tr>
<td>16</td>
<td>Valve Proving Switch</td>
<td>1 mA</td>
</tr>
<tr>
<td>17</td>
<td>Demand — Valve Proving</td>
<td>1 mA</td>
</tr>
<tr>
<td>18</td>
<td>Low Fire Switch Input</td>
<td>1 mA</td>
</tr>
<tr>
<td>19</td>
<td>High Fire Switch Input (7800/40L only)</td>
<td>1 mA</td>
</tr>
<tr>
<td>20</td>
<td>Pre-Ignition Interlock Input</td>
<td>1 mA</td>
</tr>
<tr>
<td>21</td>
<td>Interrupted/Intermittent Pilot Valve/First Stage Oil Valve or MV2</td>
<td>4A at PF = 0.5, 20A Inrush</td>
</tr>
<tr>
<td>22</td>
<td>Shutter</td>
<td>0.5A</td>
</tr>
</tbody>
</table>

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a The relay module must have an earth ground providing a connection between the subbase and the control panel or the equipment. The earth ground wire must be capable of conducting the current to blow the 15A fuse (or breaker) in event of an internal short circuit. The relay module requires a low impedance ground connection to the equipment frame, which, in turn, requires a low impedance connection to earth ground.

b 2000 VA maximum connected load to relay module assembly.

c See Tables 4 and 5.

d 220/240 Vac to 120 Vac, 10 VA (minimum) stepdown transformer (not provided) must be used to drive the shutter.
Table 4. Combinations for Terminals 8, 9, 10 and 21.

<table>
<thead>
<tr>
<th>Pilot Fuel 8</th>
<th>Main 9</th>
<th>Ignition 10</th>
<th>Valve 21</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>F</td>
<td>No Load</td>
<td>No Load</td>
</tr>
<tr>
<td>B</td>
<td>F</td>
<td>No Load</td>
<td>No Load</td>
</tr>
<tr>
<td>No Load</td>
<td>F</td>
<td>No Load</td>
<td>B</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>A</td>
<td>No Load</td>
</tr>
<tr>
<td>No Load</td>
<td>F</td>
<td>A</td>
<td>F</td>
</tr>
<tr>
<td>D</td>
<td>F</td>
<td>A</td>
<td>No Load</td>
</tr>
<tr>
<td>No Load</td>
<td>D</td>
<td>A</td>
<td>D</td>
</tr>
<tr>
<td>D</td>
<td>D</td>
<td>A</td>
<td>No Load</td>
</tr>
<tr>
<td>No Load</td>
<td>D</td>
<td>A</td>
<td>D</td>
</tr>
</tbody>
</table>

Table 5. Explanation of Each Combination.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5A ignition.</td>
<td>50 VA Pilot Duty(^a) plus 4.5A ignition.</td>
<td>180 VA ignition plus motor valve with: 660 VA inrush, 360 VA open, 260 VA hold.</td>
<td>2A Pilot Duty(^a)</td>
<td>64 VA Pilot Duty(^a) plus motor valves with: 3850 VA inrush, 700 VA open, 250 VA hold.</td>
</tr>
</tbody>
</table>

\(^a\) Pilot Duty refers to solenoid-type valves.

**Mounting RM7800L/40G,L, EC7840L Relay Module (Fig. 9)**

1. Mount the RM7800L/40G,L, EC7840L vertically on the Q7800 Subbase, or mount horizontally with the knifeblade terminals pointing downward. When mounted on the Q7800A, the RM7800L/40G,L, EC7840L must be in an electrical enclosure.

2. When mounting in an electrical enclosure, provide adequate clearance for servicing, installation and removal of the RM7800L/40G,L, EC7840L, Keyboard Display Module, flame amplifier, flame amplifier signal voltage probes, electrical signal voltage probes, and electrical connections.

3. Make sure no subbase wiring is projecting beyond the terminal blocks. Tuck in wiring against the back of the subbase so it does not interfere with the knifeblade terminals or bifurcated contacts.

**IMPORTANT**

The RM7800L/40G,L, EC7840L must be installed with a plug-in motion rather than a hinge action.

4. Mount the RM7800L/40G,L, EC7840L by aligning the four L-shaped corner guides and knifeblade terminals with the bifurcated contacts on the wiring subbase and securely tighten the two screws without deforming the plastic.
120V, 50/60 Hz (EC7840L 220-240 VAC) POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

DO NOT WIRE TO ANY UNUSED TERMINALS.

SEE FLAME DETECTOR INSTALLATION INSTRUCTIONS FOR CORRECT WIRING.
Fig. 3. Typical wiring subbase and sequence for RM7800L/40L, EC7840L without enabled Valve Proving.
Fig. 4. Wiring subbase and sequence for RM7800L/40L, EC7840L with Valve Proving feature enabled.
**Fig. 5. RM7800L/40G, L and EC7840L Relay Module operation, Valve Proving test options.**
Fig. 6. Typical wiring subbase and sequence for RM7840G without Valve Proving enabled.
**Fig. 7.** Typical wiring subbase and sequence for RM7840G with Valve Proving enabled.
VALVE PROVING SYSTEM

The Valve Proving System feature provides a systematic way of testing the valve seat integrity to assure the valves are in the closed state whenever the sequence of operation requires them to be closed. It is designed to detect a leak greater than 0.1% of the burner input capacity. For example, a 10 million Btu/hr natural gas-fueled burner would have a fuel input capacity of approximately 1,000 ft³/hr. A leak rate greater than 0.1% of 1,000 ft³/hr or 1 ft³/hr in either valve will be detected with the Valve Proving System. Smaller leaks will not be detected.

At commissioning time, the Valve Proving System may be scheduled to occur at one of five different times: Never, Before, After, Both, and Split.

Never—Device default as received: in this case Valve Proving does not occur.

Before—Valve Proving occurs concurrently with Pre-Purge.

After—Valve Proving occurs after the Run state before the internal Safety Relay dropout state and concurrent with Post Purge (if configured).

Both—Valve proving occurs at both times Before and After noted above.

Split—The downstream seat (high pressure) test is performed at the Before time and the upstream seat (low pressure) test is performed during the After time.

The Valve Proving items programmed are:

1. Specify when to perform Valve Proving. Demand input to terminal 17 actually enables the function of Valve Proving.
2. Specify the time duration of the test (calculated from Appendix A).
Typical Valve Proving System Function

Valve proving consists of monitoring the pressure in the space between two shutoff valves, MV1 (upstream) and MV2 (downstream). The valve proving function, identified by letters A through F, operates as follows:

The tolerance on all valve proving timing values is ±10%.

The following are steps performed during valve proving tests. This section is for background information and does not define the exact behavioral requirements.

A. MV2 is commanded to be open while MV1 remains closed; to depressurize the space. After 4 seconds, MV2 is commanded closed again.

B. This is followed by a three second delay during which the valve proving pressure switch (VPS) is ignored.

C. Thereafter, the VPS is monitored for the duration of the valve proving test time and, if it turns on, then a lockout occurs. (Because the gas pressure has increased due to a leaky upstream valve.) (Low pressure test.)

D. MV1 is commanded to be open while MV2 remains closed, to pressurize the space. After 4 seconds, MV1 is commanded closed again.

E. This is followed by a three second delay, during which the valve proving pressure switch (VPS) is ignored.

F. Thereafter, the VPS is monitored for the duration of the valve proving test time and, if it turns off, then a lockout occurs. (Because the gas pressure has decreased due to a leaky downstream valve.) (High pressure test.)

Pressure Switches for Valve Proving System

The Valve Proving System requires a pressure switch to be installed to monitor the pressure in the internal space between the two shutoff valves. Recommended pressure switches are the following Honeywell non-manual reset models:

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Operating Pressure Range</th>
<th>Maximum Differential (Additive)</th>
<th>Maximum Continuous Rated Pressure (psi)</th>
<th>Switch Action at Setpoint</th>
<th>Mounting Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>C6097A1004</td>
<td>0.4 to 5 in. wc</td>
<td>0.24 in. wc</td>
<td>2.9</td>
<td>Breaks N.O. to C connection on pressure fall.</td>
<td>1/4 in. NPT</td>
</tr>
<tr>
<td>C6097A1053</td>
<td>3 to 21 in. wc</td>
<td>0.48 in. wc</td>
<td>5.0</td>
<td></td>
<td>Flange</td>
</tr>
<tr>
<td>C6097A1061</td>
<td>12 to 60 in. wc</td>
<td>2.4 in. wc</td>
<td></td>
<td></td>
<td>1/4 in. NPT</td>
</tr>
<tr>
<td>C6097A1079</td>
<td>1.5 to 7 psi</td>
<td>0.3 psi</td>
<td>9.3</td>
<td></td>
<td>Flange</td>
</tr>
<tr>
<td>C6097A1129</td>
<td>0.4 to 4 in. wc</td>
<td>0.24 in. wc</td>
<td>2.9</td>
<td></td>
<td>1/4 in. NPT</td>
</tr>
<tr>
<td>C6097A1210</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Flange</td>
</tr>
</tbody>
</table>

Pressure Switch Selection

1. Determine the maximum operating inlet pressure for the upstream valve; for example, 5.0 psi (140 in. wc).
2. Divide the inlet pressure by two (2.5 psi [70 in. wc], for example).
3. From column 2 in Table 6 find the operating range upper limit that is closest to but greater than the inlet pressure divided by two. In the example given, the possible selections from column 1 are the C6097A1129 and C6097A1137 with an operating range upper limit of 7 psi. (The C6097A1079 and C6097A1087 with an upper limit of 60 in. wc are close, but 60 in. wc is less than the 70 in. wc minimum, so the next higher range must be selected.)
4. From column 6, select the preferred mounting type, 1/4 in. NPT or Flange. For example, if a flange mount is required, the pressure switch choice from column 1 would be the C6097A1137.

Pressure Switch Installation and Adjustment

1. Refer to the instructions for the C6097A Pressure Switch, form number 65-0237.
2. Install the C6097A Pressure Switch according to the instructions.
3. Adjust the setpoint to 50% of the maximum operating inlet pressure for the upstream valve.
4. Complete the operation and checkout procedures in the instructions.

Setup (Programming) of Valve Proving Function

Prior to setup of the Valve Proving Function, follow the procedures in the appendix to complete the worksheet and obtain the Valve Proving Test Time.

An S7800A1142 Keyboard Display Module (KDM) is required for this setup.
System operation requires the Valve Proving function setup and demand input must be connected to terminal 17.

NOTE:  The S7800A1142 Keyboard Display is NOT supplied on RM7840G,L or EC7840L device.

When the RM7800L/40G,L, EC7840L is installed and powered, “STANDBY” will be shown on the first line of the display.

1. Scroll down until the “Setup” is displayed in the second line. (Setup is only available when the control is in Standby or Lockout state.)

![STANDBY/Setup screen](M22662B)

**Fig. 9. STANDBY/Setup screen.**

2. Enter the Setup submenu by pressing the far right key on the display. Note that the second line now reads “BC Password”.

![Password screen](M22663B)

**Fig. 10. Password screen.**

3. Use the +/- buttons to enter the first number—7.
4. Use the far right key to shift over one space.
5. Use the +/- buttons to enter the second number—8.
6. Press Enter (left/right arrow simultaneously).

![Select/Restart screen](M22764B)

**Fig. 11. Select/Restart screen.**

7. To get to the next screen, press the down arrow. “Getting Data” will be displayed, then the following screen.

![SETUP: Valve Prove screen](M22664B)

**Fig. 12. SETUP: Valve Prove screen.**

NOTE:  This screen sets up when to do the Valve Proving Test.

8. Use the up/down arrows to select from Never, Before, After, Both, or Split, then press ENTER.

NOTE:  Use Never (as shipped) on initial startup so gas line purging and System Checkout can be performed. Then come back to set final operation configuration. Be sure to conduct final VPS System checkout when Setup is complete.

![Save Changes screen](M22665B)

**Fig. 13. Save Changes screen.**

9. Use the down arrow to save changes. After pressing the down arrow, “Getting Data” is displayed.

![Valve Prove time screen](M22666B)

**Fig. 14. Valve Prove time screen.**

This screen sets up how long the RM7800L/40G,L, EC7840L will conduct the Valve Proving Test for a given time. VP Time: 00:00 is shown.

10. Enter the appropriate Valve Proving test time from the worksheet in the appendix.

Use the (+) button to increase time and the (-) button to decrease. Time changes:
   a. 0 to 60 seconds in 1-second intervals.
   b. 60 to 600 seconds in 10-second intervals.
   c. 10 to 60 minutes in 1-minute intervals.

Press ENTER when correct time is displayed.

![Save Changes screen](M22665B)

**Fig. 15. Save Changes screen.**
11. Press down arrow to select.
12. “Getting Data” will be momentarily displayed, followed by the screen shown in Fig. 12.

### Changing the Installed Postpurge

![Fig. 17. Setting Postpurge time.](#)

This screen allows for setting up the Postpurge for the RM7800L/40GL, EC7840L. This will be the time that the Combustion Fan (terminal 5) will remain energized after the demand ends.

**NOTE:** The device comes standard with 15-second Postpurge.

13. Use the +/- buttons to adjust the postpurge time.
   Time changes:
   - 0 to 60 seconds in 1-second intervals.
   - 60 to 600 seconds in 10-second intervals.
   - 10 to 60 minutes in 1-minute intervals.

14. Press Enter (Left/Right arrow keys simultaneously) when the correct postpurge time is displayed.

![Fig. 18. Save Changes screen.](#)

15. Use the down arrow to save changes. “Getting Data” is displayed momentarily.
   The following steps are to confirm your selections.

![Fig. 19. Confirmation Acknowledgement screen.](#)

16. Press ENTER.

![Fig. 20. Confirmation Correct screen.](#)

17. Use the down arrow to confirm correct.

**NOTE:** Using the up arrow during this step will take you back to the beginning of the setup routine.

“Getting Data” will be displayed.

![Fig. 21. Confirm screen.](#)

18. Press Enter.

![Fig. 22. Confirm Correct screen.](#)

19. Use the down arrow to confirm correct.

“Getting Data” will be displayed.

The following steps are used to confirm your selection.
Once the system is in operation, the settings of the Valve Proving and Postpurge can be viewed in Diagnostics, using your S7800 Keyboard Display Module (KDM).

Future changes to the Valve Proving and Postpurge features are still possible. With the relay module in standby, scroll to the Setup line and enter the password to change the settings.

SAFETY SHUTDOWN

Safety Shutdown (Lockout) occurs if any of the following occur during the indicated period:

1. Anytime:
   a. Purge card is not installed or removed.
   b. Purge card is bad.
   c. Configuration jumpers are changed (after 200 hours of operation).
   d. Internal system fault.
   e. Demand present at terminals 6 and 17 at the same time.
   f. Failure of the Valve Proving test.
   g. Demand at terminal 17 and device at default “Never.”

2. INITIATE Period:
   a. AC line power errors occurred, see Operation section.
   b. Four minute INITIATE period has been exceeded.

3. STANDBY Period:
   a. Flame signal is present after 240 seconds.
   b. Pre-Ignition Interlock is open an accumulative time of 30 seconds.
   c. Interlock check feature is enabled (L only with JR3 clipped) and the Interlock String (including airflow switch) is closed for 120 seconds with controller closed.
   d. Ignition/pilot valve/intermittent pilot valve terminal is energized.
   e. Main valve terminal(s) energized.
   f. Internal system fault occurred.

4. PREPURGE Period:
   a. Pre-Ignition Interlock opens anytime during PREPURGE period (except during VP test). (L model only)
   b. Flame signal is detected after first ten seconds during PREPURGE (RM7800L/40L, EC7840L).
   c. High Fire Switch fails to close within four minutes and fifteen seconds after the firing rate motor is commanded to drive to the high fire position at the start of PREPURGE (RM7800L/40L, EC7840L).
   d. Low Fire Switch fails to close within four minutes and fifteen seconds after the firing rate motor is commanded to drive to the low fire position at the end of PREPURGE.
   e. Running Interlock does not close within 30 seconds (RM7840G).
   f. Lockout Interlock does not close within 10 seconds (RM7800L/40L, EC7840L).
   g. Lockout Interlock opens during PREPURGE (RM7800L/40L, EC7840L).
   h. Ignition/pilot valve/intermittent pilot valve terminal is energized.
   i. Main valve terminal is energized (except during Valve Proving testing).
5. PILOT FLAME ESTABLISHING Period (PFEP):
   a. Low Fire Switch opens.
   b. Lockout Interlock opens (RM7800L/40L, EC7840L).
   c. Ignition/pilot valve/intermittent pilot valve terminal is not energized.
   d. Early spark termination terminal is energized after five seconds.
   e. No flame is present at the end of PFEP.
   f. Main valve terminal is energized (RM7840G).

6. MAIN FLAME ESTABLISHING Period (MFEP):
   a. Low Fire Switch opens.
   b. Lockout Interlock opens (RM7800L/40L, EC7840L).
   c. Ignition/pilot valve/intermittent pilot valve terminal is not energized.
   d. Main valve terminal is not energized.
   e. No flame is present at the end of MFEP.

7. RUN Period:
   a. No flame is present.
   b. Lockout Interlock opens (RM7800L/40L, EC7840L).
   c. Interrupted pilot valve terminal is energized.
   d. Main valve terminal is not energized.

8. POSTPURGE Period:
   a. Pre-Ignition Interlock does not close in five seconds OR opens after five seconds during POSTPURGE period (except during VP testing).
   b. Ignition/pilot valve/intermittent pilot valve terminal is energized.
   c. Main valve terminal is energized (except during VP testing).

OPERATION

Sequence of Operation

The RM7800L/40GL, EC7840L has the following operating sequences, see Fig. 4, 5, 7, and 8. The RM7800L/40L, EC7840L LED provide positive visual indication of the program sequence: POWER, PILOT, FLAME, MAIN and ALARM.

Initiate

The RM7800L/40GL, EC7840L enters the INITIATE sequence when the Relay Module is powered. The RM7800L/40GL, EC7840L can also enter the INITIATE sequence if the Relay Module verifies voltage fluctuations of +10/-15 percent or frequency fluctuations of +/-10 percent during any part of the operating sequence. The INITIATE sequence lasts for ten seconds unless the voltage or frequency tolerances are not met. When the tolerances are not met, a hold condition is initiated and displayed on the VFD for at least five seconds. When the tolerances are met, the INITIATE sequence restarts. If the condition is not corrected and the hold condition exists for four minutes, the RM7800L/40GL, EC7840L locks out. Causes for hold conditions in the INITIATE sequence:

a. AC line dropout is detected.
   b. AC line noise prevents a sufficient reading of the line voltage inputs.
   c. Low line voltage brownouts occur.
   The INITIATE sequence also delays the burner motor starter from being energized and de-energized from an intermittent AC line input or control input.

Standby

The RM7800L/40GL, EC7840L is ready to start an operating sequence when the operating control determines a call for heat is present. (Terminal 6, or Terminal 17 if Valve Proving is required.) The burner switch, limits, operating control and all microcomputer monitored circuits must be in the correct state for the RM7800L/40GL, EC7840L to continue into the PREPURGE sequence.

Prepurge

The ST7800 purge timers provide 15 Pre-Purge timings selectable from 2 seconds to 30 minutes:

a. The operating control (terminal 6, or terminal 17 for valve proving), Running Interlocks, Pre-Ignition Interlocks, Burner Switch, Run/Test Switch, Lockout Interlocks and all microcomputer monitored circuits must be in the correct operating state.

b. The blower motor output, terminal 5, is powered to start the PREPURGE sequence. The firing rate motor is driven to the high fire position (RM7800L/40L, EC7840L). The PREPURGE timing does not begin until the Lockout Interlock String and High Fire Switch are both closed.

c. If Before, Split or Both Valve Proving tests are selected (and demand input T17 is used), the RM7800L/40GL, EC7840L will sequence the main valves to conduct the VP tests concurrently with Pre-Purge (beginning at 10 seconds into the purge time).

d. The Pre-Ignition Interlock input must remain closed throughout PREPURGE (except during VP testing); otherwise, control returns to the STANDBY state and holds (30 seconds) for the RM7840G or safety shutdown occurs for the RM7800L/40L, EC7840L.

e. The Lockout Interlock or Running Interlock inputs (interlock circuit including Airflow Switch) must close by ten seconds after demand; otherwise, a recycle to the beginning of PREPURGE for the RM7840G will happen or a safety shutdown for the RM7800L/40L, EC7840L occurs.

f. When PREPURGE timing is complete, the firing rate motor drives to the low fire position, RM7800L/40GL, EC7840L.

g. When the firing rate motor reaches low fire position, the Low Fire Switch, terminal 18, input must be energized before entering the Ignition Trial state.

Ignition Trials—Pilot Lighted System (Non VP Operation System) (demand into terminal 6)

1. Pilot Flame Establishing Period (PFEP):
   a. With the firing rate motor at the low fire position (Low Fire Start Switch-terminal 18 enabled): 
   b. Terminals 8, 10 and 21, are energized.

NOTE: Low Fire Start Switch-terminal 18 enabled must remain closed until the RM7800L/40GL, EC7840L releases to modulation - or a safety shutdown will occur.

   The Pre-Ignition Interlock input is ignored throughout the Ignition Trial state.

   c. After five seconds, the ignition, terminal 10, is de-energized for early spark termination.
d. Flame must be proven by the end of the ten-second PFEP (fourseconds if JR1 is clipped). If flame is not proven by the end of the PFEP, a safety shutdown occurs.

2. Main Flame Establishing Period (MFEP):
   a. Terminal 9 is energized when the presence of flame is verified at the end of a 10-second Pilot Flame Establishing Period (PFEP) (four seconds if JR1 is clipped).
   b. Terminal 8 is turned off 10 seconds after Terminal 9 is energized. (4 seconds for RM7840L1091)
   c. Terminal 21 action:
      (1) RM7800/40L, EC7840L - turned off 15 seconds after Terminal 9 is energized.
      (2) The RM7840G:
         (a) Not turned off, (intermittent pilot)
         (b) Turns off 15 seconds after Terminal 9 is energized (if configuration jumper 2 removed);
         (c) Turns off 30 seconds after Terminal 9 is energized (if configuration jumper 2 removed and terminal 5 is jumpered to terminal 19).
   d. The RM78XX releases to modulation (RUN) 15 seconds (30 seconds for RM7840G with terminal 5 to 19 jumpered) after terminal 9 is energized if flame is present.

Valve Proving Ignition Trials (demand on terminal 17) - Pilot Lighted System (Not VP DSI). (Configuration jumper 2 on RM7800L/40L, EC7840L or Jumper 3 on RM7840G MUST be removed).

1. Pilot Flame Establishing Period (PFEP):
   a. With the firing rate motor at the low fire position (Low Fire Start Switch-terminal 18 enabled):
   b. Terminals 8, 10, are energized.

   NOTE: Low Fire Start Switch-terminal 18 enabled must remain closed until the RM7800L40G, L, EC7840L releases to modulation - or a safety shutdown will occur.

   The Pre-Ignition Interlock input is ignored throughout the Ignition Trial state.

c. After five seconds, the ignition, terminal 10, is de-energized for early spark termination.

d. Flame must be proven by the end of the ten-second PFEP (four seconds if JR1 is clipped). If flame is not proven by the end of the PFEP, a safety shutdown occurs.

2. Main Flame Establishing Period (MFEP):
   a. Terminal 9 and 21 are energized when the presence of flame is verified at the end of a 10-second Pilot Flame Establishing Period (PFEP) (four seconds if JR1 is clipped).
   b. Terminal 8 is turned off 10 seconds after Terminal 9 and 21 are energized. (4 seconds for RM7840L1091)
   c. The RM7800L40G, L, EC7840L releases to modulation (RUN) 15 seconds terminal 9 and 21 are energized if flame is present.

Ignition Trials—Valve Proving with DSI System

1. Demand connected to Terminal 17:
   — JR2 Intact on RM7800L/40L, EC7840L
   — JR3 Intact on RM7840G
   a. Ignition, Main Valve 1 and Main Valve 2, Terminals 10, 9, and 21 turn on together.
   b. Flame must be proven at the end of the 4 second Main Flame Establishing Time.
   c. Ignition, Terminal 10 is turned off. System now in Run.
   d. If Flame is not proven, safety lockout occurs.

Run

1. A ten-second stabilization period occurs at the beginning of the RUN period.
2. The firing rate motor releases to modulation.
3. The RM7800L40L, EC7840L is now in RUN and remains in RUN until the controller input, terminal 6, opens (terminal 17, on VP applications), indicating that the demand is satisfied or a limit opened.

Postpurge

The RM7800L40L, EC7840L provides a programmable (default is 15 seconds) POSTPURGE following the completion of the RUN period. The blower motor output is powered to drive all products of combustion and any unburned fuel from the combustion chamber. It also supplies combustion air to burn fuel being purged from the fuel line downstream of the fuel shutoff valve.

1. The main fuel valve and intermittent pilot valve, Terminals 9 and 21, are de-energized and the firing rate motor is commanded to the low fire position to begin the POSTPURGE period.
2. The Pre-Ignition Interlock closes within the first five seconds after the demand opens.
3. If Valve Proving option—After, Split or Both have been selected, then the Valve Proving test will be conducted concurrent with Postpurge. If Postpurge timing remains after the Valve Proving test is completed, the Postpurge timing will complete before the RM7800L40G,L, EC7840L go into standby.
Table 7. Sequence Timing for Normal Operation.

<table>
<thead>
<tr>
<th>Device</th>
<th>Initiate</th>
<th>Standby</th>
<th>Purge</th>
<th>Flame Establishing Period</th>
<th>Run</th>
<th>Post-Purge Timing</th>
<th>Interlock Circuits</th>
<th>Firing Rate Circuit</th>
<th>Approval Code Bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM7840G</td>
<td>10 sec.</td>
<td>*</td>
<td>**</td>
<td>4 or 10 sec.</td>
<td>15 sec.</td>
<td>Pre-Ignition, Running, Low Fire</td>
<td>4-wire modulating</td>
<td>UL/CSA Modulating</td>
<td></td>
</tr>
<tr>
<td>RM7800L/40G</td>
<td>10 sec.</td>
<td>*</td>
<td>**</td>
<td>4 or 10 sec.</td>
<td>15 sec.</td>
<td>Pre-Ignition, Running, Low Fire</td>
<td>4-wire modulating</td>
<td>UL/CSA Modulating</td>
<td></td>
</tr>
<tr>
<td>RM7840L/EC7840L</td>
<td>10 sec.</td>
<td>*</td>
<td>**</td>
<td>4 or 10 sec.</td>
<td>15 sec.</td>
<td>Pre-Ignition, Running, Low Fire</td>
<td>4-wire modulating</td>
<td>UL/CSA Modulating</td>
<td></td>
</tr>
</tbody>
</table>

* STANDBY and RUN can be an infinite time period.
** PURGE determined by which ST7800A purge card is selected.

a The MFEP is determined by which terminal is used, configuration jumper selected or jumper wire added. See Fig. 2, 3, 4, 6, and 7.

b If DSI is enabled on a VP application (JR2 intact on RM7800/40L, EC7840L or JR3 intact on RM7800/40G) then Ignition (terminal 10) and MV1 (terminal 9), and MV2 (terminal 21) are energized together. After 4 seconds terminal 10 shuts off, and system goes to Run.

c If DSI is disabled on a VP application then MFEP is 10 seconds.

d Default is 15 seconds. Can be programmed as long as 66 minutes.

Keyboard Display Module (VFD)
The Keyboard Display Module (see Fig. 9) is provided with the RM7800 Relay Module (but is not required for operation) and is an option for the RM7840/EC7840 Relay Module. The first line of the Vacuum Fluorescent Display (VFD) provides:

- Current status of the burner sequence (STANDBY, PURGE, PILOT IGN, MAIN IGN, RUN and POSTPURGE).
- Timing information (PURGE, PILOT IGN, MAIN IGN and POSTPURGE) in minutes and seconds.
- Hold information (PURGE HOLD: T19).
- Lockout information (Lockout, Fault Code, Message and Sequence).

The extreme right side of the first line is either blank or shows a small arrow pointing to the second line followed by a two-letter code (DI-Diagnostic Information, Hn-Fault History Information, SU-Setup, SC-Setup Confirm, and EA-Expanded Annunciator). When the arrow and two-letter code are displayed, it indicates the second line is showing a selectable message submenu. The second line displays selectable or preemptive messages.

A selectable message is selected by the user to supply information on flame strength, system status indication, system or self-diagnostics and troubleshooting.

A preemptive message has parentheses around the message and supplies a detailed message to support the sequence status information. A preemptive message can also be a lockout message. A selectable message is shown for 60 seconds after a user presses any scroll button, even if a preemptive message (or lockout) is available. If no buttons have been pressed for 60 seconds, then a preemptive message will be shown.

The first line has additional details to help describe it; otherwise the most recent selectable message will appear. Pressing the third button on the display is a quick way to return to the latter condition without waiting 60 seconds.

Run/Test Switch

**WARNING**

Explosion Hazard. Can cause serious injury or death.

Do not use the Run/Test switch during the Pilot Flame Establishing Period for the RM7800/40G, EC7840L when using Direct Spark Function, because it turns on the main gas valve, causing an accumulation of fuel in the burner.

The Run/Test Switch is located on the top side of the RM7800L/40GL, EC7840L, see Fig. 29. The Run/Test Switch allows the burner sequence to be altered as follows:

1. In Pre-Purge Drive To High Fire Position (RM7800L/40L, EC7840L), the Run/Test Switch, when placed in the TEST position, holds in PREPURGE with the firing rate motor in the High Fire position.

2. In the measured PREPURGE sequence, the Run/Test Switch, when placed in the TEST position, causes the PREPURGE timing to stop. The firing rate motor is in the High Fire (RM7800L/40L, EC7840L) position (Run/Test Switch is ignored while the Valve Proving test is being conducted by the RM7800/40L, EC7840L).

3. In Pre-Purge Drive to Low Fire position, the Run/Test Switch, when placed in the TEST position, holds the burner sequence in PREPURGE with the firing rate motor in the Low Fire position.

4. In PFEP, the Run/Test Switch, when placed in the TEST position, stops the timer during the first eight seconds when a ten second PFEP is selected or during the first three seconds when a four second PFEP is selected, allowing pilot-turn-down test and other burner adjustments to be made. This activates a fifteen second flameout timer that permits pilot flame adjustment without nuisance safety shutdowns. The Run/Test Switch is ignored during PFEP for the RM7800L/40GL, EC7840L if Terminals 8 and 9 or 9 and 21 are jumpered.
5. During Run, the Run/Test Switch, when placed in the TEST position, drives the firing rate motor to the Low Fire position.

NOTE: When RM7800L/40G, EC7840L is switched to the Test mode, it stops and holds at the next Run/Test Switch point in the operating sequence. Make sure that the Run/Test Switch is in the RUN position before leaving the installation.

SETTINGS AND ADJUSTMENTS

Selectable Site-Configurable Jumpers

The RM7800L/40G, EC7840L has three site-configurable jumper options, see Fig. 29 and Table 8. If necessary, clip the site-configurable jumpers with side cutters and remove the resistors from the Relay Module.

Table 8. Site Configurable Jumper Options.

<table>
<thead>
<tr>
<th>Jumper Number</th>
<th>Description</th>
<th>Intact</th>
<th>Clipped</th>
<th>RM7800L/40L, EC7840L Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>JR1</td>
<td>Pilot Flame Establishing Period c</td>
<td>10 seconds</td>
<td>4 seconds</td>
<td>G, L</td>
</tr>
<tr>
<td>JR2</td>
<td>DSI with Valve Proving c</td>
<td>Enabled</td>
<td>Disabled</td>
<td>L</td>
</tr>
<tr>
<td>JR2</td>
<td>Pilot Valve / Main Flame Establishing Period (MFEP)</td>
<td>Intermittent</td>
<td>Interrupted</td>
<td>G^b</td>
</tr>
<tr>
<td>JR3</td>
<td>Start-Up Interlock Check</td>
<td>Disabled</td>
<td>Enabled</td>
<td>L</td>
</tr>
<tr>
<td>JR3</td>
<td>DSI with Valve Proving c</td>
<td>Enabled</td>
<td>Disabled</td>
<td>G</td>
</tr>
</tbody>
</table>

^a Pilot Valve / First Stage Oil Valve Terminal 21 cannot be used in this arrangement if Valve Proving feature is selected.

^b A 30-second MFEP can be accomplished by adding a jumper wire between terminals 19 and 5, ignored if VP is active.

^c DSI Enabled allows for Valve Proving test to be performed, then during PFEP both terminals 9 and 21 energize to light the Main Flame—note PFEP will not occur and the MFEP will automatically be 4 seconds regardless.

STATIC CHECKOUT

After checking all wiring, perform this checkout before installing the RM7800L/40G, EC7840L on the subbase. These tests verify the Q7800 Wiring Subbase is wired correctly, and the external controllers, limits, interlocks, actuators, valves, transformers, motors and other devices are operating properly.

WARNING

Explosion and Electrical Shock Hazard. Can cause serious injury, death or equipment damage.
1. Close all manual fuel shutoff valve(s) before starting these tests.
2. Use extreme care while testing the system. Line voltage is present on most terminal connections when power is on.
3. Open the master switch before installing or removing a jumper on the subbase.
4. Before continuing to the next test, be sure to remove test jumper(s) used in the previous test.
5. Replace all limits and interlocks that are not operating properly. Do not bypass limits and interlocks.
CAUTION

Equipment Damage Hazard.
Improper testing can damage equipment.
Internal surge protectors can break down and conduct a current, causing the RM7800L/40GL, EC7840L to fail the dielectric test or possibly destroy the internal lighting and high current protection. Do not perform a dielectric test with the RM7800L/40GL, EC7840L installed.

Equipment Recommended
1. Voltmeter (1M ohm/volt minimum sensitivity) set on the 0-300 Vac scale.
2. Two jumper wires; no. 14 wire, insulated, 12 inches (304.8 mm) long with insulated alligator clips at both ends.
3. Ammeter can be used to verify valve loads connected to the wiring subbase.

General Instructions
1. Perform all applicable tests listed in Static Checkout, Table 8, in the order listed.
2. Make sure all manual fuel shutoff valve(s) are closed.
3. Perform only those tests designated for the specific RM7800L/40GL, EC7840L model being tested.
4. Raise the setpoint of the operating controller to simulate a call for heat.
5. For each test, open the master switch and install the jumper wire(s) between the subbase wiring terminals listed in the Test Jumpers column.
6. Close the master switch before observing operation.
7. Read the voltage between the subbase wiring terminals listed in the Voltmeter column.
8. If there is no voltage or the operation is abnormal, check the circuits and external devices as described in the last column.
9. Check all wiring for correct connections, tight terminal screws, correct wire, and proper wiring techniques. Replace all damaged or incorrectly sized wires.
10. Replace faulty controllers, limits, interlocks, actuators, valves, transformers, motors and other devices as required.
11. Make sure normal operation is obtained for each required test before continuing the checkout.
12. After completing each test, be sure to remove the test jumper(s).

WARNING

Explosion Hazard.
Can cause serious injury or death.
Make sure all manual fuel shutoff valves are closed before performing static checkout.

<table>
<thead>
<tr>
<th>Test No.</th>
<th>RM7800/ RM7840/ EC7840 Models</th>
<th>Test Jumpers</th>
<th>Voltmeter</th>
<th>Normal Operation</th>
<th>If Operation is Abnormal, Check the Items Listed Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All</td>
<td>None</td>
<td>4-L2</td>
<td>Line voltage at Terminal 4.</td>
<td>1. Master Switch. 2. Power connected to the Master Switch. 3. Overload protection (fuse, circuit breaker, etc.) has not opened the power line.</td>
</tr>
<tr>
<td>2</td>
<td>All</td>
<td>6-L2 17-L2</td>
<td>Line voltage at Terminal 6. ForVP applications. (Terminal 17)</td>
<td>1. Limits. 2. Burner Controller.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>All</td>
<td>16-L2</td>
<td>Line voltage at 16 Valve Proving switch.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>All</td>
<td>20-L2</td>
<td>Line voltage at Terminal 20.</td>
<td>1. Pre-Ignition interlocks.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>All</td>
<td>4-10 *</td>
<td>—</td>
<td>Ignition spark (if ignition transformer is connected to Terminal 10)</td>
<td>1. Watch for spark or listen for buzz. a. Ignition electrodes are clean. b. Ignition transformer is okay.</td>
</tr>
<tr>
<td>7</td>
<td>All</td>
<td>4-8 *</td>
<td>—</td>
<td>1. Ignition spark (if ignition transformer is connected to Terminal 8). 2. Automatic pilot valve opens (if connected to Terminal 8).</td>
<td>1. Watch for spark or listen for buzz. a. Ignition electrodes are clean. b. Ignition transformer is okay. 2. Listen for click or feel head of valve for activation. a. Actuator if used. b. Pilot valve.</td>
</tr>
</tbody>
</table>

NOTE: Refer to wiring diagram of system being tested.
### Table 9. Static Checkout. (Continued)

<table>
<thead>
<tr>
<th>Test No.</th>
<th>RM7800/ RM7840/ EC7840 Models</th>
<th>Test Jumpers</th>
<th>Voltmeter</th>
<th>Normal Operation</th>
<th>If Operation is Abnormal, Check the Items Listed Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>All</td>
<td>4-21 *</td>
<td>—</td>
<td>Same as test no. 6 for connections to Terminal 8. If using direct spark ignition, check the first stage fuel valve(s) instead of the pilot valve or MV2 for VP tests.</td>
<td>Same as test no. 6. If using direct spark ignition, check the first stage fuel valve(s) instead of the pilot valve.</td>
</tr>
<tr>
<td>9</td>
<td>All</td>
<td>4-9 *</td>
<td>—</td>
<td>Automatic main fuel valve(s) open. If using direct spark ignition on a model with intermittent pilot on Terminal 21, check the optional second stage fuel valve, if used.</td>
<td>1. Listen for and observe operation of the main fuel valve(s) and actuator(s). 2. Valve(s) and actuator(s).</td>
</tr>
<tr>
<td>10</td>
<td>All</td>
<td>4-3</td>
<td>—</td>
<td>Alarm (if used) turns on.</td>
<td>1. Alarm.</td>
</tr>
<tr>
<td>11</td>
<td>All</td>
<td>4-5 and 12-13</td>
<td>18-L2</td>
<td>Firing rate motor drives open; zero volts at Terminal 18 after motor starts driving open.</td>
<td>1. Low Fire Start Switch. 2. Firing rate motor and transformer.</td>
</tr>
<tr>
<td>12</td>
<td>All</td>
<td>4-5 and 14-13</td>
<td>18-L2</td>
<td>Firing rate motor drives closed; line voltage at Terminal 18 after motor is in Low Fire position.</td>
<td>1. Low Fire Start Switch. 2. Firing rate motor and transformer.</td>
</tr>
<tr>
<td>13</td>
<td>RM7800L; RM7840L; EC7840L</td>
<td>4-5 and 12-13</td>
<td>19-L2</td>
<td>Firing rate motor drives open; line voltage at Terminal 19 after motor is in High Fire position.</td>
<td>1. High Fire Purge Switch. 2. Firing rate motor and transformer.</td>
</tr>
<tr>
<td>14</td>
<td>RM7800L; RM7840L; EC7840L</td>
<td>4-5 and 14-13</td>
<td>19-L2</td>
<td>Firing rate motor drives closed; zero volts at Terminal 19 after motor starts driving closed.</td>
<td>1. Low Fire Start Switch. 2. Firing rate motor and transformer.</td>
</tr>
<tr>
<td><strong>Final</strong></td>
<td>All</td>
<td></td>
<td></td>
<td><strong>CAUTION</strong></td>
<td>Equipment Damage Hazard. Improper wiring can damage equipment. On completing these tests, open the master switch and remove all test jumpers from the subbase terminal. Also remove bypass jumpers from the low fuel pressure limits (if used) to prevent equipment damage.</td>
</tr>
</tbody>
</table>

*An ammeter can be used to verify the proper connected loads.*
TROUBLESHOOTING

Troubleshooting can be accomplished by using the S7800 Keyboard Display Module (KDM) or a blinking POWER LED.

The POWER LED provides fault identification when the relay module locks out on an alarm. Fault identification is a series of fast and slow blinking LED lights. The fast blinks identify the tens portion of the fault code (three fast blinks is 30), while the slow blinks identify the units portion of the fault code (two slow blinks is 2). Three fast blinks followed by two slow blinks would be fault code 32. (See Table 10 for Blink Fault Code list.)

The LED code repeats as long as the fault exists. To clear the fault, press the RESET button.

Use Table 10 to identify fault code numbers, possible system failure and recommended troubleshooting procedures.

<table>
<thead>
<tr>
<th>Blink Code</th>
<th>System Failure</th>
<th>Recommended Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code 1-1</td>
<td>Low AC Line detected.</td>
<td>1. Check the relay module and display module connections.</td>
</tr>
<tr>
<td><em>Low AC Line Voltage</em></td>
<td></td>
<td>2. Reset and sequence the Relay Module.</td>
</tr>
<tr>
<td>Code 1-2</td>
<td>Excessive noise or device running on slow, fast, or AC line dropout detected.</td>
<td>3. Check the 7800 power supply and make sure that frequency and voltage meet specifications.</td>
</tr>
<tr>
<td><em>AC Quality Problem</em></td>
<td></td>
<td>4. Check the backup power supply, as appropriate.</td>
</tr>
<tr>
<td>Code 2-1</td>
<td>Flame sensed when no flame is expected during STANDBY or PURGE.</td>
<td>1. Check that flame is not present in the combustion chamber; correct any errors.</td>
</tr>
<tr>
<td><em>Unexpected Flame Signal</em></td>
<td></td>
<td>2. Make sure that the flame amplifier and flame detector are compatible.</td>
</tr>
<tr>
<td>Code 2-2</td>
<td>No-flame time present at the end of the Pilot Flame Establishing Period; lost during the Main Flame Establishing Period or during RUN.</td>
<td>3. Check the wiring and correct any errors.</td>
</tr>
<tr>
<td><em>Flame Signal Absent</em></td>
<td></td>
<td>4. Remove the flame amplifier and inspect its connections. Reset the amplifier.</td>
</tr>
<tr>
<td>Code 2-3</td>
<td>Flame signal value is too high to be valid.</td>
<td>5. Reset and sequence the relay module.</td>
</tr>
<tr>
<td><em>Flame Signal Overrange</em></td>
<td></td>
<td>6. If the code reappears, replace the flame amplifier and/or the flame detector.</td>
</tr>
<tr>
<td>Code 3-1</td>
<td>Running or Lockout Interlock fault during Pre-Purge.</td>
<td>7. If the fault persists, replace the relay module.</td>
</tr>
<tr>
<td><em>Running/Interlock Switch Problem</em></td>
<td></td>
<td>8. If the fault persists, replace the relay module.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Measure the flame signal. If one exists, verify that it meets specifications.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Make sure that the flame amplifier and flame detector are compatible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Inspect the main fuel valve(s) and valve connection(s).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Verify that the fuel pressure is sufficient to supply fuel to the combustion chamber. Inspect the connections to the fuel pressure switches. Make sure they are functioning properly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Inspect the Airflow Switch and make sure that it is functioning properly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. Check the flame detector sighting position; reset and recycle. Measure the flame signal strength. Verify that it meets specifications. If not, refer to the flame detector and/or flame amplifier checkout procedures in the installation instructions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Replace the flame amplifier and/or the flame detector, if necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. If the fault persists, replace the relay module.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. Make sure the flame detector and flame amplifier are compatible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Remove the flame amplifier and inspect its connections. Reset the flame amplifier.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Reset and sequence the relay module.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Check the flame detector sighting position; reset and recycle. Measure flame strength. Verify that it meets specifications. If not, refer to the flame detector and/or flame amplifier checkout procedures in the installation instructions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. If the code reappears, replace the flame amplifier and/or the flame detector.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6. If the fault persists, replace the relay module.</td>
</tr>
</tbody>
</table>

Code 3-1
*Running/Interlock Switch Problem*

1. Check wiring; correct any errors.
2. Inspect the fan; make sure there is no air intake blockage and that it is supplying air.
3. Make sure the Lockout Interlock switches are functioning properly and the contacts are free from contaminants.
4. Reset and sequence the relay module to Pre-Purge (place the TEST/RUN Switch in the TEST position, if available). Measure the voltage between terminal 7 and G (ground); line voltage should be present. Switch TEST/RUN back to RUN.
5. If steps 1 through 4 are correct and the fault persists, replace the relay module.
### Table 10. Blinking Fault Codes and Recommended Troubleshooting. (Continued)

<table>
<thead>
<tr>
<th>Blink Code</th>
<th>System Failure</th>
<th>Recommended Troubleshooting</th>
</tr>
</thead>
</table>
| Code 3-2         | *Running/Interlock On During Standby*                                         | 1. Check wiring to make sure that the Lockout Interlocks are connected properly between terminals 6 and 7. Correct any errors.  
2. Reset and sequence the relay module.  
3. If the fault persists, measure the voltage between terminal 6 and G (ground), then between terminal 7 and G. If there is line voltage at terminal 6 when the controller is off, the controller switch may be bad or is jumpered.  
4. If steps 1 through 3 are correct and there is line voltage at terminal 7 when the controller is closed and the fault persists, check for a welded or jumpered Running Interlock or Airflow Switch. Correct any errors.  
5. If steps 1 through 4 are correct and the fault persists, replace the relay module. |
| Code 3-3         | *VPS in Improper State*                                                        | 1. Check wiring, making sure upstream valve is connected to terminal 9 and downstream valve is connected to terminal 17.  
2. Conduct Valve Seat leakage test using a manometer.  
3. Reset and sequence the relay module; if fault repeats, test VPS (connected to terminal 16) is functioning properly; replace if necessary.  
4. Reset and sequence the relay module.  
5. If fault persists, replace the relay module. |
| Code 4-1         | *Purge Card Problem*                                                           | 1. Make sure the purge card is seated properly.  
2. Inspect the purge card and the connector on the relay module for any damage or contaminants.  
3. Reset and sequence the relay module.  
4. If the fault code reappears, replace the purge card.  
5. Reset and sequence the relay module.  
6. If the fault code persists, replace the relay module. |
| Code 4-2         | *Wiring Problem/Internal Fault*                                                | 1. Remove system power and turn off fuel supply.  
2. Check wiring; correct any errors.  
3. Inspect Pilot Fuel Valve(s), both places, and connections.  
4. Reset and sequence the relay module.  
5. If the fault persists, replace the relay module. |
| Code 4-3         | *Flame Amplifier Problem*                                                      | 1. Check wiring; correct any errors.  
2. Make sure the flame amplifier and flame detector are compatible.  
3. Remove the flame amplifier and inspect the connections. Reseat the amplifier.  
4. Reset and sequence the relay module.  
5. If the fault persists, replace the relay module. |
| Code 4-4         | *Configuration Jumper Problem*                                                | 1. Inspect the jumper connections. Make sure the clipped jumpers were completely removed.  
2. Reset and sequence the relay module.  
3. If the fault persists, replace the relay module. |
| Code 5-1         | *Pre-Ignition Interlock*                                                       | 1. Check wiring and correct any errors.  
2. Check Pre-Ignition Interlock switches to assure proper functioning.  
3. Check fuel valve operation.  
4. Reset and sequence the relay module; monitor the Pre-Ignition Interlock status.  
5. If the fault persists, replace the relay module. |
| Code 5-2         | Either High Fire Switch or Low Fire Switch failure.                            | 1. Check wiring and correct any errors.  
2. Reset and sequence the relay module.  
3. Use manual motor potentiometer to drive the motor open and closed. Verify at motor switch that the end switches are operating properly. Use RUN/TEST switch if manual potentiometer is not available.  
4. Reset and sequence the relay module.  
5. If the fault persists, replace the relay module. |
<table>
<thead>
<tr>
<th>Blink Code</th>
<th>System Failure</th>
<th>Recommended Troubleshooting</th>
</tr>
</thead>
</table>
| Code 5-3   | Man-Open Switch, Start Switch or Control On in the wrong operational state. | 1. Check wiring and correct any errors.  
2. Make sure that the Manual Open Valve Switch, Start Switch and Control are operating properly.  
4. Reset and sequence the relay module.  
5. Reset and sequence the relay module. If the fault persists, replace the relay module (RM783BA1014; RM783BB1013 or RM783BC1004 only). |
| Code 6-1   | Relay Module self-test failure.        | 1. Reset and sequence the relay module.  
2. If fault reappears, remove power from the device, reapply power, then reset and sequence the relay module.  
3. If the fault persists, replace the relay module. |
| Code 6-2   | Relay Module Self-Test failure.        | 1. Reset and sequence the relay module.  
2. If fault reappears, remove power from the device, reapply power, then reset and sequence the relay module.  
3. If fault does not repeat on the next cycle, check for electrical noise being copied into the relay module through the external loads or possibly an electrical grounding issue.  
4. If the fault persists, replace the relay module. |
| Code 6-3   | Fault with special OEM input circuits. | 1. Check wiring and operation of special OEM inputs.  
2. Reset and sequence the relay module.  
3. If fault reappears, remove power from the device, reapply power, then reset and sequence the relay module.  
4. If the fault does not repeat on the next cycle, check for electrical noise being copied into the relay module through the external loads or possibly an electrical grounding issue.  
5. If the fault persists, replace the relay module. |
| Code 6-4   | VPS setup.                             | 1. Make sure Relay Module VP is programmed.  
2. T6 and T17 powered at the same time—correct wiring.  
3. Reset control if fault persists. Replace relay module. |
| Code 7-7   | Unused at this time.                  | —                           |
APPENDIX A

Valve Proving Test

The Valve Proving System feature offers a systematic way of testing the valve seat integrity to assure the valves are indeed in the closed position when the system is off-line, in STANDBY.

WARNING

Explosion Hazard.
Can cause severe injury, death or property damage. Leaking gas valves can result in fire or explosion. The Valve Proving System is designed to detect such leaks. A valve proving test time that is too short may allow unacceptable leaks to go undetected. Use the procedure in Appendix A to select sufficient valve test times to detect any unacceptable leak.

The following steps are to determine the test time for the relay module to verify the valve seats are not leaking at a rate of greater than/equal to 0.1% of the burner capacity.

1. Identify items of your system and fill in the “Information” portion of the worksheet.
2. Go to the Lookup Tables noted (13, 14 or 15) to get the results for your system.

IMPORTANT

The Tables show information on Honeywell Valves only. Contact other valve manufacturers to obtain data on their specific valves.

![Diagram of valve train layout]

Calculation of Valve Train Volume

\[ X = V_1 + V_2 + (A \times L/144) \]

Calculation of Valve Proving Test Time

Test Time = \( 187,000 \times (P \times X)/C \)

Table 11. Valve Proving Test Time Symbols and Descriptions.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>ft(^3)</td>
<td>Volume between the two valves to be tested.</td>
</tr>
<tr>
<td>V_1</td>
<td>ft(^3)</td>
<td>Volume of upstream valve outlet cavity.</td>
</tr>
<tr>
<td>V_2</td>
<td>ft(^3)</td>
<td>Volume of downstream valve inlet cavity.</td>
</tr>
<tr>
<td>L</td>
<td>ft</td>
<td>Length of pipe between valves.</td>
</tr>
<tr>
<td>D</td>
<td>npt</td>
<td>Pipe Size—used to define A</td>
</tr>
<tr>
<td>A</td>
<td>in.(^2)</td>
<td>Pipe Cross Section Area (from Table 15)</td>
</tr>
<tr>
<td>Test</td>
<td>Seconds</td>
<td>Minimum VPS test period.</td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>psi</td>
<td>Gas inlet pressure to upstream valve.</td>
</tr>
<tr>
<td>C</td>
<td>ft(^3)/hr</td>
<td>Burner Capacity.</td>
</tr>
</tbody>
</table>

NOTE: V1 is the outlet cavity of the upstream valve and V2 is the inlet cavity of the downstream valve.

NOTE: 10 seconds is the minimum test time allowed. If your calculations are less than 10 seconds, enter 10 seconds.

For Example:

We have a 2.5 MBTU burner with 2 psi valve train inlet pressure. The upstream valve is a proof-of-closure V5044 with a solenoid V4295 valve downstream. We have a 2 in. NPT pipe, 1-3/4 ft long, between the valves.
**Table 12. VPS Worksheet Example.**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Information</th>
<th>Lookup Table</th>
<th>Results</th>
<th>Formula Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>Upstream Valve Volume</td>
<td>V5055</td>
<td>12</td>
<td>0.0218</td>
<td>V1</td>
</tr>
<tr>
<td>V2</td>
<td>Downstream Valve Volume</td>
<td>V4295</td>
<td>13</td>
<td>0.0267</td>
<td>V2</td>
</tr>
<tr>
<td>D</td>
<td>Pipe Size NPT (in.)</td>
<td>2 in. NPT</td>
<td>14</td>
<td>3.356</td>
<td>A</td>
</tr>
<tr>
<td>L</td>
<td>Pipe Length (ft)</td>
<td>1.75 ft</td>
<td>—</td>
<td>1.75</td>
<td>L</td>
</tr>
</tbody>
</table>
| P    | Valve Inlet Pressure (psig)

\[ a \text{ Divide inches w.c. by 27.7 to get psi.} \]
\[ b \text{ Divide Btuh by 1000 to get cf/hr for natural gas or by 2550 to get cf/hr for LP gas.} \]

Calculation of Valve Train Volume:

\[ X = V1 + V2 + (A \times L ÷ 144) \]

\[ X = 0.0218 + 0.0267 + (3.356 \times 1.75 + 144) = 0.0893. \]

Calculation of Valve Proving Test Time:

\[ \text{Test Time} = 187,000 \times (P \times X ÷ C) \]

\[ \text{Test Time} = 187,000 \times (2 \times 0.0893 + 2500) = 13.4 \text{ seconds.} \]

Round up to 14 seconds; enter 14 seconds into the VPS Setup.

**Table 13. V1 Upstream Volumes for Honeywell Valves.**

<table>
<thead>
<tr>
<th>Pipe Size NPT (inches)</th>
<th>V4295</th>
<th>V4297A1013</th>
<th>V4297A1005</th>
<th>V48</th>
<th>V5055</th>
<th>V5097A1004</th>
<th>V5097A1012</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>0.0002</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1/2</td>
<td>0.0002</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>3/4</td>
<td>0.0008</td>
<td>0.0093</td>
<td>0.0090</td>
<td>0.0010</td>
<td>0.0046</td>
<td>0.0066</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>0.0009</td>
<td>0.0093</td>
<td>0.0090</td>
<td>0.0010</td>
<td>0.0046</td>
<td>0.0066</td>
<td>—</td>
</tr>
<tr>
<td>1-1/4</td>
<td>0.0045</td>
<td>0.0093</td>
<td>0.0090</td>
<td>0.0035</td>
<td>0.0046</td>
<td>0.0066</td>
<td>—</td>
</tr>
<tr>
<td>1-1/2</td>
<td>0.0045</td>
<td>0.0093</td>
<td>—</td>
<td>0.0035</td>
<td>0.0218</td>
<td>0.0066</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>0.0089</td>
<td>0.0093</td>
<td>—</td>
<td>0.0048</td>
<td>0.0218</td>
<td>0.0285</td>
<td>—</td>
</tr>
<tr>
<td>2-1/2</td>
<td>0.0441</td>
<td>—</td>
<td>—</td>
<td>0.0048</td>
<td>0.0227</td>
<td>—</td>
<td>0.0285</td>
</tr>
<tr>
<td>3</td>
<td>0.0441</td>
<td>—</td>
<td>—</td>
<td>0.0048</td>
<td>0.0227</td>
<td>—</td>
<td>0.0285</td>
</tr>
<tr>
<td>4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>0.0779</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**Table 14. V2 Downstream Volumes for Honeywell Valves.**

<table>
<thead>
<tr>
<th>Pipe Size NPT (inches)</th>
<th>V4295</th>
<th>V4297A1013</th>
<th>V4297A1005</th>
<th>V48</th>
<th>V5055</th>
<th>V5097A1004</th>
<th>V5097A1012</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>0.0011</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>1/2</td>
<td>0.0011</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>3/4</td>
<td>0.0026</td>
<td>0.0282</td>
<td>0.0232</td>
<td>0.0048</td>
<td>0.0067</td>
<td>0.0093</td>
<td>—</td>
</tr>
<tr>
<td>1</td>
<td>0.0036</td>
<td>0.0282</td>
<td>0.0232</td>
<td>0.0048</td>
<td>0.0067</td>
<td>0.0093</td>
<td>—</td>
</tr>
<tr>
<td>1-1/4</td>
<td>0.0148</td>
<td>0.0282</td>
<td>0.0232</td>
<td>0.0110</td>
<td>0.0067</td>
<td>0.0093</td>
<td>—</td>
</tr>
<tr>
<td>1-1/2</td>
<td>0.0148</td>
<td>0.0282</td>
<td>—</td>
<td>0.0110</td>
<td>0.0238</td>
<td>0.0093</td>
<td>—</td>
</tr>
<tr>
<td>2</td>
<td>0.0267</td>
<td>0.0282</td>
<td>—</td>
<td>0.0184</td>
<td>0.0238</td>
<td>0.0093</td>
<td>0.0303</td>
</tr>
<tr>
<td>2-1/2</td>
<td>0.0554</td>
<td>—</td>
<td>—</td>
<td>0.0184</td>
<td>0.0245</td>
<td>—</td>
<td>0.0303</td>
</tr>
<tr>
<td>3</td>
<td>0.0554</td>
<td>—</td>
<td>—</td>
<td>0.0184</td>
<td>0.0245</td>
<td>—</td>
<td>0.0303</td>
</tr>
<tr>
<td>4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>0.0801</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
### Table 15. Schedule 40 Pipe Internal Cross-Sectional Area.

<table>
<thead>
<tr>
<th>Pipe Size NPT (Inches)</th>
<th>Cross-Sectional Area (Sq. In.) “A”</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>0.191</td>
</tr>
<tr>
<td>1/2</td>
<td>0.304</td>
</tr>
<tr>
<td>3/4</td>
<td>0.533</td>
</tr>
<tr>
<td>1</td>
<td>0.864</td>
</tr>
<tr>
<td>1-1/4</td>
<td>1.498</td>
</tr>
<tr>
<td>1-1/2</td>
<td>2.036</td>
</tr>
<tr>
<td>2</td>
<td>3.356</td>
</tr>
<tr>
<td>2-1/2</td>
<td>4.788</td>
</tr>
<tr>
<td>3</td>
<td>7.393</td>
</tr>
<tr>
<td>4</td>
<td>12.730</td>
</tr>
</tbody>
</table>

### Table 16. VPS Worksheet.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Information</th>
<th>Lookup Table</th>
<th>Results</th>
<th>Formula Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>Upstream Valve Volume</td>
<td>12</td>
<td></td>
<td></td>
<td>V1</td>
</tr>
<tr>
<td>V2</td>
<td>Downstream Valve Volume</td>
<td>13</td>
<td></td>
<td></td>
<td>V2</td>
</tr>
<tr>
<td>D</td>
<td>Pipe Size NPT (in.)</td>
<td>14</td>
<td></td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>L</td>
<td>Pipe Length (ft)</td>
<td>—</td>
<td></td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>P</td>
<td>Valve Inlet Pressure (psig)(^a)</td>
<td>—</td>
<td></td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>C</td>
<td>Burner Maximum Firing (cf/hr)(^b)</td>
<td>—</td>
<td></td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>

\(^a\) Divide inches w.c. by 27.7 to get psi.

\(^b\) Divide Btuh by 1000 to get cf/hr for natural gas or by 2550 to get cf/hr for LP gas.
APPENDIX B: RM7800L/40G,L, EC7840L IGNITION OPTIONS

Column 1 lists the ignition option.
Column 2 lists the figure letter that shows the connections for that option. The figure letters refer to the figures on pages 30–32.
Column 3 refers to the fuel changeover switch and how many connections or poles that would be required.

<table>
<thead>
<tr>
<th>Ignition Options</th>
<th>Figure Letter</th>
<th>Fuel Changeover Poles</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Valve Proving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Fuel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- MFEP 10s</td>
<td>A</td>
<td>-</td>
</tr>
<tr>
<td>- MFEP 15s</td>
<td>B</td>
<td>-</td>
</tr>
<tr>
<td>- DSI</td>
<td>C</td>
<td>-</td>
</tr>
<tr>
<td>Dual Fuel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MFEP timed for both</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Gas 10s, Oil 10s</td>
<td>D</td>
<td>2</td>
</tr>
<tr>
<td>- Gas 10s, Oil 15s</td>
<td>E</td>
<td>2</td>
</tr>
<tr>
<td>- Gas 15s, Oil 10s</td>
<td>F</td>
<td>2</td>
</tr>
<tr>
<td>- Gas 15s, Oil 15s</td>
<td>G</td>
<td>2</td>
</tr>
<tr>
<td>- Gas 10s, Oil DSI</td>
<td>H</td>
<td>3</td>
</tr>
<tr>
<td>- Gas 15s, Oil DSI</td>
<td>I</td>
<td>3</td>
</tr>
<tr>
<td>- Gas DSI, Oil 10s</td>
<td>J</td>
<td>3</td>
</tr>
<tr>
<td>- Gas DSI, Oil 15s</td>
<td>K</td>
<td>3</td>
</tr>
<tr>
<td>- DSI both</td>
<td>L</td>
<td>2</td>
</tr>
<tr>
<td>Valve Proving on Gas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Fuel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- MFEP 10s</td>
<td>M</td>
<td>-</td>
</tr>
<tr>
<td>- MFEP 15s</td>
<td>Not Possible</td>
<td></td>
</tr>
<tr>
<td>- DSI</td>
<td>N</td>
<td>-</td>
</tr>
<tr>
<td>Dual Fuel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MFEP timed for both</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Gas 10s, Oil 10s</td>
<td>O</td>
<td>4</td>
</tr>
<tr>
<td>- Gas 10s, Oil 15s</td>
<td>P</td>
<td>4</td>
</tr>
<tr>
<td>- Gas 15s, Oil 10s</td>
<td>Not Possible</td>
<td></td>
</tr>
<tr>
<td>- Gas 15s, Oil 15s</td>
<td>Not Possible</td>
<td></td>
</tr>
<tr>
<td>- Gas 10s, Oil DSI</td>
<td>Q</td>
<td>5</td>
</tr>
<tr>
<td>- Gas 15s, Oil DSI</td>
<td>Not Possible</td>
<td></td>
</tr>
<tr>
<td>- Gas DSI, Oil 10s</td>
<td>R</td>
<td>4</td>
</tr>
<tr>
<td>- Gas DSI, Oil 15s</td>
<td>S</td>
<td>4</td>
</tr>
<tr>
<td>- DSI Both</td>
<td>T</td>
<td>4</td>
</tr>
</tbody>
</table>

Gas Direct Spark Ignition during VPS Selection (powering terminal 17) automatically chooses 4 second Ignition Trial Period, regardless of configuration resistor JR1 status

CAUTION! The above options are ONLY suggestions—BE SURE to check local approval agencies for timings acceptable for your application.
APPENDIX B: 7800 IGNITION OPTIONS

A. NO VP/SINGLE FUEL:

B. NO VP/SINGLE FUEL

C. NO VP/SINGLE FUEL: DSI

D. NO VP/DUAL FUEL: BOTH 10 SECOND MFEP

E. NO VP/DUAL FUEL: 15 SECOND MFEP

F. NO VP/DUAL FUEL: GAS 10 SECOND MFEP, OIL 15 SECOND MFEP

G. NO VP/DUAL FUEL: GAS 15 SECOND MFEP, OIL 10 SECOND MFEP

H. NO VP/DUAL FUEL: GAS 10 SECOND MFEP, OIL DSI
I. NO VP/DUAL FUEL: GAS 15 SECOND MFEP, OIL DSI

LIMITS

CONTROL

GAS
INTERLOCKS

IF EA IS USED THEN GAS/OIL SWITCHING IS ALSO NEEDED HERE.

OIL
INTERLOCKS

T7

T8

T21

T9

GAS MV

OIL MV

L2

L1

RM7840G: NOT POSSIBLE.

J. NO VP/DUAL FUEL: GAS DSI, OIL 10 SECOND MFEP LIMITS

CONTROL

GAS
INTERLOCKS

IF EA IS USED THEN GAS/OIL SWITCHING IS ALSO NEEDED HERE.

OIL
INTERLOCKS

T7

T8

T21

T9

GAS MV

OIL MV

L2

L1

RM7840G: NOT POSSIBLE.

K. NO VP/DUAL FUEL: GAS DSI, OIL 15 SECOND MFEP

LIMITS

CONTROL

GAS
INTERLOCKS

IF EA IS USED THEN GAS/OIL SWITCHING IS ALSO NEEDED HERE.

OIL
INTERLOCKS

T7

T8

T21

T9

GAS MV

OIL MV

L2

L1

RM7840G: NOT POSSIBLE.

L. NO VP/DUAL FUEL: BOTH DSI

LIMITS

CONTROL

GAS
INTERLOCKS

IF EA IS USED THEN GAS/OIL SWITCHING IS ALSO NEEDED HERE.

OIL
INTERLOCKS

T7

T8

T21

GAS MV

OIL MV

L2

L1

1 RM7840G: NO JUMPER - SWITCH FUEL OFF TERMINAL 21.

M. VALVE PROVING/GAS ONLY

LIMITS

CONTROL

GAS
INTERLOCKS

IF JR2 IS CLIPPED THEN DSI IS DISABLED AND THE PILOT WILL BE USED WHENEVER A VALVE PROVING DEMAND IS PRESENT ON T17.

OIL
INTERLOCKS

T7

T6

T21

MV2

MV1

L2

L1

JR2 CLIPPED

WHEN JR2 IS INTACT THEN GAS DSI IS ENABLED WHENEVER A VALVE PROVING DEMAND IS PRESENT ON T17.

RM7840G IS JR3 INTACT.

N. VP/GAS ONLY DSI

LIMITS

CONTROL

GAS
INTERLOCKS

IF EA IS USED THEN GAS/OIL SWITCHING IS ALSO NEEDED HERE.

OIL
INTERLOCKS

T7

T6

T8

PV (10SEC)

T21

MV2

MV1

L2

L1

JR2 INTACT

WHEN JR2 IS CLIPPED THEN DSI IS DISABLED AND THE PILOT WILL BE USED WHENEVER A VALVE PROVING DEMAND IS PRESENT ON T17.

RM7840G IS JR3 INTACT.

O. VALVE PROVING/DUAL FUEL: 10 SECOND MFEP BOTH FUELS

LIMITS

CONTROL

GAS
INTERLOCKS

IF EA IS USED THEN GAS/OIL SWITCHING IS ALSO NEEDED HERE.

OIL
INTERLOCKS

T7

T6

T8

PV

T21

MV2

MV1

L2

L1

JR2 CLIPPED


RM7840G: CLIP JR3.