



RM7838B, RM7838C

7800 SERIES Relay Modules

INSTALLATION INSTRUCTIONS

APPLICATION

The Honeywell RM7838B,C is a microprocessor based integrated burner control for industrial process semiautomatically fired gas, oil, coal or combination fuel single burner modulation applications and available Valve Proving System (VPS) feature. The RM7838B,C System consists of a relay module, wiring subbase, keyboard display module (KDM), amplifier, and purge card. Options include personal computer interface, Data ControlBus Module™, remote display mounting, first-out expanded annunciator and Modbus™ network capable.

Functions provided by the RM7838B,C include automatic modulated High Fire and Low Fire proven Purge, then the sequence stops, waiting for a Start Switch input, flame supervision, system status indication, system or self-diagnostics and troubleshooting.

The RM7838C differs from the RM7838B as follows:

1. Alarms only on Safety Shutdown.
2. Has 15-second MFEP.
3. Requires ST7800C Purge Timer.

This document covers the following 7800 Series Relay Modules:

RM7838B1021
RM7838B2021
RM7838C1012
RM7838C2012

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

Form Number	Description
32-00110	S7800A2142 4-line LCD Keyboard Display Module Product Data
32-00166	204729A/C KDM NEMA4 Covers for 4-line LCD KDM
65-0084	Q7800A,B 22-Terminal Wiring Subbase Product Data.
65-0089	ST7800A,C Plug-In Purge Timer Installation Instructions.
65-0288	S7800A1142 Keyboard Display Module Product Data.
65-0091	S7810A Data ControlBus Module™ Product Data.
65-0095	S7820 Remote Reset Module Product Data.
65-0097	221729 Dust Cover Installation Instructions.
65-0101	S7830 Expanded Annunciator Product Data.
32-00235	R7824, R7847, R7848, R7849, R7861, R7862, R7886 Flame Amplifiers for the 7800 Series Product Data.
65-0131	221818A Extension Cable Assembly Product Data.
65-0229	7800 Series Relay Modules Checkout and Troubleshooting Product Data.
65-0295	50023821-001/2 NEMA4 Covers for 2-line Keyboard Display Module

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32-00211-01

The RM7838B1021 and RM7838C1012 Relay Modules offer VPS, thus they differ in the following manner from the RM7838B1013 and RM7838C1004:

1. Terminal 16 changes from Pilot Valve Hold Input to Valve Proving Switch Input.
2. Terminal 17 changes from Manual Valve Open Input to Main Valve 2 Output.
3. JR3-Deferred or Immediate Function is replaced with Fan On for VPS.
4. Blinkum fault annunciation on safety shutdown (power LED blinks a fault code).
5. Built-in features set up only using the S7800A1142 Keyboard Display Module.
 - a. Valve Proving System.
 - b. Programmable Postpurge.

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—Before Start input; concurrent with Prepurge.
- After—Valve proving occurs after the Run state, (Stop Switch pushed) before the device goes to Standby. (Concurrent with Postpurge, if selected.)
- Both—Valve proving occurs at both times Before and After, noted above.
- Split—The main valve 1 (MV1) (high pressure) seat test is performed at the Before time and the main valve 2 (MV2) (low pressure) seat test is performed during the After time.

The following assumptions apply when using the RM7838B1021 or RM7838C1012 Valve Proving testing:

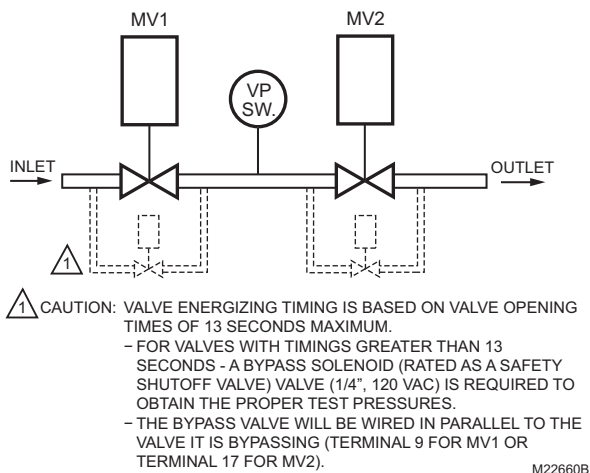


Fig. 1. The valve proving system.

MV1—Wired to terminal 9. It is located in the most upstream position of the main gas valve train.

VPS—Valve Proving Switch: Setpoint at 1/2 of Main Valve inlet pressure.

MV2—Wired to terminal 17. It is the main valve located closest to the burner.

The Proof of Closure Switch (PII—Pre-Ignition Interlock) for terminal 20 can be installed on MV1, MV2, or both valves.

! 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.

SPECIFICATIONS

Electrical Ratings (See Table 4):

Voltage and Frequency: 120 Vac (+10/-15%),
50/60 Hz (±10%).

Power Dissipation:

RM7838B,C: 10W maximum.
Maximum Total Connected Load: 2000 VA.
Fusing Total Connected Load: 15A maximum, fast blow type SC or equivalent.

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:

SIL 3 Capable in a properly designed Safety Instrumented System. See form number 65-0312-04 for Certificate Agreement.

Approvals:

Underwriters Laboratories Inc. Listed: File No. MP268, Vol. 30. UL 37260730-2-5 / CSA C22.2 No. 60730-2-5.
Factory Mutual Approved: Report No. 1V9A0.AF.
Swiss Re (formerly Industrial Risk Insurers): Acceptable.
Federal Communications Commission: Part 15, Class B, Emissions.
Exida: IEC 61508:2010 Parts 1-7, SIL 3 capable.
Control Safety Devices: Acceptable CSD-1
EAC Russia

IMPORTANT

A Flame Detection System is required for operation and must be ordered separately. Select the applicable Flame Signal Amplifier and matching Flame Detector in form 65-0109.

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

Explosion or Fire Hazard.
Can cause severe injury, death or property damage.

To prevent possible hazardous burner operation, verify safety requirements each time a control is installed on a burner.



WARNING

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

Disconnect the power supply before beginning installation. More than one power supply disconnect can be required.

IMPORTANT

1. Wiring connections for the relay modules are unique; refer to Fig. 4 or the appropriate Specifications 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 RM7838B,C must not exceed those listed on the RM7838B,C label or the Specifications; see Table 4.
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 proper jurisdiction.
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 Flame Detectors (C7927, C7961), and Visible Light Detector (C7962).

9. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, can cause interference with 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 can 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.

See Fig. 3 for the internal block diagram of the RM7838B,C Relay Module.

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% relative humidity continuous, noncondensing, moisture environment. Condensing moisture can cause a safety shutdown.

Vibration

Do not install the relay module where it can 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 in 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.
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 service, installation, access or removal of the RM7838B,C, Expanded Annunciator, KDM, 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, then drill the pilot holes.
4. Securely mount the subbase using four no. 6 screws.

Relay Module and Subbase Compatibility

NOTE: There are several different subbase models that can be purchased. It is important to note which subbase is compatible with the relay module when purchasing new, repair or replacement parts.

Series 1000 Relay Modules

All relay product codes that start with a 1 (example: RM7840G1014/U) can be used with existing subbase Q7800A1003/U and Q7800A1005/U.

Series 2000 Relay Modules

All relay product codes that start with a 2 (example: RM7840G2014/U) must be used with subbase Q7800A2003/U and Q7800A2005/U.

Subbase Compatibility

Any Relay Module in the 1000 Series with a Software Revision level number starting with a "5" or greater will be compatible with all subbase models both installed and newly purchased. This includes (Q7800A1005/U, Q7800B1003/U), and the 2000 Series subbases (Q7800A2005/U, Q7800B2003/U).

See Fig. 2 for Software Revision Level number location on the label (located on the rear of the relay module).

Wiring Subbase

WARNING

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

Any relay module in the new 2000 series will only be able to be installed on subbase Q7800A2005/U, Q7800B2003/U and will not be backward compatible with any Q7800A1003/U and Q7800A1005/U subbases already installed in the field.



Fig. 2. Software revision location.

IMPORTANT

Make sure to check the relay model number and the software revision level on the relay.

- If you attempt to place a 2000 series relay on a non-compatible 1000 series subbase, you will receive an error code of 101. This indicates that you must a) change out the subbase to a Q7800A2003/U or Q7800A2005/U or b) choose a compatible 1000 series relay module.

- Refer to Fig. 4 for proper subbase wiring.
- For proper remote wiring of the KDM, refer to the KDM Specifications (65-0288), Data ControlBus Module™ (65-0091) or Extension Cable Assembly (65-0131).
- Make sure all wiring complies with all applicable electrical codes, ordinances and regulations. Wiring, where required, must comply with NEC, Class 1 (Line Voltage) wiring.
- See Table 1 for recommended wire size and type.

Table 1. Recommended Wire Sizes and Part Numbers.

Application	Recommended Wire Size	Recommended Part Numbers
Line voltage terminals	14, 16 or 18 AWG (0.75, 1.5 or 2.5 mm ²) copper conductor, 600 volt insulation, moisture-resistant wire.	TTW60C, THW75C, THHN90C.
KDM	22 AWG (0.34 mm ²) two-wire twisted pair with ground, or five-wire.	Belden 8723 shielded cable or equivalent.
Data ControlBus Module™	22 AWG (0.34 mm ²) two-wire twisted pair with ground, or five-wire.	Belden 8723 shielded cable or equivalent.
Remote Reset Module	22 AWG (0.34 mm ²) two-wire twisted pair, insulated for low voltage.	—
13 Vdc full wave rectified transformer power input.	18 AWG (0.75 mm ²) wire insulated for voltages and temperatures for given application.	TTW60C, THW75C, THHN90C.

The KDM or Data ControlBus Module™ (for remote mounting or communications) 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 (31 meters).

5. See Table 2 for recommended grounding practices.
6. Use 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.
7. Follow directions in flame detector, Data ControlBus Module™, or Remote Reset Module Instructions.KDM: Because the KDM is powered from a low voltage, energy limited source, mount it outside of a control panel if it can be protected from mechanical damage.

NOTE: Use a separate 13 Vdc power supply any time more than two Data ControlBus Modules™ or KDM are used or are placed more than 100 feet (31 meters) from the relay module.

8. Use maximum wire lengths:
 - a. RM7838B,C leadwires—300 feet (91 meters) to terminal inputs (Control, Preignition Interlock, Running/Lockout Interlock, High Purge Switch and Low Fire Switch).
 - b. Flame Detector leadwires—limited by the flame signal strength.
 - c. Remote Reset leadwires—1000 feet (305 meters) to a Remote Reset push button.
 - d. Data ControlBus Module™—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 4000 feet (1219 meters).
9. Make sure loads do not exceed the terminal ratings. Refer to the label on the RM7838B,C or to the ratings in Table 4.

Table 2. Recommended Grounding Practices.

Ground Type	Recommended Practice
Earth Ground (Subbase and relay module)	<ol style="list-style-type: none"> 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 fast blow, type SC or equivalent, 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 lead wire 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.
Signal Ground (KDM, Data ControlBus Module™).	Use the shield of the signal wire to ground the device to the signal ground terminal 3(c) of each device. Connect the shield at both ends of the daisy chain to earth ground.

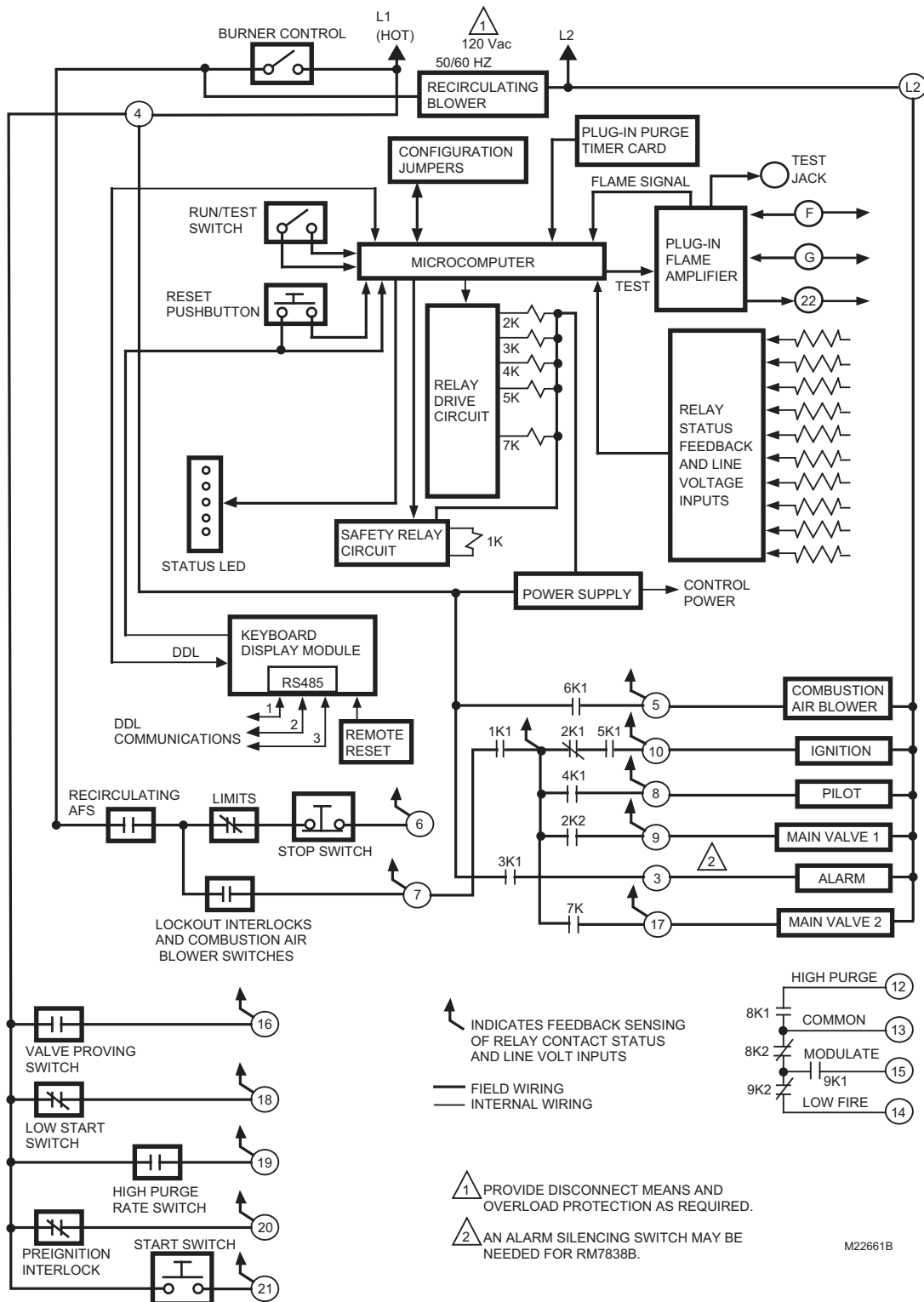
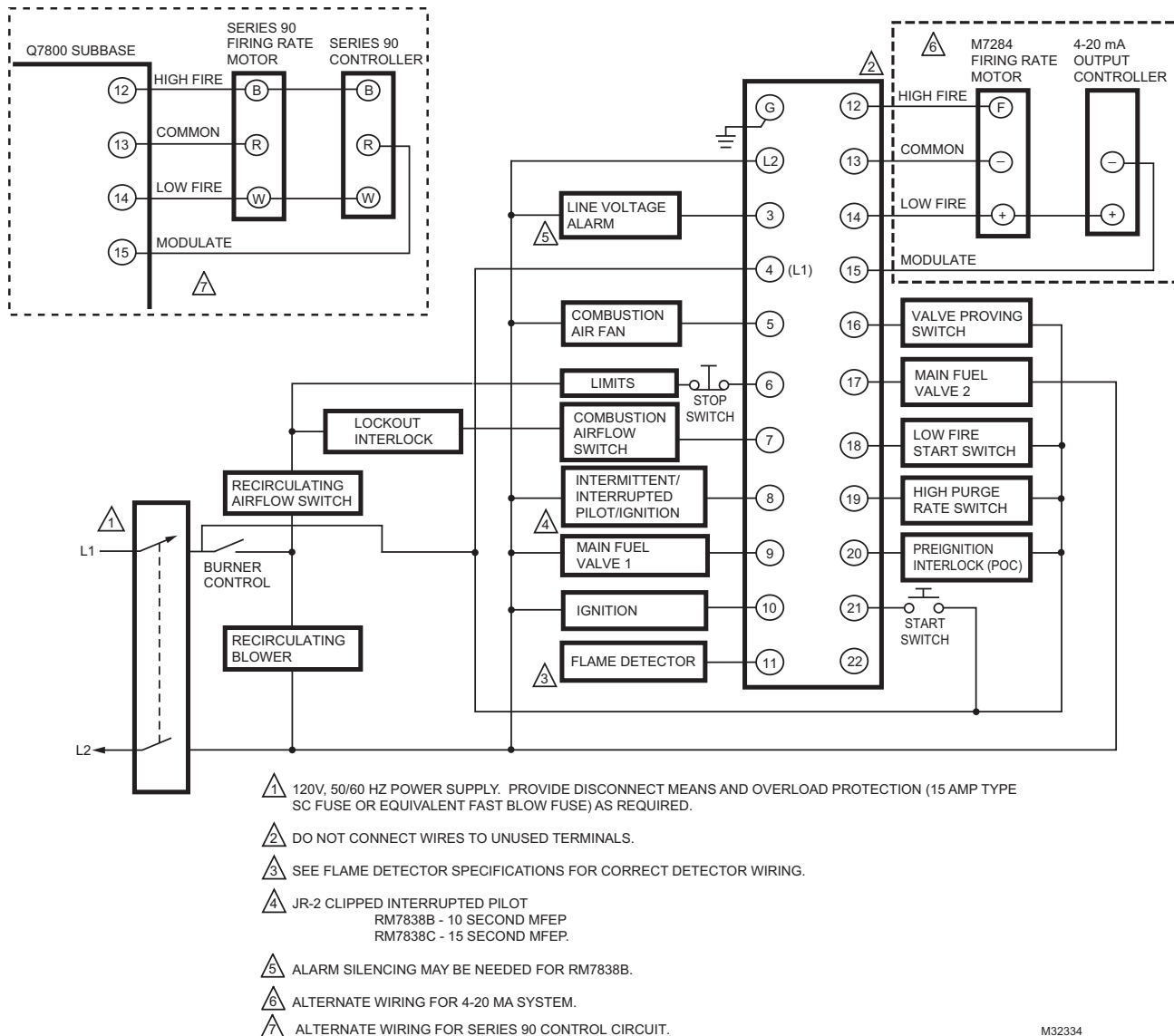


Fig. 3. Internal block diagram of RM7838B,C.



M32334

Fig. 4. Wiring subbase for RM7838B,C.

FINAL WIRING CHECK

1. Check the power supply circuit. The voltage and frequency tolerance must match those of the RM7838B,C. (A separate power supply circuit may be required for the RM7838B,C.)
2. Add the required disconnect means and overload protection.
3. Check all wiring circuits and complete the static checkout in Table 3 before installing the RM7838B,C on the subbase.
4. Install the relay module.
5. Restore power to the panel.

STATIC CHECKOUT

After checking all wiring, perform this checkout before installing the RM7838B,C 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 Hazards.
Can cause serious injury, death or equipment damage.

Close all manual fuel shutoff valve(s) before starting these tests.
Use extreme care while testing the system. Line voltage is present on most terminal connections when power is on.

Open the master switch before installing or removing a jumper on the subbase. Before continuing to the next test, be sure to remove test jumper(s) used in the previous test. Replace all limits and interlocks that are not operating properly. Do not bypass limits and interlocks.

CAUTION

Electrical Hazard.
Can cause equipment damage.

Do not perform a dielectric test with the RM7838B,C installed. Internal surge protectors break down and conduct current, causing dielectric test failure and destruction of the internal lightning and high current protection.

Equipment Recommended

1. Voltmeter (1M ohm/volt minimum sensitivity) set on the 0-300 Vac scale.
2. Two jumper wires; using No. 14 wire, insulated, 12 in. (304.8 mm) long with insulated alligator clips at both ends.

3. Ammeter can be used to verify loads (e.g. valves, ignition transformers) connected to the wiring sub-base.

General Instructions

1. Perform all applicable tests listed in the Static Checkout, Table 3, in the order listed.
2. Make sure all manual fuel shutoff valves are closed.
3. Perform only those tests designated for the specific RM7838B,C model being tested.
4. For each test, open the master switch and install the jumper wires between the subbase wiring terminals listed in the Test Jumpers column.
5. Close the master switch before observing operation.
6. Read the voltage between the subbase wiring terminals listed in the Voltmeter column.
7. If there is no voltage or the operation is abnormal, check the circuits and external devices as described in the last column.
8. Check all wiring for correct connections, tight terminal screws, correct wire, and proper wiring techniques. Replace all damaged or incorrectly sized wires.
9. Replace faulty controllers, limits, interlocks, actuators, valves, transformers, motors and other devices, as required.
10. Make sure normal operation is obtained for each required test before continuing the checkout.
11. 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.

Table 3. Static Checkout.

Test No.	Test Jumpers	Voltsmeter	Normal Operation	If Operation is Abnormal, Check These Items
1	None	4-L2	Line voltage at terminal 4.	<ol style="list-style-type: none"> 1. Master Switch. 2. Power Connected to the Master Switch. 3. Overload protection (fuse, circuit breaker, etc) has not opened the power line.
2	None	6-L2	Close burner control. Recirculating exhaust blower fan starts, then line voltage at terminal 6.	<ol style="list-style-type: none"> 1. Recirculating/exhaust blower fan. 2. Limits. 3. Stop Switch. 4. Burner Control. 5. Recirculating AFS.
2a	None	4-20	Line voltage at terminal 20.	Preignition Interlock.
2b	None	4-16	Line voltage at terminal 16.	Valve Proving Switch.
3	None	21-L2	With test 2 still running, press Start Switch. 120 Vac is present at terminal 21.	Start Switch.

Table 3. Static Checkout. (Continued)


Test No.	Test Jumpers	Voltmeter	Normal Operation	If Operation is Abnormal, Check These Items
4	None	6-L2	Push and hold Stop Switch. No voltage present at terminal 6.	Stop Switch.
5	4-3	None	Alarm (if used) turns on.	1. Alarm. 2. Alarm Silencing Switch.
6	4-5	7-L2	Close burner control. Recirculating/exhaust blower fan starts, then line voltage is present at terminal 6. 1. Combustion air fan starts. 2. Line voltage at terminal 7 within 10 seconds.	1. Combustion air fan circuit: a. Manual switch on air fan motor. b. Air fan power supply, overload protection, and starter. 2. Combustion Blower Air Flow Switch. 3. Alarm Silencing Switch. 4. Recirculating Air Flow Switch.
7	4-8	None	Automatic pilot valve opens. First stage valve (DSI application only). Ignition spark (if ignition transformer connected).	1. Listen for click or feel head of valve for activation. 2. Watch for spark or listen for buzz: a. Ignition electrodes are clean. b. Ignition transformer is okay.
8	4-9	None	Automatic main fuel valves open. (DSI checks optional second state fuel valve.)	Listen for and observe operation of the main fuel valve(s) and actuator(s).
9	4-10	None	Ignition spark (if ignition transformer connected to terminal 10).	1. Watch for spark or listen for buzz: a. Ignition electrodes are clean. b. Ignition transformer is okay.
10	4-17	None	Line voltage at terminal 17.	1. Listen for click or feel valve head for actuation of main valve # 2.
11	12-13	18-L2	Firing rate motor drives open; zero volts at terminal 18 after motor leaves Low Fire position.	1. Low Fire Start Switch. 2. Firing rate motor and transformer.
12	12-13	19-L2	Firing rate motor reaches High Purge Rate position; 120 Vac at terminal 19 when High Purge Rate Switch closes.	1. High Purge Rate Switch. 2. Firing rate motor and transformer.
13	13-14	19-L2	Firing rate motor leaves High Purge Rate Position; zero Vac at terminal 19 when High Purge Rate Switch opens.	1. High Purge Rate Switch. 2. Firing rate motor and transformer.
14	13-14	18-L2	Firing rate motor drives to Low Purge Rate position; 120 Vac at terminal 18 when switch closes.	1. Low Purge Rate Switch. 2. Firing rate motor and transformer.
15	13-15	None	Adjust firing rate control and watch tracking action of the firing rate motor.	1. Firing rate control. 2. Firing rate motor and transformer.
Final	 CAUTION Electrical Hazard. Can cause equipment damage. After completing these tests, open the Master Switch and remove all test jumpers from the subbase terminals. Also remove bypass jumpers from the low fuel pressure limits if used.			

Table 4. Terminal Ratings.

Terminal No.	Description	Ratings
G	Flame Sensor Ground ^a	—
Earth G	Earth Ground ^a	—
L2	Line Voltage Common	—
3	Alarm	120 Vac, 1A pilot duty.
4	Line Voltage Supply (L1)	120 Vac (+10/-15%), 50/60 Hz (+/-10%). ^b
5	Combustion Blower	120 Vac, 9.8 AFL, 58.8 ALR (inrush).
6	Stop Input	120 Vac, 1 mA.
7	Lockout Interlock	120 Vac, 8A running, 43A inrush.
8	Intermittent Pilot (Interrupted Pilot—if jumper JR2 is clipped)	120 Vac. ^c
9	Main Fuel Valve	120 Vac. ^c
10	Ignition	120 Vac. ^c
F(11)	Flame Sensor	60 to 220 Vac, current limited.
12	Firing Rate High Fire	120 Vac, 75 VA pilot duty.
13	Firing Rate Common	120 Vac, 75 VA pilot duty.
14	Firing Rate Low Fire	120 Vac, 75 VA pilot duty.
15	Firing Rate Modulate	120 Vac, 75 VA pilot duty.
16	Valve Proving Switch	120 Vac, 1 mA.
17	Main Valve 2	120 Vac ^c
18	Low Fire Switch	120 Vac, 1 mA.
19	High Fire Switch	120 Vac, 1 mA.
20	Preignition Interlock	120 Vac, 1 mA.
21	Start Switch Input	120 Vac, 1A pilot duty.
22	Shutter	120 Vac, 0.5A.

^a See Table 2.^b 2000 VA maximum load connected to RM7838B,C Assembly.^c See Tables 5 and 6.**Table 5. Combinations for Terminals 8, 9, 10 and 17.**

Pilot Fuel 8	Main 9	Main Valve 17	Ignition 10
C	F	F	No Load
B	F	F	No Load
F	F	F	A
No Load	F ^a	F	A
D	F	F	A
D	D	D	A
No Load	D ^a	D	A

^a Jumper Terminals 8 to 9 for direct spark ignition.**Table 6. Composition 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, 250 VA hold.	2A Pilot Duty	65 VA Pilot Duty plus motor valves with: 3850 VA inrush, 700 VA open, 250 VA hold.

Keyboard Display Module

The KDM (see Fig. 5) is provided with the RM7838B,C Relay Module. The first line of the Vacuum Fluorescent Display (VFD) provides:

- Current status of the burner sequence (STANDBY, PURGE, PILOT IGN, MAIN IGN and RUN).
- Timing information (PURGE, PILOT IGN and MAIN IGN) 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, H1—Fault History Information, 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 supplies information such as flame strength, system status indication, system or self-diagnostics and troubleshooting. Refer to checkout and troubleshooting instructions; see applicable publications listed on page 1.

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. It also replaces a selectable message after 60 seconds if it or a lockout message is available.

NOTE: RM7838B,C LED provide positive visual indication of the program sequence: POWER, PILOT, FLAME, MAIN and ALARM. See Fig. 5.

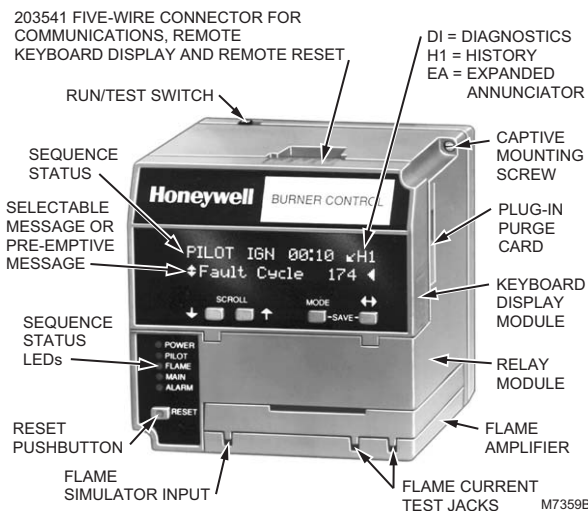


Fig. 5. Relay Module and associated system components.

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 concurrent with Prepurge and before the Start Switch (T21).

After—Valve Proving occurs after the Run state (Stop Switch) before the internal Safety Relay dropout state and concurrent with Postpurge (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. Enable Valve proving and, if so, when to perform it.
2. The time duration of the test is 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 G, operates as follows:

The tolerance on all valve proving timing values is $\pm 10\%$.

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. Some recommended pressure switches are the following Honeywell non-manual reset models:

Table 7. Honeywell Pressure Switch Selection for Valve Proving System.

1	2	3	4	5	6
Model Number	Operating Pressure Range	Maximum Differential (Additive)	Maximum Continuous Rated Pressure (psi)	Switch Action at Setpoint	Mounting Type
C6097A1004	0.4 to 5 in. wc	0.24 in. wc	2.9	Breaks N.O. to C connection on pressure fall.	1/4 in. NPT
C6097A1053	3 to 21 in. wc	0.48 in. wc	5.0		Flange
C6097A1061					1/4 in. NPT
C6097A1079	12 to 60 in. wc	2.4 in. wc	9.3		Flange
C6097A1087					1/4 in. NPT
C6097A1129	1.5 to 7 psi	0.3 psi	2.9		Flange
C6097A1137					1/4 in. NPT
C6097A1210	0.4 to 4 in. wc	0.24 in. wc	2.9		Flange

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 7 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 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 and the RM7838 must have the Valve Proving function.

When the RM7838 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.)

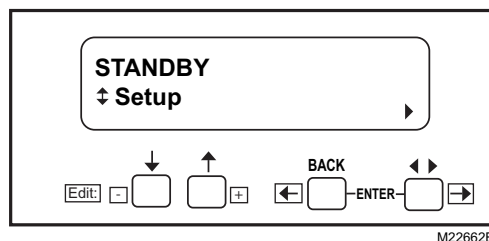


Fig. 6. STANDBY/Setup screen.

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

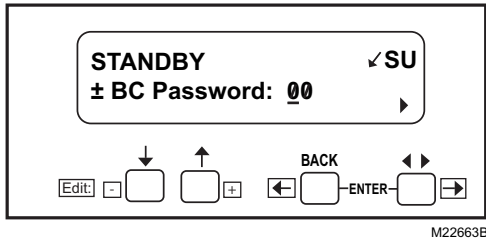


Fig. 7. Password screen.

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

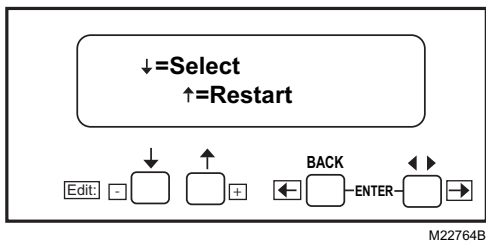


Fig. 8. Select/Restart screen.

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

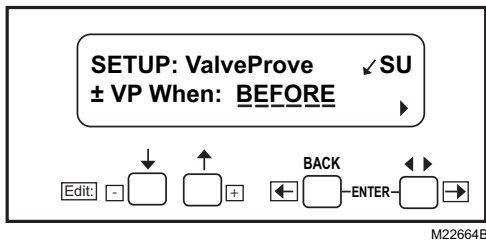


Fig. 9. SETUP: Valve Prove screen.

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 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.

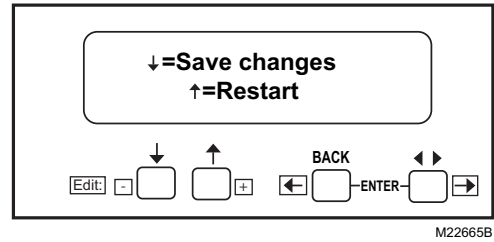


Fig. 10. Save Changes screen.

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

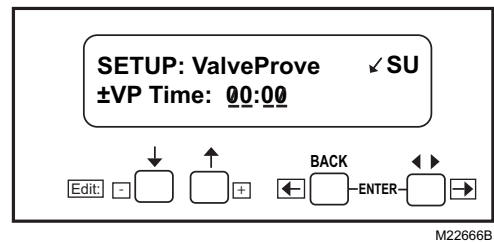


Fig. 11. Valve Prove time screen.

This screen sets up how long the RM7838 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 up arrow to increase time. Time increases:
 - 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.

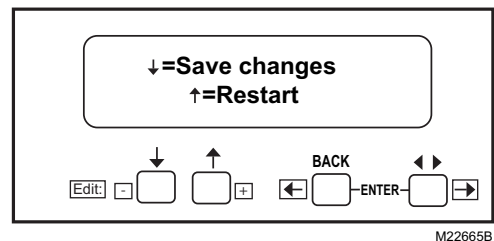


Fig. 12. Save Changes screen.

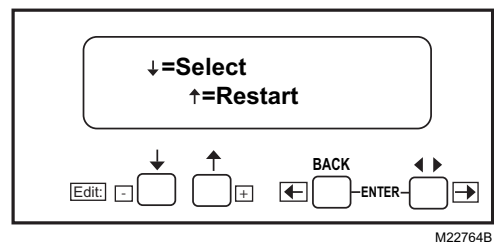


Fig. 13. Select/Restart screen.

11. Press down arrow to select.
12. "Getting Data" will be momentarily displayed, followed by the screen shown in Fig. 14.

Install Postpurge

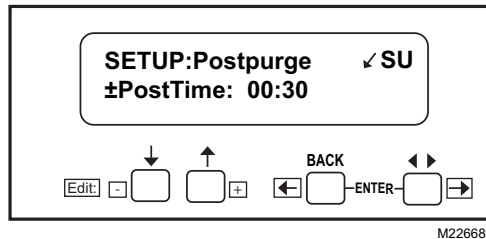


Fig. 14. Setting Postpurge time.

This screen allows for setting up the Postpurge for the RM7838B,C. This will be the time that the Combustion Fan (terminal 5) will remain energized after the STOP button is pushed.

13. Use the up arrow to increase the postpurge time. Time increases:

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.

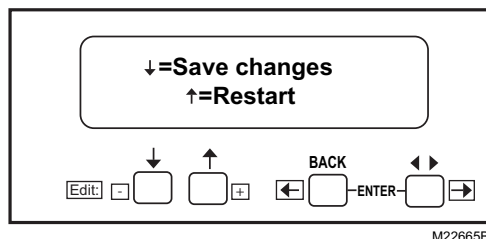


Fig. 15. Save Changes screen.

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

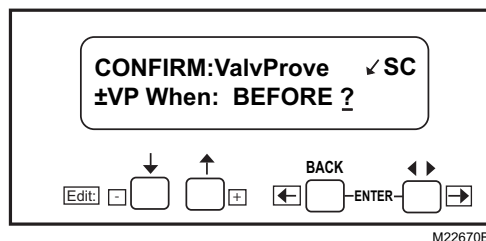


Fig. 16. Confirmation Acknowledgement screen. (The Valve Proving Test location is shown.)

16. Press ENTER.

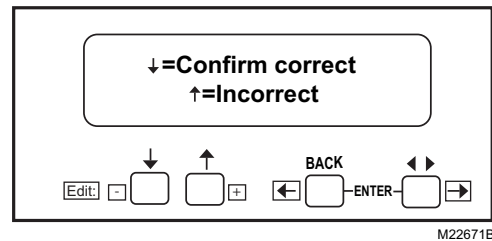


Fig. 17. Confirmation Correct screen.

17. Use the down arrow to confirm correct. "Getting Data" will be displayed.

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

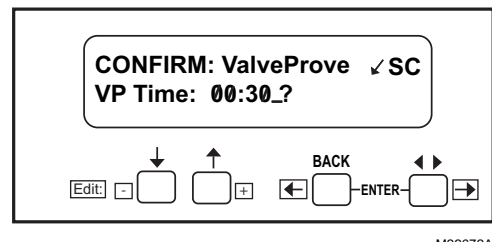


Fig. 18. Confirm screen.

18. Press Enter.

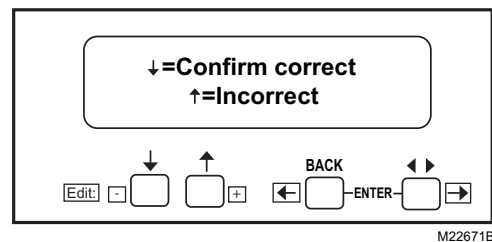


Fig. 19. Confirm Correct screen.

19. Use the down arrow to confirm correct. "Getting Data" will be displayed.

The following steps are used to confirm your selection.

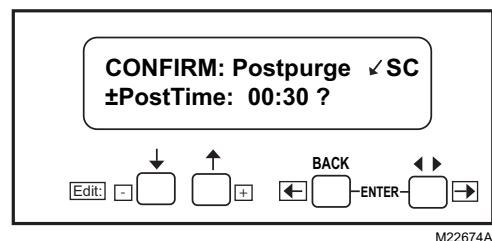


Fig. 20. Confirm Postpurge time.

20. Press Enter.

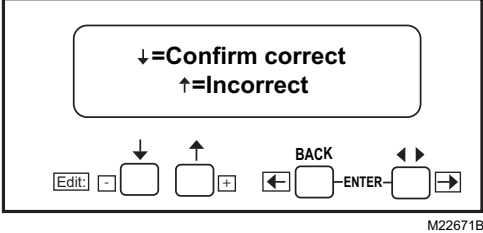


Fig. 21. Confirm correct/incorrect screen.

21. Press Enter.
22. Press the down arrow to confirm the correct post-purge time. "Getting Data" will be displayed until the screen in Fig. 22 appears.

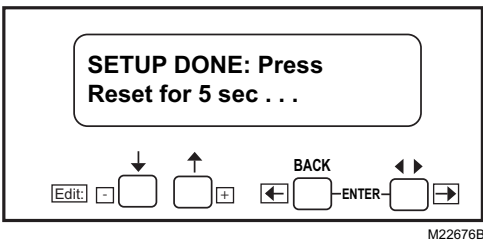


Fig. 22. Setup Done screen.

23. Go to the relay module and press and hold the RESET button for five seconds to program the Valve Proving setup into the relay module. The Release Reset screen will appear on the KDM.

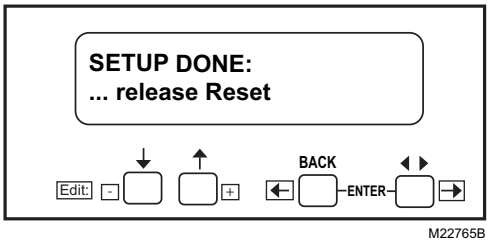


Fig. 23. Release Reset screen.



Changing the Valve Proving and Postpurge features is still possible. With the relay module in Start Switch, scroll to the Setup line and enter the password to change the settings.

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).

BEFORE

HF T19 CLOSED		4 SEC.		3 SEC.		TEST TIME		4 SEC.		3 SEC.		TEST TIME		IGNITION TRIALS			
CONTROLLER																	
	L1-6																
	L1-7																
			MV2 (17)														
									MV1 (9)								
					VPS (16)		1				VPS (16)		2				
PII (20)						PII (20)								PII (20)			

AFTER

CONTROLLER	RUN	4 SEC.	3 SEC.	TEST TIME		4 SEC.	3 SEC.	TEST TIME		STANDBY			
	L1-6												
	L1-7												
		MV2 (17)					MV1 (9)						
			VPS (16) 					VPS (16) 					
		PII (20)								PII (20)			

SPLIT

CONTROLLER	HF T19 CLOSED		4 SEC.		3 SEC.		TEST TIME		BURNER RUN TIME		4 SEC.		3 SEC.		TEST TIME		STANDBY			
	L1-6																			
	L1-7																			
			MV1 (9)										MV2 (17)							
							VPS (16)		2								VPS (16)		1	
											PII (20)								PII (20)	

- 1 LOCKOUT IF ON, M1 LEAKING (LOW PRESSURE TEST).
- 2 LOCKOUT IF OFF, MV2 LEAKING (HIGH PRESSURE TEST).
- 3 TEST IS RUN CONCURRENT WITH POSTPURGE, IF POSTPURGE TIME IS ENABLED.
- 4 TEST IS RUN CONCURRENT WITH PREPURGE TIME.

Fig. 24. RM7838B,C Relay Module operation, valve proving test options.

M24700

Mounting RM7838B,C Relay Module

1. Mount the RM7838B,C vertically on the Q7800 Subbase, or mount horizontally with the knife blade terminals pointing down. (For mounting on the Q7800A, mount the RM7838B,C in an electrical enclosure.)
2. When mounting in an electrical enclosure, provide adequate clearance for service, installation and removal of the RM7838B,C, KDM, flame amplifier, flame amplifier signal voltage probes, electrical signal voltage probes, and electrical connections.
 - a. Allow an additional 2 in. (51 mm) below the RM7838B,C for the flame amplifier mounting.
 - b. Allow an optional 3 in. (76 mm) minimum to both sides of the RM7838B,C for electrical signal voltage probes.

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 knife blade terminals or bifurcated contacts.

IMPORTANT

Install the RM7838B,C with a plug-in motion rather than a hinge action.

4. Mount the RM7838B,C by aligning the four L-shaped corner guides and knife blade terminals with the bifurcated contacts on the wiring subbase and securely tightening the two screws without deforming the plastic.

Mounting Other System Components

Mount other required and optional system components by referring to Fig. 25 and the instructions provided with each component.

PRINCIPAL TECHNICAL FEATURES

The RM7838B,C provides all customary flame safeguard functions as well as significant advancements in safety, annunciation and system diagnostics.

Safety Shutdown (Lockout) Occurs If:

1. INITIATE Period
 - a. Purge card is not installed or removed.
 - b. Purge card is bad.
 - c. Configuration jumpers were changed after 200 hours of operation.
 - d. AC line power errors, see Operation.
 - e. Four minute INITIATE period is exceeded.
2. STANDBY Period
 - a. Flame signal is present after 240 seconds.
 - b. Preignition Interlock is open after 30 seconds.
 - c. Ignition/pilot valve terminal is energized.
 - d. Main valve terminal is energized.
 - e. Internal system fault.
 - f. Purge card is not installed or removed.
 - g. Purge card is bad.
 - h. Flame detected during the last two seconds.
 - i. VPS Failure.
3. PURGE Period
 - a. Preignition Interlock opens anytime during purge.
 - b. Flame signal detected during purge.
 - c. High Purge Rate Switch fails to close within four minutes, fifteen seconds after the firing rate motor is commanded to drive to high fire position.
 - d. Low Fire Start Switch fails to close within four minutes, fifteen seconds after the firing rate motor is commanded to drive to low fire position.
 - e. Lockout Interlock does not close within five seconds.
 - f. Ignition/pilot valve terminal is energized.
 - g. Main valve terminal is energized.
 - h. Internal system fault.
 - i. Purge card is not installed or removed.
 - j. Purge card is bad.
 - k. VPS Failure.
4. Purge Hold: T21
 - a. Preignition Interlock opens.
 - b. Flame is detected.
 - c. Lockout Interlock opens during Hold.
 - d. Ignition/pilot valve/main valve is energized.
 - e. Internal system fault.
 - f. Purge card is removed.
 - g. Purge card is bad.
 - h. VPS Test Failure.
5. PILOT FLAME ESTABLISHING Period (PFEP)
 - a. Low Fire Switch opens.
 - b. Lockout Interlock opens.
 - c. Ignition/pilot valve/intermittent pilot valve terminal is not energized.
 - d. No flame is present at end of PFEP.
 - e. Internal system fault.
 - f. Purge card is not installed or removed.
 - g. Purge card is bad.
6. MAIN FLAME ESTABLISHING Period (MFEP)
 - a. Low Fire Switch opens.
 - b. Lockout Interlock opens.
 - c. Ignition/pilot valve terminal is not energized.
 - d. Main valve terminal is not energized.
 - e. No flame is present at end of MFEP.
 - f. Internal system fault.
 - g. Purge card is not installed or removed.
 - h. Purge card is bad.
7. RUN Period
 - a. Flame is present.
 - b. Lockout Interlock opens.
 - c. Main valve terminal is de-energized.
 - d. Internal system fault.
 - e. Purge card is not installed or removed.
 - f. Purge card is bad.

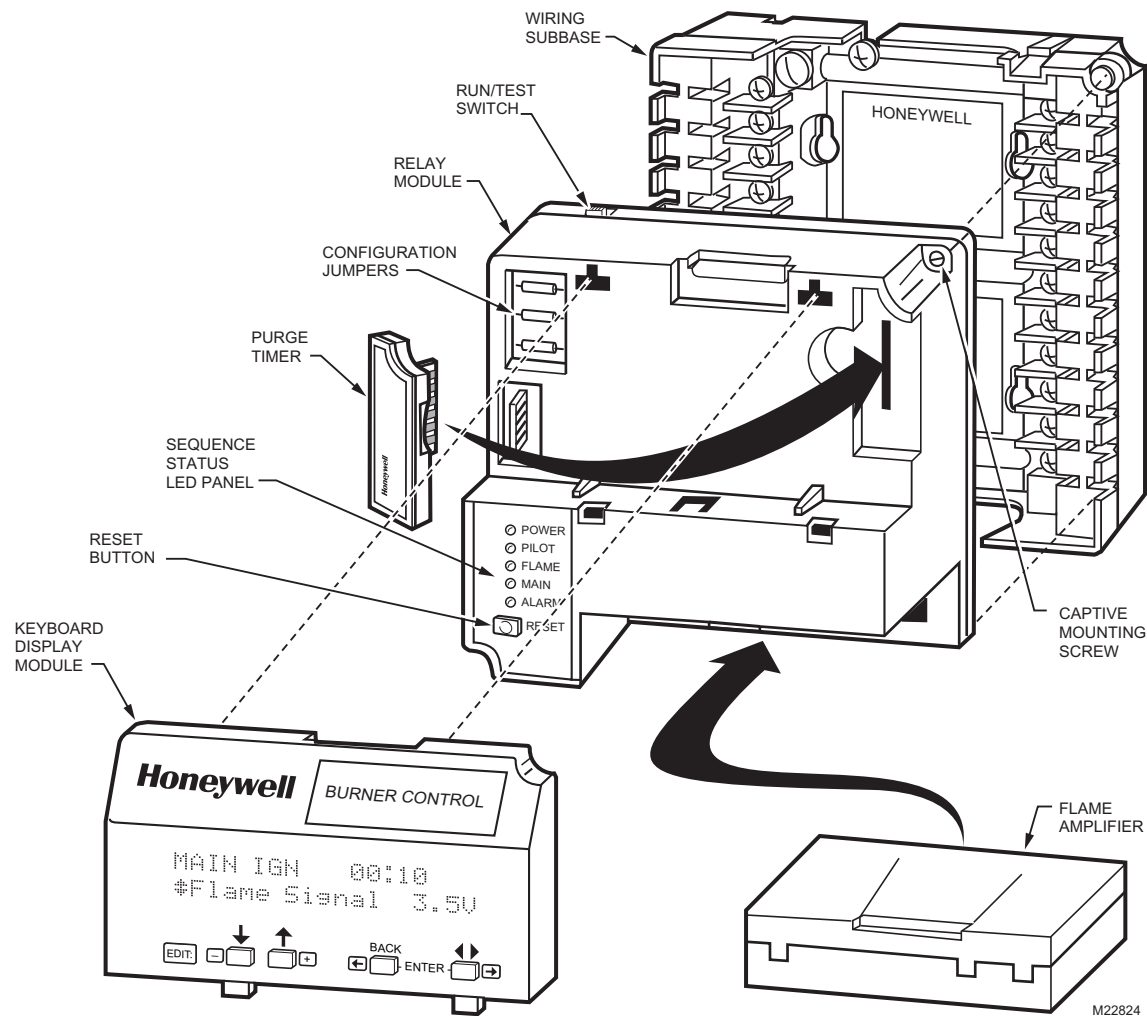
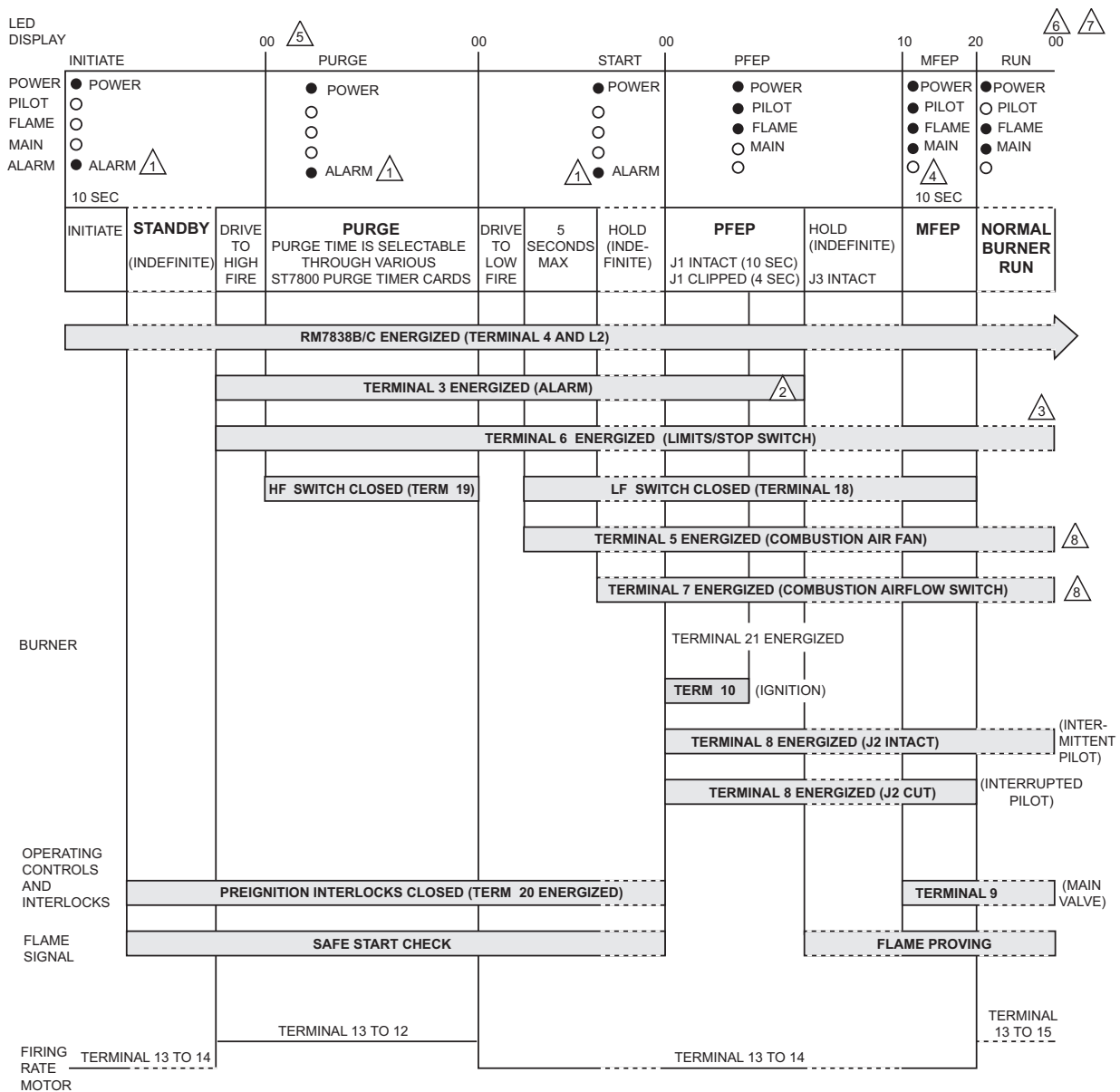


Fig. 25. RM7838B,C Relay Module exploded view.

OPERATION

Sequence of Operation

The RM7838B,C has the operating sequences listed below. The RM7838B,C LED provide positive visual indication of the program sequence: POWER, PILOT, FLAME, MAIN and ALARM. Fig. 26 shows the operating sequence.



Initiate

The RM7838B,C enters the INITIATE sequence when the Relay Module is initially powered. The RM7838B,C can also enter the INITIATE sequence if the Relay Module verifies voltage fluctuations of $\pm 10\%$ or frequency fluctuations of $\pm 10\%$ 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 KDM 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 RM7838B,C locks out. Causes for hold conditions in the INITIATE sequence:

- AC line dropout detection.
- AC line noise that prevents a sufficient reading of the line voltage inputs.
- Low line voltage brownouts.

The Alarm, terminal 3, is energized during INITIATE (RM7838B only).

Standby

The RM7838B,C remains in STANDBY until the Burner Control Switch is closed. Two seconds before leaving STANDBY, the shutter circuit is energized and verifies that no flame is present. The Alarm, terminal 3, is energized until flame is sensed (RM7838B only).

Normal Startup PURGE

Purge timing is determined by the plug-in purge timer:

- RM7838B with ST7800A Purge Timer provides 15 purge timing options from 2 seconds to 30 minutes.
- RM7838C with ST7800C Purge Timer provides 15 purge timing options from 7 seconds to 45 minutes.

NOTE: The ST7800A Purge Timer will not fit in the RM7838C and the ST7800C Purge Timer will not fit in the RM7838B.

- Closing the burner control switch starts the recirculating/exhaust blower. PURGE sequence begins when power is applied to the RM7838B,C through the recirculating/exhaust blower airflow switch, Stop Station, and the limit string to terminal 6. The Run/Test switch and all microcomputer-monitored circuits must also be in the correct operating state.
- The RM7838B,C Relay Module commands the firing rate motor to the high purge rate position by closing a circuit between terminals 12 and 13. PURGE timing begins when the High Fire Switch closes, providing input to terminal 19. Four minutes, 15 seconds are provided for the High Fire Switch to close. A jumpered High Fire Switch adds 30 seconds to the PURGE timing.
- Valve Proving Tests are conducted in Before, Split, or Both Valve Proving option is selected. The RM7838B,C will sequence the Main Valves to conduct the VP tests concurrently with Prepurge (beginning 10 seconds into purge).
 - Some applications exist that do not use combustion airflow switch to power terminal 7. Power is available on terminal 7 at the same time

terminal 6 is powered, either through lockout interlock switches or just a jumper. Leave JR3 intact (as received) for these applications.

- Systems using a combustion blower (connected to terminal 5) require the Combustion Airflow Switch to close, powering terminal 7. Remove JR3. The RM7838B,C will energize the Combustion Blower (terminal 5) to conduct the VP testing. If purging time is remaining, terminal 5 will be turned Off.

When the VP testing is complete, the prepurge timing will be displayed where it is at and complete purge. If purge timings are complete the dampers will be moving to the low fire position.

- The Pre-Ignition Interlocks must remain closed throughout Prepurge (except during valve testing), otherwise the RM7838B,C will lockout.
- When the PURGE timing is complete, the RM7838B,C commands the firing rate motor to the low fire position by closing a circuit between terminals 13 and 14. Four minutes, 15 seconds are provided for the motor to reach the low fire position.
- When the Low Fire Proving Switch is proven (input on terminal 18), the RM7838B,C commands the Combustion Blower to turn on through terminal 5. A jumpered Low Fire Switch adds 30 seconds to the PURGE timing.
- Five seconds are provided for the Combustion Blower Airflow Switch at terminal 7 to close and stabilize. Safety shutdown occurs if the Combustion Blower Airflow Switch does not close or if it opens during ignition trials or RUN.
- The RM7838B,C waits indefinitely for the Start Input to terminal 21. If Start Input is on, the RM7838B,C will hold 60 seconds, then go to a lockout.
- The Alarm is powered during PURGE timing (RM7838B only).

Ignition Trials

Ignition trials begin when the momentary Start input is received at terminal 21 of the RM7838B,C

- Pilot Flame Establishing Period (PFEP):
 - When the PFEP begins:
 - The pilot valve and ignition transformer, terminals 8 and 10, are energized.
 - Five seconds into PFEP, Ignition terminal 10 is de-energized.
 - Flame must be proven by the end of the ten-second PFEP (four seconds if Configuration Jumper JR1 is clipped) to allow the sequence to continue. If a flame is not proven by the end of PFEP, a safety shutdown occurs.
 - During PFEP, the Low Fire Switch must remain closed. If it opens, a safety shutdown occurs.
 - The Preignition Interlock input is ignored throughout the Ignition Trial state.
 - The RM7838B alarm output stops when flame is proven.
 - The RM7838B automatically sequences to Main Flame Establishing Period (MFEP).
- Main Flame Establishing Period (MFEP):

- a. Configuration jumper JR2 intact:
 - (1) Main valve terminals 9 and 17 are energized.
 - (2) After a 10 second (15 second for RM7838C) MFEP, the RM7838 is in Run with the Pilot Valve (terminal 8) energized.
- b. If configuration jumper JR2 is clipped.
 - (1) RM7838B - 10 seconds after terminals 9 and 17 are energized, the pilot valve terminal 8 is de-energized.
 - (2) RM7838C - 15 seconds after terminals 9 and 17 are energized, the pilot valve, terminal 8 is de-energized.
- c. If the flame signal is lost during the MFEP, safety shutdown occurs and the ALARM sounds.

Run

1. The RM7838B,C releases the firing rate motor to modulation (terminals 13 and 15 are closed).
2. The RM7838B,C is now in RUN and remains in RUN until the controller input, terminal 6, opens (burner control opens, Stop Switch is pushed, running interlocks open, a limit opens). The gas valves and combustion fan are de-energized. (Unless Postpurge option is chosen or VPS test is "Both" or "Split.")
3. The Pre-Ignition Interlock must close five seconds after terminal 6 opens or a lockout will occur. (Will be ignored during Valve On time if VPS option is chosen.)
4. The RM7838B,C will now begin the next purge time cycle.

Postpurge

If configured, the RM7838B,C will complete a Postpurge immediately following the terminal 6 interruption. The Pre-Ignition Interlock (terminal 20) must close within five seconds if a safety lockout occurs. Upon completion of the Postpurge, the RM7838B,C will conduct the next purge cycle. VP, if Both, Split, or After are configured, will run concurrent with Postpurge. If no Postpurge, VP will complete before starting the next purge cycle. Note the combustion blower (terminal 5) will remain energized until VP is complete.

Run/Test Switch

The Run/Test Switch is located on the top side of the RM7838B,C, see Fig. 25. The Run/Test Switch allows the burner sequence to be altered as follows:

1. In Prepurge Drive to High Fire position, the Run/Test Switch, when placed in the TEST position, holds in PURGE with the firing rate motor in the High Fire position.
2. In the measured PURGE sequence, the Run/Test Switch, when placed in the TEST position, causes the PURGE timing to stop. The firing rate motor is in the High Fire position.
3. In Purge Drive to Low Fire position, the Run/Test Switch, when placed in the TEST position, holds the burner sequence in PURGE 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, allowing pilot-turn-down test and other burner adjustments to be made.

This activates a 15 second flameout timer that permits pilot flame adjustment without nuisance safety shutdowns.

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 the RM7838B,C 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 RM7838B,C has a two site-configurable jumper option; see Fig. 27 and Table 8. If necessary, clip the site-configurable jumper with side cutters and remove the resistors from the Relay Module.

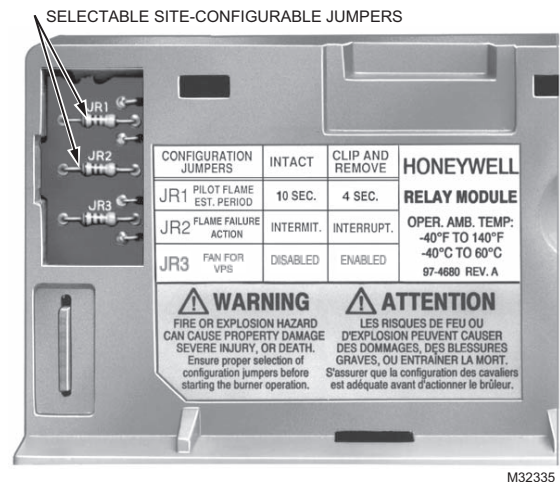


Fig. 27. Selectable site-configurable jumpers.

Table 8. Site Configurable Jumper Options.

Jumper Number	Description	Intact	Clipped
JR1	Pilot Flame Establishing Period (PFEP)	10 seconds	4 seconds
JR2	Pilot Type	Intermit.	Interrupt.
JR3	Fan for VPS	Disabled	Enabled

JR3 applies when Before, Split, or Both VP feature is enabled on the RM7838B,C.

To conduct Valve Proving during purge, power on terminal 7 is required.

- Some applications exist that do not use combustion blowers, so power is available on terminal 7 at the same time as terminal 6, either through lockout interlock switches or just a jumper. For these applications leave JR3 intact (Disabled).
- Applications using the Combustion Blower (terminal 5) clip JR3. This enables the RM7838B,C to turn On the Combustion Blower (terminal 5) 10 seconds after the High Purge Switch (terminal 19) closes. When the Combustion Airflow Switch closes, Valve Proving testing will begin. The Combustion Blower (terminal 5) will be turned Off if time is still remaining on the Purge timer.

SERVICE NOTE: Clipping and removing a site-configurable jumper enhances the level of safety.

IMPORTANT

Clipping and removing a site-configurable jumper after 200 hours of operation results in a nonresettable Fault 110 and a lockout.

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 9 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 9 to identify fault code numbers, possible system failure and recommended troubleshooting procedures.

Table 9. Blinking Fault Codes and Recommended Troubleshooting.

Blink Code	System Failure	Recommended Troubleshooting
Code 1-1 *Low AC Line Voltage*	Low AC line detected.	<ol style="list-style-type: none"> 1. Check the relay module and display module connections. 2. Reset and sequence the Relay Module. 3. Check the 7800 power supply and make sure that frequency and voltage meet specifications. 4. Check the backup power supply, as appropriate.
Code 1-2 *AC Quality Problem*	Excessive noise or device running on slow, fast, or AC line dropout detected.	
Code 2-1 *Unexpected Flame Signal*	Flame sensed when no flame is expected during STANDBY or PURGE.	<ol style="list-style-type: none"> 1. Check that flame is not present in the combustion chamber; correct any errors. 2. Make sure that the flame amplifier and flame detector are compatible. 3. Check the wiring and correct any errors. 4. Remove the flame amplifier and inspect its connections. Reseat the amplifier. 5. Reset and sequence the relay module. 6. If the code reappears, replace the flame amplifier and/or the flame detector. 7. If the fault persists, replace the relay module.
Code 2-2 *Flame Signal Absent*	No-flame time present at the end of the Pilot Flame Establishing Period; lost during the Main Flame Establishing Period or during RUN.	<ol style="list-style-type: none"> 1. Measure the flame signal. If one exists, verify that it meets specifications. 2. Make sure that the flame amplifier and flame detector are compatible. 3. Inspect the main fuel valve(s) and valve connection(s). 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. 5. Inspect the Airflow Switch and make sure that it is functioning properly. 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. 7. Replace the flame amplifier and/or the flame detector, if necessary. 8. If the fault persists, replace the relay module.

Table 9. Blinking Fault Codes and Recommended Troubleshooting. (Continued)

Blink Code	System Failure	Recommended Troubleshooting
Code 2-3 *Flame Signal Ovrerrange*	Flame signal value is too high to be valid.	<ol style="list-style-type: none"> 1. Make sure the flame detector and flame amplifier are compatible. 2. Remove the flame amplifier and inspect its connections. Reset the flame amplifier. 3. Reset and sequence the relay module. 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. 5. If the code reappears, replace the flame amplifier and/or the flame detector. 6. If the fault persists, replace the relay module.
Code 3-1 *Running/Interlock Switch Problem*	Running or Lockout Interlock fault during Prepurge.	<ol style="list-style-type: none"> 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 Prepurge (place the TEST/RUN Switch in the TEST position, if available). Measure the voltage between terminal 7 and G (ground); 120 Vac 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.
Code 3-2 *Running/Interlock On During Standby*	Lockout Interlock powered at improper point in sequence or On in Standby.	<ol style="list-style-type: none"> 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 120 Vac 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 120 Vac 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*	VPS (Valve Proving Switch) in wrong state during VPS Test.	<ol style="list-style-type: none"> 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*	No purge card or the purge card timing has changed from the original configuration.	<ol style="list-style-type: none"> 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/Inter nal Fault*	Pilot (ignition) valve terminal, main valve, ignition or Main Valve 2 was on when it should be off.	<p>⚠ WARNING Electrical Shock Hazard; Fire or Explosion Hazard. Can cause severe injury, death or property damage. Remove system power and turn off power supply.</p> <ol style="list-style-type: none"> 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.

Table 9. Blinking Fault Codes and Recommended Troubleshooting. (Continued)

Blink Code	System Failure	Recommended Troubleshooting
Code 4-3 *Flame Amplifier Problem*	Flame not sensed, or sensed when it should be on or off.	<ol style="list-style-type: none"> 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 code reappears, replace the flame amplifier and/or the flame detector. 6. If the fault persists, replace the relay module.
Code 4-4 *Configuration Jumper Problem*	The configuration jumpers differ from the sample taken at startup.	<ol style="list-style-type: none"> 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 *Preignition Interlock*	Preignition Interlock fault.	<ol style="list-style-type: none"> 1. Check wiring and correct any errors. 2. Check Preignition Interlock switches to assure proper functioning. 3. Check fuel valve operation. 4. Reset and sequence the relay module; monitor the Preignition Interlock status. 5. If the fault persists, replace the relay module.
Code 5-2 *High Fire Sw. or Low Fire Sw.*	Either High Fire Switch or Low Fire Switch failure.	<ol style="list-style-type: none"> 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.
Code 5-3 *Man-Open Sw.; Start Sw. or Control On*	Man-Open Switch, Start Switch or Control On in the wrong operational state.	<ol style="list-style-type: none"> 1. Check wiring and correct any errors. 2. Make sure that the Manual Open Valve Switch, Start Switch and Control are operating properly. 3. Stat Switch held "On" too long. 4. Reset and sequence the relay module. 5. Reset and sequence the relay module. If the fault persists, replace the relay module (RM7838A1014; RM7838B1013 or RM7838C1004 only).
Code 6-1 *Internal Faults*	Relay Module self-test failure.	<ol style="list-style-type: none"> 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 *Internal Faults*	Relay Module Self-Test failure.	<ol style="list-style-type: none"> 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 *Device Specific*	Fault with special OEM input circuits.	<ol style="list-style-type: none"> 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 *Accessory Fault*	Unused at this time.	—
Code 7-7 *Unused*	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.

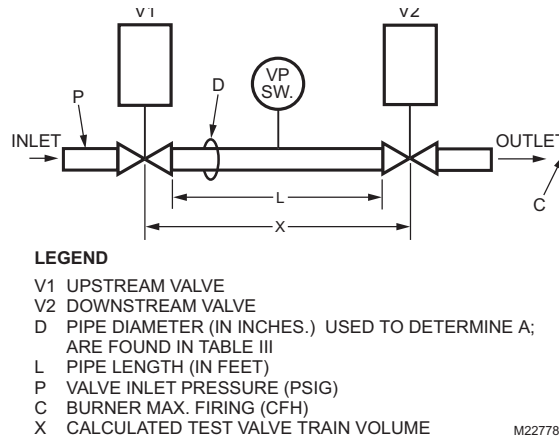
The following steps are to determine the test time for the relay module to verify the valve seats are not leaking at a rate of greater than/equal to 0.1% of the burner capacity.

Fig. 28 shows a typical valve train. The legend identifies information that will be used to fill out the worksheet that appears at the end of this appendix.

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.



M22778

Fig. 28. Typical valve train layout.

3. Use appropriate Results column items to fill in the Valve Train Volume Formula and the Calculation of Valve Proving Test Time.
4. Round up the time to the nearest second.
5. The test time calculated is the time you will enter into the VPS Setup.

Calculation of Valve Train Volume

$$X = V1 + V2 + (A \times L / 144)$$

Calculation of Valve Proving Test Time

$$\text{Test Time} = 187,000 \times (P \times X) / C$$

Table 10. Valve Proving Test Time Symbols and Descriptions.

Symbol	Unit	Description
X	ft ³	Volume between the two valves to be tested.
V ₁	ft ³	Volume of upstream valve outlet cavity.
V ₂	ft ³	Volume of downstream valve inlet cavity.
L	ft	Length of pipe between valves.
D	npt	Pipe Size—used to define A
A	in. ²	Pipe Cross Section Area (from Table III)
Test Time	Seconds	Minimum VPS test period.
P	psi	Gas inlet pressure to upstream valve.
C	ft ³ /hr	Burner Capacity.

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

For Example:

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

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 11. VPS Worksheet Example.

Item	Description	Information	Lookup Table	Results	Formula Item
V1	Upstream Valve Volume	V5055	12	0.0218	V1
V2	Downstream Valve Volume	V4295	13	0.0267	V2
D	Pipe Size NPT (in.)	2 in. NPT	14	3.356	A
L	Pipe Length (ft)	1.75 ft	—	1.75	L
P	Valve Inlet Pressure (psig) ^a	2	—	2	P
C	Burner Maximum Firing (cf/hr) ^b	2.5 mbtu	—	2500	C

^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.

Calculation of Valve Train Volume:

Test Time = 187,000 x (P x X ÷ C)

$$X = V1 + V2 + (A \times L \div 144)$$

$$\text{Test Time} = 187,000 \times (2 \times 0.0893 \div 2500) = 13.4 \text{ secs.}$$

$$X = 0.0218 + 0.0267 + (3.356 \times 1.75 \div 144) = 0.0893.$$

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

Calculation of Valve Proving Test Time:

Table 12. V1 Upstream Volumes for Honeywell Valves.

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

Table 13. V2 Downstream Volumes for Honeywell Valves.

Pipe Size NPT (inches)	V4295	V4297A1013	V4297A1005	V48	V5055	V5097A1004	V5097A1012
3/8	0.0011	—	—	—	—	—	—
1/2	0.0011	—	—	—	—	—	—
3/4	0.0026	0.0282	0.0232	0.0048	0.0067	0.0093	—
1	0.0036	0.0282	0.0232	0.0048	0.0067	0.0093	—
1-1/4	0.0148	0.0282	0.0232	0.0110	0.0067	0.0093	—
1-1/2	0.0148	0.0282	—	0.0110	0.0238	0.0093	—
2	0.0267	0.0282	—	0.0184	0.0238	0.0093	0.0303
2-1/2	0.0554	—	—	0.0184	0.0245	—	0.0303
3	0.0554	—	—	0.0184	0.0245	—	0.0303
4	—	—	—	—	0.0801	—	—

Table 14. Schedule 40 Pipe Internal Cross-Sectional Area.

Pipe Size NPT (Inches)	Cross-Sectional Area (Sq. In.) "A"
3/8	0.191
1/2	0.304
3/4	0.533
1	0.864
1-1/4	1.498
1-1/2	2.036

Pipe Size NPT (Inches)	Cross-Sectional Area (Sq. In.) "A"
2	3.356
2-1/2	4.788
3	7.393
4	12.730

Table 15. VPS Worksheet.

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

^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.

SAFETY AND SECURITY

Physical device protection

Device shall be accessible to authorized personnel only – Installation on publicly accessible places is not recommended as this could lead to unwanted and potentially unsafe changes to device (wiring, configuration, etc).

It is recommended to lock the device in an enclosed cabinet with access allowed only to approved and trained personnel. Also, it is strongly advised to keep all the wiring of device physically secure.

Physical protection of the device is applied via Run/Test switch label/seal. It is intended to prevent and detect unauthorized access.

Modbus & DDL Interface security

Any conducts critical to device functionality (DDL, Modbus lines etc.) shall be physically protected (installed outside public access) since they could be damaged or tampered-with by unauthorized people, either accidentally or for purpose.

Modbus RS-485 & DDL protocols do not support security features. For DDL interface - only DDL devices shall be connected to the Burner Controller DDL line.

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For More Information

The Honeywell Thermal Solutions family of products includes Honeywell Combustion Safety, Eclipse, Exothermics, Hauck, Kromschröder and Maxon. To learn more about our products, visit ThermalSolutions.honeywell.com or contact your Honeywell Sales Engineer.

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