7800 SERIES
RM7800L,M Relay Modules

PRODUCT DATA

GENERAL

The RM7800 is a microprocessor based integrated burner control for automatically fired gas, oil, or combination fuel single burner applications. The RM7800 consists of a Relay Module and Keyboard Display Module. Subbase, Amplifier, and Purge Card are required to complete the system. Options include Personal Computer Interface, Data ControlBus™ Module*, Remote Display Mounting, First-Out Expanded Annunciator and Combustion System Manager™* Software.

The RM7800 is programmed to provide a level of safety, functional capability and features beyond the capacity of conventional controls.

Functions provided by the RM7800 include automatic burner sequencing, flame supervision, system status indication, system or self-diagnostics and troubleshooting.

FEATURES

- **Safety Features:**
  - Interlock check.
  - Closed loop logic test.
  - Dynamic input check.
  - Dynamic safety relay test.
  - Dynamic self-check logic.
  - Expanded safe-start check.
  - High Fire Purge Switch test.
  - Internal hardware status monitoring.
  - Low Fire Start Switch test.
  - Tamper resistant timing and logic.
- **Access for external electrical voltage checks.**
- **Application flexibility.**
- **Communication interface capability.**
- **Dependable, long-term operation provided by microcomputer technology.**
- **First-out annunciation and system diagnostics provided by a 2 row by 20 column Vacuum Fluorescent Display (VFD) located on the Keyboard Display Module.**
- **First-out expanded annunciation with 26 Light Emitting Diodes (LEDs) for limits and interlocks (optional).**

Contents

SIL3 Capable

32-00120-01

- **Five sequence information Light Emitting Diodes (LEDs).**
- **Five function Run/Test Switch.**
- **Interchangeable plug-in flame amplifiers.**
- **Local or remote annunciation of operation and fault information.**
- **Nonvolatile memory for retaining history files and sequencing status after loss of power.**
- **Remote reset (optional).**
- **Report generation (optional).**
- **Burner controller data:**
  - Sequence status.
  - Sequence time.
  - Hold status.
  - Lockout/alarm status.
  - Flame signal strength.
  - Expanded annunciator status.
  - Total cycles of operation.
  - Total hours of operation.
  - Fault history of six most recent faults:
    - Cycles of operation at time of fault.
    - Expanded annunciator data at time of fault.
    - Fault message and code.
    - Hours of operation at time of fault.
    - Sequence status at time of fault.
    - Sequence time at time of fault.
  - Diagnostic information:
    - Device type.
    - Flame amplifier type.
    - Flame failure response time.
    - Manufacturing code.
    - On/Off status of all digital inputs and outputs.
    - Selected prepurge time.
    - Software revision and version of RM7800 and Keyboard Display Module.
    - Status of configuration jumpers.
    - Status of Run/Test Switch.

SPECIFICATIONS

Electrical Ratings:
Voltage and Frequency: 120 Vac (+10/-15%), 50/60 Hz (±10%).
Keyboard Display Module: 13 Vdc peak full wave rectified (+20/-15%).
Power Dissipation:
RM7800: 10W maximum.
Display Module: 3W maximum.
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 +40°C).
Storage: -40°F to +150°F (-40°C to +66°C).
Humidity: 85% RH continuous, noncondensing.
Vibration: 0.5G environment.

Dimensions: Refer to Figs. 1 and 2.

Weight:
RM7800: 1 pound 13 ounces, unpacked.
Keyboard Display Module: 4 ounces, unpacked.

IMPORTANT:
Flame Detection System available for use with RM7800. To select your Plug-in Flame Signal Amplifier and matching Flame Detector, see Table 1.

Approvals:
Underwriters Laboratories Inc. listed, File No. MP268, guide No. MCCZ.
Factory Mutual approved, Report No. J.I.1V9A0.AF.
IRI acceptable.
Federal Communications Commission, Part 15, Class B—Emissions.

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

Mounting: Q7800A for panel mount.

Required Components:
Plug-in Flame Signal Amplifier, see Table 1.
Plug-in Purge Timer Cards; selectable ST7800A: two seconds to 30 minutes.
Q7800 Universal Wiring Subbase.

Accessories:
Optional:
ControlBus 5-Wire Electrical Connector—part no. 203541.
Combustion System Manager™—part no. ZM7850A1001.
Communication Interface Base Unit—part no. Q7700A1014.
Communication Interface ControlBus Module—part no. QS7800A1001.
Data ControlBus Module™—part no. S7810A1009.
Expanded Annunciator—part no. S7830A1005.
Flame Simulators:
—part no. 203659 UV Flame Simulator.
—part no. 123514A Rectification Simulator.
Remote Display Mounting Bracket—part no. 203765.
Remote Display Power Supply (13 Vdc)—part no. 203968A Plug-In.
Sixty-inch Extension Cable Assembly—part no. 221818A.
120-inch Extension Cable Assembly—part no. 221818C.
Tester—part no. A7800A1002.
Data ControlBus Module™ Multi-Drop Switch Module—part no. S7810B1007.
Data ControlBus Module™ ModBus Module—part no. S7810M1008.

Table 1. Flame Detection Systems (Figs. 3, 4, 5).

Plug-in Flame Signal Amplifiers					Applicable Flame Detectors		
Type	**Color**	**Self-Checking**	**Model**	**Flame Failure Response Time**	**Fuel**	**Type**	**Models**
Rectification	Green	No	R7847A	3 sec	Gas	Rectifying Flame Rod[a] Holder	C7004, C7007, C7011. Complete Assemblies: C7008, C7009, Q179.
					Gas, oil, coal	Ultraviolet (Purple Peeper™)	C7012A,C.[b]
Ultraviolet	Purple	No	R7849A	3 sec	Gas, oil	Ultraviolet (Minipeeper™)	C7027, C7035, C7044.[b]

[a]Order Flame Rod separately; see instructions for the holder.

[b]The C7012A,C; C7027, C7035 and C7044 Flame Detectors should be used only on burners that cycle on-off at least once every twenty-four hours.

Table 3 provides sequence timing for normal operation.

Table 2. Sequence Timing for Normal Operation.

Device	Initiate	Standby	Purge	Flame Establishing Period		Run	Post-Purge Timing	Interlock Circuits	Firing Rate Circuit	Energy-Saving Prepurge	Approval Code Bodies
				Pilot	Main[c]						
RM7800L	10 sec.	a	b	4 or 10 sec.	10 or 15 sec.	a	15 sec.	Preignition, Lockout, High and Low Fire	4-wire modulating	No	FM/IRI Modulating
RM7800M	10 sec.				10 sec. or Intermittent			Preignition, Running, Low Fire	2-wire isolated On-Off-On contacts		UL/CSA On/Off

[a] STANDBY and RUN can be an infinite time period.

[b] PURGE will be determined by which ST7800A purge card is selected.

[c] The MFEP will be determined by which terminal is used, configuration jumper selected or jumper wire added, see Figs. 7, 8 and 25.

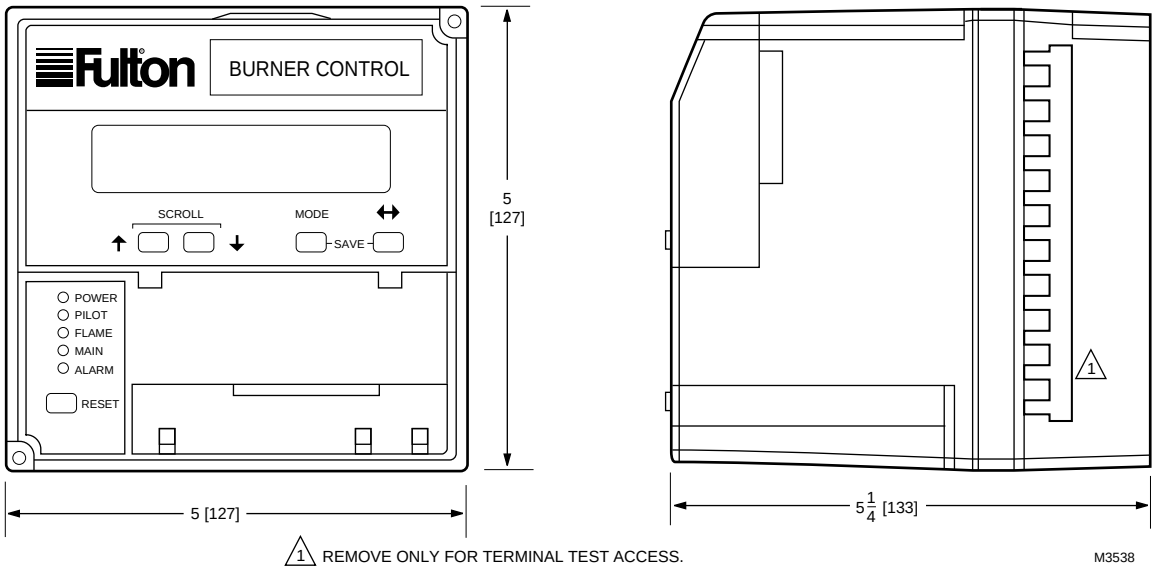


Fig. 1. Mounting dimensions of RM7800 Relay Module and Q7800 Subbase in in. (mm).

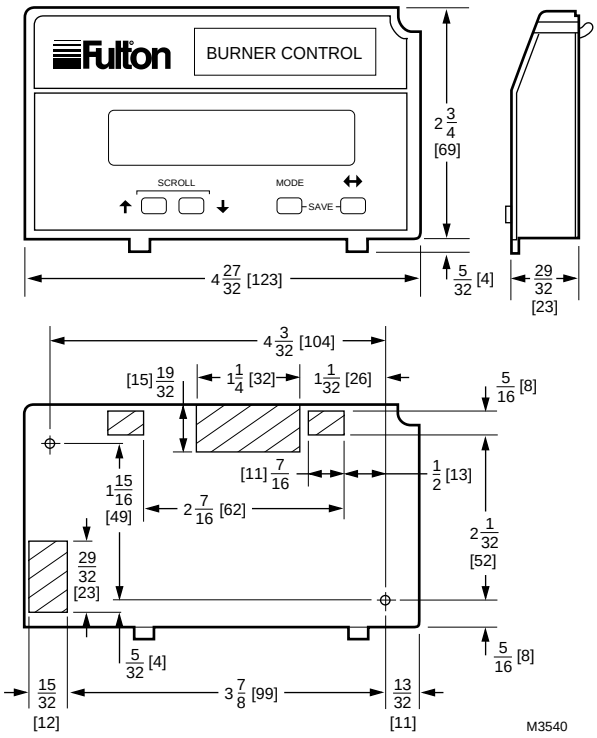


Fig. 2. Mounting dimensions of Keyboard Display Module in in. (mm).

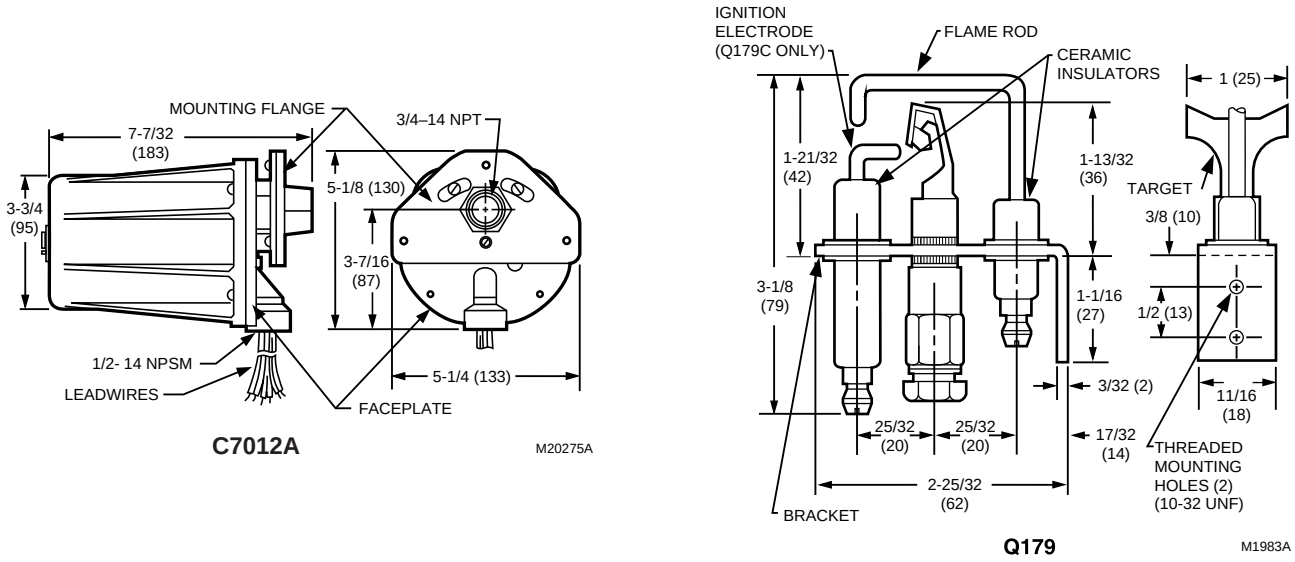


Fig. 3. Rectification detectors.

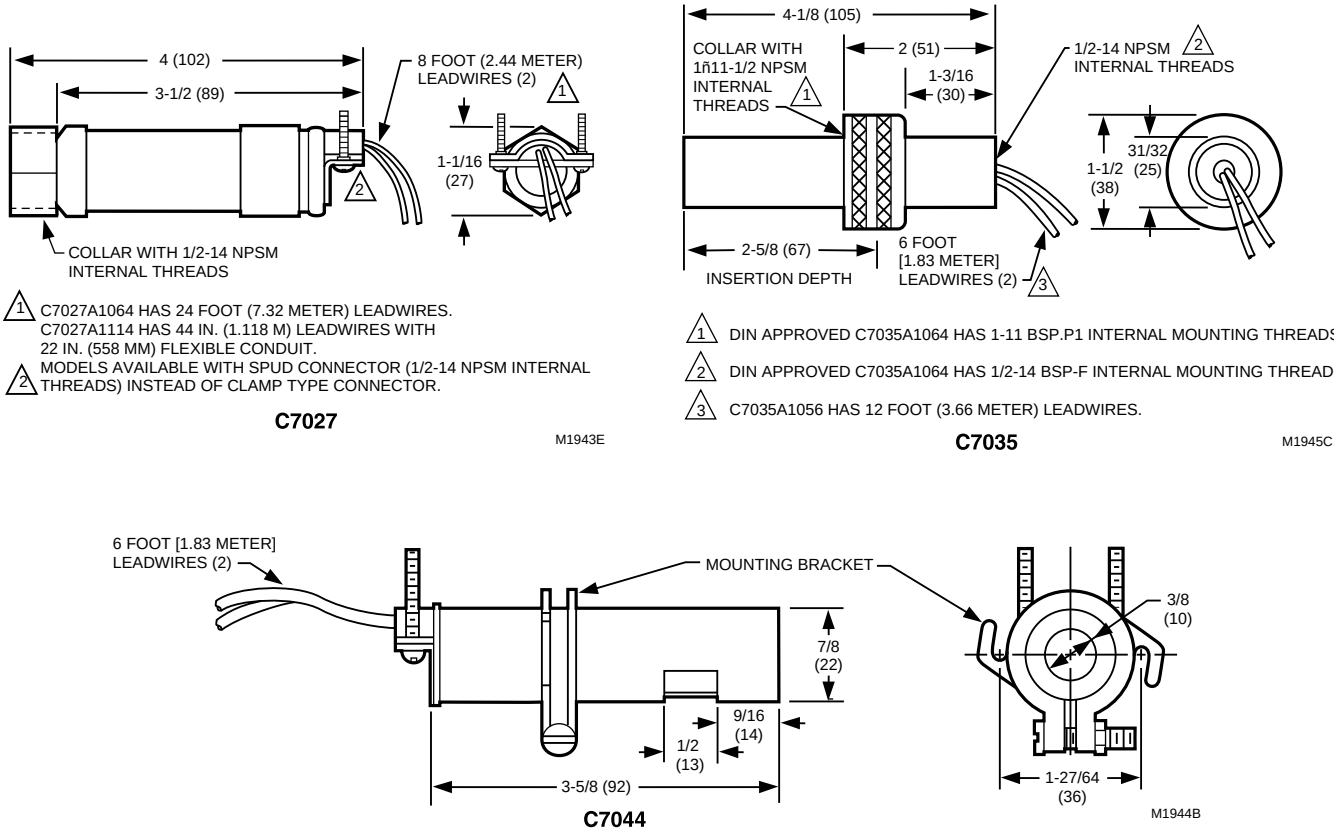


Fig. 4. Ultraviolet detectors.

PRINCIPAL TECHNICAL FEATURES

The RM7800 provides all customary flame safeguard functions while providing significant advancements in the areas of 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).
   d. AC line power errors, see Operation.
   e. Four minute INITIATE period is exceeded.
2. STANDBY Period
   a. Flame signal is present after 40 seconds.
   b. Preignition Interlock is open an accumulative time of 30 seconds.
   c. Interlock check feature is enabled and the Interlock String (including the airflow switch) is closed for 120 seconds with controller closed.
   d. Ignition/pilot valve/intermittent pilot valve terminal is energized.
   e. Main valve terminal is energized.
   f. Internal system fault.
   g. Purge card is not installed or removed.
   h. Purge card is bad.
3. PREPURGE Period
   a. Preignition Interlock opens anytime during Prepurge (RM7800L).
   b. Flame signal detected after first ten seconds during prepurge (RM7800L).
   c. High Fire Switch fails to close within four minutes, fifteen seconds after the firing rate motor is commanded to drive to high fire position at start of prepurge (RM7800L).
   d. Low Fire Switch fails to close within four minutes, fifteen seconds after firing rate motor is commanded to drive to low fire position at end of prepurge.
   e. Running Interlock does not close within 30 seconds (RM7800M).
   f. Lockout Interlock does not close within ten seconds (RM7800L).
   g. Lockout Interlock opens during prepurge (RM7800L).
   h. Ignition/pilot valve/intermittent pilot valve terminal is energized.
   i. Main valve terminal is energized.
   j. Internal system fault.
   k. Purge card is removed.
   l. Purge card is bad.

4. PILOT FLAME ESTABLISHING Period (PFEP)
   a. Low Fire Switch opens.
   b. Lockout Interlock opens (RM7800L).
   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 end of PFEP.
   f. Main valve terminal is energized (RM7800M).
   g. Internal system fault.
   h. Purge card is removed.
   i. Purge card is bad.
5. MAIN FLAME ESTABLISHING Period (MFEP)
   a. Low Fire Switch opens.
   b. Lockout Interlock opens (RM7800L).
   c. Ignition/pilot valve/intermittent 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.
6. RUN Period
   a. No flame is present.
   b. Lockout Interlock opens (RM7800L).
   c. Interrupted pilot valve terminal is energized (RM7800M).
   d. Main valve terminal is not energized.
   e. Internal system fault.
   f. Purge card is not installed or removed.
   g. Purge card is bad.
7. POSTPURGE Period
   a. Preignition Interlock does not close within five seconds or opens after five-second time period.
   b. Ignition/pilot valve/intermittent pilot valve terminal is energized.
   c. Main valve terminal is energized.
   d. Internal system fault.
   e. Purge card is removed.
   f. Purge card is bad.

SAFETY PROVISIONS

Internal Hardware Status Monitoring

The RM7800 checks the purge card for correct parity to prevent purge timing shifts and circuitry failures. It also analyzes the integrity of the configuration jumpers and internal hardware. The Power LED blinks every four seconds, signifying an internal hardware check.

Closed Loop Logic Test

The test verifies the integrity of all safety critical loads, terminals 8, 9, 10 and 21. If the loads are not energized properly; i.e., the main valve terminal is powered during prepurge, the RM7800 will lockout on safety shutdown. The RM7800 must react to input changes but avoid the occurrence of nuisance shutdown events. Signal conditioning is applied to line voltage inputs to verify proper operation in the presence of normal electrical line noise such as transient high voltage spikes or short periods of line dropout. Signal conditioning is tolerant of synchronous noise (line noise events that occur at the same time during each line cycle).

Dynamic Flame Amplifier and Shutter Check

Self-checking circuitry tests all electronic components in the flame detection system and amplifier 10 to 12 times per minute and shuts down the RM7800 if the detection system fails.

Dynamic Input Check

All system input circuits are examined to verify the RM7800 is capable of recognizing the true status of external controls, limits and interlocks. If any input fails this test, a safety shutdown occurs and the fault is annunciated.

Dynamic Safety Relay Test

Checks the ability of the dynamic safety relay contacts to open and close. It also verifies that the safety critical loads, terminals 8, 9, 10 and 21, can be de-energized, as required, by the Dynamic Self-Check logic.

Dynamic Self-Check Safety Circuit

The microcomputer tests itself and related hardware while at the same time the safety relay system tests the microcomputer operation. If a microcomputer or safety relay failure occurs and does not allow proper execution of the
self-check routine, safety shutdown will occur and all safety critical loads will be de-energized.

Expanded Safe-Start Check

The conventional safe-start check, which prevents burner start-up if flame is indicated at start-up, is expanded to include a flame signal check during STANDBY, a preignition interlock check, an interlock check, and a safety critical load check.

High Fire Purge and Low Fire Start Switch Tests

High Fire Purge Switch Test (RM7800L) examines the Purge Position Interlock Switch at the moment the firing rate motor is commanded to the high fire position. If the switch is bypassed, welded or otherwise closed prematurely, the system will automatically add 30 seconds to allow additional drive time for the firing rate motor to reach or near the open position before starting the purge timing; otherwise, purge timing starts when the High Fire Switch is closed. This switch will also cause a hold (four minutes, fifteen seconds) condition when the switch is open before purge or opens during purge. The RM7800L will lockout and annunciate an alarm if the switch fails to close within the hold time period.

Low Fire Start Switch Test examines the Low Fire Start Switch at the moment prepurge is completed. If the switch is bypassed, welded or otherwise prematurely closed, the

system automatically adds 30 seconds to allow the firing rate motor additional time to reach or near the low fire start position before ignition trials; otherwise, ignition trials start after the Low Fire Switch closes. The test also is used to prove that the firing rate motor is at low fire position throughout the ignition trial period. This switch will also cause a hold (four minutes, fifteen seconds) condition if the switch opens after purging is complete. The RM7800 will lockout and annunciate an alarm if the switch fails to close within the hold time period.

Mandatory Purge

If lockout occurs after the initiation of ignition trials, (or at anytime during a sequence when the fuel valves may have been energized), a mandatory postpurge period is imposed.

Off Cycle (Standby or Prepurge) Flame Signal Check

The flame detection subsystem (flame detector and amplifier) is monitored during STANDBY. If a flame simulating condition or an actual flame exists, a system hold occurs and start-up is prevented. If the flame signal exists at any time after the first 40 seconds of STANDBY, a safety shutdown will occur and be annunciated. A shutter-check amplifier and self-checking detector are energized for the first 40 seconds during STANDBY and the last two seconds before exiting STANDBY. If a flame exists, a safety shutdown occurs.

Preignition Output Circuit Check

At the end of prepurge, the Dynamic Safety Relay operation is checked. Also, all safety critical loads, terminals 8, 9, 10 and 21 are checked to verify the terminals are not powered. If the Dynamic Safety Relay operation is faulty, or if any of the safety critical loads are powered, safety shutdown occurs and is annunciated.

Tamper Resistant Timing and Logic

Safety and logic timings are inaccessible and cannot be altered or defeated.

Verified Spark Termination

The ignition terminal is monitored to verify early spark termination (five seconds ignition and pilot and five seconds pilot only).

First-Out Annunciation and Self-Diagnostics

Sequence Status Lights (LEDs) provide positive visual indication of the program sequence: POWER, PILOT, FLAME, MAIN and ALARM. The green POWER LED blinks every four seconds to signify the RM7800 hardware is running correctly.

Multi-function Keyboard Display Module shows elapsed time during prepurge, PILOT IGN, MAIN IGN, and postpurge. As an additional troubleshooting aid, it provides sequence timing, diagnostic information, historical information and expanded annunciator information when a safety shutdown or hold or normal operation occurs.

First-out Annunciation reports the cause of a safety shutdown or identifies the cause of a failure to start or continue the burner control sequence with an English text and numbered code via the Keyboard Display Module. It monitors all field input circuits, including the Flame Signal Amplifier and Firing Rate Position Switches. The system distinguishes 127 modes of failure and detects and annunciates difficult-to-find intermittent failures.

Self-Diagnostics adds to the First-out Annunciation by allowing the RM7800 to distinguish between field (external device) and internal (system related) problems. Faults associated within the flame detection subsystem, RM7800 or plug-in Purge Card, are isolated and reported by the Keyboard Display Module, see Troubleshooting section and 7800 SERIES System Annunciation Diagnostics and
Troubleshooting, form 65-0118.

Interlock Requirements

The following interlock inputs are provided:

Low Fire Interlock (RM7800 ALL)

This interlock verifies the firing rate motor is in the low fire position before and during ignition trials.

High Fire Interlock (RM7800L)

This interlock verifies the firing rate motor is in the high fire position prior to and during PREPURGE. If the High Fire Switch is jumpered on the RM7800E, the Energy Saving function will not be performed.

Running Interlock (RM7800M)

This interlock (ILK) input signifies a Running Interlock. If a Running Interlock is open at the beginning of PREPURGE, a 30 second hold condition is initiated. If 30 seconds elapse and the Running Interlock still has not closed, a lockout will occur. After entering PREPURGE, if the Running Interlock opens during the first ten seconds, the purge timer will be reset. This provides a continuous PURGE to occur without interruption before the Pilot Flame Establishing Period. If the Running Interlock opens after 10 seconds into PREPURGE, it will recycle back to the beginning of PREPURGE. If it opens anytime during the Ignition Trials or Run, it will proceed to POSTPURGE.

A typical Running Interlock string contains an airflow switch (see Fig. 7). The Interlock Check is a site configurable option (see Table 6). If this feature is enabled, the RM7800 will lockout after 120 seconds, whenever control terminal 6 is energized, and the Running Interlock string (including airflow switch) is closed during STANDBY.

Lockout Interlock (RM7800L)

This interlock (ILK) input signifies a Lockout Interlock. If the Lockout Interlock is open for more than ten seconds into PREPURGE, the RM7800L will lockout. After entering PREPURGE, if the Lockout Interlock opens during the first ten seconds, the purge timer will be reset. This provides a

continuous PURGE to occur without interruption before the Pilot Flame Establishing Period. If a Lockout Interlock opens anytime after ten seconds into PURGE, during the Ignition Trials or Run, it causes a lockout.

A typical Lockout Interlock string contains an airflow switch (see Fig. 6). The Interlock Check is a site configurable option (see Table 6). If this feature is enabled, the RM7800 will lockout after 120 seconds whenever control terminal 6 is energized, and the Lockout Interlock string (including airflow switch) is closed during STANDBY.

Preignition Interlock (RM7800 ALL)

The Preignition Interlock input is typically connected to proof-of-closure switches for fuel valve(s). The Preignition Interlock must be energized throughout PREPURGE. If the Preignition Interlock opens during STANDBY, it causes a hold (30 seconds). The RM7800 will lockout if the interlock does not close within 30 seconds during STANDBY. If the Preignition Interlock opens during PREPURGE, it will recycle to STANDBY (RM7800M) or will lockout (RM7800L). If the Preignition Interlock is open after five seconds into POSTPURGE, the RM7800 will lockout. The Preignition Interlock is ignored during the ignition trials state and during RUN.

INSTALLATION

⚠ WARNING

Fire or Explosion Hazard.
Can cause property damage, severe injury or death.
To prevent possible hazardous burner operation, verification of safety requirememts must be performed each time a control is installed on a burner.

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 safe-guard service technician.
4. After installation is complete, check out the product operation as provided in these instructions.

⚠ CAUTION

Equipment Damage Hazard and Electrical Shock Hazard.
Can cause property damage and injury.

1. Disconnect the power supply before beginning installation to prevent electrical shock, equipment and control damage. More than one power supply disconnect may be involved.
2. Wiring connections for the RM7800 are unique; therefore, refer to Fig. 6 through 11 or the correct Specifications for proper subbase wiring.
3. Wiring must comply with all applicable codes, ordinances and regulations.
4. Wiring, where required, must comply with NEC Class 1 (Line Voltage) wiring.
5. Loads connected to the RM7800 must not exceed those listed on the RM7800 label or the Specifications, see Table 6.
6. Limits and interlocks must be rated to simultaneously carry and break current to the ignition transformer, pilot valve, and main fuel valve(s).
7. All external timers must be listed or component recognized by authorities who have jurisdiction for the specific purpose for which they are used.

IMPORTANT:

1. *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).*
2. *Two Flame Detectors can be connected in parallel.*
3. *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.*
4. *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.*

Humidity

Install the RM7800 where the relative humidity never reaches the saturation point. The RM7800 is designed to operate in a maximum 85% RH continuous, noncondensing, moisture environment. Condensing moisture may cause a safety shutdown.

Vibration

Do not install the RM7800 where it could be subjected to vibration in excess of 0.5G continuous maximum vibration.

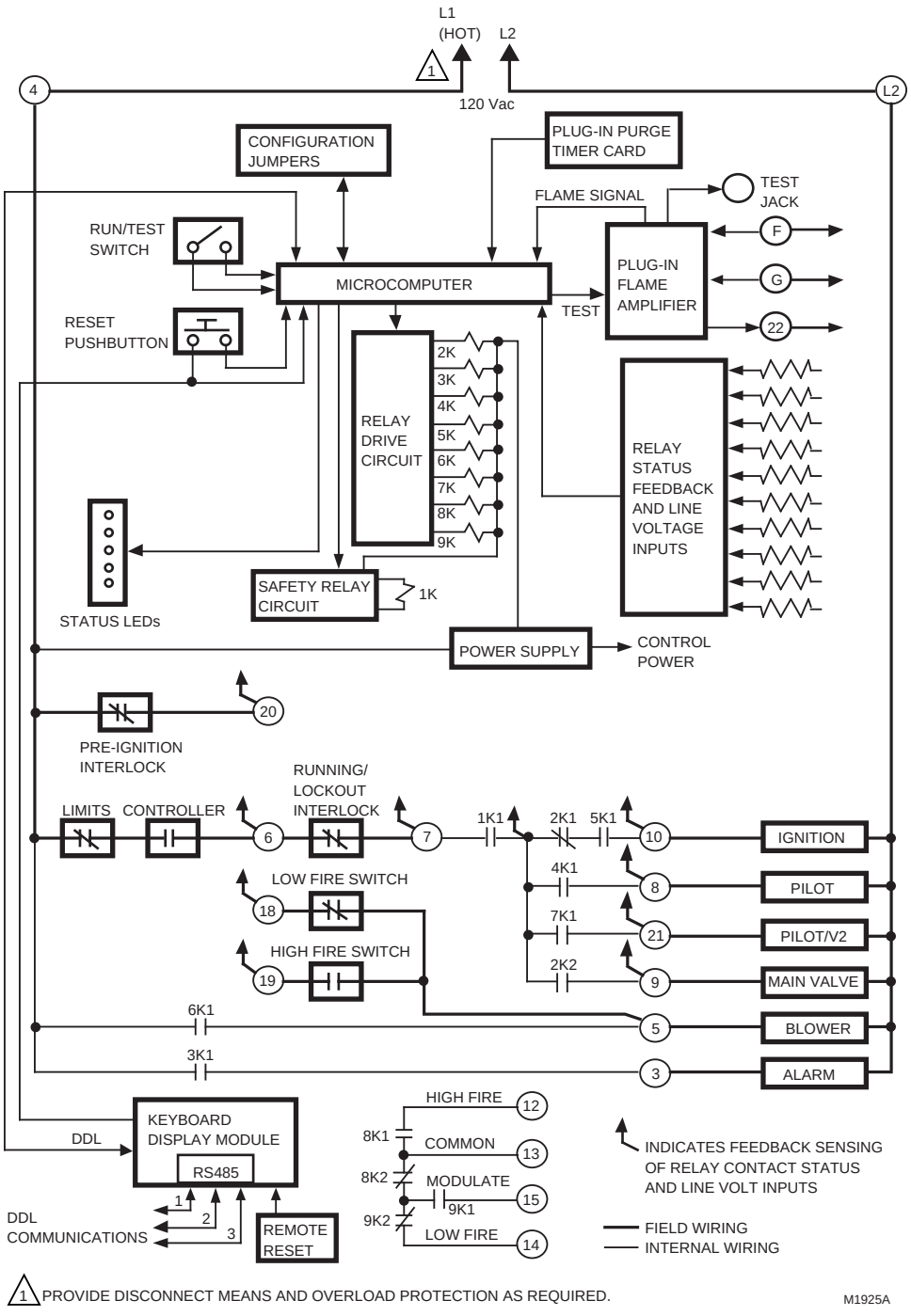


Fig. 5. Internal block diagram of the RM7800L (See Fig. 7, 8, 9, 10 or 11 for detailed wiring instructions).

Weather

The RM7800 is not designed to be weather tight. If installed outdoors, the RM7800 must be protected by an approved weather-tight enclosure.

Mounting Wiring Subbase

NOTE: For installation dimensions, see Fig. 1 and 2.

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 RM7800, 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

IMPORTANT

For proper subbase wiring, refer to Fig. 7 or 8.

For proper remote wiring of the Keyboard Display Module, refer to Fig. 9 through 11 or to the Specifications for the Keyboard Display Module (65-0090), Communication Interface Base Unit (63-2278), Data ControlBus Module™ (65-0091) or Extension Cable Assembly (65-0131).

NOTE: Part number 203541 5-Wire Connector (order separately) is required except when using the extension cable assembly.

⚠ 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 remote wiring of the Keyboard Display Module, refer to the Specifications for the Keyboard Display Module (65-0090), Network Interface Unit (63-2278), Data ControlBus Module™ (65-0091) or Extension Cable Assembly (65-0131).
2. 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.
3. All wiring must comply with all applicable electrical codes, ordinances and regulations. Wiring, where required, must comply with NEC, Class 1 (Line Voltage) wiring.
4. Recommended wire size and type: see Table 4.
5. Recommended grounding practices: see Table 5.
6. The Keyboard Display Module, Data ControlBus Module™ (for remote mounting or communications) or Communication Interface ControlBus Module 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. 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.
7. 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.

8. Maximum wire lengths follow:
   a. RM7800/RM7840 leadwires—The maximum length of leadwire is 300 feet to terminal inputs (Control, Preignition 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.
9. Make sure loads do not exceed the terminal ratings. Refer to the label on the RM7800/RM7840 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 RM7800. A separate power supply circuit may be required for the RM7800. Add the required disconnect means and overload protection.
2. Check all wiring circuits and complete the Static Checkout, see Table 12, before installing the RM7800 on the subbase.
3. Install all electrical connectors.

4. Restore power to the panel.

Table 3. Recommended Wire Sizes and Part Numbers.

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

Table 4. Recommended Grounding Practices.

Ground Type	Recommended Practice
Earth ground (subbase and relay module).	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 20A 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.
Signal ground (KDM, Data ControlBus Module™, Communications Interface ControlBus™ Module).	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.

Table 5. Terminal Ratings.

Terminal No.	Description	Ratings
G	Flame Sensor Ground[a]	—
Earth G	Earth Ground[a]	—
L2(N)	Line Voltage Common	—
3	Alarm	120 Vac, 1A pilot duty.
4	Line Voltage Supply (L1)	120 Vac (+10%/-15%), 50 or 60 Hz (±10%).[b]
5	Burner Motor	120 Vac, 9.8 AFL, 58.8 ALR (inrush).
6	Burner Controller and Limits	120 Vac, 1 mA.
7	Lockout/Running Interlock	120 Vac, 9A.
8	Pilot Valve/Ignition	120 Vac, 4.5A ignition and 50 VA pilot duty.[c]
9	Main Fuel Valve	120 Vac, 2A pilot duty.[d]
10	Ignition	120 Vac, 4.5A Ignition.[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	Unused	—
17	Unused	—
18	Low Fire Switch Input	120 Vac, 1 mA.
19	High Fire Switch Input	120 Vac, 1 mA.
20	Preignition Interlock Input	120 Vac, 1 mA.
21	Interrupted/Intermittent Pilot Valve/First Stage Oil Valve	120 Vac, 2A pilot duty.
22	Shutter	120 Vac, 0.5A.

.[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]Can also be 120 Vac, 1A pilot duty.

[d]Can also be 65 VA pilot duty with motorized valve, 1150 VA inrush, 460 VA open, 250 VA hold.

Table 6. Combinations for Terminals 8, 9, 10 and 21.

Combination No.	Pilot Fuel 8	Main 9	Ignition 10	Intermittent Pilot Valve 21
1	C	F	No Load	No Load
2	B	F	No Load	No Load
3	No Load	F	No Load	B
4	F	F	A	No Load
5	No Load	F	A	F
6	D	F	A	No Load
7	No Load	D	A	D
8	D	D	A	No Load
9	No Load	D	A	D

Table 7. Explanation of Each Combination.

A	B	C	D	F
4.5A ignition.	50 VA Pilot Duty plus 4.5A ignition.	180 VA ignition plus motor valve with: 660 VA inrush, 360 VA open, 260 VA hold.	2A Pilot Duty.	64 VA Pilot Duty plus motor valves with: 3850 VA inrush, 700 VA open, 250 VA hold.

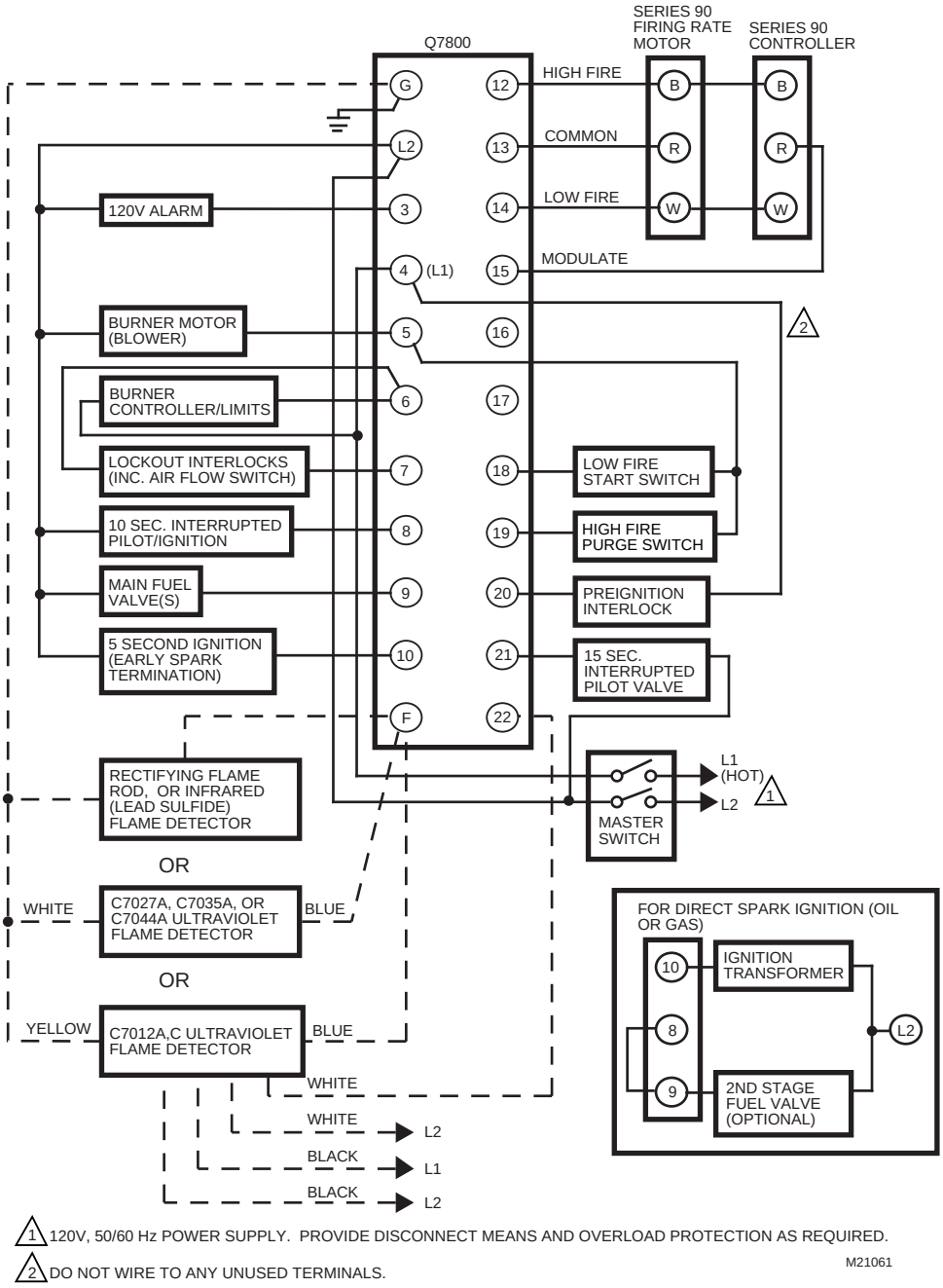
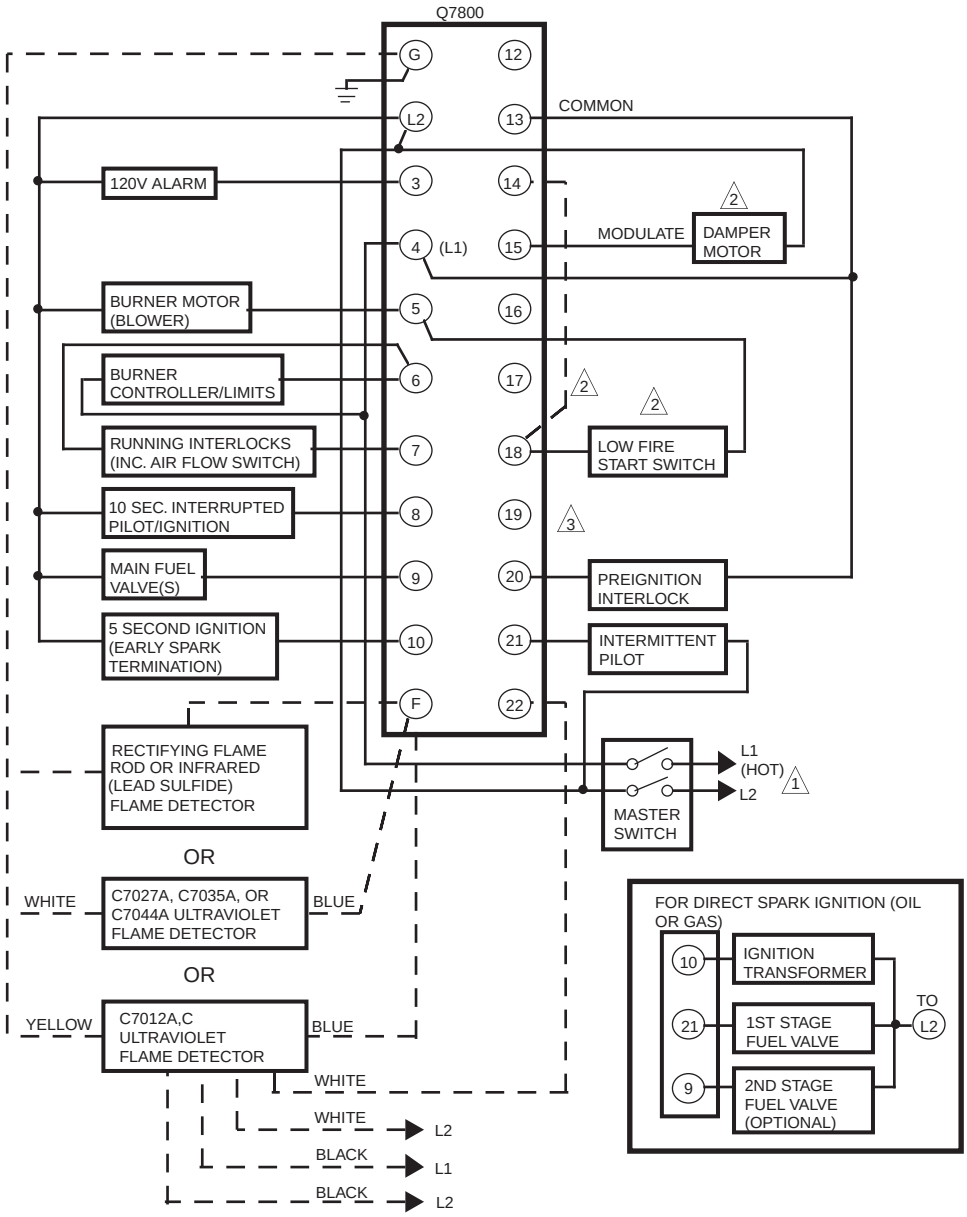


Fig. 6. Wiring RM7800L Relay Module.



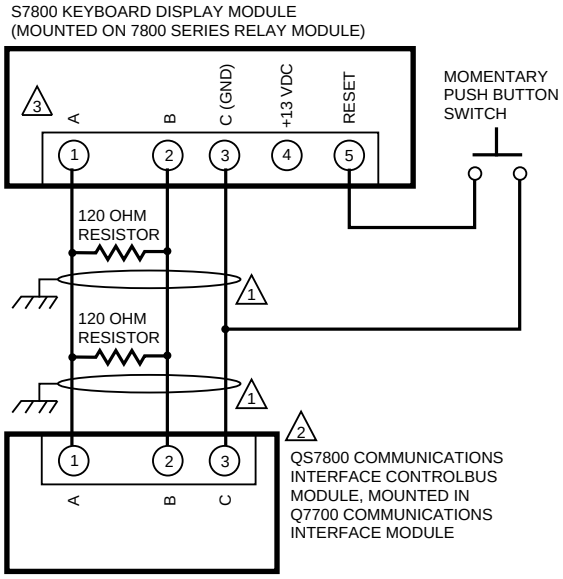
1 120V, 50/60 Hz POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.

2 WHEN NO DAMPER MOTOR OR LOW FIRE SWITCH IS USED, JUMPER TERMINAL 14 TO TERMINAL 18, AND DO NOT WIRE TERMINAL 15.

3 DO NOT WIRE TO ANY UNUSED TERMINALS.

M3541B

Fig. 7. Wiring RM7800M Relay Module.

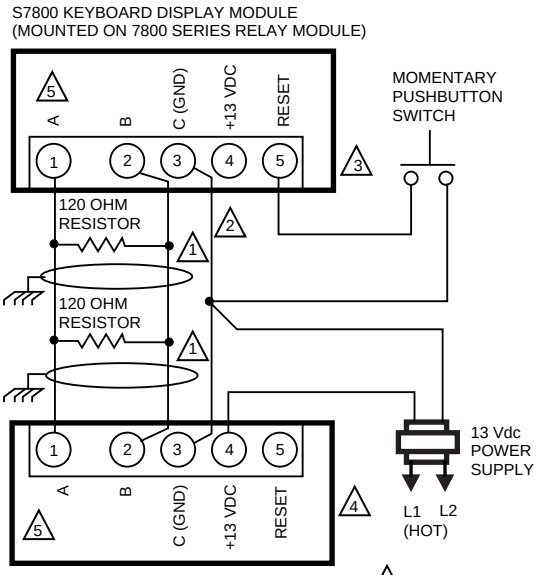


1 THREE WIRE SHIELDED CABLE MAY BE REQUIRED. TWO 120 OHM TERMINATING RESISTORS ARE REQUIRED FOR CONNECTIONS OVER 100 FEET (30 METERS). CABLE SHIELD MUST BE TERMINATED TO EARTH GROUND AT BOTH ENDS. IF SHIELDED CABLE IS NOT USED, TWISTED PAIR WIRE MUST BE USED.

2 WHEN CONNECTING THE KEYBOARD DISPLAY MODULE, DATA CONTROLBUS MODULE", OR REMOTE RESET MODULE EXTERNAL FROM THE CONTROL CABINET, APPROPRIATE MEASURES MUST BE TAKEN TO MEET EN60730 SAFETY LOW VOLTAGE REQUIREMENTS (SEE APPROVALS).

3 TERMINALS OF 203541 5-WIRE CONNECTOR. M1990F

Fig. 8. Wiring the Keyboard Display Module with Communication Interface ControlBus Module.



1 THREE WIRE SHIELDED CABLE MAY BE REQUIRED. TWO 120 OHM TERMINATING RESISTORS ARE REQUIRED FOR CONNECTING OVER 100 FEET [30 METERS]. CABLE SHIELD MUST BE TERMINATED TO EARTH GROUND AT BOTH ENDS. IF SHIELDED CABLE IS NOT USED, TWISTED PAIR WIRE MUST BE USED.

2 WHEN CONNECTING THE KEYBOARD DISPLAY MODULE DATA CONTROLBUS MODULE", OR REMOTE RESET MODULE EXTERNAL FROM THE CONTROL CABINET, APPROPRIATE MEASURES MUST BE TAKEN TO MEET EN60730 SAFETY LOW VOLTAGE REQUIREMENTS (SEE APPROVALS).

3 7800 SERIES RELAY MODULE CAN SUPPORT ONE S7800 KEYBOARD DISPLAY MODULE. A 13 Vdc POWER SUPPLY IS REQUIRED FOR EACH ADDITIONAL DISPLAY.

4 UP TO 36 S7800 KEYBOARD DISPLAYS CAN BE CONNECTED TO A SINGLE 7800 RELAY MODULE NOT TO EXCEED 4000 FEET (1219M) TOTAL LEADWIRE RUN. DAISY CHAIN 1 TO 1, 2 TO 2, 3 TO 3 AND PROVIDE 13 Vdc POWER SUPPLY FOR EACH S7800 DISPLAY.

5 TERMINALS OF 203541 5-WIRE CONNECTOR. M5006G

Fig. 9. Wiring multiple Keyboard Display Modules.

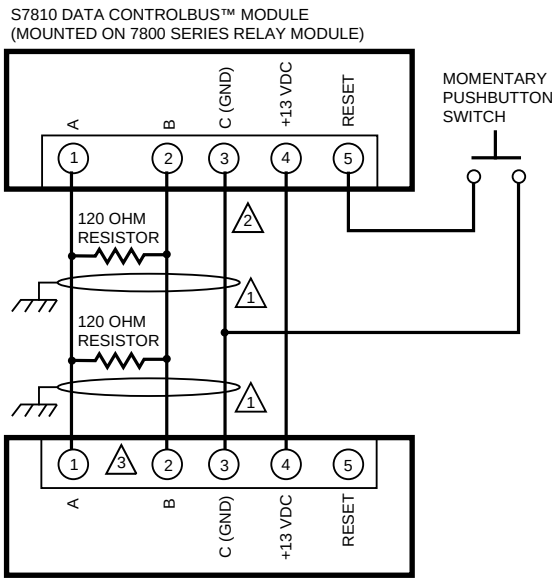


Fig. 10. Wiring the Data ControlBus Module™ with Remote Keyboard Display.

ASSEMBLY

Mounting RM7800

NOTE: For installation dimensions, see Fig. 1 .

Relay Module Mounting

1. Mount the RM7800 vertically, see Fig. 11 or mount horizontally with the knife blade terminals pointing downward. When mounted on the Q7800A, the RM7800 must be in an electrical enclosure.
2. Select the location in the electrical enclosure. Be sure to allow adequate clearance for servicing, installation and removal of the RM7800, Keyboard Display Module, flame amplifier, flame amplifier signal voltage probes, electrical signal voltage probes, and electrical connections.
   a. Allow an additional two inches below the RM7800 for the flame amplifier mounting.
   b. Allow an optional three-inch minimum to both sides of the RM7800 for electrical signal voltage probes.
3. Make sure no subbase wiring is projecting beyond the terminal blocks. Tuck wiring in against the back of the subbase so it does not interfere with the knife blade terminals or bifurcated contacts.

IMPORTANT:

The RM7800 must be installed with a plug-in motion rather than a hinge action.

4. Mount the RM7800 by aligning the four L shaped corner guides and knife blade terminals with the bifurcated contacts on the wiring subbase and tightening the two screws securely without deforming the plastic.

Installing ST7800 Purge Card

1. Remove the Keyboard Display Module, Data ControlBus Module™ or Extension Cable Assembly, see Fig. 12.
2. Remove the current ST7800 from the RM7800 by pulling upward the plastic support cover.
3. Make sure that the ST7800 selected has the desired timing.
4. Insert the Purge Card into the opening of the RM7800 compartment, see Fig. 12.
5. Reinstall the Keyboard Display Module or Data ControlBus Module™ onto the RM7800 and restore power to the device.
6. Run the burner system through at least one complete cycle to verify the system is operating as desired.

IMPORTANT:

The RM7800 will not function properly without one of the following mounted correctly: Keyboard Display Module, DATA CONTROLBUS MODULE™ or an Extension Cable Assembly.

Fig. 11. Electrical Panel installation.

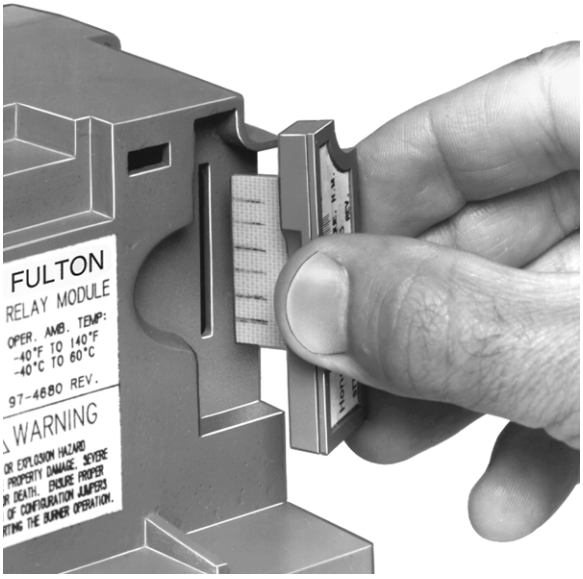


Fig. 12. ST7800 Purge Card installation.

Mounting Keyboard Display Module

1. Align the two interlocking ears of the Keyboard Display Module with the two mating slots on the RM7800, see Fig. 13.
2. Insert the two interlocking ears into the two mating slots and with a hinge action push on the lower corners of the Keyboard Display Module to secure it to the RM7800.
3. Verify the Keyboard Display Module is firmly in place.

Fig. 13. Keyboard Display Module mounting.

Fig. 14. Data ControlBus Module™ mounting.

Fig. 15. Extension Cable Assembly mounting.

Mounting Data ControlBus Module™ and Extension Cable Assembly

1. Align the two interlocking ears with the two mating slots on the RM7800, See Figs. 14 and 15.
2. Insert the two interlocking ears into the two mating slots and push on the lower corners of the Data ControlBus Module™ to secure it to the RM7800.
3. Be sure the Data ControlBus Module™ or Extension Cable Assembly is firmly in place.

Remote Mounting of Keyboard Display Module

The Keyboard Display Module can be mounted either on the face of a panel door or on other remote locations. See Fig. 16. When mounting the Keyboard Display Module on the face of a door panel, closely follow these instructions:

1. Select the location on the door panel for flush mounting.
   Pay attention to the insertion dimension of the two Keyboard Display Module screws, two interlocking

ears and the two plug-in connectors to allow for sufficient clearance, 1/4 in. (6 mm) inward from the surface of the door panel.

2. Use the Keyboard Display Module as a template (see Fig. 30). Mark the two screw locations, two interlocking ear locations and the two plug-in connector locations. Drill the pilot holes on the door panel for the interlocking ears and plug-in connector holes.
3. Mount the Keyboard Display Module, securing the module with two no. 4 screws.

Fig. 16. Panel mounting of Keyboard Display Module.

When mounting the Keyboard Display Module on a wall or remote location, use the 203765 Remote Mounting Bracket. See Fig. 17.

1. Using the Remote Mounting Bracket as a template, mark the four screw locations and drill the pilot holes.
2. Mount the remote Mounting Bracket by securing it with four no. 6 screws.
3. Mount the Keyboard Display Module by aligning the two interlocking ears with the two mating slots on the Remote Mounting Bracket.
4. Insert the two interlocking ears into the two mating slots on the Remote Mounting Bracket.
5. Push on the lower corners of the Keyboard Display Module to secure it to the Remote Mounting Bracket.
6. Verify that the Keyboard Display Module is firmly in place.

IMPORTANT

A Keyboard Display Module, Data ControlBus™ Module or Extension Cable Assembly is required on the Relay Module to remote mount the Keyboard Display Module. Follow wiring diagrams in Fig. 8, 9 or 10 when using the Keyboard Display Module or Data ControlBus™ Module.

Fig. 17. Mounting the Keyboard Display Module on the Remote Mounting Bracket. (203541 5-Wire Connector provided with Remote Mounting Bracket.)

Installing Plug-in Flame Signal Amplifier

⚠ WARNING

Electrical Shock Hazard.
Can cause serious injury, death or property damage.
Disconnect the power supply before beginning installation of the flame signal amplifier. More than one disconnect may be involved.

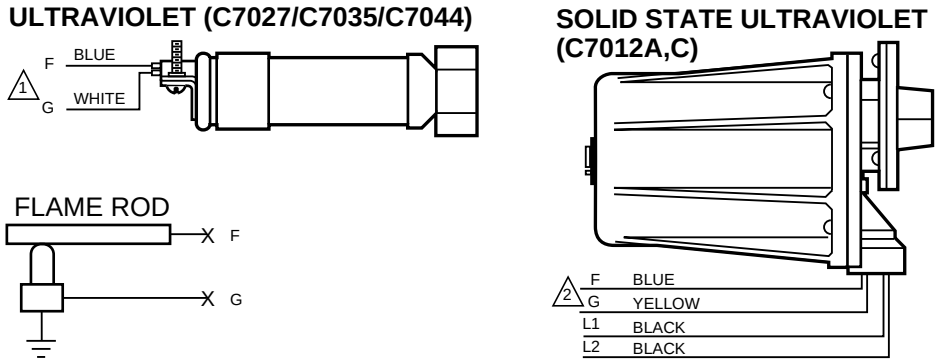
1. Align the flame amplifier circuit board edge connector with the keyed receptacle on the RM7800. Verify that the amplifier nameplate faces away from the Relay Module. See Fig. 18.
2. Push in the amplifier until the circuit board is fully inserted into the receptacle and then push the amplifier toward the RM7800 retaining clasp.
3. Verify that the amplifier is firmly in place.
4. Perform all required checkout tests.

Fig. 18. Flame signal amplifier mounting.

Installing the Flame Detector

NOTE: Table 2 lists the flame detection systems available for use with the RM7800. Make sure the correct combination of amplifier and flame detector(s) is used.

Proper flame detector installation is the basis of a safe and reliable flame safeguard installation. Refer to the instructions packed with the flame detector and the equipment manufacturer instructions. See Fig. 19.



1 FLAME DETECTOR LEADS ARE COLOR CODED. THE BLUE LEAD MUST BE CONNECTED TO THE F TERMINAL AND THE WHITE MUST BE CONNECTED TO THE G TERMINAL. THE UV SENSING TUBE IS POLARITY SENSITIVE. REVERSING THE LEADS EVEN MOMENTARILY CAN DAMAGE OR DESTROY THE UV TUBE.

2 FLAME DETECTOR LEADS ARE COLOR CODED. THE BLUE LEAD MUST BE CONNECTED TO THE F TERMINAL AND THE YELLOW MUST BE CONNECTED TO THE G TERMINAL. THE UV SENSING TUBE IS POLARITY SENSITIVE. REVERSING THE LEADS EVEN MOMENTARILY CAN DAMAGE OR DESTROY THE UV TUBE. M21060

Fig. 19. Flame detector wiring.

OPERATION

Sequence of Operation

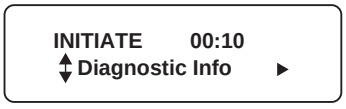
The RM7800 has the following operating sequences, see Figs. 20 and 21, and Table 3.

INITIATE

The RM7800 enters the INITIATE sequence when the Relay Module is powered. The RM7800 can also enter the INITIATE sequence if the Relay Module verifies voltage fluctuations of +10/-15% or frequency fluctuations of +/-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 will be initiated and will be displayed on the VFD for at least five seconds. When the tolerances are met, the INITIATE sequence will restart. If the condition is not corrected and the hold condition exists for four minutes, the RM7800 will lockout. Causes for hold conditions in the INITIATE sequence:

1. AC line dropout is detected.
2. AC line noise that can prevent a sufficient reading of the line voltage inputs.
3. Brownouts caused by a low line voltage.

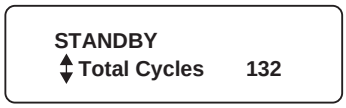
The INITIATE sequence also delays the burner motor starter from being energized and de-energized from an intermittent AC line input or control input.



M20277

STANDBY

The RM7800 is ready to start an operating sequence when the operating control determines a call for heat is present. The burner switch, limits, operating control and all microcomputer monitored circuits must be in the correct state for the RM7800 to continue into the PREPURGE sequence.

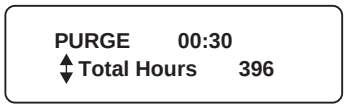


M20278

NORMAL START-UP PREPURGE

The RM7800 provides a prepurge timing selectable from two seconds to 30 minutes with power applied and the RM7800 operating control indicating a call for heat.

Running Interlocks, Preignition Interlocks, Burner Switch, Run/Test Switch, Lockout Interlocks and all microcomputer monitored circuits must be in the correct operating state.



M20282

1. The blower motor output, terminal 5, is powered to start the PREPURGE sequence, except for the RM7800E. The firing rate motor is driven to the high fire position. The PREPURGE timing for the RM7800L does not begin until the Lockout Interlock String and High Fire Switch are both closed.
2. The Preignition Interlock input must remain closed throughout PREPURGE; otherwise, control returns to the STANDBY state and holds (30 seconds) for the RM7800M or safety shutdown for the RM7800L occurs.
3. The Lockout Interlock or Running Interlock inputs (interlock circuit including Airflow Switch) must close by ten seconds into PREPURGE; otherwise, a recycle to the beginning of PREPURGE for the RM7800M will happen or a safety shutdown for the RM7800L occurs.
4. After the firing rate motor reaches the PREPURGE rate position and PREPURGE timing is completed, the firing rate motor will drive to the low fire position, RM7800L.
5. 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

1. Pilot Flame Establishing Period (PFEP):
   a. With the firing rate motor at the low fire position:
      (1) The pilot valve and ignition transformer, terminals 8, 10 and 21, are energized. The RM7800M has an intermittent pilot valve, terminal 21. The RM7800L has a fifteen second interrupted pilot valve, terminal 21. All the RM7800s have a ten second interrupted pilot valve/ignition, terminal 8.
      (2) During PFEP, the Low Fire Switch must remain closed. If it opens, a safety shutdown occurs.
      (3) The Preignition Interlock input is ignored throughout the Ignition Trial state.
   b. Flame must be proven by the end of the four or ten second PFEP to allow the sequence to continue. If flame is not proven by the end of PFEP, a safety shutdown occurs.

M20283

With flame proven, the ignition, terminal 10, is de-energized for early spark termination.

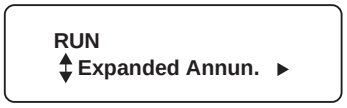
M20284

2. Main Flame Establishing Period (MFEP):
   a. The RM7800L has a selectable ten second or fifteen second MFEP. After the Ignition Trials, and with the presence of flame, the main fuel valve, terminal 9, is powered. If a flameout occurs, the RM7800 will lockout within .8 or 3 seconds, depending on the Flame Failure Response Time (FFRT) of the amplifier.
   b. After the Ignition Trials, and with the presence of flame, the main fuel valve, terminal 9, is powered. If a flameout occurs, the RM7800 will lockout within .8 or 3 seconds, depending on the FFRT of the amplifier.

c. The RM7800M has a ten second MFEP. After the Ignition Trials, and with the presence of flame, the main fuel valve, terminal 9, is powered. If a flameout occurs, the RM7800 will lockout within .8 or 3 seconds, depending on the FFRT of the amplifier.

RUN

1. A ten second stabilization period occurs at the beginning of the RUN period.
2. The firing rate motor releases to modulation (RM7800L).
3. The RM7800 is now in RUN and will remain in RUN until the controller input, terminal 6, opens, indicating that the demand is satisfied or a limit has opened.



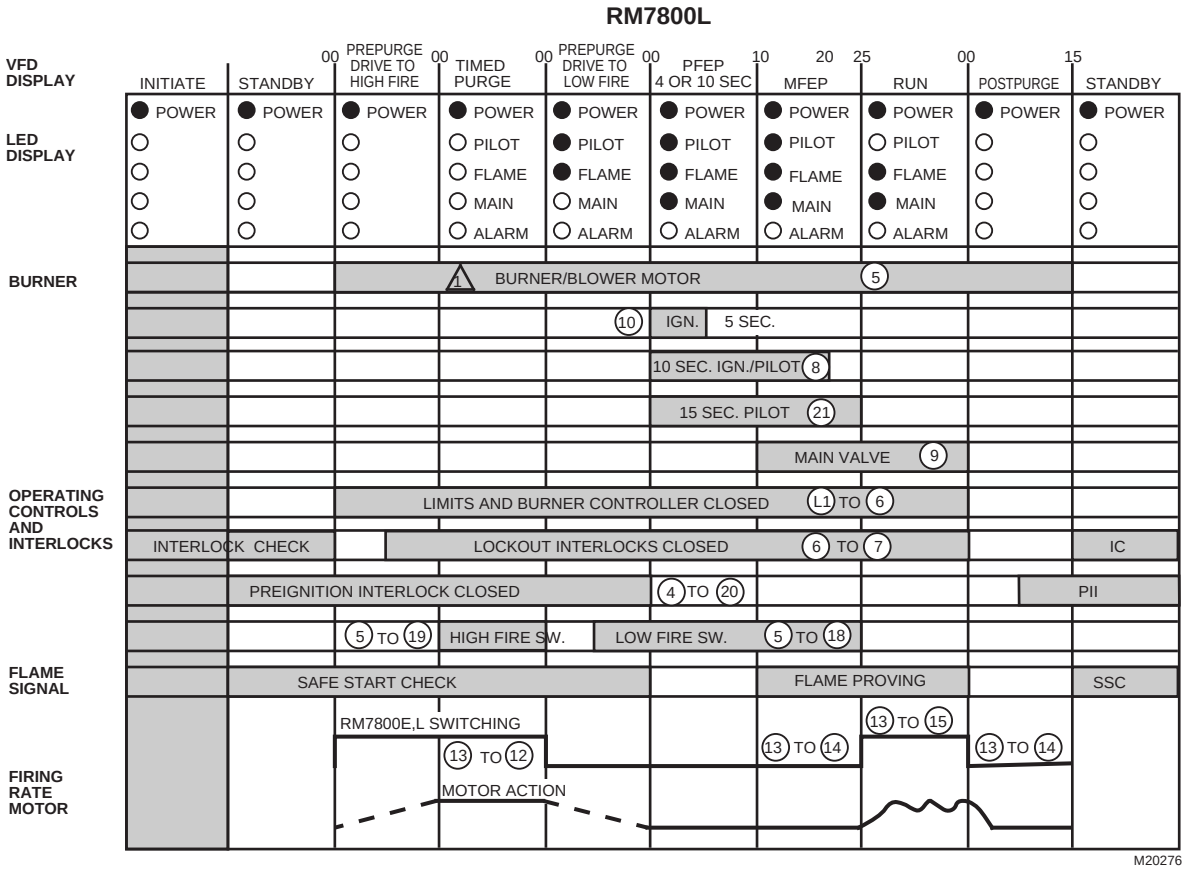
M20285

POSTPURGE

The RM7800 provides a fifteen second 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.

M20286

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 Preignition Interlock closes within the first five seconds of POSTPURGE.
3. After the fifteen second POSTPURGE period is completed, the RM7800 reenters Standby.



M20276

Fig. 20. RM7800L sequence.

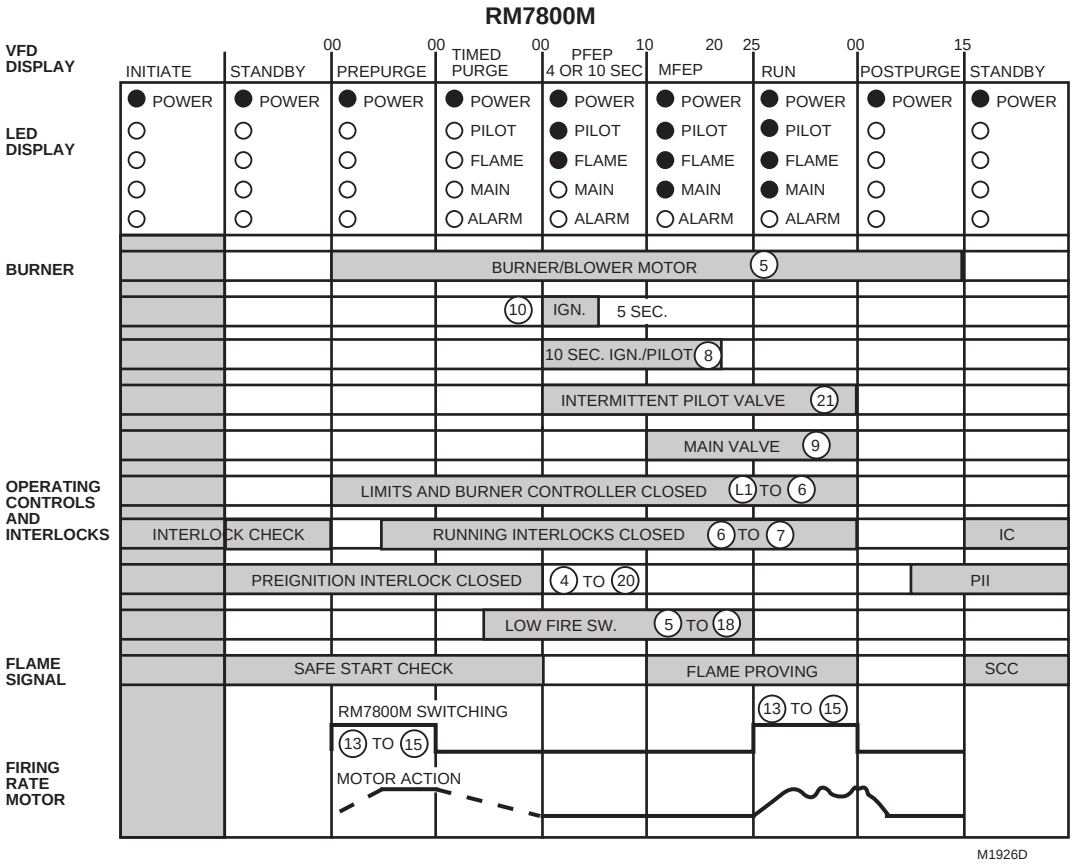


Fig. 21. RM7800M sequence.

KEYBOARD DISPLAY 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:) and lockout information (Lockout, Fault Code, Message and Sequence), see Fig. 21. The extreme right side of the first line will either be blank or it will show a small arrow pointing to the second line followed by a two-letter code (DI-Diagnostic Information, Hn-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 will display selectable or preemptive messages. A selectable message supplies information for flame strength, system status indication, system or self-diagnostics and troubleshooting. A preemptive message will have parentheses around the message and supply a detailed message to support the sequence status information. A preemptive message can also be a lockout message. A preemptive message will replace a selectable message to support the sequence status information. It will also replace a selectable message after 60 seconds if it or a lockout message is available. The RM7800 LEDs provide positive visual indication of the program sequence: POWER, PILOT, FLAME, MAIN and ALARM.

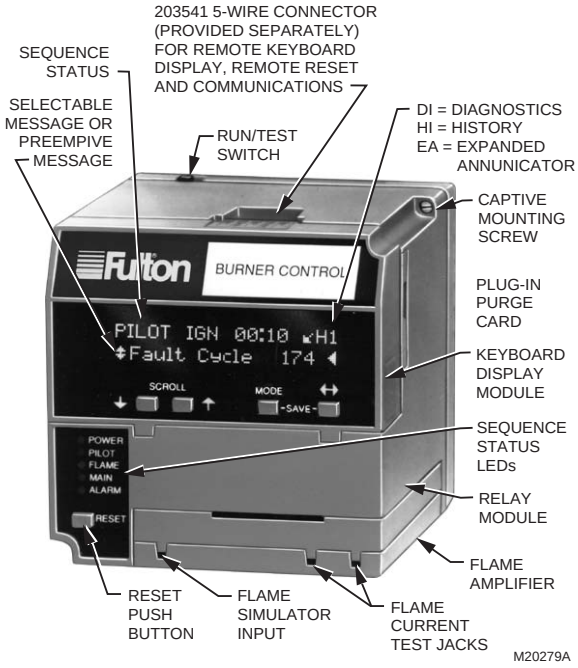


Fig. 22. Keyboard Display Module and sequence status LED (see Table 4).

NOTE: Normal sequences are in BOLD TYPE, while abnormal sequences are not in bold type.

Table 8. Sequence Status Display Information (see Fig. 22).

Burner Sequence	LED Energized
INITIATE minutes:seconds Selectable—message	POWER, PILOT, FLAME, MAIN AND ALARM.
INITIATE HOLD: AC (AC Freq/Noise)	POWER, PILOT, FLAME, MAIN AND ALARM.
INITIATE HOLD: AC (AC Line Dropout)	POWER, PILOT, FLAME, MAIN AND ALARM.
INITIATE HOLD: AC (AC Frequency)	POWER, PILOT, FLAME, MAIN AND ALARM.
INITIATE HOLD: AC (Low Line Voltage)	POWER, PILOT, FLAME, MAIN AND ALARM.
STANDBY selectable—message	POWER, PILOT, FLAME, MAIN AND ALARM.
STANDBY HOLD: REM (Remote Control)	POWER, PILOT, FLAME, MAIN AND ALARM.
STANDBY HOLD: F/G (Flame Detected)	POWER, PILOT, FLAME, MAIN AND ALARM.
STANDBY HOLD: (Preignition ILK)	POWER, PILOT, FLAME, MAIN AND ALARM.
STANDBY HOLD: (Running ILK)	POWER, PILOT, FLAME, MAIN AND ALARM.
STANDBY HOLD: (Lockout ILK)	POWER, PILOT, FLAME, MAIN AND ALARM.
PURGE HOLD: (High Fire Switch)	POWER, PILOT, FLAME MAIN AND ALARM.
PURGE DELAY: (High Fire Jumpered)	POWER, PILOT, FLAME, MAIN AND ALARM.
PURGE HOLD: TEST (Run/Test Switch)	POWER, PILOT, FLAME, MAIN AND ALARM.
PURGE DELAY: (Low Fire Jumpered)	POWER, PILOT, FLAME, MAIN AND ALARM.
PURGE HOLD: F/G (Flame Detected)	POWER, PILOT, FLAME, MAIN AND ALARM.
PURGE HOLD: (Low Fire Switch)	POWER, PILOT, FLAME, MAIN AND ALARM.
PURGE minutes:seconds selectable—message	POWER, PILOT, FLAME, MAIN AND ALARM.
PURGE HOLD: (Running ILK)	POWER, PILOT, FLAME, MAIN AND ALARM.
PILOT IGN minutes:seconds selectable—message	POWER, PILOT, FLAME, MAIN AND ALARM.
PILOT HOLD: TEST (Run/Test Switch)	POWER, PILOT, FLAME, MAIN AND ALARM.

Table 8. Sequence Status Display Information (see Fig. 22).

Burner Sequence	LED Energized
MAIN IGN minutes:seconds selectable—message RUN selectable—message RUN selectable—message RUN LOWFIRE: TEST (Run/Test Switch)	POWER, PILOT, FLAME, MAIN AND ALARM. POWER, PILOT, FLAME, MAIN AND ALARM. POWER, PILOT, FLAME, MAIN AND ALARM. POWER, PILOT, FLAME, MAIN AND ALARM.
POSTPURGE minutes:seconds selectable—message Waiting for connection... RESET/ALARM TEST selectable—message	POWER, PILOT, FLAME MAIN AND ALARM. POWER, PILOT, FLAME MAIN AND ALARM. POWER, PILOT, FLAME MAIN AND ALARM.
Additional sequence status information when an Expanded Annunciator is connected to the Relay Module, also see 7800 SERIES System Annunciation Diagnostics and Troubleshooting, Form 65-0018.	
BURNER OFF: (Burner Switch) STANDBY HOLD: (Expanded Annunciator hold message) STANDBY HOLD: (Circuit Fault)	POWER, PILOT, FLAME MAIN AND ALARM. POWER, PILOT, FLAME MAIN AND ALARM. POWER, PILOT, FLAME MAIN AND ALARM.

KEYBOARD FUNCTIONS

The keyboard contains four pushbuttons and each has separate functions (Scroll-Down, Scroll-Up, Mode and Change-Level). The Mode and Change-Level pushbuttons, when pressed together, provide a Save function.

SCROLL Down-Up pushbuttons (⇳), see Fig. 23.

The scroll Down-Up pushbuttons (⇳) are used to scroll through the selectable messages. The double-headed arrow (×), which is located in the lower left position of the second line of the display, represents the scroll Down-Up pushbuttons. The scroll Down-Up pushbuttons (⇳) can be pressed to display selectable messages one at a time or held down to scroll through the selectable messages at a rate of two per second. When the last item of the selectable message is viewed, the display wraps around and displays the first selectable message again.

Change-Level pushbutton (⇔), see Fig. 24.

The Change-Level pushbutton is used to change between the first hierarchy of selectable messages to a subset of selectable messages. The Change-Level pushbutton can also be used to change from a subset message to a first level selectable message. The symbol (>) located on the second line in the lower right corner of the VFD represents a first level hierarchy of selectable messages. The symbol (<) located on the second line in the lower right corner of the VFD represents a subset of selectable messages.

Mode pushbutton, see Fig. 25.

The Mode pushbutton instantaneously switches the display from a second-line-selectable message to second-line-preempted message. The sixty second timeout function also can be used for this task. The Mode pushbutton will work only if there is a second-line-preempted message or lockout message.

Save function, see Fig. 26.

The Save function enables users to identify the selectable message they want to view upon power restoration. The second line selectable message will be restored to the most recently saved selection when power returns. The save function is performed by pressing and holding the Mode key and then pressing the Change-Level pushbutton («). The second line of the display will briefly note "...SAVING..." to confirm the key press.

SELECTABLE MESSAGES

VFD Second Line Display, Two-Level Hierarchy, see Table 5.

The display values are as follows:

n represents a numbered value.

T represents the terminal number.

x represents the suffix letter of the Relay Module.

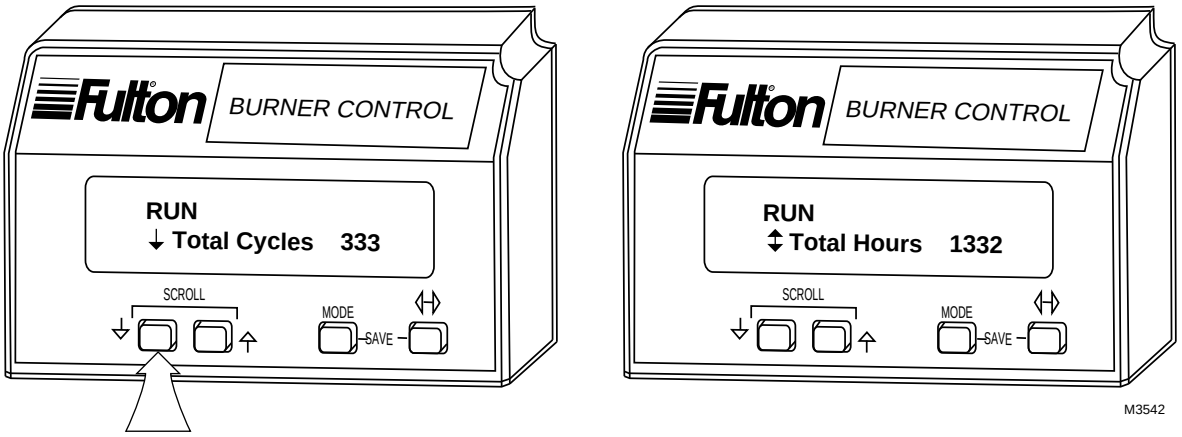


Fig. 23. (Þ) SCROLL pushbutton function.

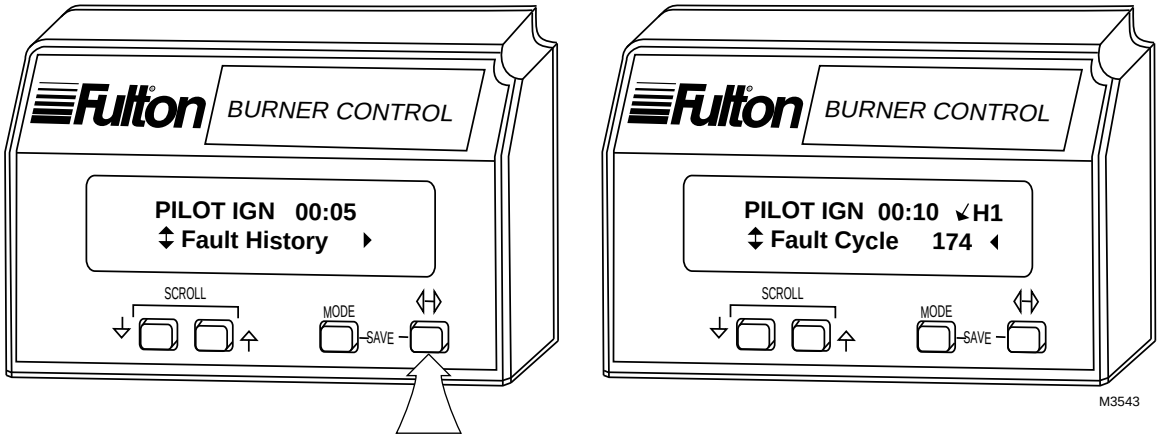


Fig. 24. (↔) Change-Level pushbutton function.

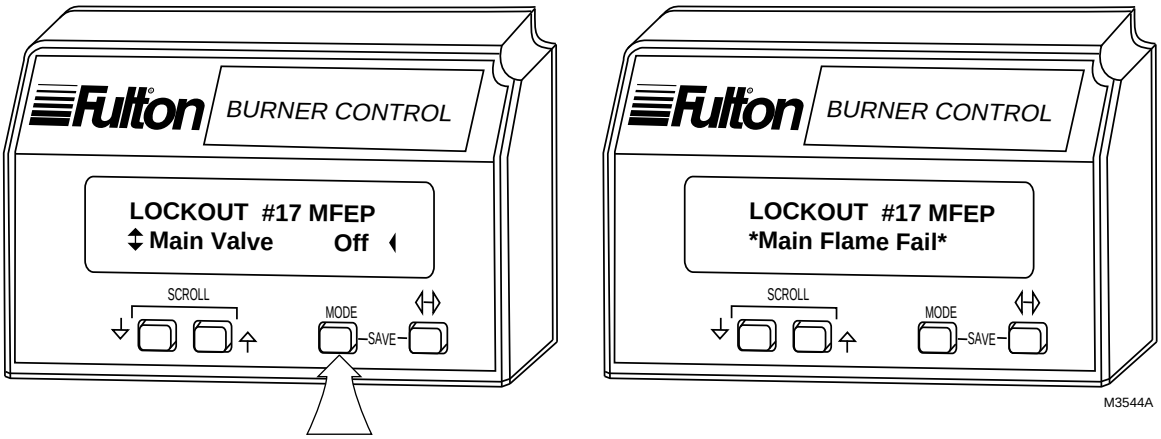


Fig. 25. MODE pushbutton function.

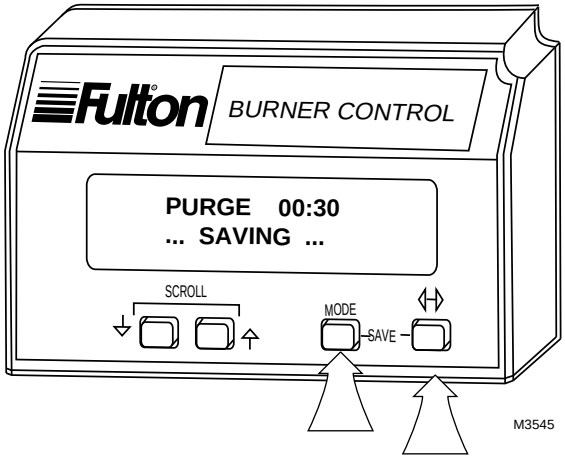


Fig. 26. SAVE function.

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Table 9. Selectable Messages.

Selectable Message (Second Line)	Display Value (Second Line)	First Line Message
ÞFlame Signal	n.nV	
ÞTotal Cycles	nnnnn	
ÞTotal Hours		
ÞFault History↔		
ÞFault Cycle	nnnnn <	↓H1
ÞFault Hours	nnnnn <	↓H1
ÞFault Code	nnn <	↓H1
Þ*fault—message*<		↓H1
Þsequence—message<		↓H1
Þ(second-line-msg)<		↓H1
ÞFault Cycle	nnnnn <	↓H2
ÞFault Hours	nnnnn <	↓H2
ÞFault Code	nnn <	↓H2
Þ*fault—message*<		↓H2
Þsequence—message<		↓H2
Þ(second-line-msg)		↓H2
ÞFault Cycle	nnnnn <	↓H3
ÞFault Hours	nnnnn <	↓H3
ÞFault Code	nnn <	↓H3
Þ*fault—message*<		↓H3
Þsequence—message<		↓H3
Þ(second-line-msg)<		↓H3
ÞFault Cycle	nnnnn <	↓H3
ÞFault Hours	nnnnn <	↓H3
ÞFault Code	nnn <	↓H4
Þ*fault—message*<		↓H4
Þsequence—message<		↓H4
Þ(second-line-msg)<		↓H4

Table 9. Selectable Messages. (Continued)

Selectable Message (Second Line)	Display Value (Second Line)	First Line Message
ÞFault Cycle	nnnnn <	↓H5
ÞFault Hours	nnnnn <	↓H5
ÞFault Code	nnn <	↓H5
Þ*fault—message*<		↓H5
Þsequence—message<		↓H5
Þ(second-line-msg)<		↓H5
ÞFault Cycle	nnnnn <	↓H6
ÞFault Hours	nnnnn <	↓H6
ÞFault Code	nnn <	↓H6
Þ*fault—message*<		↓H6
Þsequence—message<		↓H6
Þ(second-line-msg)<		↓H6
ÞDiagnostic Info↔		
ÞDevice	RM78nnx <	↓DI
ÞDevice Suffix	nnnn <	↓DI
ÞRun/Test Sw.	RUN or TEST <	↓DI
ÞOperating Control (OperControl)	1 or 0<	↓DI
ÞInterlock	1 or 0<	↓DI
ÞPilot Valve	1 or 0<	↓DI
ÞMain Valve	1 or 0<	↓DI
ÞIgnition	1 or 0<	↓DI
ÞLow Fire Sw	1 or 0<	↓DI
ÞHigh Fire Sw	1 or 0<	↓DI
ÞPreignition Interlock (PreIgn ILK)	1 or 0<	↓DI
ÞPilot Valve/First Stage Oil Valve (Valv/Start, V25)	1 or 0<	↓DI
ÞJumper 1	INTACT or CLIPPED <	↓DI
ÞJumper 2	INTACT or CLIPPED <	↓DI
ÞJumper 3	INTACT or CLIPPED <	↓DI
ÞAmplifier Type (Amp Type)	NORMAL or AMP-CHECK or SHUTTER	↓DI
ÞFlame Response	0.8s or 3s <	↓DI
ÞPurge Time	mm:ss <	↓DI
ÞManufacturing Code (Mfg Code)	nnnn <	↓DI
ÞSoftware Revision (SW Rev)	nnnn/nnnn <	↓DI
ÞExpanded Annun. ↔ (See Table 5)		
ÞRemote Command	NONE/HOLD/HF/LF	

Expanded Annunciator Messages, See Table 5

The Expanded Annunciator (EA) may or may not be connected because it is an optional device. If the EA is not connected, a display message of "(EA not connected)" will be shown. If the EA is connected, display messages will be shown, see Table 6 and 7800 SERIES System Annunciation Diagnostics and Troubleshooting, form 65-0118, Tables 6 and 7 for fault codes. When accessing Expanded Annunciator Messages, follow the same operations as used with the Selectable Messages.

Table 10. Expanded Annunciator Messages.

Selectable Message (Second Line)	Display Value (Second Line)	First Line Message
ÞExpanded Annun.↔		
ÞExpanded Annunciator (EA not connected) <		
ÞCurrent Status (CS:)[a]	EA Message <	↓EA
ÞValve Closure (Valve Close)	1 or 0<	↓EA
ÞBurner Switch (Burner Sw.)	1 or 0<	↓EA
ÞOperating Control (OperControl)	1 or 0<	↓EA
ÞAuxiliary Limit (Aux Limit 1)	1 or 0<	↓EA
ÞAuxiliary Limit (Aux Limit 2)	1 or 0<	↓EA
ÞLow Water Cutoff (LWCO)	1 or 0<	↓EA
ÞHigh Limit (High Limit)	1 or 0<	↓EA
ÞAuxiliary Limit (Aux Limit 3)	1 or 0<	↓EA
ÞOil Selection Switch (Oil Select)	1 or 0<	↓EA
ÞHigh Oil Pressure Switch (Hi OilPres)	1 or 0<	↓EA
ÞLow Oil Pressure Switch (LowOilPres)	1 or 0<	↓EA
ÞHigh Oil Temperature Switch (Hi OilTemp)	1 or 0<	↓EA
ÞLow Oil Temperature Switch (LoOilTemp)	1 or 0<	↓EA
ÞAtomizing Switch (Atomize Sw)	1 or 0<	↓EA
ÞGas Selection Switch (Gas Select)	1 or 0<	↓EA
ÞHigh Gas Pressure Switch (Hi GasPres)	1 or 0<	↓EA
ÞLow Gas Pressure Switch (LowGasPres)	1 or 0<	↓EA
ÞAirflow Switch (Airflow Sw)	1 or 0<	↓EA
ÞAuxiliary Interlock (Aux ILK 4)	1 or 0<	↓EA
ÞAuxiliary Interlock (Aux ILK 5)	1 or 0<	↓EA
ÞEA Fault Code	nnn <	↓EA
ÞSoftware Revision (SW Rev.)	nnnn <	↓EA

[a]Expanded Annunciator Diagnostic Current Status Messages can be reviewed in 7800 SERIES System Annunciation Diagnostics and Troubleshooting, form 65-0118, Table 7.

Run/Test Switch Functions

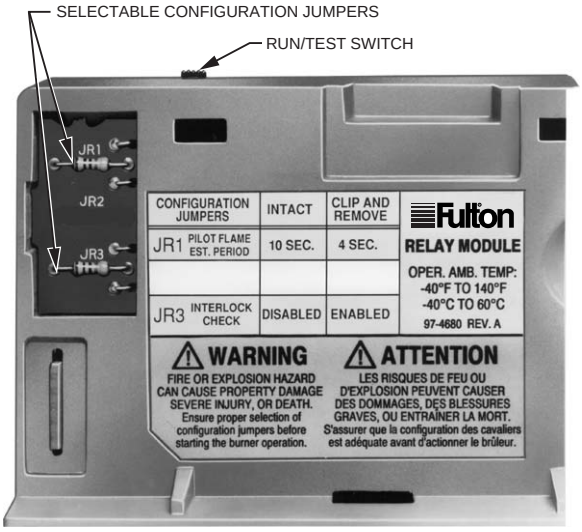
The Run/Test Switch is located on the top side of the RM7800, see Fig. 26. The Run/Test Switch allows the burner sequence to be altered as follows:

1. In Prepurge Drive To High Fire Position, the Run/Test Switch, when placed in the TEST position, will hold 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, will cause the PREPURGE timing to stop. The firing rate motor will be in the High Fire position.
3. In Prepurge Drive to Low Fire position, the Run/Test Switch, when placed in the TEST position, will hold 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, will stop 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 shut-downs. The Run/Test Switch will be ignored during PFEP for the RM7800E,L if terminals 8 and 9 or 9 and 21 are jumpered.
5. During Run, the Run/Test Switch, when placed in the TEST position, will drive the firing rate motor to the Low Fire position.

NOTE: When RM7800 is switched to the Test mode, it will stop and hold 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.

Selectable Site-Configurable Jumpers

The RM7800 has two site-configurable jumper options, see Fig. 27 and Table 7. The site-configurable jumpers should be clipped with side cutters and the resistors removed from the Relay Module.



M20280

Fig. 27. Selectable site-configurable jumpers.

Table 11. Site-Configurable Jumper Options.

Jumper Number	Description	Intact	Clipped	RM7800 Type
JR1	Pilot Flame Establishing Period (PFEP)	10 seconds	4 seconds	(All)
JR3	Start-up Interlock Check	Disabled	Enabled	(All)

SERVICE NOTE: Clipping and removing a site-configurable jumper enhances the level of safety. Clipping and removing a jumper after 200 hours of operation results in a hard lockout—Code 110.

STATIC CHECKOUT

⚠ WARNING

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

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

After checking all wiring, perform this checkout before installing the RM7800 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.

NOTE: Do not perform a dielectric test with the RM7800 installed. Internal surge protectors will break down and conduct a current. This could cause the RM7800 to fail the dielectric test or possibly destroy the internal lightning and high current protection.

Equipment Recommended

1. Voltmeter (1 megohm/volt minimum sensitivity) set on the 0-300 Vac scale.
2. Two jumper wires; no. 14 wire, insulated, 12 inches (305 mm) long with insulated alligator clips at both ends.

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 RM7800 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. Ensure 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).

Table 12. Static Checkout .

Test Number	RM7800 Models	Test Jumpers	Voltmeter	Normal Operation	If Operation is Abnormal, Check the Items Listed Below
⚠ WARNING **Explosion Hazard.** **Can cause serious injury, death or equipment damage.** Make sure all manual fuel shutoff valves are closed. ***IMPORTANT*** *Low pressure fuel limits, if used, could be open. Bypass them with jumpers for the remaining Static Tests (if required).*					
1	All	None	4-L2	Line voltage at terminal 4.	1. Master switch. 2. Power connected to the master switch. 3. Overload protection (fuse, circuit breaker, etc.) has not opened the power line.
2	All	None	6-L2	Line voltage at terminal 6.	1. Limits. 2. Burner control.
3	All	None	20-L2	Line voltage at terminal 20.	1. Preignition Interlocks.
4	All	4-5	7-L2	1. Burner motor (fan or blower) starts. 2. Line voltage at terminal 7 within 10 seconds.	1. Burner motor circuit. a. Manual switch of burner motor. b. Burner motor power supply, overload protection, and starter. c. Burner motor. 2. Running or Lockout Interlocks (including Airflow Switch.
5	All	4-10	—	Ignition spark (if ignition transformer is connected to terminal 10.	1. Watch for spark or listen for buzz. a. Ignition electrodes are clean. b. Ignition transformer is okay.
6	All	4-8	—	1. Ignition spark (if ignition transformer is connected to terminal 8. 2. Automatic pilot valve opens (if connected to terminal 8).	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.
7	All	4-21	—	Same test as for number 6 for connections to terminal 8. If using direct spark ignition, check the first stage fuel valve(s) instead of the pilot valve.	Same as test number 6. If using direct spark ignition, check the first stage fuel valve(s) instead of the pilot valve.
8	All	4-9	—	Automatic main fuel valve(s) opens. If using direct spark ignition on a model with intermittent pilot on terminal 21, check the optional second stage fuel valve, if used.	1. Listen for and observe operation of the main fuel valve(s) and actuator(s). 2. Valve(s) and actuator(s).
9	All	4-3	—	Alarm (if used) turns on.	1. Alarm.
10	RM7800L models	4-5 and 12-13	18-L2	Firing rate motor drives open; zero volts at terminal 18 after motor starts driving open.	1. Low Fire Start Switch. 2. Firing rate motor and transformer.

Table 12. Static Checkout (Continued).

Test Number	RM7800 Models	Test Jumpers	Voltmeter	Normal Operation	If Operation is Abnormal, Check the Items Listed Below
11	RM7800L models	4-5 and 12-13	18-L2	Firing rate motor drives open; line voltage at terminal 18 after motor is in Low Fire position.	1. Low Fire Start Switch. 2. Firing rate motor and transformer.
12	RM7800L models	4-5 and 12-13	19-L2	Firing rate motor drives open; line voltage at terminal 19 after motor is in High Firing position.	1. High Fire Purge Switch. 2. Firing rate motor and transformer.
13	RM7800L models	4-5 and 14-13	19-L2	Firing rate motor drives closed; zero volts at terminal 19 after motor starts driving closed.	1. Low Fire Start Switch. 2. Firing rate motor and transformer.
14	RM7800L models	15-13	—	1. Raise setpoint of Series 90 controller—firing rate motor should drive toward open. 2. Lower setpoint of Series 90 controller—firing rate motor should drive toward closed.	1. Series 90 Controller. 2. Firing rate motor and transformer.
15	RM7800 M models with Open Damper Contacts	4-13	—	If damper motor is used, motor drives damper open.	1. Damper motor.
16	RM7800 M models with Open Damper Contacts	4-5	18-L2	If damper motor is used, spring return drives motor and damper closed; line voltage at terminal 18 after motor is in Low Fire position.	1. Low Fire Start Switch. 2. Damper motor.
17	RM7800 M models with Open Damper Contacts	4-5 and 4-13	18-L2	If damper motor is used, motor drives open; zero volts at terminal 18 after motor starts driving open.	1. Low Fire Start Switch. 2. Damper motor.
Final	All	**CAUTION** **Equipment Damage Hazard.** **Can cause equipment damage or incorrect operation.** On 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).			

CHECKOUT

WARNING

Explosion Hazard.

Can cause serious injury, death and equipment damage.

Do not allow fuel to accumulate in the combustion chamber. If fuel is allowed to enter the chamber for longer than a few seconds without igniting, an explosive mixture could result. It is recommended that you limit the trial for pilot to ten seconds, and limit the attempt to light the main burner to two seconds from the time the fuel has reached the burner nozzle. In any case, do not exceed the nominal lightoff time specified by the equipment manufacturer; close the manual fuel shutoff valve(s) if the flame is not burning at the end of the specified time.

WARNING

Electrical Shock Hazard.

Can cause serious injury or death.

1. Use extreme care while testing the system. Line voltage is present on most terminal connections when power is on.
2. Open the master switch before removing or installing the RM7800 or Keyboard Display Module connector.
3. Make sure all manual fuel shutoff valve(s) are closed before starting the initial lightoff check and the Pilot Turndown tests.
4. Do not put the system in service until you have satisfactorily completed all applicable tests in this section and any others required by the equipment manufacturer.

⚠ CAUTION

Equipment Damage Hazard.
Can damage equipment or cause improper operation.
If an RM7800 is replaced with a lower functioning 7800 SERIES Relay Module, the burner will not sequence unless wiring changes are made.

IMPORTANT:

1. *If the system fails to perform properly, note the fault code, fault message, equipment status, and sequence time on the display. Refer to the Troubleshooting section and 7800 SERIES System Annunciation Diagnostics and Troubleshooting, form 65-0118.*
2. *Repeat ALL required Checkout tests after all adjustments are made. ALL tests must be satisfied with the flame detector(s) in its FINAL position.*

Equipment Recommended

Volt-ohmmeter (1 Mohm/volt minimum sensitivity) with:
- 0-300 Vac capability.
- 0-6000 ohm capability.
- 0-10 Vdc capability.

Checkout Summary

1. Preliminary inspection—all installations.
2. Flame signal measurement—all installations.
3. Initial lightoff check for proved pilot—all installations using a pilot.
4. Initial lightoff check for direct spark ignition of oil—all burners using DSI.
5. Pilot turndown test—all installations using a pilot.
6. Hot refractory saturation test—all installations using Infrared (lead sulfide) Flame Detectors.
7. Hot refractory hold-in test—all installations.
8. Ignition interference test—all installations using flame rods.
9. Ignition spark pickup—all installations using Ultraviolet Flame Detectors.
10. Response to other ultraviolet sources—all installations using Ultraviolet Flame Detectors.
11. Flame signal with hot combustion chamber—all installations.
12. Safety shutdown tests—all installations.

See Fig. 1 for location of component parts and Fig. 6 and 7 or Q7800 Specifications for terminal locations.

Preliminary Inspection

Perform the following inspections to avoid common problems. Make certain that:

1. Wiring connections are correct and all terminal screws are tight.
2. Flame detector(s) is clean, and installed and positioned properly. Consult the applicable Instructions.
3. Correct combination of amplifier and flame detector(s) is used. See Table 2 in the Specifications.
4. Plug-in amplifier and purge card are securely in place.
5. Burner is completely installed and ready to fire; consult equipment manufacturer instructions. Fuel lines are purged of air.
6. Combustion chamber and flues are clear of fuel and fuel vapor.
7. Power is connected to the system disconnect switch, (master switch).
8. Lockout is reset, (push in reset button) only if the Relay Module is powered, see Fig. 1.
9. Run/Test Switch is in RUN position.
10. System is in the STANDBY condition. STANDBY message is viewable in the VFD.
11. All limits and interlocks are reset.

Flame Signal Measurement (Table 9 and Fig. 29)

Measure the flame signal at the appropriate times as defined in the following Checkout tests. Read the flame signal in volts dc at the flame amplifier test jacks + and (Com) or at the Keyboard Display Module.

1. Use 1 Mohm/volt meter with a 0 to 10 Vdc capability.
2. Set the meter to the 0 to 10 Vdc range.
3. Insert the positive (red) probe into the + jack of the flame amplifier. Insert the negative (black) probe into the (Com) jack of the flame amplifier, see Fig. 29.
4. Allow a few seconds for the meter reading to stabilize.
5. The meter reading must be as specified in Table 7, after all tests are completed and all adjustments made.

As an option, the flame signal can be checked by using the Keyboard Display Module.

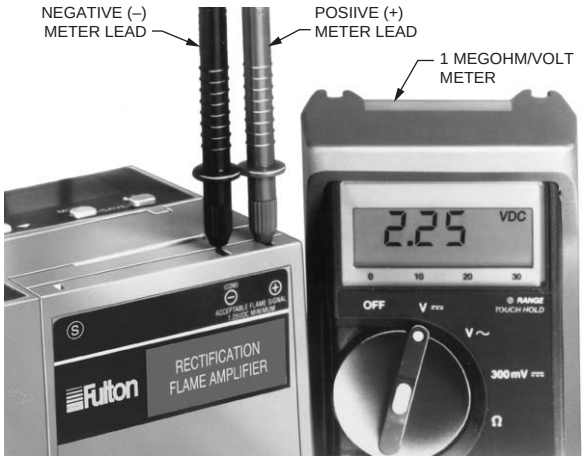


Fig. 28. Flame signal measurement.

If the signal is unstable or less than the minimum acceptable voltage, check flame detector installation and circuitry.

Table 13. Flame Signal.

Flame Detector	Flame Signal Amplifier	Minimum Acceptable Steady dc Voltage[a]	Maximum Expected dc Voltage
Flame Rod Photocell C7012A,C	R7847A	1.25 Vdc	5.0 Vdc at Keyboard Display Module OR 5.0 Vdc at 1 Mohm/volt meter.
C7027A C7035A C7044A	R7849A		

[a]This minimum or stronger signal should easily be obtained if the detector is correctly installed and positioned to properly sense the flame. This voltage must be obtained before completing checkout.

1. Check the supply voltages at terminals 4 (L1) and L2 (N). Make sure the master switch is closed, connections are correct, and the power supply is of the correct voltage, frequency and is sinusoidal.
2. Check the detector wiring for defects including:
   a. Incorrect connections.
   b. Wrong type of wire.
   c. Deteriorated wire.
   d. Open circuits.
   e. Short circuits.
   f. Leakage paths caused by moisture, soot or accumulated dirt.
3. For a flame rod, make sure:
   a. There is enough ground area.
   b. The flame rod is properly located in the flame.
   c. The temperature at the flame rod insulator is no greater than 500°F (260°C).
4. For all optical detectors, clean the detector viewing window and inside of the sight pipe as applicable.
5. With the burner running, check temperature at the detector. If it exceeds the detector maximum rated temperature:
   a. Add a heat block to stop conducted heat traveling up the sight pipe.
   b. Add a shield or screen to reflect radiated heat.
   c. Add cooling (refer to sight pipe ventilation in the detector Instructions).
6. Make sure the flame adjustment is not too lean.
7. Make sure the detector is properly sighting the flame.
8. If necessary, resight or reposition the detector.

Initial Lightoff Check for Proved Pilot

Perform this check on all installations that use a pilot. It should immediately follow the preliminary inspection.

NOTE: Low fuel pressure limits, if used, could be open. If so, bypass them with jumpers during this check.

1. Open the master switch.
2. Make sure that the manual main fuel shutoff valve(s) is closed. Open the manual pilot shutoff valve. If the pilot takeoff is downstream from the manual main fuel shutoff valve(s), very slightly open the manual main valve to supply pilot gas flow. Make sure the main fuel is shut off just upstream from the burner inlet, or disconnect power from the automatic main fuel valve(s).
3. Close the master switch and start the system with a call for heat by raising the set point of the operating controller, see Figs. 19, 20 or RM7800 sequence. The program should start the ten second INITIATE sequence.
4. Let the sequence advance through PREPURGE. When the PILOT IGN status is displayed on the Keyboard Display Module, ignition spark should occur and the pilot should light. If the pilot ignites, the FLAME LED will be energized. Proceed to step 7.
5. If the pilot flame is not established in four or ten seconds, safety shutdown occurs. Let the sequence complete its cycle. Consult the equipment operating manual for further information.
6. Push the reset pushbutton, and let the system recycle once. If the pilot still does not ignite, make the following ignition/pilot adjustments:
   a. Open the master switch and remove the RM7800 from the subbase.
   b. On the subbase, jumper terminal 4 to ignition terminals 8, 10 or 21; refer to the appropriate wiring diagram to determine the proper terminal. Disconnect the leadwire to the pilot valve if it is connected to the same terminal.
   c. Close the master switch to energize only the ignition transformer.
   d. If the ignition spark is not strong and continuous, open the master switch and adjust the ignition electrode spark gap setting to the manufacturer recommendations.
   e. Make sure the ignition electrodes are clean.
   f. Close the master switch and observe the spark.
   g. After a continuous spark is obtained, open the master switch and add a jumper on the subbase from terminal 4 (L1) to the pilot terminal 8 or 21. Reconnect the leadwire from the pilot valve if it was disconnected in step b.
   h. Close the master switch to energize both the ignition transformer and the pilot valve.
   i. If the pilot does not ignite and if the ignition spark is still continuous, adjust the pressure regulator until a pilot is established.
   j. When the pilot ignites properly and stays ignited, open the master switch and remove the jumper(s) from terminals 4 - 8, 4 - 10 and 4 - 21 of the subbase.
   k. Check for adequate bleeding of the fuel line.
   l. Reinstall the RM7800 on the subbase, close the master switch, and then return to step 4.

7. When pilot ignites, measure the flame signal. If the pilot flame signal is unsteady or approaching the 1.25 Vdc minimum value, adjust the pilot flame size or detector sighting to provide a maximum and steady flame signal.
8. Recycle the system to recheck lightoff and pilot flame signal.
9. When the MAIN IGN period is displayed on the VFD, make sure the automatic main fuel valve is open; then smoothly open the manual main fuel shutoff valve(s) and watch for main burner flame ignition. When the main burner flame is established, proceed to step 15.
10. If the main burner flame is not established within five seconds or the normal lightoff time as specified by the equipment manufacturer, close the manual main fuel shutoff valve(s).
11. Recycle the system to recheck the lightoff and pilot flame signal.
12. Smoothly open the manual fuel shutoff valve(s) and try lightoff again. (The first reattempt may have been required to purge the lines and bring sufficient fuel to the burner.)
13. If the main burner flame is not established within five seconds or the normal lightoff time specified by the equipment manufacturer, close the manual main fuel shutoff valves(s). Check all burner adjustments.
14. If the main burner flame is not established after two attempts:
    a. Check for improper pilot size.
    b. Check for excess combustion air at low fire.
    c. Check for adequate low fire fuel flow.
    d. Check for proper gas supply pressure.
    e. Check for proper valve operation.
    f. Check for proper pilot flame positioning.
15. Repeat steps 10 through 14 to establish the main burner flame; then proceed to step 16.
16. With the sequence in RUN, make burner adjustments for flame stability and Btu input rating.
17. Shut down the system by opening the burner switch or by lowering the set point of the operating controller. Make sure the main flame goes out. There may be a delay due to gas trapped between the valve(s) and burner. Make sure all automatic fuel valve(s) close.
18. Restart the system by closing the burner switch and/or raising the set point of the operating controller. Observe that the pilot is established during PILOT IGN and the main burner flame is established during MAIN IGN within the normal lightoff time.
19. Measure the flame signal. Continue to check for the proper signal, see Table 8, through the RUN period. Check the signal at both High and Low Firing Rate positions and while modulating.
20. Run the burner through another sequence, observing the flame signal for:
    a. Pilot flame alone (DSI).
    b. Pilot and main flame together.
    c. Main flame alone (unless monitoring an intermittent pilot). Also observe the time it takes to light the main flame. Ignition of main flame should be smooth.
21. Make sure all readings are in the required ranges before proceeding.
22. Return the system to normal operation.

NOTE: After completing these tests, open the master switch and remove all test jumpers from the subbase terminals, limits/controls or switches.

Initial Lightoff Check for Direct Spark Ignition

This check applies to gas and oil burners not using a pilot. It should immediately follow the preliminary inspection. Refer to the appropriate sample block diagram of field wiring for the ignition transformer and fuel valve(s) hookup.

NOTE: Low fuel pressure limits, if used, could be open. If so, bypass them with jumpers during this check.

1. Open the master switch.
2. Complete the normal ready-to-fire checkout of the fuel supply and equipment as recommended by the equipment manufacturer.
3. Close all manual main fuel shutoff valve(s). Check that the automatic fuel valve(s) are closed. Make sure fuel is not entering the combustion chamber.
4. Close the master switch and start the system with a call for heat by raising the setpoint of the operating controller, see Fig. 19 or 20 for RM7800 sequencing. The program sequence should start the ten second INITIATE sequence.
5. Let the sequence advance through PREPURGE. Ignition spark should occur after PREPURGE period. Listen for the click of the first stage fuel solenoid valve(s).
6. Let the program sequence complete its cycle.
7. Open the manual fuel shutoff valve(s).
8. Push the reset button and recycle the program sequence through PREPURGE.
9. When PILOT IGN status is displayed , watch that the first stage burner flame is established. If it is established, proceed to step 15.
10. If the first stage burner flame is not established within four seconds, or within the normal lightoff time specified by the equipment manufacturer, close the manual fuel shutoff valve(s), and open the master switch after POSTPURGE is completed.
11. Check all burner adjustments.
12. Wait about three minutes. Close the master switch, open the manual fuel shutoff valve(s), and try to lightoff the burner again. The first attempt may have been required to purge the lines and bring sufficient fuel to the burner.
13. If the first stage burner flame is not established within four seconds, or within the normal lightoff time specified by the equipment manufacturer, close the manual fuel shutoff valve(s), and open the master switch.
14. If necessary, repeat steps 11 through 13 to establish the first stage burner flame. Then proceed to step 15.
15. When the first stage burner flame is established, the sequence will advance to RUN. Make burner adjustments for flame stability and input rating. If a second stage is used, proceed to step 18.
16. 16. Shut down the system by opening the burner switch or by lowering the set point of the operating controller. Make sure the burner flame goes out and all automatic fuel valve(s) close.

17. If used, remove the bypass jumpers from the low fuel pressure limit and subbase.
18. If a second stage is used, make sure the automatic second stage fuel valve(s) has opened. Check the lightoff as follows (otherwise proceed to step 19):
    a. Open the manual second stage fuel valve(s).
    b. Restart the system by raising the set point of the operating controller.
    c. When the first stage burner flame is established, watch for the automatic second stage fuel valve(s) to open. Observe that the second stage lights off properly.
    d. Make burner adjustments for flame stability and input rating.
    e. Shut down the system by lowering the set point of the operating controller. Make sure the burner flame goes out and all automatic fuel valve(s) close.
    f. Proceed to step 19.
19. Restart the system by closing the burner switch and/or raising the set point of the operating controller. Observe that the burner flame is established during PILOT IGN, within the normal lightoff time specified by the equipment manufacturer.
20. Measure the flame signal. Continue to check for the proper signal, see Table 8, through the RUN period. Check the signal at both high and low firing rate positions and while modulating. Any pulsating or unsteady readings will require further attention.
21. Make sure all readings are in the required ranges before proceeding.

NOTE: Upon completing these tests, open the master switch and remove all test jumpers from the subbase terminals, limits/controls or switches.

22. Return the system to normal operation.

Pilot Turndown Test (All Installations Using a Pilot)

Perform this check on all installations that use a pilot. The purpose of this test is to verify that the main burner can be lit by the smallest pilot flame that will hold in the flame amplifier and energize the FLAME LED. Clean the flame detector(s) to make sure that it will detect the smallest acceptable pilot flame.

NOTE: Low fuel pressure limits, if used, could be open. If so, bypass them with jumpers during this test.

1. Open the master switch.
2. Close the manual main fuel shutoff valve(s).
3. Connect a manometer (or pressure gauge) to measure pilot gas pressure during the turndown test.
4. Open the manual pilot shutoff valve(s).
5. Close the master switch and start the system with a call for heat. Raise the set point of the operating controller. The program sequence should start, and PREPURGE should begin.
6. When the PILOT IGN begins, set the Run/Test Switch to TEST position to stop the sequence. The FLAME LED will come on when the pilot ignites.

NOTE: If the sequence does not stop, reset the system and make sure you set the Run/Test Switch to TEST within the first eight seconds of the PILOT IGN sequence.

IMPORTANT:

You have eight seconds or three seconds, depending on PFEP selected, to position the Run/Test Switch to the TEST position to stop the sequence after the start of the PILOT IGN period.

7. Turn the pilot pressure down very slowly, reading the manometer (or pressure gauge) as it drops. Stop instantly when the FLAME LED goes out. Note the pressure at the RM7800 flame relay dropout point. The pilot is at the minimum turndown position. Immediately turn up the pilot pressure until the FLAME LED comes on again or the flame signal increases to 1.25 Vdc.

NOTE: If there is no flame for fifteen seconds with the sequence stopped at this point, the RM7800 will lockout and flash a lockout message, see Fig. 28.

8. Repeat step 7 to verify the pilot gas pressure reading at the exact point the FLAME LED light goes out.
9. Increase the pilot pressure immediately until the FLAME LED comes on, and then turn it down slowly to obtain a pressure reading just above the dropout point or until the flame signal increases to 1.25 Vdc.
10. Set the Run/Test Switch in the RUN position and let the sequence proceed. At ten seconds into the Ignition Trial period, make sure the automatic main fuel valve(s) open; then smoothly open the manual main fuel shutoff valve(s) (or any other manually opened safety shutoff valve(s), if used) and watch for main burner ignition.
    If the main burner flame is established, proceed to step 18.

NOTE: This step requires two people, one to open the manual valve(s) and one to watch for ignition.

11. If the main burner flame is not established within five seconds, or within the normal lightoff time specified by the equipment manufacturer, close the manual main fuel shutoff valve(s) and open the master switch. If the lightoff was rough, the pilot flame size is too small.
12. Recycle the burner and stop the sequence in the PILOT IGN period by using the Run/Test Switch.
13. Increase the pilot flame size by increasing its fuel flow until a smooth main flame is accomplished.
14. Reposition the flame scanner sight tube or use orifices until the pilot flame signal voltage is in the range of
    1.25 - 1.50 Vdc.
15. When the main burner lights reliably with the pilot at turndown, disconnect the manometer (or pressure gauge) and turn the pilot gas flow up to that recommended by the equipment manufacturer.
16. If used, remove the bypass jumpers from the subbase terminals, limits/controls, or switches.
17. Run the system through another cycle to check for normal operation.
18. Return the system to normal operation.

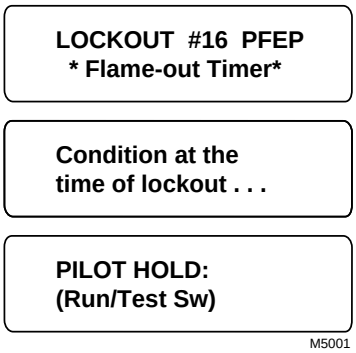


Fig. 29. Flame-out timer lockout.

Ignition Interference Test (All Flame Rods)

Test to make certain that a false signal from a spark ignition system is not superimposed on the flame signal.

Ignition interference can subtract from (decrease) or add to (increase) the flame signal. If it decreases the flame signal enough, it will cause a safety shutdown. If it increases the flame signal, it could cause the FLAME LED to come on when the true flame signal is below the minimum acceptable value.

Start the burner and measure the flame signal with both ignition and pilot (or main burner) on, and then with only the pilot (or main burner) on. Any significant difference (greater than .5 Vdc) indicates ignition interference.

To Eliminate Ignition Interference

1. Make sure there is enough ground area.
2. Be sure the ignition electrode and the flame rod are on opposite sides of the ground area.
3. Check for correct spacing on the ignition electrode:
   a. 6000V systems—1/16 to 3/32 in. (1.6 to 2.4 mm).
   b. 10,000V systems—1/8 in. (3.2 mm).
4. Make sure the leadwires from the flame rod and ignition electrode are not too close together.
5. Replace any deteriorated leadwires.
6. If the problem cannot be eliminated, the system may have to be changed to an ultraviolet flame detection system.

Hot Refractory Hold-in Test (Rectifying Photocell)

Test to make certain hot refractory will not delay the flame detection system response to a flameout. This condition can delay response to flame failure and also can prevent a system restart as long as hot refractory is detected.

To check rectifying photocells for hot refractory hold-in, operate the burner until the refractory reaches its maximum temperature. Then terminate the firing cycle by lowering the set point of the operating controller, or set the Fuel Selector Switch to OFF. Do not open the master switch. Visually observe when the burner flame or FLAME LED goes out. If this takes more than 0.8 or 3 seconds (depending on the FFRT of the amplifier), the photocell is sensing hot refractory. This condition must be corrected as described in the last paragraph of this test.

NOTE: Some burners continue to purge oil lines between the valve(s) and nozzle(s) even though the fuel valve(s) are closed. Terminating the firing cycle (instead of opening the master switch) will allow purging the combustion chamber. This will reduce a buildup of fuel vapors in the combustion chamber caused by oil line purging.

If the detector is sensing hot refractory, the condition must be corrected. Add an orifice plate in front of the cell to restrict the viewing area of the detector. If this does not correct the problem, resight the detector at a cooler, more distant part of the combustion chamber. While resighting the detector, be aware that it must also properly sight the flame. For an infrared detector, try lengthening the sight pipe or decreasing the pipe size (diameter). For details, refer to the detector Instructions and the equipment Operating Manual. Continue adjustments until hot refractory hold-in is eliminated.

Utraviolet Sensor, Ignition Spark Response Test (All Ultraviolet Detectors)

Test to make certain that the ignition spark is not actuating the FLAME LED.

1. Close the pilot and main burner manual fuel shut-off valve(s).
2. Start the burner and use the Run/Test Switch to stop the sequence in the PILOT IGN period. Ignition spark should occur, but the flame signal should not be more than 0.5 Vdc.
3. If the flame signal is higher than 0.5 Vdc and the FLAME LED does come on, consult the equipment operating manual and resight the detector farther out from the spark, or away from possible reflection. It may be necessary to construct a barrier to block the ignition spark from the detector view. Continue adjustments until the flame signal due to ignition spark is less than 0.5 Vdc.

NOTE: The Honeywell Q624A Solid State Spark Generator will prevent detection of ignition spark when properly applied with C7027, C7035 or C7044 Minipeeper Ultraviolet Flame Detectors. The Q624A is only for use with gas pilots.

Response to Other Ultraviolet Sources

Some sources of artificial light, such as incandescent or fluorescent bulbs, mercury sodium vapor lamps and daylight, produce small amounts of ultraviolet radiation. Under certain conditions, an ultraviolet detector will respond to these sources as if it is sensing a flame. To check for proper detector operation, check the Flame Failure Response Time (FFRT) and conduct Safety Shutdown Tests under all operating conditions.

Flame Signal With Hot Combustion Chamber (All Installations)

With all initial start-up tests and burner adjustments completed, operate the burner until the combustion chamber is at the maximum expected temperature. Observe the equipment manufacturer warm-up instructions. Recycle the burner under these hot conditions and measure the flame signal. Check the pilot alone, the main burner flame alone, and both together (unless monitoring only the pilot flame when using an intermittent pilot, or only the main burner flame when using DSI). Check the signal at both High and Low Firing Rate positions and while modulating, if applicable.

Check the FFRT of the Flame Amplifier. Lower the set point of the operating controller and observe the time it takes for the burner flame to go out. This should be within 0.8 or 3 seconds maximum depending on the amplifier selected.

If the flame signal is too low or unsteady, check the flame detector temperature. Relocate the detector if the temperature is too high. If necessary, realign the sighting to obtain the proper signal and response time. If the response time is still too slow, replace the Plug-in Flame Signal Amplifier. If the detector is relocated or resighted, or the amplifier is replaced, repeat all required Checkout tests.

Safety Shutdown Tests (All Installations)

Perform these tests at the end of Checkout, after all other tests have been completed. If used, the external alarm should turn on. Press the RM7800 reset pushbutton to restart the system.

1. Opening a Preignition Interlock during STANDBY or PREPURGE period.
   a. *Preignition ILK* fault will be displayed on the VFD. Fault code 10 or 33 will be displayed to denote the fault.
   b. Safety shutdown will occur.
2. Opening a Lockout Interlock during PREPURGE, PILOT IGN, MAIN IGN or RUN period.
   a. *Lockout ILK* fault will be displayed on the VFD. Fault code 11 or 12 or 21 or 29 will be displayed to denote the fault.
   b. Safety shutdown will occur.
3. Detection of flame 40 seconds after entry to STANDBY, fault code 9. Detection of flame ten seconds into Drive to Purge Rate for RM7800L or 30 seconds for RM7800M during measured PREPURGE time.
   a. Simulate a flame to cause the flame signal voltage level to be at least 1.25 Vdc for 40 seconds after entry to STANDBY and also simulate a flame signal for 10 seconds for RM7800L and 30 seconds for RM7800M during PREPURGE.
   b. *Flame Detected* fault will be displayed on the VFD. Fault code 9 or 15 or 18 will be displayed to denote the fault.
   c. Safety shutdown will occur.
4. Failure to ignite pilot.
   a. Close pilot and main fuel manual shutoff valve(s).
   b. Depress the reset button.
   c. Start the system.
   d. The automatic pilot valve(s) should be energized but the pilot cannot ignite.
   e. *Pilot Flame Fail* fault will be displayed on the VFD. Fault code 28 will be displayed four or ten seconds (depending on the jumper configuration selection for PFEP) after the pilot valve(s) is energized to denote the fault.
   f. Safety shutdown will occur.
5. Failure to ignite main.
   a. Open the manual pilot valve(s); leave the main fuel manual shutoff valve(s) closed.
   b. Depress the reset button.
   c. Start the system.
   d. The pilot should ignite and the flame signal should be at least 1.25 Vdc but the main burner cannot light.
   e. The flame signal should drop below 1.25 Vdc within 0.8 or 3 seconds (depending on the FFRT of the amplifier) after the interrupted pilot goes out.
   f. *Main Flame Ign.* fault will be displayed on the VFD. Fault code 19 will be displayed to denote the fault.
   g. Safety shutdown will occur.
6. Loss of flame during RUN.
   a. Open the main fuel manual shutoff valve(s) and open manual pilot shutoff valve(s).
   b. Depress the reset button.
   c. Start the system. Start-up should be normal and the main burner should light normally.
   d. After the sequence is in the normal RUN period for at least ten seconds with the main burner firing, close the manual main fuel shutoff valve(s) to extinguish the main burner flame.
   e. The flame signal should drop below 1.25 Vdc within 0.8 or 3 seconds (depending on the FFRT of the amplifier) after the main flame goes out.
   f. *Main Flame Fail* fault will be displayed on the VFD. Fault code 17 will be displayed to denote the fault.
   g. Safety shutdown will occur.
7. Opening a Preignition Interlock after the first five second of POSTPURGE.
   a. *Preignition ILK* fault will be displayed on the VFD. Fault code 33 will be displayed to denote the fault.
   b. Safety shutdown will occur.

IMPORTANT:

1. *1. If the RM7800 fails to shut down on any of these tests, take corrective action; refer to Troubleshooting and the RM7800 diagnostics and return to the beginning of all Checkout tests.*
2. *2. When all Checkout tests have been completed, reset all switches to original status.*

TROUBLESHOOTING

RM7800 System Diagnostics

Troubleshooting control system equipment failures is made easier with the RM7800 self-diagnostics and first-out annunciation. In addition to an isolated spst alarm relay (audible annunciation), the RM7800 provides visual annunciation by displaying a fault code and fault or hold message at the Keyboard Display Module 2 row by 20 column VFD. The RM7800 provides 118 diagnostic messages for troubleshooting the system (see 7800 SERIES System Annunciation Diagnostics and Troubleshooting,
form 65-0118).

Self-diagnostics of the RM7800 enables it to detect and annunciate both external and internal system problems. Internal faults and external faults such as interlock failures, flame failures and false flame signals are annunciated by the RM7800, which energizes the ALARM LED or visually displayed at the Keyboard Display Module VFD.

The VFD displays a sequence status message indicating: STANDBY, PREPURGE, PILOT IGN, MAIN IGN, RUN and POSTPURGE. The selectable messages also provide visual indication of current status and historical status of the equipment such as: Flame Signal, Total Cycles, Total Hours, Fault History, Diagnostic Information and Expanded Annunciator terminal status (if used). With this information, most problems can be diagnosed without extensive trial and error testing.

Table 3 provides the sequence and status hold messages. Table 9 provides a summary of all RM7800 fault messages and fault codes. In addition, Diagnostic Information and History Data are available to assist in troubleshooting the RM7800, see Table 5.

The RM7800 provides diagnostic information to aid the service mechanic in obtaining information when troubleshooting the system, see Tables 3, 4, 5 and 9. Information available in the Diagnostic Information includes Device Type, Device Suffix, Software Revision, Manufacturing Code, Flame Amplifier Type, Flame Failure Response Time, Selectable Jumper Configuration Status, Run/Test Switch Status and Terminal Status.

Diagnostic Information Index

The RM7800 monitors input/output terminals and can display the status of the terminal at the VFD (example: Pilot Valve T8 ON<). See Table 4 for a complete terminal description and number. The display will show the actual status of the terminal. If voltage is detected at the terminal, ON is displayed, but if no voltage is detected at the terminal, OFF is displayed, see Table 4.

Historical Information Index

The RM7800 has nonvolatile memory that allows the Relay Module to retain Historical Information for the six most recent lockouts. Each of the six lockout files retains the cycle when the fault occurred, the hour of operation when the fault occurred, a fault code, a fault message and burner status when the fault occurred, see Table 4.

SERVICE NOTE: If the Keyboard Display Module is scrambled, remove and reinstall the Keyboard Display Module, and reset the 7800 SERIES Relay Module.

SERVICE NOTE: Reset RM7800 by pressing the reset pushbutton on the RM7800, or pressing a remote reset pushbutton wired through the 203541 5-Wire Connector (ordered separately) on the Keyboard Display Module, Data ControlBus™ Module or Remote Reset Module. A power-up reset will cause an electrical reset of the RM7800 but will not reset a lockout condition.

SERVICE NOTE: Use the access slots on the sides of the Q7800A,B to check terminal voltage.

Table 14. Hold and Fault Message Summary.

Fault Number	Annunciation Message
Fault 1	*No Purge Card*
Fault 2	*AC Frequen/Noise*
Fault 3	*AC Line Dropout*
Fault 4	*AC Frequency*
Fault 5	*Low Line Voltage*
Fault 6	*Purge Card Error*
Fault 7	*Flame Amplifier*
Fault 8	*Flame Amp/Shutr*
Fault 9	*Flame Detected*
Fault 10	*Preignition ILK*
Fault 11	*Running ILK On*
Fault 12	*Lockout ILK On*
Fault 14	*High Fire Sw.*
Fault 15	*Flame Detected*
Fault 16	*Flame-Out Timer*
Fault 17	*Main Flame Fail*
Fault 18	*Flame Detected*
Fault 19	*Main Flame Ign.*
Fault 20	*Low Fire Sw. Off*
Fault 21	*Running ILK*
Fault 24	*Call Service*
Fault 25	*Call Service*
Fault 28	*Pilot Flame Fail*
Fault 29	*Lockout ILK*
Fault 33	*Preignition ILK*
Fault 35 - 40	*Call Service*
Fault 41	*Main Valve Off*
Fault 42	*Pilot Valve On*
Fault 43	*Ignition On*
Fault 44	*Pilot Valve 2 On*
Fault 45	*Low Fire Sw. Off*
Fault 46	*Flame Amp Type*
Fault 47	*Jumpers Changed*
Fault 50	*Jumpers Wrong*
Fault 51	*Flame Too Strong*
Fault 52 - 70	*Call Service*
Fault 71 - 75	*Device Specific*
Fault 76 - 93	*Accessory Fault*
Fault 94 - 108	*Call Service*
Fault 109	*Call Service*
Fault 110 - 127	*Call Service*

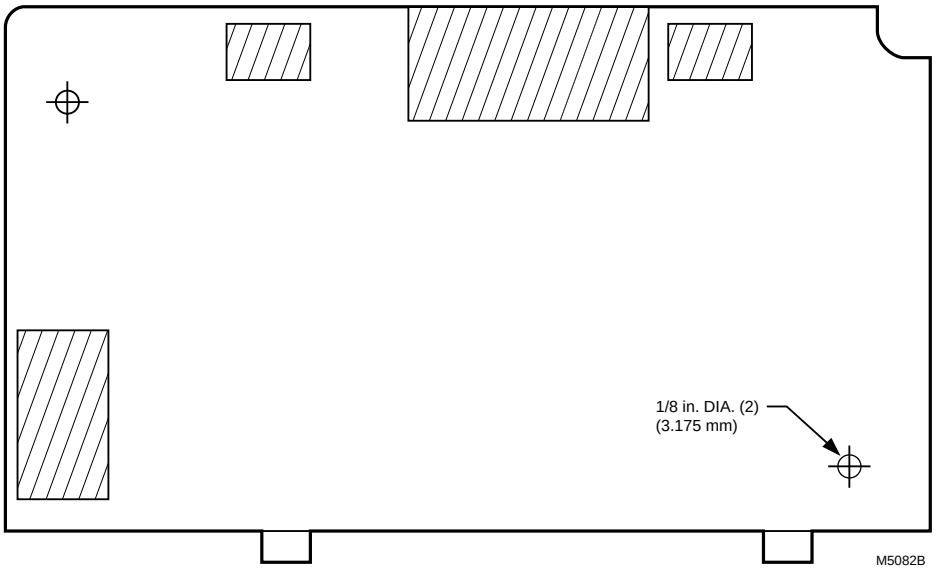


Fig. 30. Template for flush-mounting a Keyboard Display Module.

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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