

Installation and Maintenance Manual

IM 1300-1

Group: **Applied Air Systems**

Part Number: **IM1300-1**

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Vision® / Skyline® Gas Heat



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Introduction

General Information

CAUTION

Sharp edges and coil surfaces are a potential injury hazard. Avoid contact.

The system design and installation must follow accepted industry practice as described in the ASHRAE Handbook, the National Electric Code, and other applicable standards. Install this equipment in accordance with regulations of authorities having jurisdiction and all applicable codes.

Installation and maintenance must be performed by qualified personnel familiar with applicable codes and regulations and experienced with this type of equipment. Sheet metal parts, self-tapping screws, fins, clips, and such items inherently have sharp edges; the installer should exercise caution.

Receiving and Handling

Inspection

- Carefully check items against the bills of lading to verify all crates and cartons have been received. Carefully inspect all units for shipping damage. Report damage immediately to the carrier and file a claim.

Hazardous Information Messages

CAUTION

Caution indicates a potentially hazardous situations, which can result in minor injury or equipment damage if not avoided.

WARNING

Warning indicates a potentially hazardous situations, which can result in property damage, personal injury, or death if not avoided.

WARNING

Warning indicates potentially hazardous situations for PVC (Polyvinyl Chloride) and CPVC (Chlorinated Polyvinyl Chloride) piping in chilled water systems. If ever the inside wall of the pipe is exposed to POE (Polyolester) oil used in the refrigerant system, environmental stress fractures in the pipe will occur and may result in system failure and property damage. In the event the pipe is exposed to POE (Polyolester) oil used in the refrigerant system, the pipe can be chemically damaged and pipe failure can occur.

DANGER

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

NOTICE

Notice indicates practices not related to physical injury.

WARNING

LOCKOUT/TAGOUT all power sources prior to servicing the unit. Hazardous gas condition can cause serious injury or death. Close gas connections/valves before servicing equipment. More than one disconnect may be required to de-energize the unit.

Nomenclature

OAH 003 G D A C

Model

OAH = Outdoor custom modular air handler
OAC = Outdoor custom modular component
CAH = Indoor custom modular air handler
CAC = Indoor custom modular component

Nominal unit size

(cataloged size—nominal square foot of coil)
003, 004, 006, 008, 010, 012, 014, 017,
021, 025, 030, 035, 040, 050, 065, 080, 085, 090

Vintage of Daikin Applied air handling unit
Unit type/coil position

B = Blow-through cooling coil location
D = Draw-through cooling coil location
H = Heating only
V = Vent only
M = Multizone

Unit cross section

C = Standard unit cross section
M = Custom size cross section

Motor location

A = Motor along side of fan housing
C = Motor downstream of ECM fan
D = Motor downstream of belt-drive plenum fan
F = Motor on inline fan
G = Motor downstream of direct-drive plenum fan
H = Motor downstream of direct-drive plenum fan in fan array
T = Motor behind twin fan housing

Duct Gas Furnace

Indirect-Fired Tubular Duct Furnaces

DANGER

FIRE OR EXPLOSION HAZARD - READ CAREFULLY

Failure to follow safety warnings exactly could result in serious injury, death, or property damage

Be sure to read and understand the installation, operation, and service instructions in this manual

Improper installation, adjustment alteration, service, or maintenance can cause serious injury, death, or property damage

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or other appliances

WHAT TO DO IF YOU SMELL GAS:

- Do not try to light any appliance
- Do not touch any electrical switch; do not use any phone in the building
- Leave the building immediately
- Immediately call your gas supplier, follow the gas supplier's instructions
- If you cannot reach your gas supplier, call the Fire Department

Installation and service must be performed by a qualified installer, service agency, or gas supplier

The optional gas-fired duct furnace design consists of a tubular heat exchanger(s), burner manifold with gas valve, induced combustion blower, gas heat control module and all operational safeties. The tubular heat exchanger is standard with stainless steel construction. The safety switches include a high-limit temperature switch, an auxiliary high-limit switch, a combustion blower proof of airflow, and the flame roll-out switch.

The high limit switch is an automatic reset switch and it opens up at 160°F to shut the duct furnace down and closes at 130°F. The auxiliary limit switch is a manual reset and opens up at 180°F to shut the duct furnace down.

Warranty Exclusion

Warranty may be voided if the duct furnace is operated in the presence of chlorinated vapors, if the airflow through the duct furnace is not in accordance with rating plate, or if the wiring or controls have been modified or tampered with.

Gas Piping

DANGER

READ CAREFULLY: All field gas piping must be pressure/leak tested prior to operation. NEVER use an open flame to check for leaks. Use a soap solution or other leak detecting solution.

Gas pressure to appliance controls must never exceed 13.5" w.c. (½ psi)

Installation of piping must conform with local building codes and ordinances, or in the absence of local codes with ANSI Z223.1 the National Fuel Gas Code. In Canada, installation must be in accordance with CAN/CGA –B149.1 for Natural gas and B149.2 for propane units. A gas regulator servicing multiple units must have the proper pipe size and internal orifice for the total input of all heating units serviced by that regulator. A field supplied sediment trap and shut off valve is to be provided at the Daikin Applied unit.

The duct furnace gas piping was leak tested prior to shipping. However, during shipping and installation connections may have loosened. Check for leaks using a soap solution and correct any leaks before placing the duct furnace in operation.

Minimum Gas Pressure

Individual duct furnaces require a minimum gas pressure noted in [Table 1](#)

Table 1: Minimum Gas Pressure

Individual Duct Furnace Size - READ	Natural Gas	Propane Gas
50,000 to 400,000 BTUH	5.0" w.c.	11.0" w.c.
<400,000 BTUH	6.0" w.c.	12.0" w.c.

The Daikin Applied duct furnace modules have a maximum inlet pressure of 13.5" w.c. Installer is responsible for supplying a pressure regulator if required.

Airflow Requirements

When variable air moving (2 stage or variable frequency drive) is provided by others the allowable minimum cfm to the duct furnace is 2/3 (67%) of the listed minimum CFM for the duct furnace model when applied as follows:

1. The unit has two stage or modulating gas controls.
2. The air handling unit is equipped with a discharge air controller.
3. The system does not include a room thermostat.

Systems utilizing variable air volume to maintain the desired building pressure require separate control of the heating unit input to ensure that the maximum temperature rise of the duct furnace is not exceeded. Consult the factory for assistance with system control design in these applications.

Ventilation and Flue Pipe Requirements

WARNING

Hot surface hazard. Can cause equipment damage, personal injury, or death. Allow burner assembly to cool before servicing equipment.

WARNING

Units equipped with gas heating must not be operated in an atmosphere contaminated with chemicals which will corrode the unit such as hydrocarbons, chlorine, cleaning solvents, refrigerants, swimming pool exhaust, etc. Exposure to these components may cause severe damage to the gas duct furnace and result in improper or dangerous operation. Operation of the gas duct furnace in such a contaminated atmosphere constitutes product abuse and will void all warranty coverage by the manufacturer. Questions regarding specific contaminants should be referred to your local gas utility.

Standard Efficiency Models

The Daikin Applied outdoor air handling unit is equipped with an outdoor air hood to supply adequate combustion air. The unit also has a flue outlet assembly and requires no additional chimney, flue pipe, Breidert cap, draft inducer, etc..

High Efficiency Models

All unit installations must be in accordance with the National Fuel Gas Code ANSI Z223.1 (NFPA 54) in the United States and Can/CGA-B149 Installation Code in Canada, and all other applicable local codes and ordinances. These requirements include but are not limited to:

- Duct furnace Location and clearances
- Circulating airflow and ductwork
- Combustion air supply to the heating equipment
- Venting of the products of combustion (flue gases)
- Gas supply, piping and connections

Condensate Drain Lines

WARNING

Failure to connect condensate drains can result in accumulation of condensate during heater operation and result in hazardous operation and can damage the heat exchanger.

WARNING

Failure to connect and properly install condensate drains can result in water flow into the building causing structural or property damage or personal injury and death.

WARNING

For outdoor installations, the condensate drain line must be routed through a heated space. **DO NOT DRAIN ON THE ROOF.** Failure to properly connect condensate drains can result in significant amounts of ice buildup, causing structural or property damage or personal injury.

WARNING

LOCKOUT/TAGOUT all power sources prior to servicing the unit. Hazardous gas condition can cause serious injury or death. Close gas connections/valves before servicing equipment. More than one disconnect may be required to de-energize the unit.

Where condensate drains are located outside a heated space or in a space where temperatures may fall below freezing, the drain line must be protected. Use a 2.5 to 5 watt per foot (0.003 to 0.005 kW per meter) at 115 VAC, 40° F (4.4° C) self-regulating, shielded and waterproof heat tape. Wrap the drain trap and drain line with heat tape and secure with ties. Follow the heat tape manufacturer's installation recommendations.

Disposal of condensate is subject to local codes and ordinances. In some locals the condensate drain system may be connected to a sanitary drain within the building. Some municipalities require that the acidic condensate produced be neutralized before being discharged into the sanitary sewer. A condensate neutralizer kit should be used. Refer to installation instructions provided with the kit. Locate neutralizer where it is readily accessible for inspection and maintenance. When a drain is not readily available, a condensate pump might be needed. Installer is responsible for providing the neutralization kit and condensate pump.

Wiring/Controls

Single Duct Furnace

2-Stage Controls

Sequence

When system is powered up 24 VAC will be applied to the ignition control (IC) terminals 24VAC/GND. The control will reset, perform a self-check routine, initiate full time flame sensing, flash the diagnostic LED for up to four seconds and enter the thermostat scan standby state. Call for Heat

1. Thermostat (controller) closes on call for heat powering terminal T2.
2. 24 VAC is supplied to IC terminal Tstat, provided limit switch is in closed position.
3. The control will check that pressure switch contacts are open (IC terminal APS (PSW) is not powered).
4. The Induced Draft Fan (ID Fan) is then energized at high speed through IC terminal IND.
5. When the Air Switch (APS-1) closes, a 15 second pre-purge period begins.
6. At end of pre-purge period, the spark commences and either 1st stage or both 1st and 2nd stage gas valves (depending on status of call for heat) are energized for the trial for ignition period.
7. If the thermostat (controller) is calling for 1st stage heat only, the 1st stage valve will open (1.0 to 1.4" w.c. manifold pressure on Natural Gas or 2.5 to 3.0" w.c. on Propane Gas). If the thermostat (controller) is calling for high heat, both 1st and 2nd stage valves will open (3.3 to 3.5" w.c. manifold pressure on Natural Gas or 9.5 to 10.0" w.c. on Propane Gas).
8. Burners ignite and cross light.
9. When flame is detected by flame sensor the spark is shut-off immediately and gas valve(s) and combustion blower remain energized.
10. During heating operation, the thermostat, pressure switch and main burner flame are constantly monitored to assure proper system operation.
11. If the 2nd stage thermostat (controller) is satisfied, the 2nd stage contact opens, de-energizing the 2nd stage valve. Heater will continue to operate at 1st stage (low fire).
12. When the thermostat (controller) is satisfied and the demand for heat ends, the 1st stage valve is de-energized immediately, the control senses loss of flame and a 30 second post-purge occurs before de-energizing the ID Fan.

Recovery from Lockout

1. If the thermostat (controller) is still calling for heat one hour after a lockout occurs, the control will automatically reset and initiate a call for heat sequence.
2. The ignition control may also be manually reset, by turning the thermostat (controller) down and back up to previous temperature setting or removing power (24V) to IC terminal 24VAC.

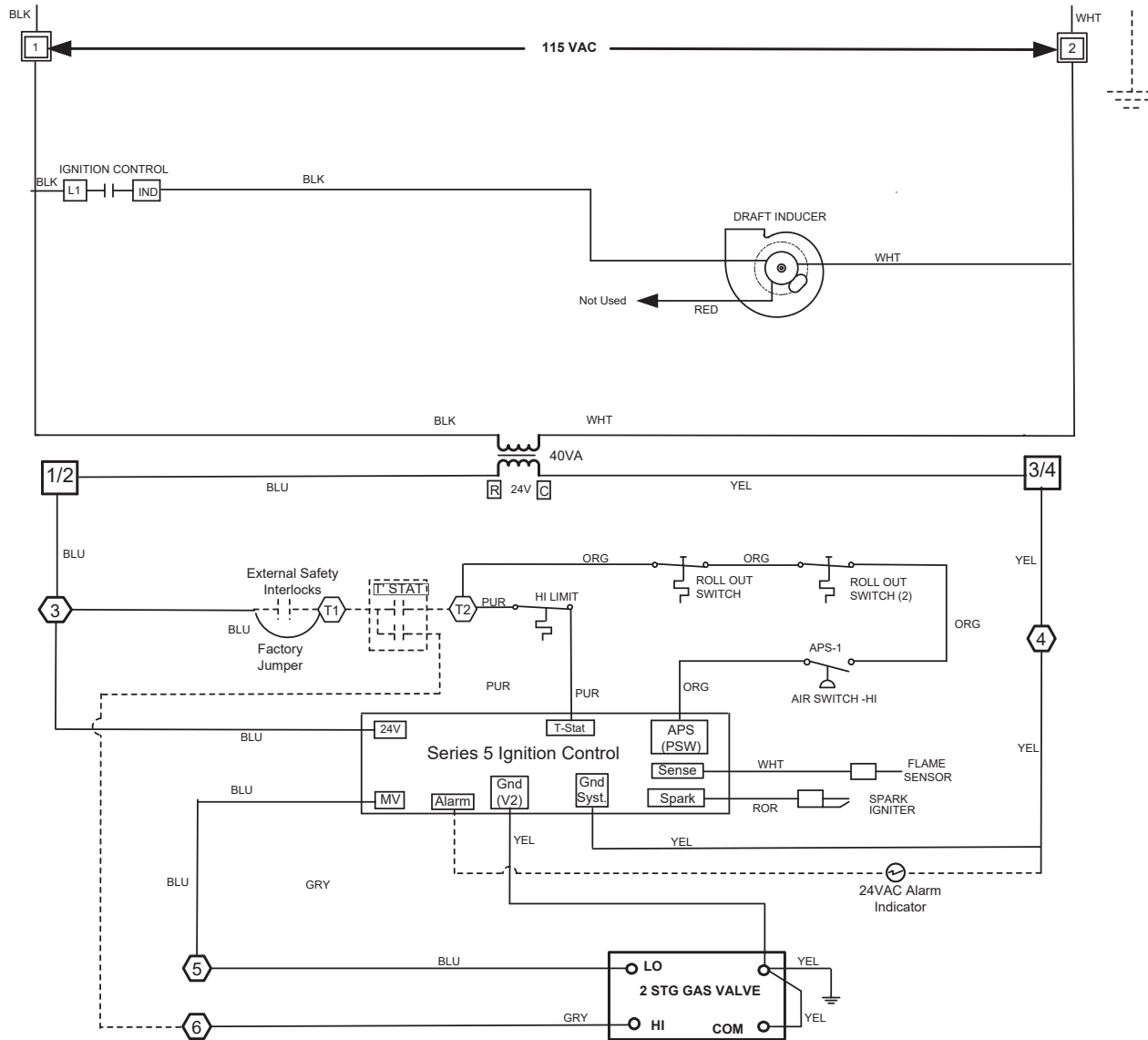
LED Indications, Normal Operation

- Green, ½ sec ON, ½ sec OFF: Pre-purge, Inter-purge, Post-purge
- Green, blinking rapidly: Trial for ignition
- Green, on solid: Flame detected, pilot/main burners on

ERROR CODES - Red Flashes Error Definition Error Type

- 1 flash, then pause No flame in trial time Lockout
- 2 flashes, then pause Flame sense stuck on Lockout
- 3 flashes, then pause Pilot/Main relay failure Lockout
- 4 flashes, then pause Repetitive flame loss error Lockout
- 5 flashes, then pause Rollout error Lockout
- 6 flashes, then pause APS Airflow error Lockout
- 7 flashes, then pause Internal control error Lockout ON Solid Red Line Voltage/Freq Error Standby

Figure 1: HM/HD Series – SN Control (Staged Control)



CUSTOMER PROVIDED COMPONENT

----- CUSTOMER / FIELD WIRING

INTERNAL TERMINAL CONNECTION

EXTERNAL TERMINAL CONNECTION

(2) 2nd ROLLOUT SWITCH ON HORIZONTAL BURNER TRAY ONLY

TIMER RELAY – TR1-090LH15

TR1 TIMER RELAY TERMINAL CONNECTION

5:1 Modulating Duct Furnace



WARNING

LOCKOUT/TAGOUT all power sources prior to servicing the unit. Hazardous gas condition can cause serious injury or death. Close gas connections/valves before servicing equipment. More than one disconnect may be required to de-energize the unit.

Sequence

When system is powered, 24 VAC will be applied to the ignition control (IC) across terminals 24VAC/GND, to the SC40 (Blue LED lit) and to the EXA Valve. The ignition control will reset, perform a self-check routine, initiate full time flame sensing, flash the diagnostic LED for up to four seconds and enter the thermostat scan standby state.

Call for Heat

1. Thermostat (or heat enable) closes (T1/T2) on call for heat.
2. 24 VAC is supplied to IC terminal T'STAT, provided the high limit switch is in closed position.
3. The control will check that pressure switch contacts are open (IC terminal APS (PSW) is not powered).
4. The Induced Draft Fan (ID Fan) is then energized at high speed. SC40 Green (AFS) LED is lit.
5. Air Switch (APS-1 Low) closes initiating a 15 second pre-purge period.
6. At end of pre-purge period, the spark commences and the combination gas valve is energized for a trial for ignition period.
7. The SC40 will output 5 VDC to the EXA modulating control valve regardless of the analog input signal to SC40 terminals T10 & T11.
8. Burners ignite and cross light, operating at the adjusted mid-fire input rate
9. When flame is detected by flame sensor, the spark is shut-off immediately and gas valve and ID Fan remain energized.
10. SC40 is powered (terminal T4) simultaneously (Yellow (SU) LED lit) and begins timing a 30 second warm-up period while maintaining the ID Fan at high speed (Green AFS LED remains lit).
11. When the initial timer in SC40 times out, control will respond to analog input at terminals T10 and T11. Green (Mod) LED is lit.
12. If the controller is providing an analog signal between 0.5 and 5.0 VDC to the SC40 control, relay R1 is energized. RED (R1) LED is lit.
13. The ID Fan will run at low speed and the EXA modulating valve will be powered proportional to the analog input voltage signal and will open or close modulating the gas input between low and mid-fire.
14. If the signal is 5.1 VDC or higher, the SC40 relay R1 is de-energized and ID Fan goes to high speed.

15. Provided the High Air Switch (APS-2) contacts are closed, with analog inputs between 5.1 and 10.0 VDC the EXA Valve will modulate the gas input between mid-fire and high fire.
16. During heating operation, the thermostat, pressure switch and main burner flame are constantly monitored by the IC to assure proper system operation.
17. Operation continues in the High fire mode until the controller input signal to the SC40 control drops to 4.8 VDC. At this point the SC40 R1 relay circuit is energized and switches the ID Fan to low speed operation. Low-fire modulation will continue for analog input voltages from 4.7 VDC.
18. When the thermostat (temperature controller) is satisfied and the demand for heat ends, the heat enable contact opens, power is removed from the T'stat terminal on IC and the combination gas valve is de-energized immediately and a 30 second post-purge occurs (at high speed) before de-energizing the ID Fan.

Ignition and Operational failures during a call for heat result in "lockout" of the ignition control

1. If flame is lost during an operational cycle, the control will respond within 0.8 seconds. The spark will be energized for a trial for ignition period to attempt to relight burners and prove flame sensor. If flame is re-established, normal operation resumes
2. If the burners fail to light or carryover during a trial for ignition, the control will attempt two additional ignition trials. If no flame is present at the flame sensor within 10 seconds, the spark and gas valve will be de-energized. A 15 second inter-purge period begins and the combustion blower continues to run. After the inter-purge period another ignition trial will take place.
3. If burner fails to light or prove the flame sensor following the two additional trials the control will go into lockout. The valve relay in the IC will be de-energized shutting of the gas valve immediately and the induced draft fan following a 30 second post-purge.

Recovery from Lockout

1. If the thermostat (controller) is still calling for heat one hour after a lockout occurs, the control will automatically reset and initiate a call for heat sequence.
2. The ignition control may also be manually reset, removing power (24V) to IC terminal 24VAC for 5 seconds then restoring power.

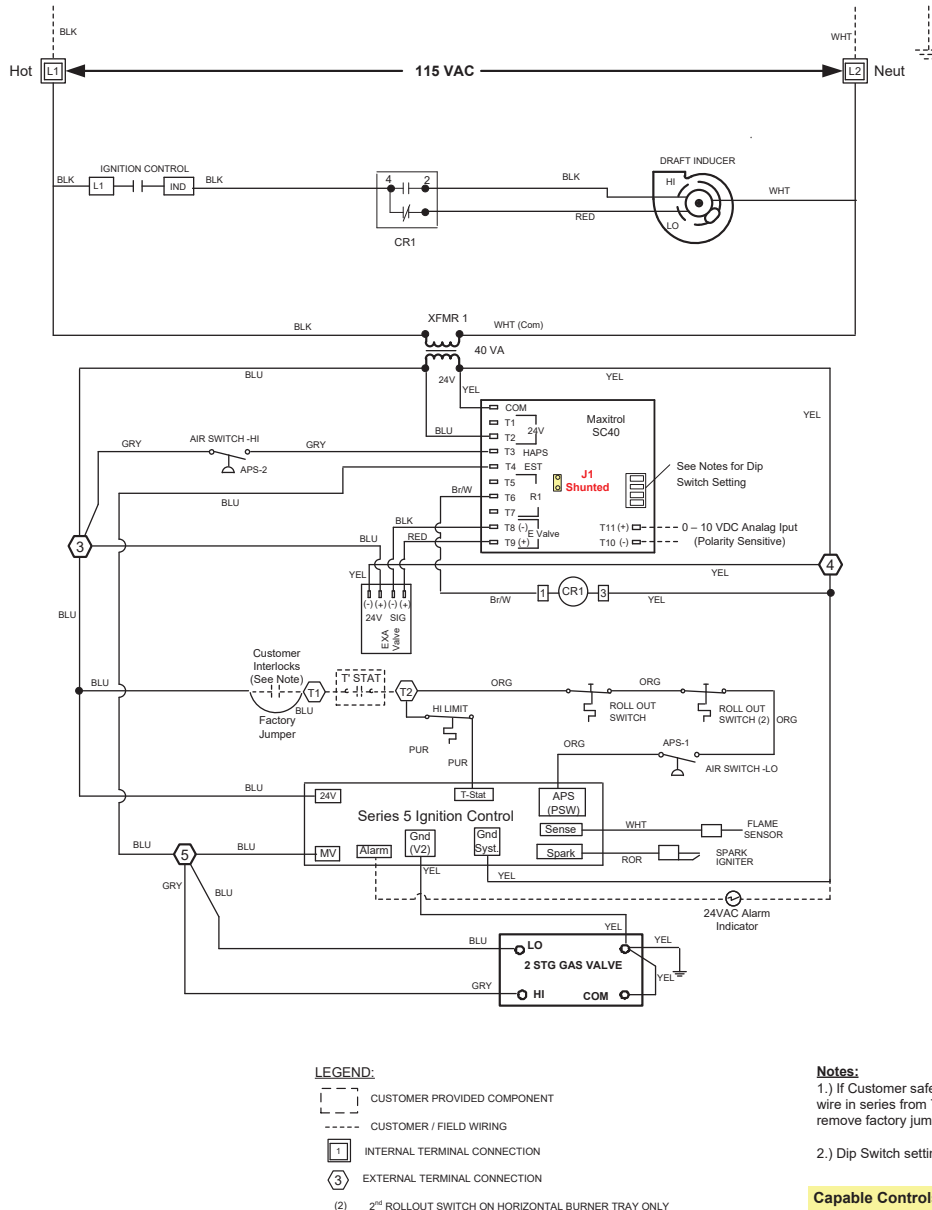
LED Indications, Normal Operation

- Green, ½ sec ON, ½ sec OFF: Pre-purge, Inter-purge, Post-purge
- Green, blinking rapidly: Trial for ignition
- Green, on solid: Flame detected, pilot/main burners on

ERROR CODES - Red Flashes Error Definition Error Type

- 1 flash, then pause - No flame in trial time Lockout
- 2 flashes, then pause - Flame sense stuck on Lockout
- 3 flashes, then pause - Pilot/Main relay failure Lockout
- 4 flashes, then pause - Repetitive flame loss error Lockout
- 5 flashes, then pause - Rollout error Lockout
- 6 flashes, then pause - APS Airflow error Lockout
- 7 flashes, then pause - Internal control error Lockout
- On Solid Red - Line Voltage/Frequency Error Standby

Figure 2: HM/HD Series – SN Control (Staged Control)



10:1 Modulating Duct Furnace



WARNING

LOCKOUT/TAGOUT all power sources prior to servicing the unit. Hazardous gas condition can cause serious injury or death. Close gas connections/valves before servicing equipment. More than one disconnect may be required to de-energize the unit.

Sequence

Standby Mode

1. Heat enable (Thermostat) open (No call for heat)
2. Line Voltage applied to Terminals L1 & L2
3. 24 VAC is applied to Terminals T2/COM on the SC30-SM2A (Blue LED lit), to both Ignition Controls (IC) across terminals 24VAC/GND.
4. The ignition control (IC) performs a self-check routine, initiates full time flame sensing, flashes the diagnostic LED for up to four seconds and enters the thermostat scan standby state (Green LED blinks ½ second ON / ½ second OFF).

Startup/Operation - Call for Heat

1. On call for heat, Thermostat (or heat enable) closes (Terminals T1/T2 on terminal strip).
2. Provided that the system safety interlocks (circulating airflow switch and auxiliary high limit) and high limit contacts are closed, 24 VAC is supplied to Section A IC terminal TSTAT.
3. Section A ignition control (IC) will check that APS-1 pressure switch contacts are open, [IC terminal APS (PSW) is not powered].
4. Section A IC Blower (IND) relay contacts close, powering the Induced Draft Fan (ID Fan) which operates at high speed.
5. Combustion Air Switch (APS-1 Low) closes powering terminal APS (PSW) initiating a 15 second pre-purge period.
6. At end of pre-purge period, main gas valve and spark igniter are energized to initiate a trial for ignition. Burners ignite.
7. The SC30-SM2A will output 8.5 VDC to the M Series modulating valve for a pre-programmed 30 second warm-up period (Yellow (SU) and Green (AFS) LED's lit) while maintaining the ID Fan at high speed (Green AFS LED remains lit) and heater Section A operates at preset mid-fire input (30% of total heater input).
8. During this warm-up period, the SC30-SM2A ignores the analog input signal to terminals T12/T13.
9. When the initial timer in SC30-SM2A times out, control will respond to analog input at terminals T12 and T13. Green (Mod) LED is lit.

10. If the controller is providing an analog signal between 0.5 and 5.0 VDC to the SC30-SM2A control, only the modulating section (Section A) will operate from 10%-50% of total heater input. For analog inputs from 0.5 to 2.5 VDC, the ID Fan will run at low speed and LED's PWR (Blue), MOD (Green) R1 (Red) are lit. (Note: Green (AFS) LED may be lit if ID Fan pressure is sufficient to close APS-2). The modulating valve will be powered proportional to the analog input voltage signal and modulating gas input from 10 to 30% of total heater input.
11. For analog inputs from 2.6 to 5.0 VDC to SC30-SM2A the ID Fan will run at high speed (APS-2 closed) and LED's PWR (Blue), MOD (Green) and AFS (Green) are lit. The modulating valve will be powered proportional to the analog input voltage signal and will modulate Section A gas input from 30 to 50% of total heater input.
12. For analog inputs between 5.2 – 7.5 VDC, the SC30-SM2A relay R2 is energized closing contacts between T8 & T9, powering T'stat terminal of Section B Ignition Control (IC). Section B, IC ID Fan relay contacts close powering contact APS (PSW) provided APS-3 and Rollout Switch 2 contacts are closed.
13. Following a 15 second time delay, Section B main gas valve(s) and spark igniter are energized to initiate a trial for ignition. Burners ignite. Section B operates at low fire (25% of total heater input) and ID Fan remains in high speed. LED's PWR (Blue), MOD (Green) R2 (Red) and AFS (Green) are lit.
14. For analog inputs less than 7.6 VDC, Modulating Section A input will be reduced proportional to the analog input voltage signal and will modulate gas input from 25 to 50% of total heater input.
15. For analog inputs between 7.7 – 10.0 VDC, the SC30-SM2A relay R3 is energized closing contacts between T10 & T11, powering Section B 2nd stage gas valve. Section B operates at high fire (50% of total heater input) and ID Fan remains in high speed. LED's PWR (Blue), MOD (Green) R2 (Red), R3 (Red) and AFS (Green) are lit.
16. For analog inputs less than 9.9 VDC, Modulating Section A input will be reduced proportional to the analog input voltage signal and will modulate the gas input from 25 to 50% of total heater input.
17. At an analog input 10.0 VDC, both Section A and Section B will operate at maximum input.
18. During heater operation, the thermostat, pressure switches and main burner flame of both sections are

constantly monitored by their IC's and SC30-SM2A to assure proper system operation.

19. Section B operation continues to operate at high fire until the analog input signal to the SC30SM2A control drops below 7.4 VDC. At this point the SC30SM-2A R3 relay opens (Red R3 LED OFF). Section B will operate at low fire.
20. Modulation will continue on the modulating Section A for analog input voltages from 7.4 to 4.9 VDC. Section B operation continues until the analog input signal to the SC30SM2A control drops below 4.8 VDC. At this point the SC30SM-2A R2 relay opens (Red R2 LED OFF). Section B switches OFF.
21. Modulation will continue on the modulating Section A for analog input voltages from 4.8 down to .05 VDC.
22. When the thermostat (temperature controller) is satisfied and the demand for heat ends, the heat enable (thermostat) contact opens, power is removed from the Tstat terminal on Section A IC and the combination gas valve is de-energized immediately and a 30 second post-purge occurs (at high speed) before de-energizing the ID Fan.

Ignition Control Operational Features

Ignition and Operational failures during a call for heat result in "lockout" of the ignition control.

1. If flame is lost during an operational cycle, the ignition control will respond within 0.8 seconds. The spark will be energized for a trial for ignition period to attempt to relight burners and prove flame sensor. If flame is re-established, normal operation resumes
2. If the burners fail to light or carryover during a trial for ignition, the control will attempt two additional ignition trials. If no flame is present at the flame sensor within 10 seconds, the spark and gas valve will be de-energized. A 15 second interpurge period begins and the combustion blower continues to run. After the inter-purge period another ignition trial will take place.
3. If burner fails to light or prove the flame sensor following the two additional trials the control will go into lockout. The valve relay in the IC will be de-energized shutting of the gas valve immediately and the induced draft fan following a 30 second post-purge.

Recovery from Lockout

1. If the thermostat (controller) is still calling for heat one hour after a lockout occurs, the control will automatically reset and initiate a call for heat sequence.
2. The ignition control may also be manually reset, removing power (24V) to IC terminal 24VAC for 5 seconds then restoring power.

Capable Controls Status Indicator LED

LED Indications, Normal Operation

- Green, ½ sec ON, ½ sec OFF: Pre-purge, Inter-purge, Post-purge
- Green, blinking rapidly: Trial for ignition
- Green, on solid: Flame detected, pilot/main burners ON

ERROR CODES - Red Flashes Error Definition Error Type

- 1 flash, then pause - No flame in trial time Lockout
- 2 flashes, then pause - Flame sense stuck on Lockout
- 3 flashes, then pause - Pilot/Main relay failure Lockout
- 4 flashes, then pause - Repetitive flame loss error Lockout
- 5 flashes, then pause - Rollout error Lockout
- 6 flashes, then pause - APS Airflow error Lockout
- 7 flashes, then pause - Internal control error Lockout ON Solid Red - Line Voltage/Frequency Error Standby

Section A

Section B

Note: If Customer safety interlocks provided, wire in series from Terminal 3 to

Note: If Customer safety interlocks provided, wire in series from Terminal 3 to T1 & remove factory jumper

Capable Controls – 5 Series Ignition Control

Rack Duct Furnace

HD Rack assemblies employ a Vernier staging modulating control that modulate gas flow up and down to a lead modulating duct furnace to account for varying heat requirements during operation. Additional slave duct furnaces have two stage controls which are activated by relays on the staging control to meet higher heating requirements. As slave units are brought on line, the modulating heater gas supply is reduced to meet the system heat demand. Controls are pre-programmed depending on the number of duct furnaces in the system. The modulating heater is always the top heater.

Figure 4: Typical Rack Distribution Wiring

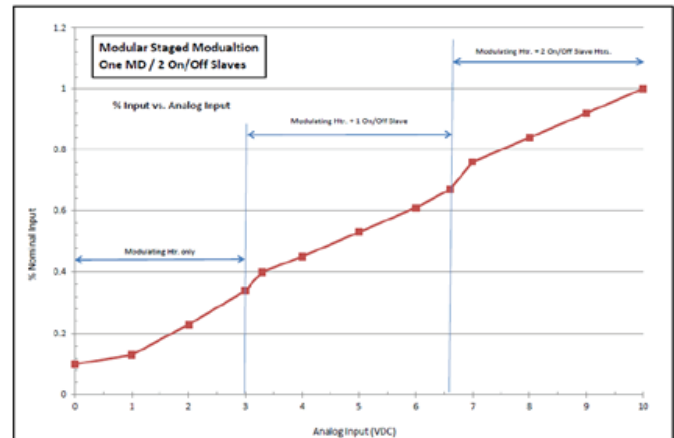
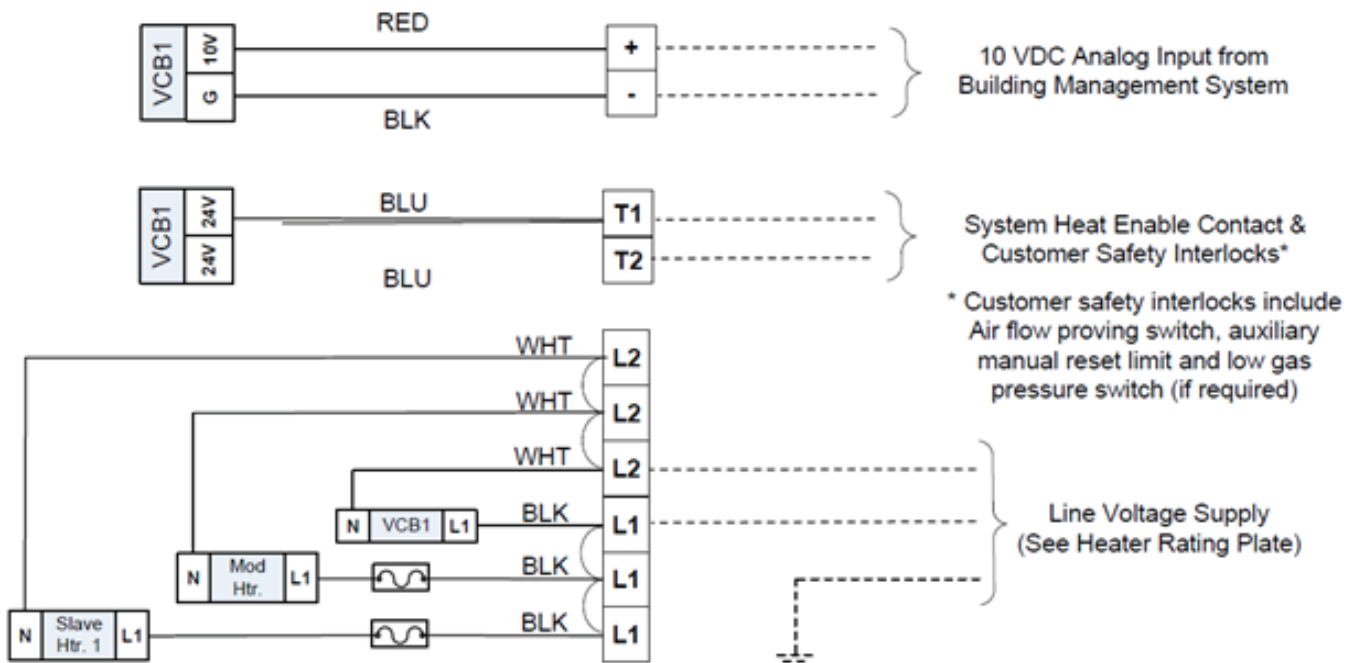


Figure 5: Typical Vernier Control Wiring

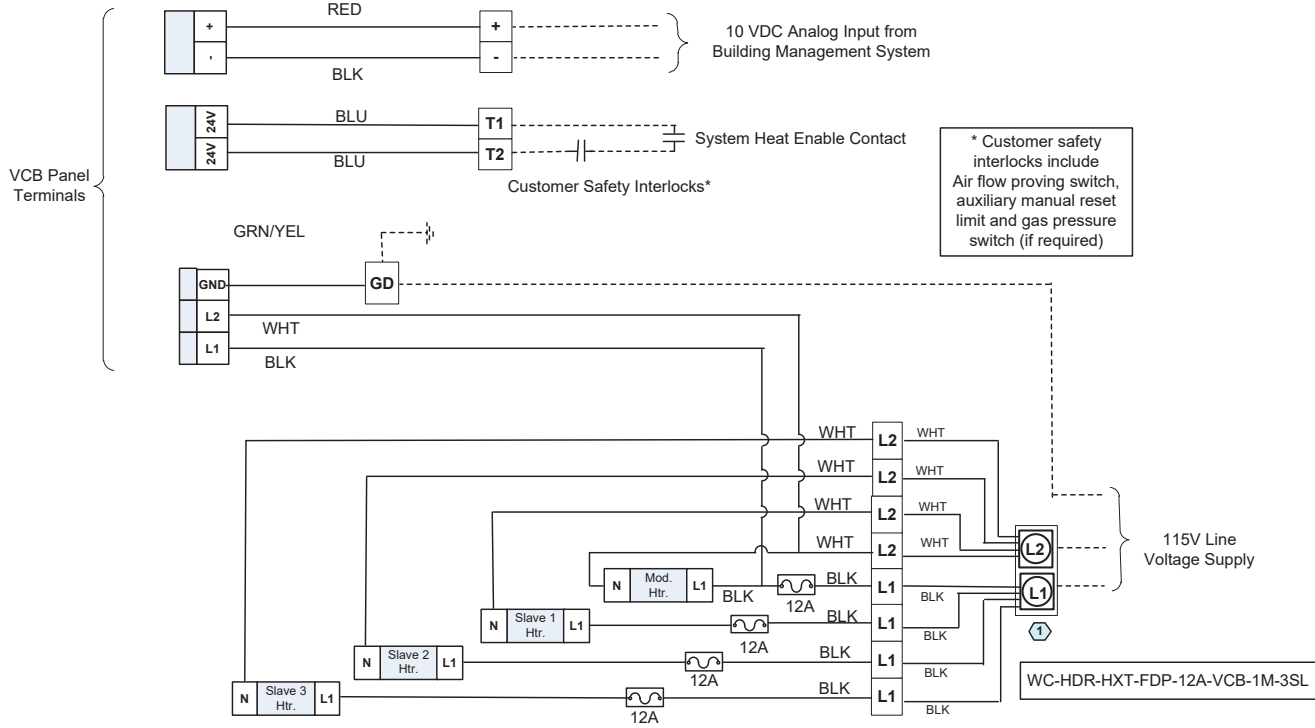


Legend

- Factory Wiring
- Field Wiring
- Flame Safeguard Terminal
- Burner Terminal Strip
- Component Terminal
- Junction Box Terminal-Field Connections

SCEBM-2 Controller

Figure 7: Rack Duct Furnace Wiring Diagram



Legend:

	Distribution Panel Terminal Connection		Factory Wiring
	VCB Control Panel terminal		Customer Wiring
			Fuse

For use with modular heater assemblies
Models HXT100-125

Direct Fired Heater



WARNING

LOCKOUT/TAGOUT all power sources prior to servicing the unit. Hazardous gas condition can cause serious injury or death. Close gas connections/valves before servicing equipment. More than one disconnect may be required to de-energize the unit.



WARNING

Improper installation, adjustment, alteration, service, or maintenance can cause property damage, injury, or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.



CAUTION

The use and storage of gasoline or other flammable liquids and vapors in open containers in the vicinity of this appliance is hazardous.



DANGER

If you smell gas:

1. Open windows.
2. Do Not touch electrical switches.
3. Extinguish any open flames.
4. Immediately call your gas supplier.



WARNING

Failure to provide proper venting could result in property damage, serious injury, or death.

The unit must have the desiccant reactivation exhaust properly vented to the outside of the building.



WARNING

Alterations to the air tunnel requires the direct fired burner to be recommissioned.

An optional direct fired burner consists of the burner, gas train, and a pCO₅ controller. The pCO₅ controller only controls the direct fired gas heater and its safeties. It is not a unit controller.

A manual shut-off and sediment trap (supplied by others) shall be installed on the outside of the unit's gas vestibule to be used as the main shut-off of the unit's gas supply, or as how local codes require the installation of such a valve. A minimum 1/8 inch NPT plugged tapping, accessible for test gauge connection, must be installed immediately upstream of the gas supply connection to the unit. All the different gas piping configurations are not shown in this manual because of the many manifold arrangements that are available for various building code and insurance company requirements, and types of gas modulation. Gas piping must comply with "Standards of National Board of Fire Underwriters" and all applicable local codes and insurance company requirements.

Installation

The following recommendations are not intended to supplant any requirements of federal, state, or local codes having jurisdiction. This equipment shall be installed and wired in accordance with regulations of the National Boards of Fire Underwriters, National Electric Code, and local governing bodies. In Canada, equipment should be installed in accordance with the applicable provincial regulations. Furthermore this document is not to relinquish the responsibility of the installer from the correct application of the equipment, nor the safe and correct operation of the unit(s) and other systems that may be required or associated with it. When the unit is to be installed in an airplane hangar, install the unit in accordance with the standard for "Aircraft Hangers", ANSI/NFPA 409 and with CAN/CGA B149 Installation Code when in Canada. When the unit is to be installed in a public garage, install the unit in accordance with the Standard for "Parking Structures", ANSI/NFPA 88A or with the Standard for "Repair Garages", ANSI/NFPA 88B and with CAN/CGA B149 Installation Code when in Canada. Before the unit is turned on for the first time. Steps need to be taken to provide adequate pressure relief for the building to avoid over pressurizing the building when the unit is operated at rated capacity. Pressure relief of the building can be accomplished by taking into account, through standard engineering methods, the structure's design infiltration rate; by providing properly sized relief openings; or by interlocking a power exhaust system; or by a combination.

The air handler must be LEVEL and located so that there is enough clearance for opening the access doors. In addition to allowing room for access door swing, local codes may require 42" or more of clearance in front of the electrical panel or vestibule. Refer to the submittal documents for air flow direction through the unit so that it may be positioned to accommodate. Necessary duct work. Also note from the submittal where electrical and gas hookup points are located so that proper connections can be made. Remember to verify position and ability of support beams, pad, or curb to properly support the unit. Locate the unit so that air intakes are not too close to any exhaust fan outlets, gasoline storage, or other contaminants that could potentially cause dangerous situations. The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous. The direct fired furnace is burning gas directly into the air stream being heated, therefore anything passing across the burner may be combustive. Prior to locating the unit, authorities that have jurisdiction should be consulted before installations are made.

Burner shut down

1. Shut of main disconnect
2. Close main gas valve.

Restarting the gas heat after short shut down

1. Open manual gas supply valve and check for leaks
2. Turn on main disconnect
3. Follow pCO5 instructions

Restarting the gas heat after a long shut down

1. Check the unit for general cleanliness. ALL debris, small or large, must be removed
2. Make sure all terminals and connections are checked for tightness
3. Check the supply air outlet for and blower inlets to ensure they are free from any obstructions
4. Check blower(s) to make sure shaft rotates freely and sheaves re-aligned.
5. Check sheaves, blowers, and motor bolts or set screws for tightness
6. Check all damper linkages to ensure they are free to move and no binding will occur
7. Open manual gas supply valve and check for leaks
8. Turn on main disconnect
9. Follow pCO5 instructions

Air Stream Velocity

⚠ DANGER

Improper installation, adjustment, alteration, service, or maintenance can cause property damage, injury, or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

The use and storage of gasoline or other flammable liquids and vapors in open containers in the vicinity of this appliance is hazardous.

⚠ CAUTION

This heater requires at least 4 cfm outside air per 1000 btu per hour. For details and application limitations, see the manufacturer's instructions.

For your safety, the use and storage of gasoline or other flammable liquids and vapors in open containers in the vicinity of this appliance is hazardous.

Clearance from combustibles: 0" floor, 6" top, and 6" ends.

Standard Burner

Air stream velocity across and through the burner's mixing plates must be kept uniform and within desired limits by use of a silhouette profile plate through which the burner fires.

Low NOx Burner

Air stream velocity across and through the burner's mixing plates must be kept uniform and within desired limits by use of a silhouette profile plate through which the burner fires. A 6" (minimum) profile plate should be installed surrounding the interior duct walls at the leading edge of the burner mixing plates.

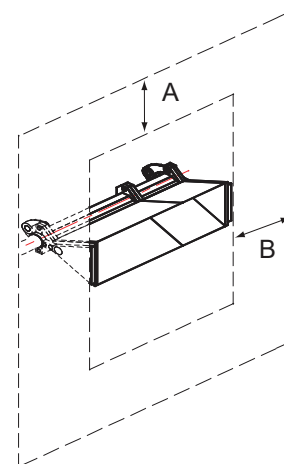
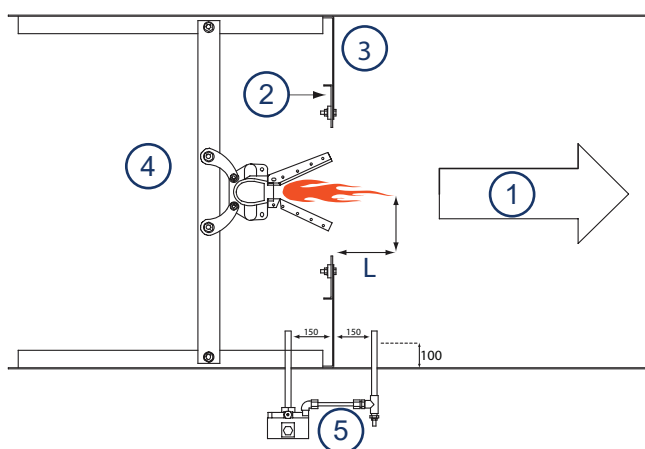
Figure 8: Silhouette Profile Plate

- 1) Direction of process air movement
- 2) Adjustable profile plate
- 3) Fixed profile plate
- 4) Universal support bracket
- 5) Differential pressure switch

A : Minimum 6 in.

B : Minimum 6 in.

L : Flame length



Maintenance Instructions

Periodic maintenance will insure continued trouble-free operation of your Series NP-LE AIRFLO® Burner system.



WARNING

The Dakin Applied unit should be maintained and serviced by qualified personnel only.

At least a yearly inspection is recommended for make-up air heating installations and more frequently for process applications in year-round operation. Your own experience is the best guide in determining frequency of inspection. As a minimum, the following procedure should be followed:

1. Shut the system down totally. Disconnect or lock out power supply so there can be no accidental start-up during inspection.
2. Inspect the burners carefully, including upstream and downstream sides of mixing plates as well as burner body face. Any accumulation of scale or foreign material on either side of the mixing plates should be removed with a wire brush. Check visually that no holes in the mixing plates are blocked. See next page for inspection and maintenance instructions for gas ports. If any mixing plates are loose or missing fasteners, tighten/replace as necessary. Always use zinc plated or stainless metric fasteners.



WARNING

Do not enlarge burner ports or performance may be drastically affected.

3. Put system back into operation and, if possible, view from downstream side while cycling burner through full firing range. This will give a visual check for blocked burner ports.
4. Observe flame pattern and, if necessary, take steps to correct velocity and/ or air distribution problems

Inspection and Maintenance of Flame Rods

In addition to the yearly maintenance of the burner assembly as a whole, flame rods can need extra maintenance depending on project site conditions. In a very dirty environment, the flame rods might need monthly, or even weekly cleaning. Your own experience is the best guide in determining frequency of cleaning.

Inspection and Maintenance of Gas Ports

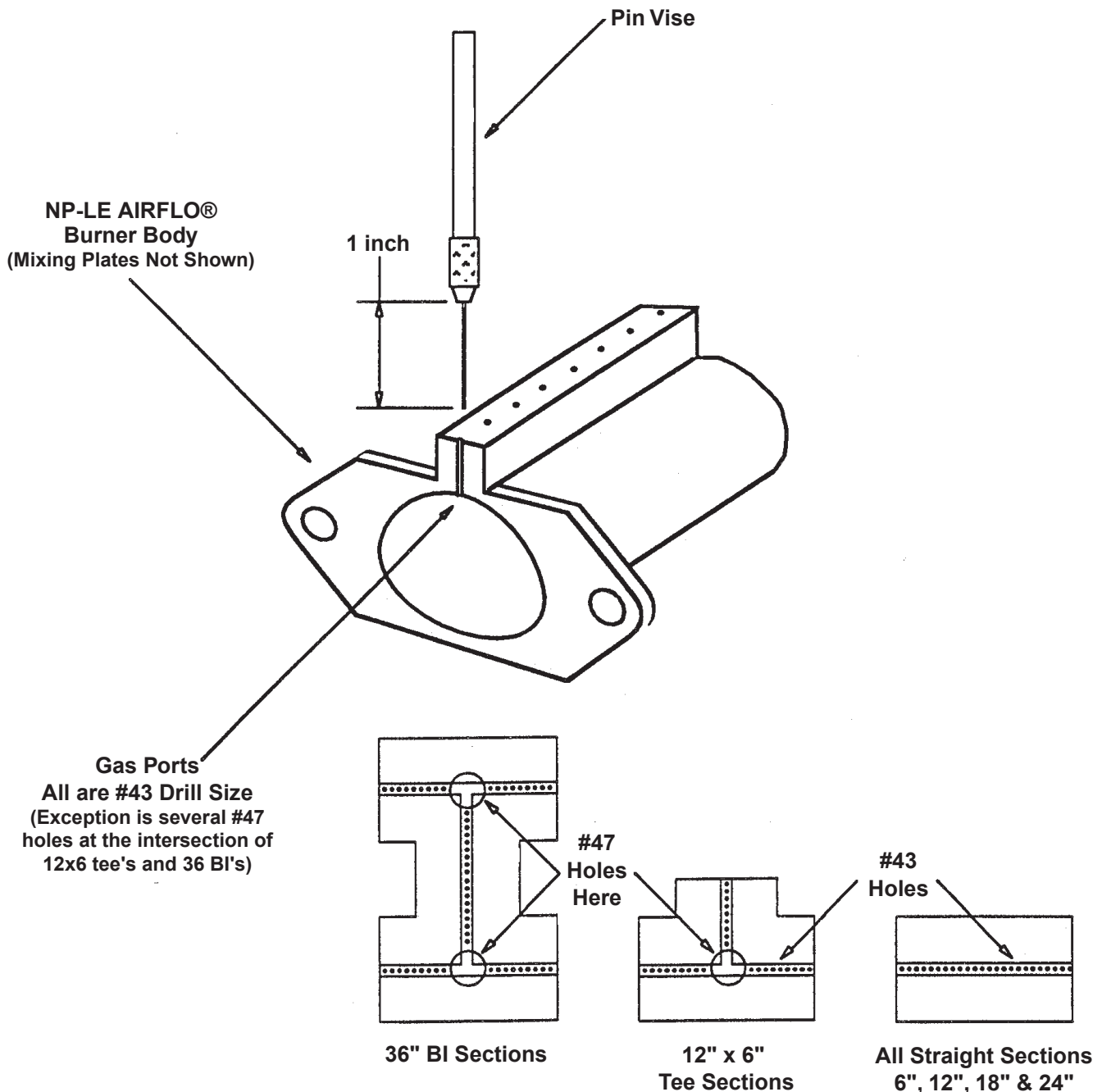
Conduct initial inspection within the first month after commissioning. Visually check the gas ports of new burner assemblies for any piping scale or debris. Use Pin Vise with drill bit to remove.

Annual inspections are normally adequate once the initial piping debris is removed. The operating conditions of the burner will determine how frequently maintenance is actually required.

Use of an electric drill motor is not suggested unless both Pin Vise and Drill (Figure 9) can be chucked up in a vari-speed drill unit. Use caution, because it is easy to snap the bits off in a port when using a drill motor. Removal of broken bits from the gas ports is difficult.

Contact your Daikin Applied Representative to answer questions or address any problems.

Figure 9: Gas Ports



Airflow Diagram

Figure 10: Airside Safety / Control Diagram

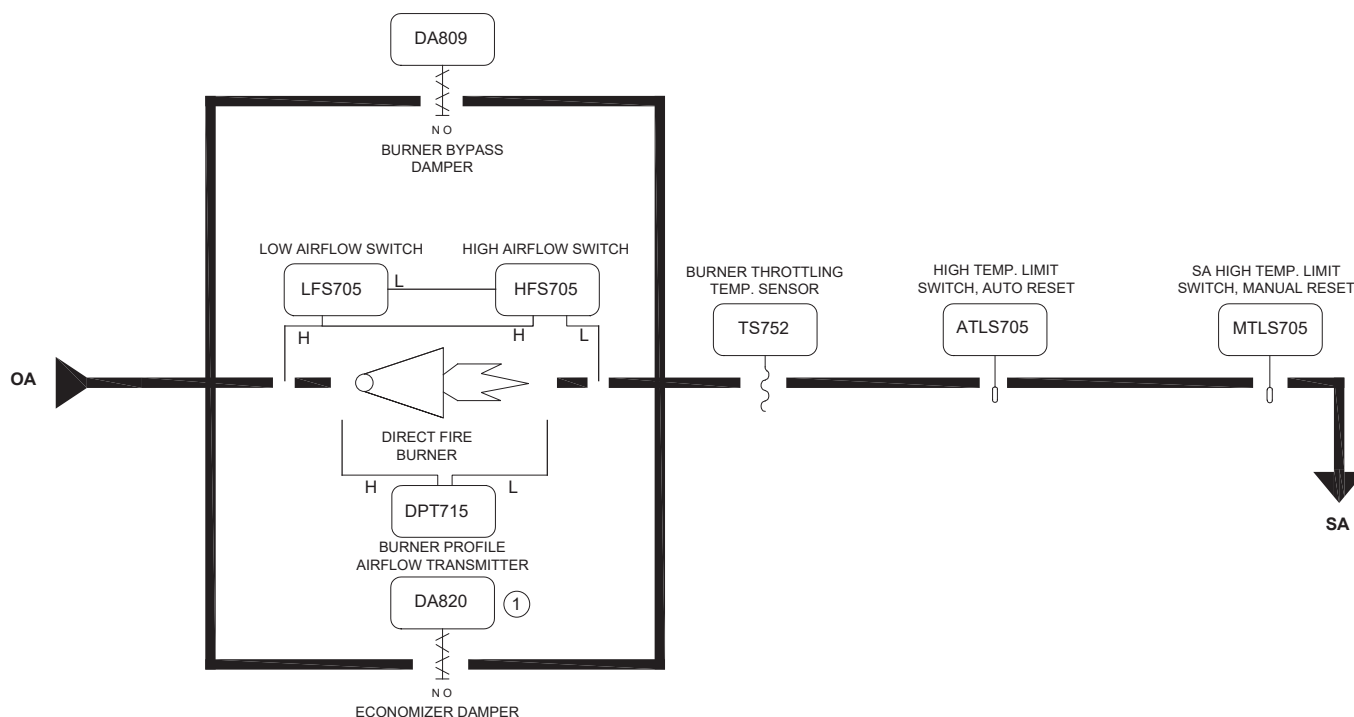


Table 2: Safety / Control Devices

Quantity	Drawing Number	Manufacturer	Part Number	Description	Point Type	Signal Type	Device Range	Power Requirements	Accuracy
1	DA809	Belimo	AFB24-SR	Burner Bypass Damper Actuator, Spring Return with Modulation	AO	2-10VDC	0-180 in-lbs	24VAC/VDC	NA
1	DA820	Belimo	AFB24-SR	Economizer Damper Actuator, Spring Return with Modulation	AO	2-10VDC	0-180 in-lbs	24VAC/VDC	NA
1	DPT715	Dwyer	MS2-W102-LCD	Pressure Transmitter, Wal-Mount, 1 to 5" WC, LCD Display	AI	0 to 10VDC	0-1, 2, 3.5" WC	21.6 to 33 VAC	±1% FS
1	LFS705, HSF705	Antunes	8021200198	Dual Differential Pressure Switch 0.17-1" WC & 0.17-6" WC 1/4"	DI	Dry Contact	0.17-1.0" WC/ 0.17-6.0" WC	NR	NA
1	TS752	ACI	A/10KE1-RA24"-GD	Burner Throttling Averaging Temperature Sensor, 24" Probe	AI	10KE1	-40-302°F	NR	±0.4°F
1	ATLS705	Honeywell	L40081130	High Temperature Limit Switch, SPDS, Auto Reset	DI	Dry Contact	130-270°F	NR	±5°F
1	MTLS705	Honeywell	L4008E1263	High Temperature Limit Switch, SPDS, Manual Reset	DI	Dry Contact	130-200°F	NR	±5°F

The burner throttling sensor, automatic, and manual reset switches are mounted downstream of the burner section. Depending on section splits, field wiring will be required to complete the safety circuit. Consult wiring diagram in Figure 11, lines 703 - 705, for terminal locations.

Wiring Diagrams

Figure 11: Typical Wiring Diagram

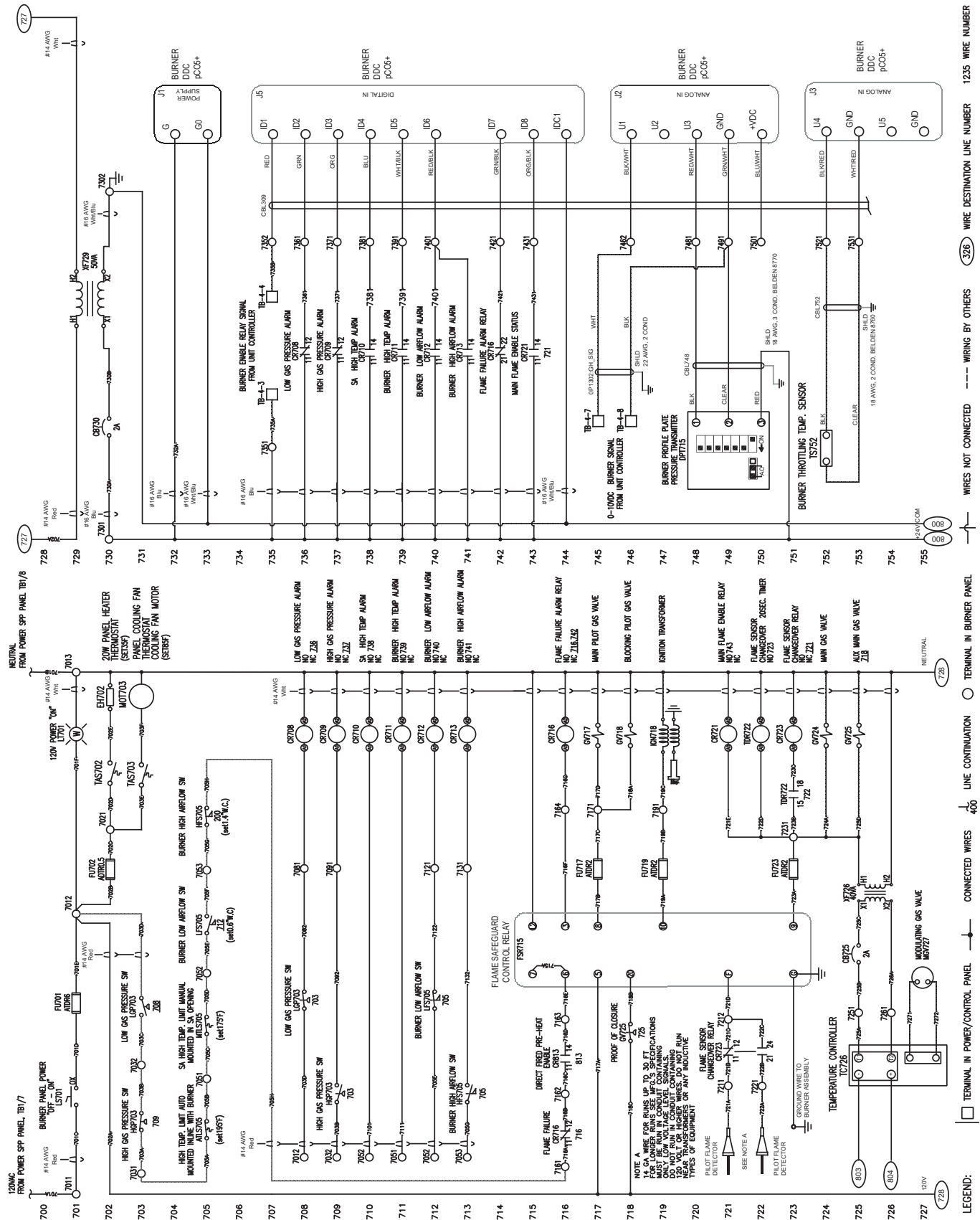
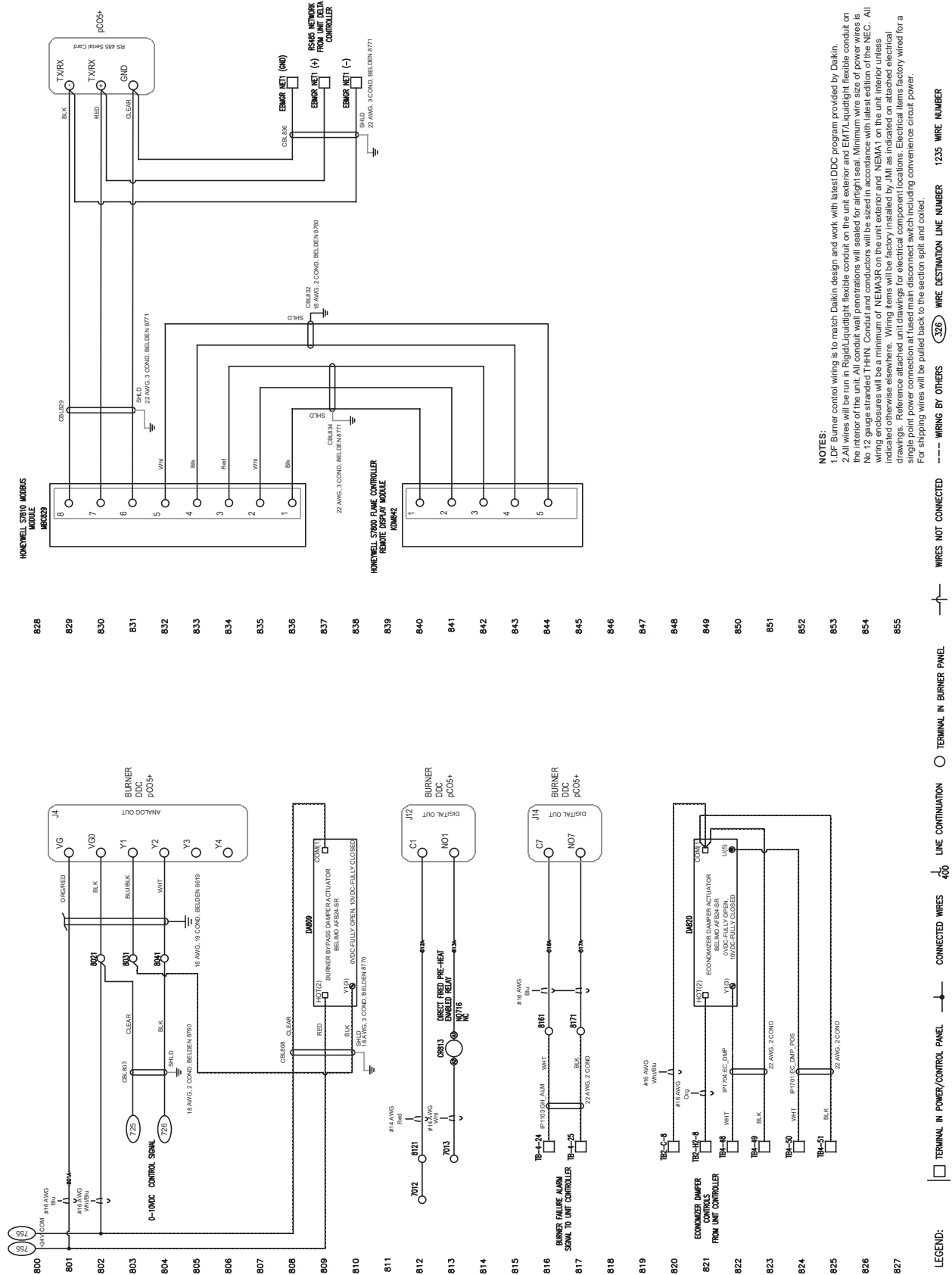
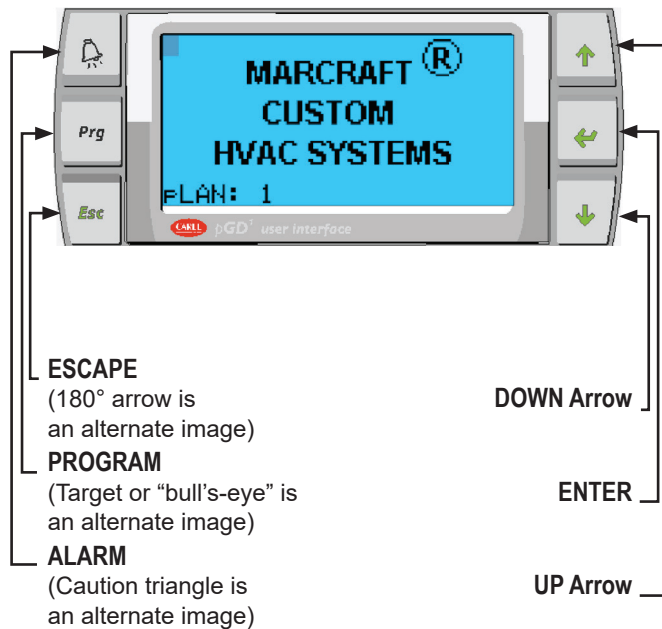


Figure 12: ModBus Module Wiring Diagram



Appendix — Marcraft Controller Interface

Display Overview



Shown is the **Start Up** screen, after a few seconds the **Home Screen** is displayed.

UP Arrow: Change (scroll) to previous screen or increase an adjustable parameter.

DOWN Arrow: Change (scroll) to next screen or decrease an adjustable parameter.

ENTER: Select menu or adjustable parameter and accept new value.

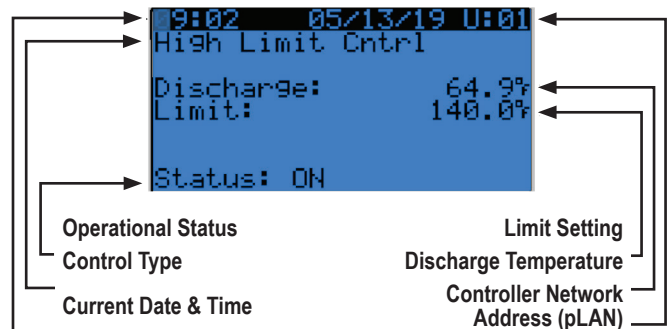
ALARM: Open the **Alarm Menu** from any screen where all active alarms may be seen. Once in the Alarm Menu, press the Alarm button to try to clear the alarm. Alarm button will illuminate red to indicate there is an active alarm. On some models this key is a caution triangle.

PROGRAM: Open the **Program Menu** where the following menus are available to select: Mode, Setpoints, Schedule, Alarm Log, and Factory. On some models this key is a target

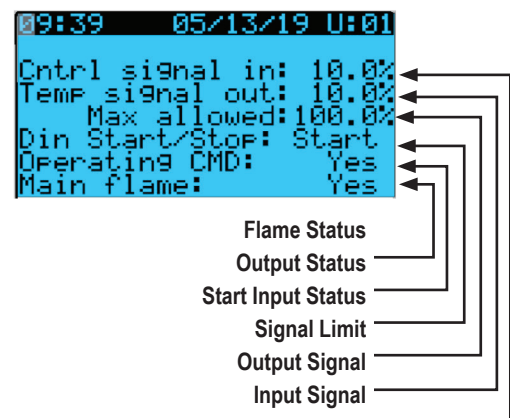
ESCAPE: Return to previous menu, ultimately return to Home Screen. If the ESCAPE button is pressed while changing a parameter before the ENTER key has been pressed to accept the new value, that parameter will not be changed. On some models this key is 180° arrow.

Home Screen

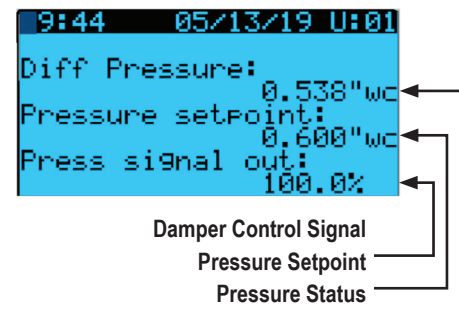
The image shown below is an example of the **Home Screen**. The screen shows the Date and Time, Control Type, and Status.



From the Home Screen, pressing the **Down Arrow** once will show more status information. This screen will show the current heat control signal, the maximum control signal limit, and input status.

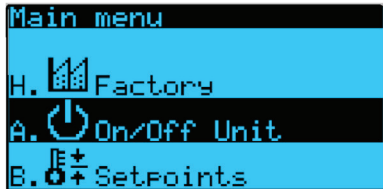


Pressing down again will show the burner profile pressure, pressure setpoint, and the bypass damper signal (for units that have a bypass damper).

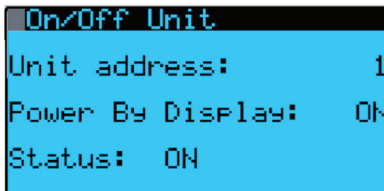


Programming Menu Screen

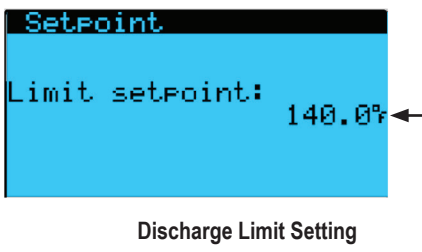
Pressing the PRG (or bulls-eye) button will enter the Main Menu. The image below shows the first menu. The different menu options can be scrolled through by using the **Up** and **Down** arrow keys. Menus can be selected by pressing the Enter key.



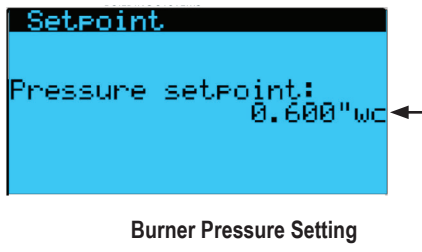
Enter Menu A by pressing the **Enter** button. Menu A controls the ON/OFF operation of the burner. In order for the burner to operate, Power By Display must be set to ON. This screen will also display the burner status.



Pressing **ESC** (or the 180 arrow) once will return to the Main Menu. Scrolling down to Menu B (Setpoints) will give access to the operation setpoints. Enter the password when prompted, and the screen will show the Burner Discharge Limit setpoint.

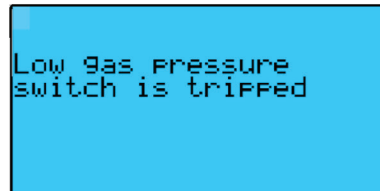


Pressing Down once will display the pressure setpoint.



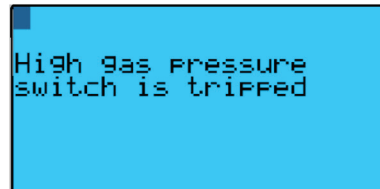
Alarm Description

Active alarms are indicated by the red flashing alarm button (this button either has a bell or a red triangle). Press the alarm button to view the most recent active alarm. Use the **Arrow Keys** to scroll through any other active alarms. Alarms will clear themselves when the alarm condition is no longer present. Shown are the most common alarms (there are also alarms for broken or disconnected sensors).



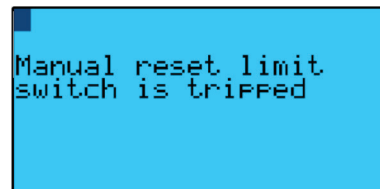
This alarm indicates that the low gas pressure switch has tripped.

The alarm will clear when the switch is reset.



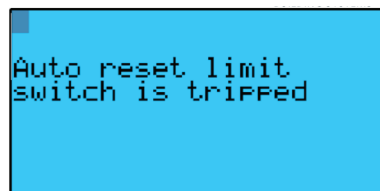
This alarm indicates that the high gas pressure switch has tripped.

The alarm will clear when the switch is reset.



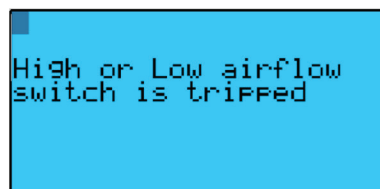
This alarm indicates that the Manual Reset temperature limit has tripped.

The alarm will clear when the limit is reset.



This alarm indicates that the Auto Reset temperature limit has tripped.

The alarm will clear when the limit resets.



This alarm indicates that either the High airflow or Low airflow switch has tripped.

The alarm will clear once required airflow is resumed.

```
Flame lost or failed
to light

Refer to flame
controller
```

This alarm indicates that the flame signal is not present.

When the flame sensor indicates flame, the alarm will clear.

```
Main flame status
mismatch

Status with no run
command or run command
with no status
```

This alarm indicates that the Start contact and the Status contact are conflicting.

This alarm will clear once the conflict is gone.

```
Burner pressure too
low to operate
(<0.40"wc)
```

This alarm indicates that the burner pressure is too low for operation.

This alarm will clear once the burner pressure is in range.

```
Burner pressure too
high to operate
(>0.90"wc)
```

This alarm indicates that the burner pressure is too high for operation.

This alarm will clear once the burner pressure is in range.

Factory Settings

Factory settings are password protected and should not be changed without approval. After entering the password, the Manufacturer Menu is shown.

```
Manufacturer menu

d.Initialization
a.Configuration
b.I/O Configuration
```

Under the Configuration Menu you will find the setting for Control Type.

```
Temperature Control 1

Control Type:
Discharge Limit
```

This can be set to either Discharge Limit or Discharge Setpoint

Pressing the **Down Button** will show the Pressure Control settings (for units that have a bypass damper).

```
Pressure Control 1

Enable Burner P Con.:
Yes

Burner P Con.:
Auto
```

Burner pressure control can be set to Manual control.

If so, the Pressure Setpoint screen will change accordingly.

Pressing down again shows various configuration options.

```
Configuration

Temperature Units: %
Pressure Units: psi
Force Clock Enable: Yes
Clock Mode: 24h
Disable Buzzer: Yes
Startup Delay: 10s
```

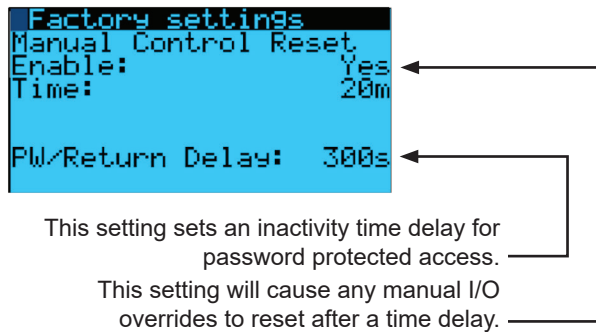
Pressing down again shows the ON/OFF Control options:

```
Configuration

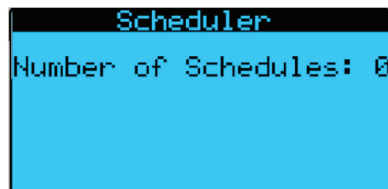
Enable Unit On/Off
By digit input: ON
By supervisor: OFF
By PLAN network: OFF
By schedule: OFF
```

You can enable and disable different input options in this screen.

Pressing down again gives options for resetting manual controls and password delays.



Pressing down again will allow for the creation of schedules (if required).



Pressing down again will allow for the creation of holidays (if needed).



Appendix — RM 7800 Series Relay Modules

Application

The RM7897A,C are microprocessor-based integrated burner controls for automatically fired gas, oil, or combination fuel single burner applications. The RM7897A,C system consist of a relay module, subbase, amplifier, and purge card. Options include: 2-line VFD (see document 65-0090) or 4-line LCD (see document 32- 00110) Keyboard Display Module, Data ControlBus™ Module, remote display mounting, Expanded Annunciator or Modbus module.

Functions provided by the RM7897A,C include automatic burner sequencing, flame supervision, system status indication, system or self-diagnostics and troubleshooting.

The RM7897 adds a proof of closure input to the standard primary control function of the RM7895/RM7896 product. It adds a blinking fault code function to the POWER LED on Alarm shutdown. It also adds programmable postpurge using the S7800A1142 Keyboard Display Module (KDM).

The RM7897A1002 offers selectable pilot operation, intermittent on terminal 8 or interrupted on terminal 21.

The RM7897C1000 offers interrupted pilot and delayed main valve for 2-step firing (Low-High-Low) applications.

The RM7897C1018 has 4 second MFEP (main flame establishing period).

The RM7897C1026 provides a special recycle function for configuration of Jumper JR2:

- JR 2 intact: Recycle on loss of flame.
- JR2 clipped: If flame loss occurs during the first 15 seconds in the Run period, then lockout occurs. If flame loss occurs after 15 seconds into the Run period, then recycle.

Factory default for Post Purge time: 15 seconds.

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

Publication No.	Product
32-00110	S7800A2142 4-line LCD Keyboard Display Module Product Data
65-0084	Q7800A,B 22-Terminal Wiring Subbase Product Data
65-0288	S7800A1142 Keyboard Display Module Product Data
65-0091	S7810A Data ControlBus Module™ Product Data
65-0095	S7820 Remote Reset Module Product Data
65-0097	221729C Dust Cover Installation Instructions
65-0101	S7830 Expanded Annunciator Product Data
65-0109	R7824, R7847, R7848, R7849, R7851, R7852, R7861, R7886 Flame Amplifiers for the 7800 Series Product Data
65-0131	221818A Extension Cable Assembly Product Data
65-0229	7800 SERIES Relay Modules Checkout and Troubleshooting Product Data.

This document covers the following 7800 Series Relay Modules:

- RM7897A1002
- RM7897C1000
- RM7897C2002
- RM7897C2000

Specifications

Electrical Ratings

- Voltage and Frequency: (See Table 3)
- RM7897A,C: 120 Vac (+10/-15%), 50/60 Hz (± 10%).
- Power Dissipation: 10W maximum.
- Maximum Total Connected Load: 2000 VA.
- Fusing Total Connected Load: 15A Fast Blow, type SC or equivalent.

Environmental Ratings

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

SIL 3 Capable

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

Approvals

- Underwriters Laboratories Inc. Listed: File No. MP268, Guide No. MCCZ.
- Factory Mutual Approved: Report No. 1V9A0.AF.
- Swiss RE (formerly IRI): Acceptable.
- Federal Communications Commission: Part 15, Class B, Emissions.

Installation



WARNING

LOCKOUT/TAGOUT all power sources prior to servicing the unit. Hazardous gas condition can cause serious injury or death. Close gas connections/valves before servicing equipment. More than one disconnect may be required to de-energize the unit.



DANGER

Fire or Explosion Hazard.

Can cause severe injury, death or property damage.

Follow applicable safety requirements when installing a control on a burner to prevent death or severe injury.



DANGER

Electrical Shock Hazard.

Can cause serious injury, death or equipment damage.

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

When Installing this Product:

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

Important

1. Wiring connections for the relay modules are unique; refer to [Figure 14](#) and [Figure 15](#) or the appropriate Specifications for proper subbase wiring.
2. Wiring must comply with all applicable codes, ordinances and regulations.
3. Wiring must comply with NEC Class 1 (Line Voltage) wiring.
4. Loads connected to the RM7897A,C must not exceed those listed on the RM7897A,C label or the Specifications; see [Table 3](#).
5. Limits and interlocks must be rated to simultaneously carry and break current to the ignition transformer, pilot valve, and main fuel valve(s).
6. All external timers must be listed or component-recognized by authorities who have proper jurisdiction.
7. For ON-OFF gas-fired systems, some authorities who have jurisdiction prohibit the wiring of any limit or operating contacts in series between the flame safeguard control and the main fuel valve(s).
8. Two flame detectors can be connected in parallel with the exception of Flame Detectors C7015, C7915, C7927, C7961 and C7952.
9. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, can cause interference with radio communications. It has been tested and found to comply with the limits for a Class B computing device of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference, in which case, the users, at their own expense, may be required to take whatever measures are required to correct this interference.
10. This digital apparatus does not exceed the Class B limits for radio noise for digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Location

Humidity

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

Vibration

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

Weather

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

Mounting Wiring Subbase

1. Mount the subbase in any position except horizontally with the bifurcated contacts pointing down. The standard vertical position is recommended. 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 relay module, Expanded Annunciator, Keyboard Display Module, flame amplifier, flame amplifier signal voltage probes, Run/Test Switch, electrical signal voltage probes and electrical field connections.
3. For surface mounting, use the back of the subbase as a template to mark the four screw locations. Drill the pilot holes.
4. Securely mount the subbase using four no. 6 screws.

Wiring Subbase



DANGER

Electrical Shock Hazard.

Can cause serious injury, death or equipment damage.

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

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

Series 1000 Subbase

All relay product codes that start with a 1 (example: RM7840G1014/U) can be used with existing subbase Q7800A1005/U. These relays can also be used on the Series 2000 subbase noted below.

Series 2000 Subbase

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

Subbase Compatibility

Any relay module in the 1000 series is fully backward compatible with any subbase already installed in the field (Q7800A1005/U, Q7800B1003/U, Q7800A2005/U, Q7800B2003/U).

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

Important

Make sure to check the relay model number and check the subbase compatibility prior to ordering or attempting a new installation or field upgrade.

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

The internal block diagram of the RM7897A,C is shown in Fig. 1.

1. For proper subbase wiring and sequence chart, refer to [Figure 14](#) and [Figure 15](#).
2. For remote wiring of the Keyboard Display Module, refer to the Specifications for the Keyboard Display Module. There are two options for the separately purchased display: 2-line VFD display (65-0090) or a 4-line LCD display (32-00110), Data ControlBus Module (65-0091) or Extension Cable Assembly (65- 0131).
3. Disconnect the power supply from the main disconnect before beginning installation to prevent electrical shock and equipment damage. More than one disconnect can be required.
4. All wiring must comply with all applicable electrical codes, ordinances and regulations. Wiring, where required, must comply with NEC, Class 1 (Line Voltage) wiring.
5. For recommended wire size and type, see [Table 3](#).
6. For recommended grounding practices, see [Table 4](#).
7. Recommended wire routing of leadwires:
 - a. Do not run high voltage ignition transformer wires in the same conduit with the flame detector, Data ControlBus Module, or RemoteReset Module wiring.
 - b. Do not route flame detector, Data ControlBus Module, or Remote Reset Module leadwires in conduit with line voltage circuits.
 - c. Enclose flame detector leadwires without armor cable in metal cable or conduit.
 - d. Follow directions in flame detector, Data ControlBus Module, or Remote Reset Module Instructions.
8. 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 KDM is used.

9. Maximum wire lengths:
 - a. RM7897A,C leadwires: The maximum leadwire length is 300 feet to terminal inputs (Control, Running/Lockout Interlock).
 - 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 (305 meters) to a Remote Reset push button.
 - 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 4000 feet (1219 meters).
10. Be sure loads do not exceed the terminal ratings. Refer to the label on the RM7897A,C or to the terminal ratings in [Table 5](#).

Final Wiring Check

1. Check the power supply circuit. The voltage and frequency tolerance must match those of the RM7897A,C. A separate power supply circuit can be required for the RM7897A,C. Add the required disconnect means and overload protection.
2. Check all wiring circuits and complete Static Checkout in [Table 8](#) before installing the RM7897A,C on the subbase.
3. Install all electrical connectors.
4. Restore power to the panel.

Static Checkout

After checking all wiring, perform this checkout before installing the RM7897A,C on the subbase. These tests verify the Q7800 Wiring Subbase is wired correctly, and the external controllers, limits, interlocks, actuators, valves, transformers, motors and other devices are operating properly.

Figure 13: Internal Block Diagram of RM7897A,C

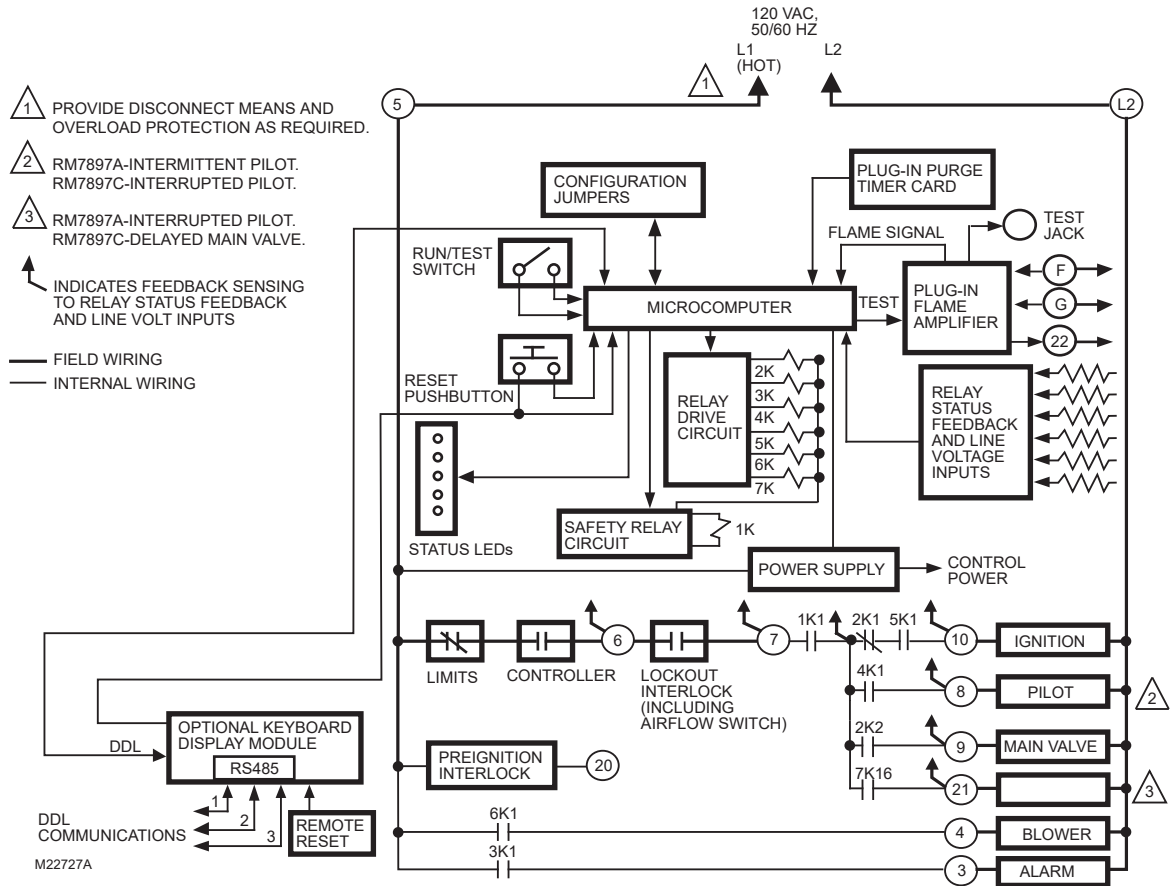
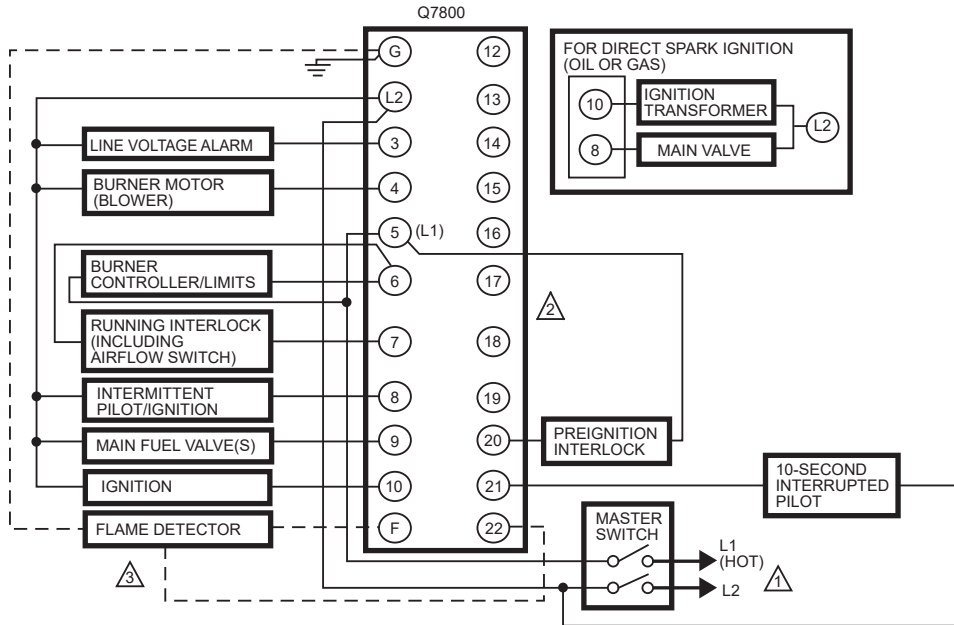


Figure 14: Wiring Subbase and Sequence Chart for RM7897A



	INITIATE (INITIAL POWERUP ONLY)	STANDBY	00 TIMED PREPURGE	00 10 SEC. PFEP (4 SEC. IF JR1 CLIPPED)	10 MFEP	20 RUN	00 10 SEC. POSTPURGE	STANDBY
LED DISPLAY	● POWER ○ ○ ○ ○	● POWER ○ ○ ○ ○	● POWER ○ PILOT ○ FLAME ○ MAIN ○ ALARM	● POWER ● PILOT ● FLAME ○ MAIN ○ ALARM	● POWER ○ PILOT ● FLAME ● MAIN ○ ALARM	● POWER ● PILOT ● FLAME ● MAIN ○ ALARM	● POWER ○ ○ ○ ○	● POWER ○ ○ ○ ○
BURNER			BURNER/BLOWER MOTOR (4)					
			(10) IGN.					
			INTERMITTENT PILOT (8)					
			INTERRUPTED PILOT (21)					
			MAIN VALVE (9)					
OPERATING CONTROLS AND INTERLOCKS		LIMITS AND	BURNER CONTROLLER CLOSED (L1) TO (6)					
			RUNNING INTERLOCKS CLOSED (6) TO (7)					
			PREIGNITION INTERLOCK CLOSED (5) TO (20)					Pii
FLAME SIGNAL		SAFE START CHECK			FLAME PROVING			SSC

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

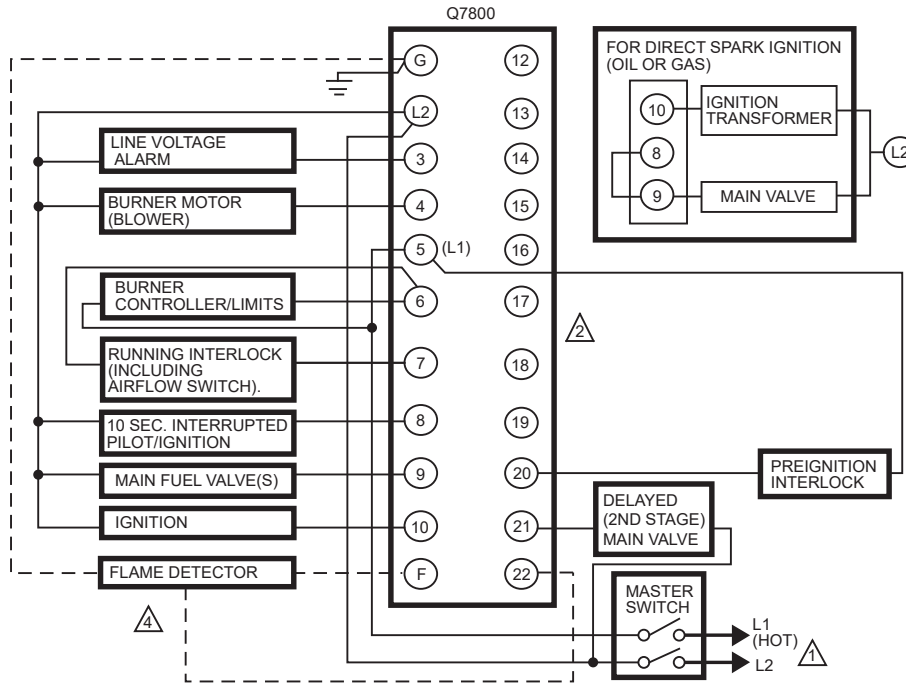
2 DO NOT CONNECT ANY WIRES TO UNUSED TERMINALS.

3 SEE FLAME DETECTOR SPECIFICATIONS FOR CORRECT WIRING.

4 PROGRAMMED ON SETUP USING S7800A1142 DISPLAY.

5 PURGE TIME DEPENDS ON WHICH ST7800 IS INSTALLED.

Figure 15: Wiring Subbase and Sequence Chart for RM7897C



	INITIATE (INITIAL POWERUP ONLY)	STANDBY	00 TIMED PREPURGE	PFEP 10 SEC. (4 SEC. IF JR1 CLIPPED)	10 MFEP	20	00	STANDBY
	● POWER	● POWER	● POWER	● POWER	● POWER	● POWER	● POWER	● POWER
LED DISPLAY	○	○	○ PILOT	● PILOT	● PILOT	○ PILOT	○	○
	○	○	○ FLAME	● FLAME	● FLAME	○ FLAME	○	○
	○	○	○ MAIN	○ MAIN	● MAIN	● MAIN	○	○
	○	○	○ ALARM	○ ALARM	○ ALARM	○ ALARM	○	○
BURNER			BURNER/BLOWER MOTOR (4)					
			(10) IGNITION					
			INTERRUPT/PILOT (8)					
			MAIN VALVE (9)					
			DELAYED MAIN VALVE (21)					
OPERATING CONTROLS AND INTERLOCKS		LIMITS AND BURNER CONTROLLER CLOSED (L1) TO (6)						
		RUNNING INTERLOCK (6) TO (7)						
		PREIGNITION INTERLOCK CLOSED (5) TO (20)					PII	
FLAME SIGNAL		SAFE START CHECK			FLAME PROVING			SSC

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

2 DO NOT CONNECT ANY WIRES TO UNUSED TERMINALS.

3 PROGRAMMABLE POST PURGE TIMING USING S7800A1142 KDM.

4 SEE FLAME DETECTOR SPECIFICATIONS FOR CORRECT WIRING.

5 PURGE TIME DEPENDS ON WHICH S7800 IS INSTALLED.

6 RM7897C1018 IS 14 SECONDS FOR 4 SECOND MFEP.

M22729C

Table 3: Recommended Wire Sizes and Part Numbers

Application	Recommended Wire Size	Recommended Part Numbers
Line voltage terminals	14, 16 or 18 AWG copper conductor, 600 volt insulation, moisture-resistant wire	TTW60C, THW75C, THHN90C
Keyboard Display Module	22 AWG two-wire twisted pair with ground, or five wire	Belden 8723 shielded cable or equivalent
Data ControlBus Module ^a	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	—
13 Vdc full-wave rectified transformer power input	18 AWG wire insulated for voltages and temperatures for given application	TTW60C, THW75C, THHN90C

^a The KDM or Data ControlBus Module (for remote mounting or communications) must be wired in daisy chain configuration, 1(a)-1(a), 2(b)-2(b), 3(c)-3(c). The order of interconnection of all the devices listed above is not important. Be aware that modules on the closest and farthest end of the daisy chain configuration string require a 120 ohm (1/4 watt minimum) resistor termination across terminals 1 and 2 of the electrical connectors for connections over 100 feet (31 meters).

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 15A, type SC, fast blow 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 is required, 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 (Keyboard Display Module, Data ControlBus Module)	Use the shield of the signal wire to ground the device to the signal ground terminal 3(c) of each device. Connect the shield at both ends of the daisy chain to earth ground.

Table 5: Terminal Ratings

Terminal Number	Description	Ratings
		RM7897A,C
G	Flame Sensor Ground	—
Earth G	Earth Ground ^a	—
L2(N)	Line Voltage Common	—
3	Alarm	120 Vac, 1A pilot duty
4	Burner Motor	120 Vac, 9.8A AFL, 58.8 ALR (inrush)
5	Line Voltage Supply (L1)	120 Vac (+10/-15%), 50 or 60 Hz (±10%) ^b
6	Burner Controller and Limits	120 Vac, 1 mA
7	Lockout Interlock	120 Vac, 8A run, 43A inrush
8	Pilot Valve/Ignition	120 V _{ac}
9	Main Fuel Valve	120 V _{ac}
10	Ignition	120 V _{ac}
F(11)	Flame Sensor	60 to 220 Vac, current limited
12 to 19	—	—
20	Preliminary Interlock	120 Vac, 1 mA
21	Interrupted Pilot (RM7897A)	120 Vac
21	2nd Stage Main Valve (RM7897C)	120 V _{ac} ^c
22	Shutter	120 Vac, 0.5A

^a See Table 4.

^b 2000 VA maximum load connected to RM7897A,C Assembly.

^c See Table 6 and Table 7

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

Combination Number	Pilot Fuel 8	Main 9	Ignition 10	Interrupted Pilot Valve 21 (RM7897A Only)	Delayed Main Valve 21 (RM7897C Only)
1	C	F	No Load	C	No Load
2	B	F	No Load	B	No Load
3	F ^a	F	A	F	No Load
4	F	F	A	F	No Load
5	F ^a	F	A	F	F
6	D	F	A	D	No Load
7	D ^a	D	A	D	D
8	D	D	A	D	No Load
9	D ^a	No Load	A	D	D

^a RM7897C only, jumper terminals 8 to 9

Table 7: Composition of Each Combination.

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


DANGER

LOCKOUT/TAGOUT all power sources prior to servicing the unit. Hazardous gas condition can cause serious injury or death. Close gas connections/valves before testing the equipment. More than one disconnect may be required to de-energize the unit.

Can cause property damage, severe injury or death.

Use extreme care while testing the system. Line voltage is present on most terminal connections when power is on.

Ensure proper selection of configuration jumpers before starting the burner operation.


DANGER
Electrical Hazard.

LOCKOUT/TAGOUT all power sources prior to wiring or servicing the unit. Hazardous voltage can cause serious injury or death. Disconnect electric power before servicing equipment. More than one disconnect may be required to de-energize the unit.

Can cause equipment damage or failure.

Do not perform a dielectric test with the relay module installed. Internal surge protectors can break down, allowing relay module to fail the dielectric test and destroy the internal lightning and high current protection.

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

Equipment Recommended

1. Voltmeter (1M ohm/volt minimum sensitivity) set on the 0 to 300 Vac scale.
2. Two jumper wires, no. 14 wire, insulated, 12 in. (304.8 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. For each test, open the master switch and install the jumper wire(s) between the subbase wiring terminals listed in the Test Jumpers column.
4. Close the master switch before observing operation.
5. Read the voltage between the subbase wiring terminals listed in the Voltmeter column.
6. If there is no voltage or the operation is abnormal, check the circuits and external devices as described in the last column.
7. Check all wiring for correct connections, tight terminal screws, correct wire, and proper wiring techniques. Replace all damaged or incorrectly sized wires.
8. Replace faulty controllers, limits, interlocks, actuators, valves, transformers, motors and other devices, as required.
9. Make sure normal operation is obtained for each required test before continuing the checkout.
10. After completing each test, be sure to open the master power switch and remove the test jumper(s) before proceeding to the next test.

Mounting RM7897A,C Relay Module



Explosion hazard.

Can cause serious injury or death.

Be sure all manual fuel shutoff valves are closed.

LOCKOUT/TAGOUT all power sources prior to servicing the unit. Hazardous gas condition can cause serious injury or death. Close gas connections/valves before testing the equipment. More than one disconnect may be required to de-energize the unit.

1. Mount the RM7897A,C vertically on the Q7800 Subbase or mount horizontally with the knife blade terminals pointing down. When mounted on the Q7800A, the RM7897A,C must be in an electrical enclosure.
2. When mounting in an electrical enclosure, provide adequate clearance for servicing, installation and removal of the RM7897A,C, KDM, flame amplifier, flame amplifier signal voltage probes, electrical signal voltage probes and electrical connections.

Allow an optional three-inch (76 mm) minimum on both sides of the RM7897A,C for electrical signal voltage probes.

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

IMPORTANT: The RM7897A,C, must be installed with a plug-in motion rather than a hinge action.

4. Mount the RM7897A,C by aligning the four L-shaped corner guides and knife blade terminals with the bifurcated contacts on the wiring subbase and securely tightening the two screws without deforming the plastic.

Mounting Other System Components

Refer to the applicable specifications for mounting other system components (Figure 16).

Figure 16: RM7897A,C Relay Module, exploded view

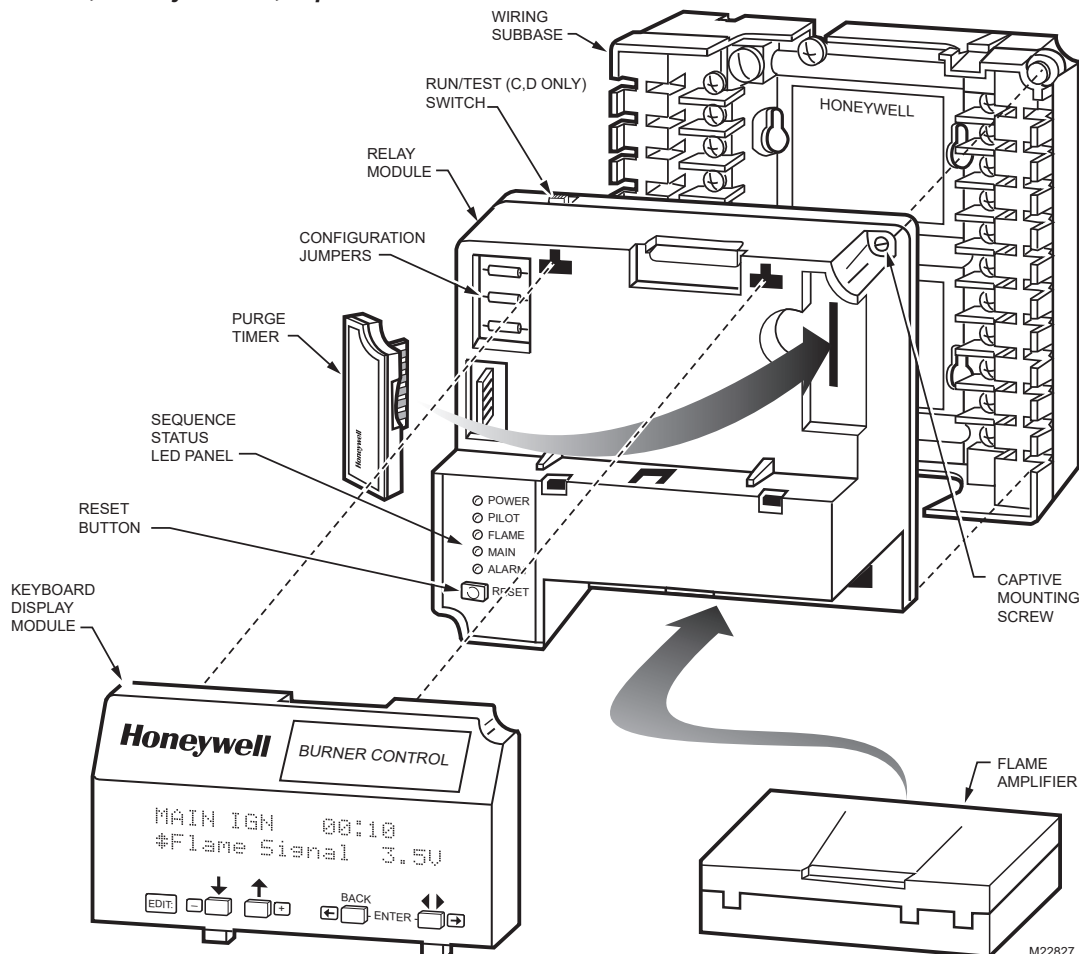



Table 8: Static Checkout.

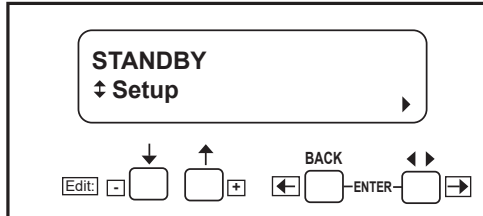
Test Number	Relay Module Model	Test Jumpers	Voltmeter Normal Operation	If Operation is Abnormal, Check Items Listed Below	
1	All	None	5-L2	Line voltage at terminal 5	1. Master switch 2. Power connected to master switch 3. Overload protection (fuse, circuit breaker, etc.) has not opened power line
2	All	None	6-L2	Line voltage at terminal 6	1. Limits 2. Burner controller
3	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.
4	All	5-10	—	1. 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
5	All	20-L2	Line voltage at Terminal 20	Preignition Interlocks	
6	All	5-8	—	1. Ignition spark (if ignition transformer is connected to terminal 8) 2. Automatic pilot valve opens (if connected to terminal 8) NOTE: Refer to wiring diagram of system being tested	1. Watch for spark or listen for buzz 2. Listen for click or feel head of valve for activation a. Actuator if used b. Pilot valve
7	All	5-9	—	Automatic fuel valve(s) open(s). If using direct spark ignition, check first stage fuel valve(s) instead of pilot valve	Same as test 6. If using direct spark ignition, check first stage fuel valve(s) instead of pilot valve
8a	RM7897A	5-21	—	1. Ignition spark (if ignition connected to terminal 21) 2. Automated Pilot Valve opens (if connected to terminal 21) NOTE: Refer to wiring diagram of system being tested	1. Watch for spark or listen for buzz 2. Listen for click or feel head of valve for activation a. Actuator if used b. Pilot valve.
8b	RM7897C	5-21	—	Automatic second stage main fuel valve(s) open(s)	1. Listen for and observe operation of second stage main fuel valve(s) and actuator(s) 2. Valve(s) and actuator(s)
9	All	5-3	—	Alarm (if used) turns on	1. Alarm
Final	All	<div style="text-align: center; background-color: yellow; border: 1px solid black; padding: 5px;">  CAUTION </div> <div style="border: 1px solid black; padding: 5px;"> <p>Equipment Damage Hazard.</p> <p>Can cause equipment damage.</p> <p>After completing these tests, open master switch and remove all test jumpers from subbase terminals. Also remove bypass jumpers, if used, from low fuel pressure limits.</p> </div>			

Setup of Post Purge

An S7800A1142, Keyboard Display Module (KDM), is required for the setup of the RM7897 Post Purge Timing, and must be purchased separately.

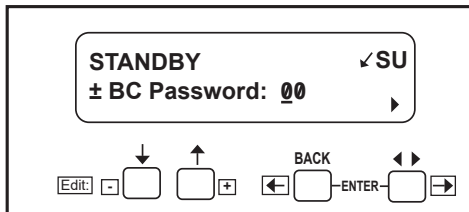
When the RM7897A,C is installed and powered, “STANDBY” will be shown on the first line of the display (Figure 17).

Figure 17: Setup Needed Screen



1. Scroll down until “Setup” is displayed in the second line.
2. Enter the setup sub-routine by pressing the **Far Right Arrow** key on the display.

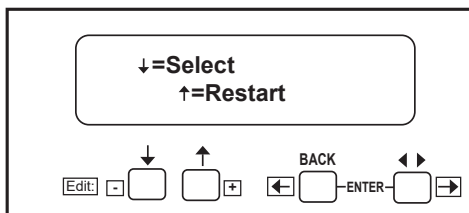
Figure 18: Entering the Setup Sub-Routine



The second line reads “BC Password”.

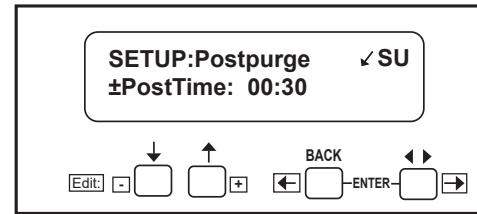
3. Use the **Up/Down Arrows** to enter the first number, 7.
4. Use the **Far Right Arrow** key to shift over one space.
5. Use the **Up/Down Arrows** to enter the second number, 8.
6. Press **Enter** (left/right arrow simultaneously).

Figure 19: Select/Restart Screen



7. Press **Down Arrow** to select.
8. “Getting Data” will be momentarily displayed, followed by the screen shown in Figure 20.

Figure 20: Setting Post Purge time



This screen allows for setting up the Postpurge for the RM7897A,C. This will be the time that the Combustion Fan (terminal 4) will remain energized after the call for heat has ended (terminal 6).

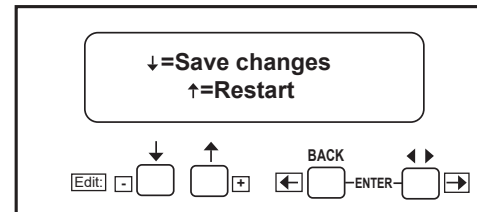
9. Use the **Up Arrow** to increase the postpurge time.

Time increases:

- 0 to 60 seconds in 1 second intervals
- 60 to 600 seconds in 10 second intervals
- 10 to 60 minutes in 1 minute intervals

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

Figure 21: Save Changes Screen

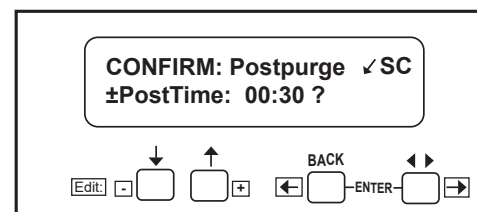


11. Use the **Down Arrow** to save changes. “Getting Data” is displayed momentarily.

Confirming Selection

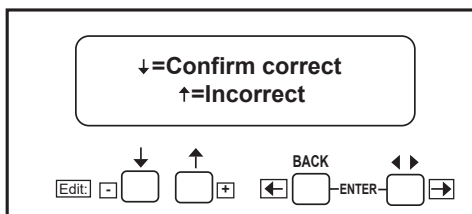
The following steps are used to confirm your selection.

Figure 22: Confirm Postpurge Time



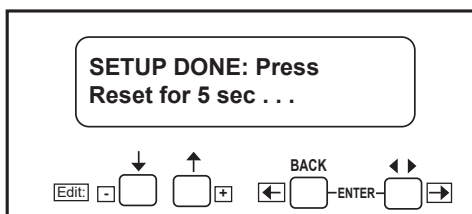
1. Press **Enter**.

Figure 23: Confirm Correct/Incorrect Screen



2. Press the **Down Arrow** to confirm the correct postpurge time. "Getting Data" will be displayed until the screen in Figure 24 appears.

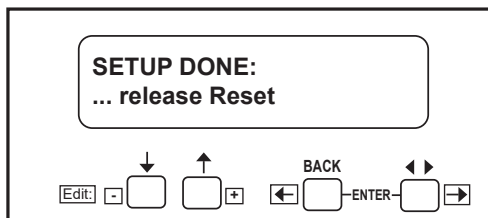
Figure 24: Setup Done Screen



3. Go to the RM7897 and press and hold the **Reset** button for five seconds to program the postpurge time into the relay module.

The Release Reset screen will appear on the KDM.

Figure 25: Release Reset Screen



Changing the postpurge time feature is still possible. With the RM7897 in Standby, scrolling to the Setup line and entering with the password allows the settings to be changed.

Once the system is in operation, the settings of the postpurge time can be viewed under Diagnostics, using your S7800 Keyboard Display Module.

Principal Technical Features

The RM7897 provides all customary flame safeguard functions as well as significant advancements in safety, annunciation, and system diagnostics.

Safety Shutdown (Lockout) Occurs if:

1. Initiate Period
 - a. Purge card is not installed or removed.
 - b. Purge card is bad.
 - c. Configuration jumpers have been changed (after 200 hours)—Fault Code 110.
 - d. AC line power errors occurred, see Operation.
 - e. Four minute INITIATE period has been exceeded.
2. Standby Period
 - a. Airflow lockout feature is enabled (JR3 clipped) and the airflow switch does not close after ten seconds or within the specified purge card timing.
 - b. Flame signal is detected after 240 seconds.
 - c. Ignition/pilot valve terminal is energized.
 - d. Main valve terminal is energized.
 - e. Delayed main valve terminal is energized (RM7897C).
 - f. Internal system fault occurred.
 - g. Purge card is removed.
 - h. Purge card is bad.
 - i. Preignition Interlock open.
3. Prepurge Period
 - a. Airflow lockout feature is enabled (JR3 clipped) and the airflow switch opens.
 - b. Ignition/pilot valve terminal is energized.
 - c. Main valve terminal is energized.
 - d. Delayed main valve terminal is energized (RM7897C).
 - e. Internal system fault occurred.
 - f. Purge card is removed.
 - g. Purge card is bad.
 - h. Flame signal is detected for 30 seconds.
 - i. Preignition interlocks open during standby.

4. Pilot Flame Establishing Period (PFEP)

- a. Airflow lockout feature is enabled and the airflow switch opens.
- b. No flame signal at end of PFEP.
- c. Ignition/pilot valve/intermittent pilot valve terminal is not energized.
- d. Main valve terminal is energized (RM7897A).
- e. Delayed (second stage) main valve terminal is energized (RM7897C).
- f. Internal system fault occurred.
- g. Purge card is removed.
- h. Purge card is bad.

5. Main Flame Establishing Period (MFEP)

- a. Airflow lockout feature is enabled and the airflow switch opens.
- b. Ignition terminal is energized.
- c. Ignition/pilot valve terminal is not energized.
- d. Main valve terminal is not energized.
- e. Delayed main valve terminal is energized.
- f. Loss of flame signal.
- g. Internal system fault occurred.
- h. Purge card is removed.
- i. Purge card is bad.

6. Run Period

- a. No flame present (JR2 removed).a
- b. Airflow lockout feature is enabled and the airflow switch opens.
- c. Interrupted pilot valve terminal is energized (RM7897A, terminal 21; RM7897C, terminal 8).
- d. Main valve terminal is not energized.
- e. Delayed main valve terminal is not energized (RM7897C).
- f. Internal system fault occurred.
- g. Purge card is removed.
- h. Purge card is bad.
- i. Ignition terminal is energized.

Safety Shutdown Sequence:

1. A safety shutdown occurring during Initiate or Standby will lockout the RM7897 (prevent it from starting) indicated by an alarm.
2. A safety shutdown occurring during purge results the blower motor terminal 4 being de-energized and the system will lockout indicated by an alarm.
3. A safety shutdown during the ignition trial period (pilot or main) or Run, all fuel valves and the ignition (if on) will be de-energized and the system will lockout indicated by an alarm. The RM7897 will complete the programmed post purge before the blower motor terminal 4 is de-energized. If no post purge is programmed, the RM7897 will default to a 15 second post purge.

Manual reset is required following any safety shutdown.

Manual reset may be accomplished by pressing the push button on the device, pressing the remote reset wired through an attached display or S7820 remote reset module.

^a For RM7897C1026, if flame loss occurs during the first 15 seconds in the Run period, then lockout occurs. If flame loss occurs after 15 seconds into the Run period, then recycle.

NOTE: Interrupting power will cause electrical resets, but does not reset a safety shutdown (lockout) condition.

Operation

Sequence of Operation

The RM7897A,C has the operating sequences listed below; see [Figure 14](#) and [Figure 15](#). The RM7897A,C LED provide positive visual indication of the program sequence: POWER, PILOT, FLAME, MAIN and ALARM.

Initiate

The RM7897A,C Relay Module enters the INITIATE sequence when the relay module is initially powered. The RM7897A,C can also enter the INITIATE sequence if the relay module verifies voltage fluctuations of +10/-15% or frequency fluctuations of $\pm 10\%$ during any part of the operating sequence. The INITIATE sequence lasts for ten seconds unless the voltage or frequency tolerances are not met. When not met, a hold condition is initiated and displayed on the optional KDM for at least five seconds; when met, the INITIATE sequence restarts. If the condition is not corrected and the hold condition exists for four minutes, the RM7897A,C locks out. Causes for hold conditions in the INITIATE sequence:

1. AC line dropout detection.
2. AC line noise that can prevent a sufficient reading of the line voltage inputs.
3. Low line voltage brownouts.

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

Standby

The RM7897A,C is ready to start an operating sequence when the operating control input determines a call for heat is present. The burner switch, limits, operating limit control and all microcomputer-monitored circuits must be in the correct state for the relay module to continue into the PREPURGE sequence.

Normal Start-Up Prepurge

The RM7897A,C Relay Module provides PREPURGE timing, selectable with ST7800 Purge Timer cards, from two seconds to thirty minutes with power applied and the operating control indicating a call for heat.

1. The Airflow Interlock, burner switch, Run/Test switch and all microcomputer-monitored circuits must also be in the correct operating state.
2. The motor output, terminal 4, is powered to start the PREPURGE sequence.
3. The Airflow Interlock input closes ten seconds into PREPURGE or within the specified purge card timing; otherwise, a recycle to the beginning of PREPURGE or lockout occurs, depending on how the Airflow Switch selectable jumper (JR3) is configured.

Ignition Trials

1. Pilot Flame Establishing Period (PFEP):
 - a. When the PFEP begins:
 - (1) The pilot valve and ignition transformer, terminals 8 and 10 (also terminal 21, RM7897A), are energized. The RM7897A has an intermittent pilot valve, terminal 8, and interrupted pilot valve on terminal 21. The RM7897C has an interrupted pilot valve, terminal 8.
 - (2) Flame must be proven by the end of the ten second PFEP (four seconds if Configuration Jumper JR1 is clipped) to allow the sequence to continue. If a flame is not proven by the end of PFEP, a safety shutdown occurs.
 - (3) the Pre-Ignition Interlock is ignored throughout the Trial for Ignition State.
2. Main Flame Establishing Period (MFEP):
 - a. After PFEP, and with the presence of flame, the main fuel valve, terminal 9, is powered. If a flameout occurs, the relay module locks out within 0.8 or 3 seconds, depending on the Flame Failure Response Time (FFRT) of the amplifier.
 - b. The RM7897A (terminal 21) and RM7897C (terminal 8) have a ten second MFEP (RM7897C1018 is four seconds). After the Ignition Trials, the interrupted pilot valve, terminal 8 or 21, is de-energized. If a flameout occurs, the relay module recycles (locks out if jumper JR2 clipped) within 0.8 or 3 seconds, depending on the Flame Failure Response Time (FFRT) of the amplifier.

Run

1. The RM7897C has a delayed main valve that is energized once the RUN period is entered.
2. The relay module is now in RUN and remains in RUN until the controller input, terminal 6, opens, indicating that the demand is satisfied or a limit has opened.

Post Purge

After the demand is satisfied or a limit opens, deenergizing terminal 6, the Ignition/Pilot valve, main valve and delayed main valve, terminals 8, 9 and 21, are deenergized. The blower motor, terminal 4, remains powered during the specified programmed time. The Pre-Ignition Interlock closes within the first five seconds of Post Purge.

Run/Test Switch

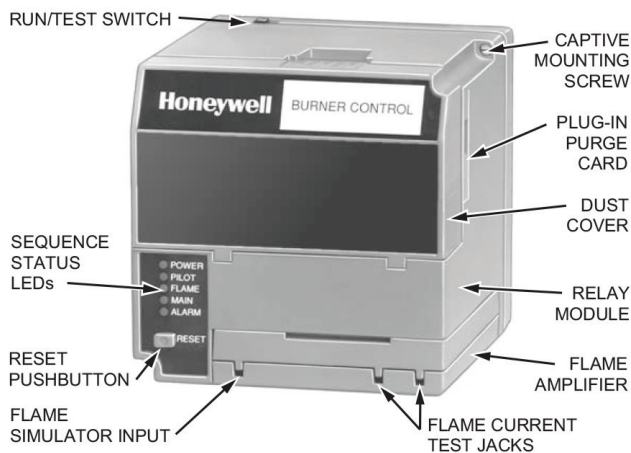
The Run/Test Switch is located on the top side of the relay module, see [Figure 26](#). The Run/Test Switch allows the burner sequence to be altered as follows:

1. In the measured PREPURGE sequence, the Run/Test Switch, placed in the TEST position, causes the PREPURGE timing to stop.
2. In the Pilot Flame Establishing Period, the Run/Test Switch, placed in the TEST position, stops the timer during the first eight seconds of a ten-second PFEP selection or during the first three seconds of a four-second PFEP selection. It also allows for pilot turn-down test and other burner adjustments. This activates a fifteen-second flameout timer that permits pilot flame adjustment without nuisance safety shutdowns. The Run/Test Switch is ignored during PFEP for the C relay module if terminals 8 and 9 or 9 and 21 are jumpered.

Important

When the relay module is switched to the TEST mode, it stops and holds at the next Run/Test Switch point in the operating sequence. Make sure that the Run/Test Switch is in the RUN position before leaving the installation.

Figure 26: Sequence Status LEDs



Settings and Adjustments

Selectable Site-Configurable Jumpers

The relay module has three site-configurable jumper options, see [Figure 27](#) and [Table 9](#). If necessary, clip the siteconfigurable jumpers with side cutters and remove the resistors from the relay module.

SERVICE NOTE: Clipping and removing a siteconfigurable jumper enhances the level of safety.

Important

Clipping and removing a jumper after 200 hours of operation causes a nonresettable Fault 110. The relay module must then be replaced.

Figure 27: Selectable Site-Configurable Jumpers

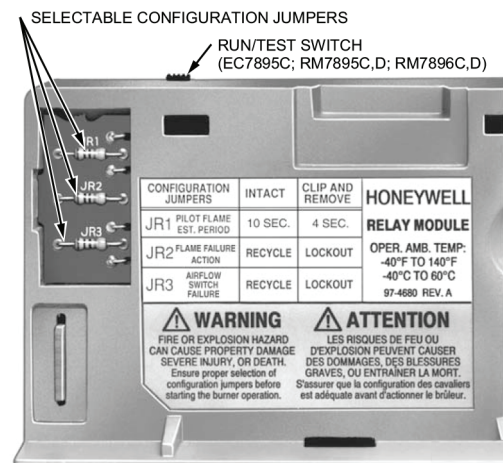


Table 9: Site-Configurable Jumper Options.

Jumper Number	Description	Intact	Clipped
JR1	Pilot Flame Establishing Period (PFEP)	10 seconds	4 seconds
JR2	Flame Failure Action	Recycle	Lockout ^a
JR3	Airflow Switch (ILK) Failure	Recycle	Lockout

^a For RM7897C1026, if flame loss occurs during the first 15 seconds in the Run period, then lockout occurs. If flame loss occurs after 15 seconds into the Run period, then recycle

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 and 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.

License Agreement

Copying and reverse engineering is prohibited by the law.

Troubleshooting


The POWER LED provides fault identification when the Relay Module locks out on an alarm. Fault identification is a series of fast- and slow-blinking LED lights. The fast blinks identify the tens portion of the fault code (three fast blinks is 30), while the slow blinks identify the units portion of the fault code (two slow blinks is 2). Three fast blinks followed by two slow blinks would be fault code 32. This identifies a running interlock on during STANDBY. (See Table 8 for Blinking Fault Code List.)

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

NOTE: Blink codes do not match fault codes viewed by an S7800 KDM.

Table 10: Blinking Fault Codes and Recommended Troubleshooting.

Fault Code	System Failure	Recommended Troubleshooting
Code 1-1 *Low AC Line Voltage*	Low AC Line detected	1. Check the relay module and display module connections 2. Reset and sequence the Relay Module
Code 1-2 *AC Quality Problem*	Excessive noise or device running on slow, fast, or AC line dropout detected	3. Check the 7800 power supply and make sure that frequency and voltage meet specifications 4. Check the backup power supply, as appropriate
Code 2-1 *Unexpected Flame Signal*	Flame sensed when no flame is expected during STANDBY or PURGE	1. Check that flame is not present in the combustion chamber; correct any errors 2. Make sure that the flame amplifier and flame detector are compatible 3. Check the wiring and correct any errors 4. Remove the flame amplifier and inspect its connections. Reseat the amplifier 5. Reset and sequence the relay module 6. If the code reappears, replace the flame amplifier and/or the flame detector 7. If the fault persists, replace the relay module
Code 2-2 *Flame Signal Absent*	No-flame time present at the end of the Pilot Flame Establishing Period; lost during the Main Flame Establishing Period or during RUN	1. Measure the flame signal. If one exists, verify that it meets specifications 2. Make sure that the flame amplifier and flame detector are compatible 3. Inspect the main fuel valve(s) and valve connection(s) 4. Verify that the fuel pressure is sufficient to supply fuel to the combustion chamber. Inspect the connections to the fuel pressure switches. Make sure they are functioning properly 5. Inspect the Airflow Switch and make sure that it is functioning properly 6. Check the flame detector sighting position; reset and recycle. Measure the flame signal strength. Verify that it meets specifications. If not, refer to the flame detector and/or flame amplifier checkout procedures in the installation instructions 7. Replace the flame amplifier and/or the flame detector, if necessary 8. If the fault persists, replace the relay module.
Code 2-3 *Flame Signal Overrange*	Flame signal value is too high to be valid	1. Make sure the flame detector and flame amplifier are compatible 2. Remove the flame amplifier and inspect its connections. Reset the flame amplifier 3. Reset and sequence the relay module 4. Check the flame detector sighting position; reset and recycle. Measure flame strength. Verify that it meets specifications. If not, refer to the flame detector and/or flame amplifier checkout procedures in the installation instructions 5. If the code reappears, replace the flame amplifier and/or the flame detector 6. If the fault persists, replace the relay module
Code 3-1 *Running/ Interlock Switch Problem*	Running or Lockout Interlock fault during Prepurge	1. Check wiring; correct any errors 2. Inspect the fan; make sure there is no air intake blockage and that it is supplying air 3. Make sure the Lockout Interlock switches are functioning properly and the contacts are free from contaminants 4. Reset and sequence the relay module to Prepurge (place the TEST/RUN Switch in the TEST position, if available). Measure the voltage between terminal 7 and G (ground); 120Vac should be present. Switch TEST/RUN back to RUN 5. If steps 1 through 4 are correct and the fault persists, replace the relay module.
Code 3-2 *Running/ Interlock On During Standby*	Lockout Interlock powered at improper point in sequence or ON in Standby	1. Check wiring to make sure that the Lockout Interlocks are connected properly between terminals 6 and 7. Correct any errors 2. Reset and sequence the relay module 3. If the fault persists, measure the voltage between terminal 6 and G (ground), then between terminal 7 and G. If there is 120 Vac at terminal 6 when the controller is off, the controller switch may be bad or is jumpered 4. If steps 1 through 3 are correct and there is 120 Vac at terminal 7 when the controller is closed and the fault persists, check for a welded or jumpered Running Interlock or Airflow Switch. Correct any errors 5. If steps 1 through 4 are correct and the fault persists, replace the relay module
Code 3-3 *VPS in Improper State*	VPS (Valve Proving Switch) in wrong state during VPS Test	1. Check wiring, making sure upstream valve is connected to terminal 9 and downstream valve is connected to terminal 17 2. Conduct Valve Seat leakage test using a manometer 3. Reset and sequence the relay module; if fault repeats, test VPS (connected to terminal 16) is functioning properly; replace if necessary 4. Reset and sequence the relay module 5. If fault persists, replace the relay module
Code 4-1 *Purge Card Problem*	No purge card or the purge card timing has changed from the original configuration	1. Make sure the purge card is seated properly 2. Inspect the purge card and the connector on the relay module for any damage or contaminants 3. Reset and sequence the relay module 4. If the fault code reappears, replace the purge card 5. Reset and sequence the relay module 6. If the fault code persists, replace the relay module

Fault Code	System Failure	Recommended Troubleshooting
Code 4-2 *Wiring Problem/ Internal Fault*	Pilot (ignition) valve terminal, main valve, ignition or Main Valve 2 was ON when it should be OFF	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">  WARNING Electrical Shock Hazard; Fire or Explosion Hazard. Can cause severe injury, death or property damage. Remove system power and turn OFF power supply. </div> <ol style="list-style-type: none"> 1. Remove system power and turn off fuel supply 2. Check wiring; correct any errors 3. inspect Pilot Fuel Valve(s), both places, and connections 4. Reset and sequence the relay module 5. If the fault persists, replace the relay module
Code 4-3 *Flame Amplifier Problem*	Flame not sensed, or sensed when it should be ON or OFF	<ol style="list-style-type: none"> 1. Check wiring; correct any errors 2. Make sure the flame amplifier and flame detector are compatible 3. Remove the flame amplifier and inspect the connections. Reseat the amplifier 4. Reset and sequence the relay module 5. If the code reappears, replace the flame amplifier and/or the flame detector 6. If the fault persists, replace the relay module
Code 4-4 *Configuration Jumper Problem*	The configuration jumpers differ from the sample taken at startup	<ol style="list-style-type: none"> 1. Inspect the jumper connections. Make sure the clipped jumpers were completely removed 2. Reset and sequence the relay module 3. If the fault persists, replace the relay module
Code 5-1 *Preignition Interlock*	Preignition Interlock fault	<ol style="list-style-type: none"> 1. Check wiring and correct any errors 2. Check Preignition Interlock switches to assure proper functioning 3. Check fuel valve operation 4. Reset and sequence the relay module; monitor the Preignition Interlock status 5. If the fault persists, replace the relay module
Code 5-2 *High Fire Sw. or Low Fire Sw.*	Either High Fire Switch or Low Fire Switch failure	<ol style="list-style-type: none"> 1. Check wiring and correct any errors 2. Reset and sequence the relay module 3. Use manual motor potentiometer to drive the motor open and closed. Verify at motor switch that the end switches are operating properly. Use RUN/TEST switch if manual potentiometer is not available 4. Reset and sequence the relay module 5. If the fault persists, replace the relay module
Code 5-3 *Man-Open Sw.; Start Sw. or Control ON*	Man-Open Switch, Start Switch or Control ON in the wrong operational state	<ol style="list-style-type: none"> 1. Check wiring and correct any errors 2. Make sure that the Manual Open Valve Switch, Start Switch and Control are operating properly 3. Stat Switch held "ON" too long 4. Reset and sequence the relay module 5. Reset and sequence the relay module. If the fault persists, replace the relay module (RM7838A1014; RM7838B1013 or RM7838C1004 only)
Code 6-1 *Internal Faults*	Relay Module self-test failure	<ol style="list-style-type: none"> 1. Reset and sequence the relay module 2. If fault reappears, remove power from the device, reapply power, then reset and sequence the relay module 3. If the fault persists, replace the relay module
Code 6-2 *Internal Faults*	Relay Module Self-Test failure	<ol style="list-style-type: none"> 1. Reset and sequence the relay module 2. If fault reappears, remove power from the device, reapply power, then reset and sequence the relay module 3. If fault does not repeat on the next cycle, check for electrical noise being copied into the relay module through the external loads or possibly an electrical grounding issue 4. If the fault persists, replace the relay module.
Code 6-3 *Device Specific*	Fault with special OEM input circuits	<ol style="list-style-type: none"> 1. Check wiring and operation of special OEM inputs 2. Reset and sequence the relay module 3. If fault reappears, remove power from the device, reapply power, then reset and sequence the relay module 4. If the fault does not repeat on the next cycle, check for electrical noise being copied into the relay module through external loads or possibly and electrical grounding issue 5. If the fault persists, replace the relay module
Code 6-4 *Accessory Fault*	Unused at this time	—
Code 7-7 *Unused*	Unused at this time	—

Appendix — ModBus S7810M Module



Application

The Honeywell 7800 SERIES is a microprocessor-based integrated burner control for automatically fired gas, oil or combination fuel single-burner applications. The 7800 SERIES is programmed to provide a level of safety, functional capability and features beyond the capacity of conventional controls. Functions provided by the 7800 SERIES include automatic burner sequencing, flame supervision, system status indication, system or self-diagnostics and troubleshooting.

The S7810M ModBus® Module supports remote mounting of a Keyboard Display Module (KDM), personal computer/PLC interface for multi-dropped 7800 SERIES subnetworks, and remote control of a 7800 SERIES Relay Module.

Features

- Multi-dropped communications bus interface
- Remote control capabilities:
 - Standby Hold
 - Drive to High Fire
 - Drive to Low Fire
 - Reset
- Ability to remotely mount a Keyboard Display Module
- S7810M1029 meets Gastec approval (cannot be reset through data highway)
- ModBus RTU slave device

Specifications

Model:

S7810M ModBus Module

Electrical Ratings:

Voltage and Frequency: 13 Vdc peak full-wave rectified (+20/-15%)

Power Dissipation: 2W maximum

Terminal Ratings:

Power: 13 Vdc peak full-wave rectified

Earth ground

ControlBus™ (1,2,3) and Multi-Drop ModBus (6,7,8):

5 Vdc at 60 mA maximum.

Electrical Connector (included):

ControlBus: 208727 8-pin electrical connector

Environmental Ratings:

Ambient Temperature:

Operating: -40°F to +140°F (-40°C to +60°C)

Storage: -40°F to +150°F (-40°C to +66°C)

Humidity: 85% relative humidity, continuous, noncondensing

Vibration: 0.5G environment.

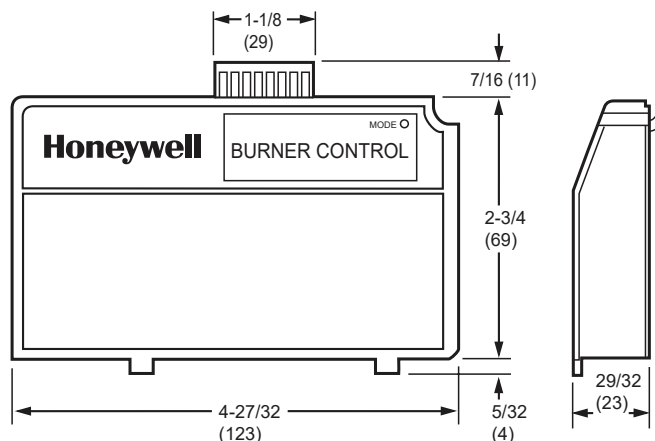
Weight: 4 ounces

Replacement Part: 208727 eight-pin connector

Approvals: S7810M1029: Gastec EN268, Report 1156791

Dimensions: See [Figure 28](#)

Figure 28: Mounting dimensions of S7810M ModBus



Ordering Information

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:

1. Your local Honeywell Automation and Control Products Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
1885 Douglas Drive North
Minneapolis, Minnesota 55422-4386

In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Toronto, Ontario M1V 4Z9. International Sales and Service Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

Installation

When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and marked on the product to make sure the product is suitable for your application.
3. The installer must be a trained, experienced flame safeguard technician.
4. Disconnect the power supply before beginning installation to prevent electrical shock and equipment damage. More than one power supply disconnect can be required.
5. Wiring must comply with all applicable codes, ordinances and regulations.
6. After installation is complete, check out product operation as provided in these instructions.

Important:

This equipment can cause interference with radio communications.

This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the Instructions Manual, may cause interference with radio communications. It has been tested and found to comply with the limits for a Class B computing device pursuant to Subpart J 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 is likely to cause interference, in which case, users, at their own expense, will be required to take whatever measures may be required to correct the interference. Any unauthorized modification of this equipment may result in the revocation of the owner's authority to continue its operation. When operating the S7810M remotely with a separate power supply, FCC compliance is not guaranteed unless an FCC-approved power supply is used.

Canadian EMI: This digital apparatus does not exceed the Class B limits for radio noise emission from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la Classe B prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

Humidity

Install the S7810M where the relative humidity never reaches the saturation point. The S7810M is designed to operate in a maximum humidity environment of 85 percent relative humidity, continuous, noncondensing moisture.

Weather

The S7810M is not designed to be weather-tight. When installed outdoors, protect the S7810M with an approved weather-tight enclosure.

Vibration

Do not install the S7810M where it could be subjected to vibration in excess of 0.5G continuous maximum vibration.

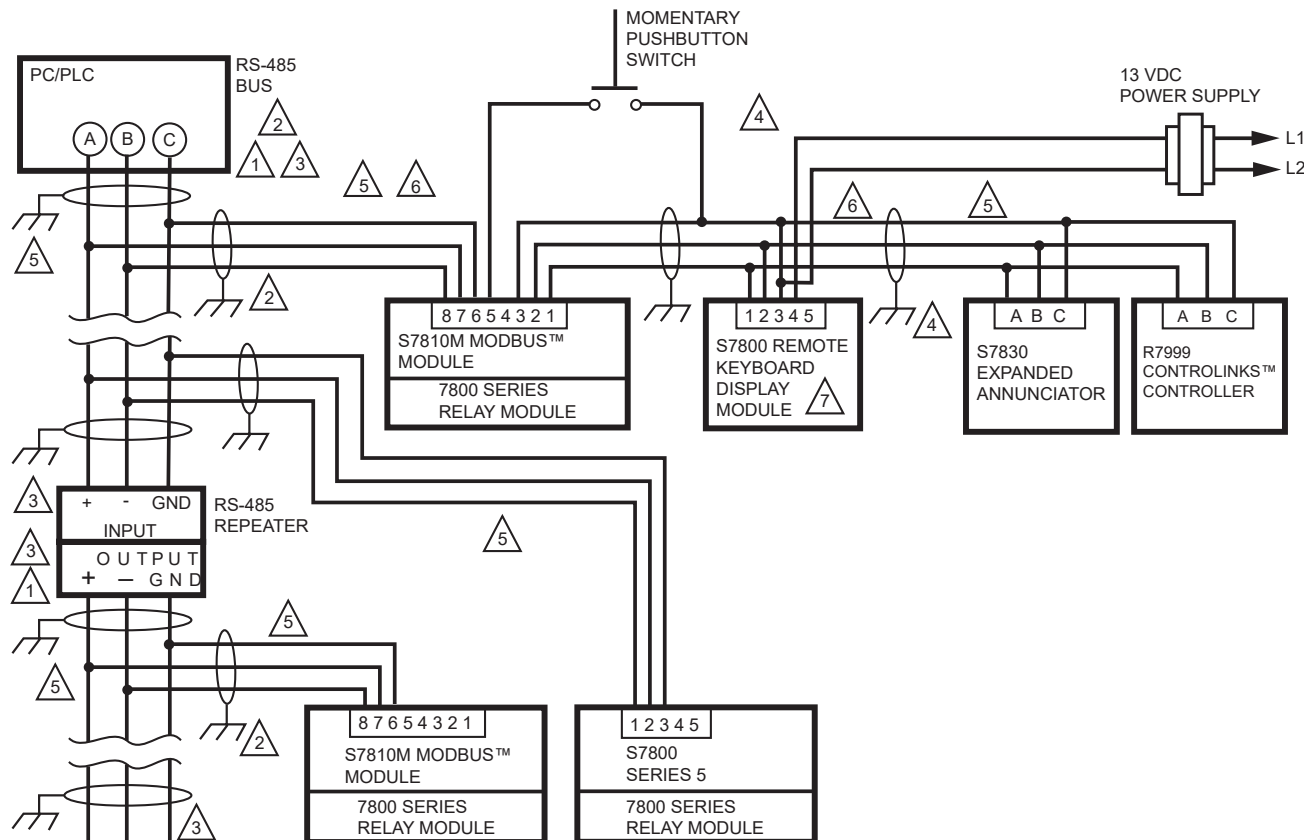
Mounting the S7810M ModBus Module

1. Align the two ears of the ModBus Data ControlBus Module with the two mating slots on the 7800 SERIES Relay Module ([Figure 29](#)).
2. Insert the two interlocking ears into the two mating slots and, with a hinge action, push on the lower corners of the ModBus Data ControlBus Module to secure it to the 7800 SERIES Relay Module.

Figure 29: ModBus Module Mounting



Figure 30: S7810M ModBus Module Wiring



- 1 MULTI-DROP RS-485 COMMUNICATION BUS. UP TO 31 S7810M MODBUS™ MODULES CAN BE CONNECTED TO A SINGLE BUS WITHOUT AN RS-485 REPEATER. UP TO 99 S7810M MODBUS™ MODULES (SUBNETWORKS) CAN BE CONNECTED TO A BUS WITH RS-485 REPEATERS. WHEN USING AN RS-485 REPEATER, THE REPEATER MUST BE INSTALLED EVERY 30TH MODULE.
- 2 THE SUBNETWORKS MUST BE WIRED IN A DAISY CHAIN CONFIGURATION. RECOMMEND THAT THE PC/PLC BE AT ONE END OF THE DAISY CHAIN.
- 3 MODBUS™ COMMUNICATION BUS TERMINATION RESISTORS:
 - A. WITHOUT RS-485 REPEATER:

MODULES AT THE CLOSEST AND FARTHEST END OF THE DAISY CHAIN REQUIRE TERMINATION RESISTORS. INSTALL A 120 OHM, 1/4 WATT RESISTOR BETWEEN TERMINALS A AND B OF THE PC/PLC (IF INSTALLED AT ONE END OF THE DAISY CHAIN). INSTALL A 120 OHM, 1/4 WATT RESISTOR BETWEEN TERMINALS 7 AND 8 OF THE LAST S7810M MODBUS™ MODULE IN THE DAISY CHAIN.
 - B. WITH RS-485 REPEATER:

WHEN AN RS-485 REPEATER IS USED, TWO DAISY CHAIN CONFIGURATIONS ARE EFFECTIVELY FORMED. MODULES AT THE CLOSEST AND FARTHEST ENDS OF EACH DAISY CHAIN REQUIRE TERMINATION RESISTORS. INSTALL A 120 OHM, 1/4 WATT RESISTOR BETWEEN TERMINALS A AND B OF THE PC/PLC (IF INSTALLED AT THE END OF THE DAISY CHAIN). INSTALL A 120 OHM, 1/4 WATT RESISTOR BETWEEN INPUT TERMINALS DATA+ AND DATA- OF THE RS-485 REPEATER. INSTALL A 120 OHM, 1/4 WATT RESISTOR BETWEEN TERMINALS 7 AND 8 OF THE LAST S7810M MODBUS™ MODULE IN THE ADDITIONAL DAISY CHAIN.
- 4 LOCAL RS-485 COMMUNICATIONS BUS. THE DEVICES ON THIS BUS MUST BE WIRED IN A DAISY CHAIN CONFIGURATION. THE ORDER OF INTERCONNECTION IS NOT IMPORTANT. THE MODULES ON THE CLOSEST AND FARTHEST ENDS OF THE DAISY CHAIN REQUIRE A 120 OHM, 1/4 WATT TERMINATION RESISTOR BETWEEN TERMINALS 1 AND 2 OR A AND B.
- 5 THREE WIRE SHIELDED CABLE (BELDEN 8723 SHIELDED OR EQUIVALENT) IS RECOMMENDED AND SHOULD BE GROUNDED AS FOLLOWS: IF NO INTERFERENCE IS PRESENT, OR TO REDUCE CAPACITIVE INTERFERENCE, THE SHIELD SHOULD BE GROUNDED AT ONE END. WHEN GROUNDING ONLY ONE END OF THE SHIELD, THE SHIELD END CLOSEST TO THE S7810M MODBUS™ MODULE SHOULD BE ATTACHED TO EARTH GROUND. TO REDUCE INDUCTIVE INTERFERENCE (RF INTERFERENCE), THE SHIELD SHOULD BE GROUNDED AT BOTH ENDS.
- 6 THE MODBUS™ BUS COMMON, S7810M MODBUS™ TERMINAL 6, AND THE LOCAL BUS COMMON (S7810M MODBUS™ TERMINAL 3), MUST NOT BE ELECTRICALLY CONNECTED TOGETHER.
- 7 TERMINAL NUMBERS ARE ON 203541 5-WIRE CONNECTOR (SUPPLIED WITH REMOTE MOUNTING BRACKET).

Wiring

1. Refer to [Figure 30](#) for proper wiring.
2. All wiring must comply with all applicable electrical codes, ordinances and regulations.
3. Recommended wiring size and type:
 - a. For all communications, use 22 AWG, 3-wire shielded cable (Belden part number 8723 or equivalent).
 - b. For 13 Vdc and remote reset switch operation, use 22 AWG wire insulated for voltages and temperatures in the application. Suggested wire types include TW (60°C), THW (75°C) and THHN (90°C). Terminal identification numbers and letters are shown in [Table 11](#).
4. Wire routing:
 - a. Do not route the communication cable in conduit with line voltage circuits.
 - b. Do not route the communication cable close to the ignition transformers.
 - c. Route the communication cable outside of conduit if properly supported and protected from damage.
 - d. Route the communication cable so that all devices are connected in a daisy chain configuration. See [Figure 30](#).
5. Maximum wire lengths:
 - a. Communications bus, 4000 feet (1219 meters).
 - b. Remote reset switch, 1000 feet (305 meters).

Table 11: S7810M Terminal Identification.

ControlBus Data +	1
ControlBusData -	2
Common • ControlBus Common • +13 Vdc Common • Remote Reset Common	3
+13 Vdc	4
Remote Reset	5
ModBus Common	6
ModBus Data +	7
ModBus Data -	8

MODE LED Light Patterns

[Table 12](#) explains the MODE LED light patterns.

Table 12: Explanation of MODE LED Light Patterns

LED Code/ Behavior	Pulse Period	Interval	Meaning
Always OFF		OFF	Not powered or device failure
Always ON		ON	S7810M device failure
Mostly ON with 1 blink	50 ms (OFF)	1 second	Both ControlBus and ModBus are active
Mostly OFF with 1 flash	50 ms (ON)	3.85 seconds	ControlBus is active, and ModBus is not active
Mostly OFF with 2 pulses	2 × (200 ms ON, 200 ms OFF)	1.75 seconds	Program CRC error.
Mostly OFF with 3 pulses	3 × (200 ms ON, 200 ms OFF)	2.15 seconds	No ControlBus signal from the Burner Control

Operation

The S7810M ModBus Data ControlBus Module has two communications ports. The ControlBus communications port allows communications on a bus that contains a 7800 SERIES burner controller and an S7800 Keyboard Display Module and/ or an S7830 Expanded Annunciator and/or an R7999 ControlLinks™ Controller.

A second communications port supports RS-485 communications using ModBus protocol. The following tables provide ModBus mapping information.

Table 10 provides register mapping. It identifies the mapping of the 7800 SERIES parameters to ModBus registers. These codes are transmitted by the relay modules and the S7830 Expanded Annunciator.

Function Codes

Supported function codes of ModBus Protocol Reference Guide (PI-MBUS-300 Rev. J) are 3, 4, 6, and 17. Function codes 3 and 4 are treated the same by the S7810M. Two registers need to be read when the data format is a U32 value (4 bytes); if both registers are not read, then a data value of 0 (zero) is returned. U32 values are in little endian format. The maximum number of addresses that can be queried is 127 (0x7F) for query messages 3 and 4.

Table 13 through Table 17 provide information on the function codes.

NOTE: All Query and Response cells below are 1 byte.

Table 13: Query Message Format for Function Codes 3 and 4

Slave Address	Function Code	Starting Address High	Starting Address Low	Number of Addresses High	Number of Addresses Low	CRC	CRC
01	03	00	0A	00	01	A4	08

Table 14: Response Message Format for Function Codes 3 and 4

Slave Address	Function Code	Byte Count	Data High	Data Low	CRC	CRC
01	03	02	00	22	38	5D

Table 15: Query Message Format for Function Code 6 (Broadcast is supported by using a slave address of 00)

Slave Address	Function Code	Starting Address High	Starting Address Low	Preset Data High	Preset Data Low	CRC	CRC
01	06	00	7F	00	04	B9	D1

Table 16: Table 6. Response Message Format for Function Code 6 (There is no response if the query was broadcast)

Slave Address	Function Code	Starting Address High	Starting Address Low	Preset Data High	Preset Data Low	CRC	CRC
01	06	00	7F	00	04	B9	D1

Table 17: Query Message Format for Function Code 17

Slave Address	Function Code	CRC	CRC
03	11	C1	4C

NOTE: See Table 20 for function code 17 response format.

Table 18: Exception Response Message Format

Slave Address	Function Code + 80h	Exception Code	CRC	CRC
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Table 19: Table 9. Exception Codes.

Exception Code	Definition	Description
01	Illegal Function	An illegal function as requested. Only 3, 4, 6 and 17 are supported
02	Illegal Data Address	Too many bytes requested, address is out of range, register is read only, or the number of address requested is past the last register
03	Illegal Data Value	The "Preset Data" from function code 6 is invalid/out of range

Device Address and Baud Rate

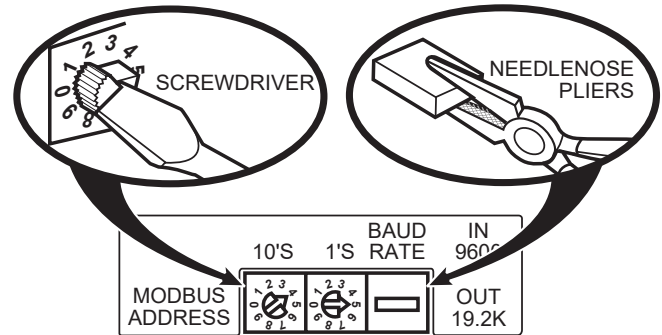
Assign each S7810M in the system a unique address by setting the MODBUS ADDRESS switches on the bottom of the device to the correct number. See [Figure 31](#). Only RTU communications with 1 Start Bit, 8 Data Bits, 1 Stop Bit and no parity is supported.

NOTE: Assign a device address number from 01 to 99. 00 is not an acceptable address number and will not work. The default baud rate is 9600. To change the baud rate to 19.2K, use a needlenose pliers to remove the jumper. See [Figure 31](#).

Important:

S7999B requires a baud rate of 19.2K.

Figure 31: 7810M Address Switches and Baud Rate Jumper



NOTE: In [Table 20](#), [Table 25](#) and [Table 29](#): Line 1 and Line 2 refer to the two lines of text on the S7800 Keyboard Display Module. In [Table 25](#), [Table 27](#) and [Table 29](#): The String Code column references [Table 26](#), String Codes. In [Table 25](#): The Burner Control State Bits column references [Table 32](#), Burner Control State Bits.

Table 20: ModBus Register Assignments

Address (hex)	Register (dec)	Parameter Name	Read/Write	Format	Notes
0000	40001	Burner Control (BC) Fault Code	R	U16	See Table 27. Non-zero value = Lockout number
0001	40002	BC Fault String Code	R	U16	See Table 26. Lockout text
0002	40003	BC Sequence State	R	U16	See Table 25 (current only if Fault code = 0)
0003	40004	BC State String Code (line 1)	R	U16	See Table 26. Simulates Line 1 of S7800
0004	40005	BC State String Code (line 2)	R	U16	See Table 26. Simulates Line 2 of S7800
0005	40006	BC Sequence time	R	U16	0–4095 Seconds
0006	40007	BC Total cycles	R	U32	Max value is 0xFFFFFFFF
0008	40009	BC Total hours	R	U32	Max value is 0xFFFFFFFF
000A	40011	BC Flame 1 signal strength	R	U16	0 to 255 represents 0.0 to 25.5 volts. Not clipped to 5.0V like S7800 and S7999B
000B	40012	Unused			
000C	40013	BC State Bits	R	U16	See Table 32
000D	40014	S7830 First Out Code	R	U16	See Table 29
000E	40015	S7830 State Bits	R	U32	Bit 31 (MSB) to Bit 0 (LSB) represent Terminals T31 to T0 of the Expanded Annunciator. Only T4-T22 are used
0010-0019	40017-40026	BC Fault history record 1	R		Newest fault record. See Table 28
001A-0023	40027-40036	BC Fault history record 2	R		Second newest fault record. See Table 28
0024-002D	40037-40046	BC Fault history record 3	R		Third newest fault record. See Table 28
002E-0037	40047-40056	BC Fault history record 4	R		Fourth newest fault record. See Table 28
0038-0041	40057-40066	BC Fault history record 5	R		Fifth newest fault record. See Table 28
0042-004B	40067-40076	BC Fault history record 6	R		Oldest fault record. See Table 28
004C	40077	BC Flame Failure Response Time	R	U16	Tenths of Seconds
004D	40078	BC Manufacturing code	R	U32	
004F	40080	BC Type Code	R	U16	See Table 31
0050	40081	S7810M/BC Software version	R	U32	
0052	40083	EA Software version	R	U32	
0054	40085	BC Remote Command status	R	U16	Bit 0: Autonomous Bit 1: Remote commanded OFF Bit 2: Remote commanded High Fire Bit 3: Remote commanded Low Fire Bit 4: Remote reset has/will be sent to BC ^a Bits 5-14: Unused Bit 15: Copied after the most recent write to the burner control command (40128 bit 15)
0055	40086	BC Flame Amplifier type	R	U16	0 = Standard 1 = Unknown 2 = Amplicheck or missing amplifier 3 = Shutter
0056	40087	BC Purge Time	R	U16	Seconds
0057-0065	40088-40102	BC Diagnostics	R	U16	String codes indicating terminal/jumper state. See Table 16. There are up to 15 codes. Not all are used for some burner controls.
0066	40103	Post-Purge time	R	U16	Seconds
0067	40104	Valve Proving Mode	R	U16	0 = Valve Proving is not enabled 1 = Enabled before Run 2 = Enabled after Run 3 = Enabled before and after Run 4 = Enabled split half before and half after Run
0068	40105	Valve Proving option	R	U16	1 = Uncommissioned 2 = Commissioned
0069	40106	Valve Proving time	R	U16	Seconds
0066-007E	40103-40127	Unused			
007F	40128	BC Remote Command	R/W	U16	Only one bit in the LSByte must be set, with the exception of bit 15: Bit 0 = Revert to autonomous operation Bit 1 = Don't fire, remain OFF Bit 2 = Go to Hi Fire during Run Bit 3 = Go to Lo Fire during Run Bit 4 = Remote reset ^a Bits 5-7 must be 0 Bits 8-14 are ignored Bit 15: Copied to the control status register. The remote control status register can be used to verify operation of the command NOTE: Bits 1-3 must be refreshed at least every 120 seconds, but not more than once a second, for the burner control to remain in the commanded state.

^a Remote Reset command not accepted by S7810M1029

Table 21: ModBus R7999 Register Assignments.

Address (hex)	Register (dec)	Parameter Name	Format	Notes
0080	40129	R7999 reserved	U16	Not used—always zero
0081	40130	R7999 program mode	U16	0—Initiate State 1—Normal Operation 2—Alarm Initiate State 3—Lockout 4—Not Configured 5—Factory Test 6—Low Voltage 7—Commissioning 8—Reset
0082	40131	R7999 fault code	U16	See Table 36
0083	40132	R7999 operational status	U16	00—Standby Hold 01—Standby Stop Position 02—Standby Main Valve 03—Standby Low Fire Main Valve 04—Standby Purge 05—Fault 1 06—Standby Hi Fire Main Valve 07—Fault 2 08—Processing Demand 09—Light Off 10—Modulate 11—Light Off Low Fire Main Valve 12—Purge 13—Fault 3 14—Purge Main Valve 15—Fault 4 16—Initialize 17—Post Purge
0084	40133	R7999 air position	U16	0–4095
0085	40134	R7999 active fuel position	U16	0–4095
0086	40135	R7999 FGR position	U16	0–4095
0087	40136	R7999 fuel ID	U16	0 = Fuel 1 1 = Fuel 2
0088-0089	40137-40138	R7999 cycles	U32	0–1,000,000 Same as register 40410.
008A	40139	R7999 diagnostic bits	U16	Bit Meaning 15—LCO state 14—HFP state 13—LFP state 12—ALARM state 11—LCI state 10—HF state 9—MV state 8—LF state 7—LCO Relay Drive 2 feedback 6—LCO Relay Drive 1 feedback 5—LCM state 4—AUTO/MAN select 3—Selected Fuel 2—Fuel Select 2 Input 1—Fuel Select 1 Input 0—Hold State (Bit will be set On if Aux Input is in a hold condition or disabled)
008B	40140	R7999 firing rate input	U16	0–255 = 0–21.1 mA.
008C	40141	R7999 manual pot input	U16 0-255 = 2.1–44.1 mA.	
008D	40142	R7999 auxiliary input	U16	0–255 = 0–21.1 mA.
008E	40143	Unused		
008F	40144	R7999 Hold	U16	Same as register 40139 bit 0
0090-009E	40145-40159	Unused		

Table 22: ModBus R7999 Register Assignments.

Address (hex)	Register (dec)	Parameter Name	Bytes	Notes
009F	40160	R7999 Message Counter		Format—U16 Bits 0-2 = The Buffer Index of the oldest information from the R7999. (Incremented by the BC status message once a second) Bits 0-15 = A counter synchronized with R7999 messages.
00A0-00A5	40161-40166	R7999 buffer # 0	0-11	These buffers store an 8-second history of status data from the R7999. The oldest buffer is indicated by register 40160, bits 0-2. This scheme forms a circular buffer of information. A buffer will contain all zeros if the S7810M received bad data for the buffer time slot. See Table 35 for interpretation of bytes 0-11
00A6-00AB	40167-40172	R7999 buffer # 1	0-11	
00AC-00B1	40173-40178	R7999 buffer # 2	0-11	
00B2-00B7	40179-40184	R7999 buffer # 3	0-11	
00B8-00BD	40185-40190	R7999 buffer # 4	0-11	
00BE-00C3	40191-40196	R7999 buffer # 5	0-11	
00C4-00C9	40197-40202	R7999 buffer # 6	0-11	
00CA-00CF	40203-40208	R7999 buffer # 7	0-11	

Table 23: ModBus R7999 Register Assignments

Address (hex)	Register (dec)	Parameter Name	Format	Notes
00D0-015F	40209-40352	R7999 Profile		See Table 23
0160	40353	Fuel 1 closed endpoint	U16	0-4095
0161	40354	Fuel 1 open endpoint	U16	0-4095
0162	40355	Fuel 2 closed endpoint	U16	0-4095
0163	40356	Fuel 2 open endpoint	U16	0-4095
0164	40357	Inactive motor position	U16	0-4095
0165	40358	Registers 40353-40357 are current	U16	0-1
0166	40359	Air closed endpoint position	U16	0-4095
0167	40360	Air open endpoint position	U16	0-4095
0168	40361	FGR closed endpoint position	U16	0-4095
0169	40362	FGR open endpoint position	U16	0-4095
016A	40363	Unused	U16	
016B	40364	Registers 40359-40363 are current	U16	0-1
016C-018F	40365-40400	R7999 Fault Information		Ref. Table 34
0190	40401	Air Total Resistance	U16	0-4095. Air actuator feedback pot resistance.
0191	40402	Fuel 1 Total Resistance	U16	0-4095. Fuel 1 actuator feedback pot resistance.
0192	40403	Fuel 2 Total Resistance	U16	0-4095. Fuel 2 actuator feedback pot resistance.
0193	40404	FGR Total Resistance	U16	0-4095. FGR actuator feedback pot resistance.
0194	40405	Air Resistance Change	U16	0-4095. Bit 15 is a sign flag. 1 = negative, 0 = positive.
0195	40406	Registers 40401-40405 are current	U16	0-1
0196	40407	Fuel 1 Resistance Change	U16	0-4095. Bit 15 is a sign flag. 1 = negative, 0 = positive.
0197	40408	Fuel 2 Resistance Change	U16	0-4095. Bit 15 is a sign flag. 1 = negative, 0 = positive.
0198	40409	FGR Resistance Change	U16	0-4095. Bit 15 is a sign flag. 1 = negative, 0 = positive.
0199	40410-40411	LCO Cycle Count	U32	0-1,000,000 Same as 40137
019B	40412 Registers 40407-40411 are current	U16	0-1	
019C	40413 Air Purge Preset Position	U16	0-4095	
019D	40414 Fuel Purge Preset Position	U16	0-4095	
019E	40415 FGR Purge Preset Position	U16	0-4095	
019F	40416 Air Lightoff Preset Position	U16	0-4095	
01A0	40417 Fuel Lightoff Preset Position	U16	0-4095	
01A1	40418 Registers 40413-40417 are current	U16	0-1	
01A2	40419 Lightoff Preset FGR	U16	0-4095	
01A3	40420 Air Standby Position	U16	0-4095	
01A4	40421 Fuel Standby Position	U16	0-4095	
01A5	40422 FGR Standby Position	U16	0-4095	
01A6	40423 Non-Selected Fuel Standby Position	U16	0-4095	
01A7	40424	Registers 40419-40423 are current	U16	0-1
01A8	40425	Number of Profile Points	U16H	0-23
		Major Software Revision	U16L	

Address (hex)	Register (dec)	Parameter Name	Format	Notes
01A9	40426	Minor Software Revision	U16H	
		Software Version Code	U16L	
01AA	40427	R7999 ControlBus revision	U16H	Bits 0-3 FlameNet™ and R7999 display
		R7999 Compatibility Code for ZM7999	U16L	
01AB	40428	R7999 Software Build Code	U16	0x0000-0xFFFF
01AC	40429	Abort Code	U16H	0-255
		Abort Code Count	U16L	0-255
01AD	40430	Registers 40425-40429 are current	U16	0-1
01AE	40431	Low Fire Hold Configuration	U16H	0—Disabled (Not configured—See note in register 40139) 1—Low Fire Hold (Position the FGR, Air and Fuel actuators at the Light OFF Position) 2—Modulate with FGR closed (FGR closed, Air and fuel modulating) 3—Low Fire Hold with FGR closed (FGR closed, Air and Fuel at Light OFF Position)
		Configuration Options	U16L	If a Bit = 1, then the option is configured Bit 0: FGR is set to follow the profile (curve) during purge Bit 1: Maximum Firing rate is controlled by the Manual Firing Rate input Bits 2-15: Unused
01AF	40432	Min. Auxiliary Temperature	U16	0x0000-0xFFFF. Subtract 40 to get the actual value
01B0	40433	Max. Auxiliary Temperature	U16	0x0000-0xFFFF. Subtract 40 to get the actual value
01B1	40434	Auxiliary Release Temperature Counts	U16	Release the Low Fire Hold condition and allow Modulation after the Aux. temperature reaches this temperature or higher. See Note 5, page 58
01B2	40435	Auxiliary Enforce Temperature Counts	U16	Initiate a Hold condition when the Aux. temperature reaches this temperature or lower. See Note 5, page 58
01B3	40436	Registers 40431-40435 are current	U16	0—1
01B4-01B5	40437-40438	Running Time in Hours	U32	
01B6	40439	Running Time in Minutes	U16H	
		Unused	U16L	
01B7-01B8	40440-40441	Unused	U32	
01B9	40442	Registers 40437-40440 are current	U16	0—1
01BA	40443	Device Data Ready	U16	Device data was properly received by S7810M Bit(s) Device 0 RM78XX 1 R7999 2 S7830 Expanded Annunciator 3 EC78XX 4-15 Unused
01BB	40444	S7810M Device Compatibility with Current Software Revision	U16	Device is compatible with the S7810M version Bit(s) Device 0 RM78XX 1 R7999 2 S7830 Expanded Annunciator 3 EC78XX 4-7 Unused
		S7810M Software Revision Compatibility with Legacy Software Revisions		Used for indication of S7810M revision compatibility. Bit(s) Compatible with: 8 Series 2 9-15 Future

NOTES:

1. Due to the amount of data provided by the R7999, some registers contain two parameters, one in the Data Hi byte and one in the Data Lo byte. Using Register 40429 as an example: The format for "Abort Code" is "U16H", meaning the Data Hi byte is the parameter's value, and for "Abort Code Count", with a format of "U16L", the Data Lo byte is the parameter's value. So a query of 01 03 01 AC 00 01 might result in a response of 01 03 00 02 05 10 which means "Abort Code = 5" and "Abort Code Count = 0x10". Each parameter value is a byte.
2. Parameter values in this table change infrequently and can take up to 39 seconds for all data to be available, except for registers 40443 through 40444, which are updated twice a second.
3. "Device Data Ready" and "S7810M Compatibility" bits can be used to quickly check device availability and compatibility then read/write registers of only these devices.
4. If "Device Data Ready" is true for the R7999, then all "Registers nnnnn-nnnnn are current" flags are true. If "Device Data Ready" is false for the R7999, then one or more of the "Registers nnnnn-nnnnn are current" flags are false. This is used to verify that the R7999 parameter values were received when expected. Otherwise, the values for the register range could be greater than 40 seconds old.
5. R7999 Auxiliary Temperature data: Release Temperature, Enforce Temperature and Auxiliary Input Temperature need to be calculated. use the following conversion formulas:
 - a. $m = ((\text{MaxAuxTmp}) - (\text{MinAuxTmp})) / 3108$.
 - b. $b = \text{MinAuxTmp} - (m * 777)$.
 - c. $\text{Release Temperature} = (m * \text{ReleaseTemperatureCounts}) + b$.
 - d. $\text{Enforce Temperature} = (m * \text{EnforceTemperatureCounts}) + b$.
 - e. $m_{\text{Aux}} = 193.37 / (\text{MaxAuxTmp} - \text{MinAuxTmp})$.
 - f. $b_{\text{Aux}} = 48.34 - (m_{\text{Aux}} * \text{MinTmp} - 40)$
 - g. $\text{Auxiliary Input Temperature} = (\text{AuxiliaryInput} - b_{\text{Aux}}) / m_{\text{Aux}}$

See Table 14 for register numbers and variables.

6. 0-4095 translates to 0-115 degrees except for pot resistance which translates to 0-10000 ohms. The actuators have a maximum movement of 115 degrees. $115 / 4095 = \text{about } 0.028 \text{ degrees per count}$. All positions are in reference to the actuators' closed endpoint.

To translate to Degrees:

- Closed Endpoint is considered a virtual = 0 degrees
- $\text{Span} = (\text{Open Endpoint} - \text{Closed Endpoint}) * 0.028$
- $\text{Current Position} = (\text{Current Position} - \text{Closed Endpoint}) * 0.028$
- $\text{Actuator Preset Position} = (\text{Actuator Preset} - \text{Closed Endpoint}) * 0.028$
- To Translate to Percent 0-100%:
- $\text{Position} = ((\text{Current Position} - \text{Closed Endpoint}) / (\text{Open Endpoint} - \text{Closed Endpoint})) * 100$
- $\text{Preset Position} = ((\text{Preset Position} - \text{Closed Endpoint}) / (\text{Open Endpoint} - \text{Closed Endpoint})) * 100$

Table 24: Temperature Data Registers

Register (Decimal)	Variable
40142	AuxiliaryInput
40432	MinAuxTmp
40433	MaxAuxTmp
40334	ReleaseTemperatureCounts
40435	EnforceTemperatureCounts

7800 Series Sequence State Codes

Sequence state codes are provided by the Burner Control. Each code is translated into two string codes for displaying an associated message in two lines. Each code is also translated into burner control state bits which may be used to generate and control system diagrams on an operator interface.

The Sequence State Codes shown in Table 25 are current only if the Fault Code has a value of zero. If the Fault Code is nonzero, the sequence state field contains the sequence state code when the lockout occurred.

The codes can also be retrieved from registers 40004, 40005, and 40013.

Table 25: 7800 Series Sequence State Codes and Associated Register Code Values

Register 40003	7800 SERIES Sequence State	String Code		Uses mm:ss	Burner Control State Bits
		Line 1	Line 2		
Fault code not zero	LOCKOUT	52	Table 17		8000h
0	UNUSED HISTORY	0	0		0000h
1	INITIATE	48	0	✓	0001h
2	INITIATE HOLD: AC FREQUENCY/NOISE	49	8		4001h
3	INITIATE HOLD: AC LINE DROPOUT	49	9		4001h
4	INITIATE HOLD: AC FREQUENCY	49	7		4001h
5	INITIATE HOLD: LOW LINE VOLTAGE	49	60		4001h
6	STANDBY	103	0		0002h
7	STANDBY HOLD: REM REMOTE CONTROL	104	94		4002h
8	STANDBY HOLD: START SWITCH	104	106		4002h
9	STANDBY HOLD: F/G FLAME DETECTED	104	35		4002h
10	STANDBY HOLD: T20 PREIGNITION	104	86		4002h
11	STANDBY HOLD: T7 RUNNING INTERLOCK	104	101		4002h
12	STANDBY HOLD: T7 LOCKOUT INTERLOCK	104	54		4002h
13	STANDBY HOLD: AIRFLOW SWITCH	104	13		4002h
14	PURGE HOLD: T19 HIGH FIRE SWITCH	93	40		4004h
15	PURGE DELAY: T19 HIGH FIRE JUMPRD	89	39		4004h
16	PURGE HOLD: TEST RUN/TEST SWITCH	93	98		4004h
17	PURGE DELAY: T18 LOW FIRE JUMPRD	89	56		4004h
18	PURGE HOLD: F/G FLAME DETECTED	93	35		4004h
19	PURGE	87	0	✓	0004h
20	PURGE HOLD: T18 LOW FIRE SWITCH	93	58		4004h
21	PURGE HOLD: T7 RUNNING INTERLOCK	93	101		4004h
22	PURGE HOLD: LOCKOUT INTERLOCK	93	54		4004h
23	PURGE HOLD: AIRFLOW SWITCH	93	13		4004h
24	PURGE HOLD: START SWITCH	93	106		4004h
25	PILOT IGN	78	0	✓	0008h
26	PILOT HOLD: TEST RUN/TEST SWITCH	77	98		4008h
27	PILOT HOLD: START SWITCH	77	106		4008h
28	MAIN IGN	66	0	✓	0010h
29	MAIN IG HOLD: MANUAL-OPEN SWITCH	67	72		4010h
30	RUN	95	0		0020h
31	RUN PV HOLD: LOW FIRE SWITCH	96	58		4020h
32	PVHOLD IGN	77	46	✓	4008h
33	PV HOLD: PV HOLD SWITCH	77	45		4008h
34	RUN/LOWFIRE: TEST RUN/TEST SWITCH	97	98		4020h
35	POSTPURGE	83	0		0040h
36	STATE UNKNOWN	31	0		0000h
37	RESET/ALARM TEST	111	0		6000h
38	SAFETY START	102	105		4002h

Register 40003	7800 SERIES Sequence State	String Code		Uses mm:ss	Burner Control State Bits
		Line 1	Line 2		
39	SAFETY1-1	102	2	✓	0008h
40	SAFETY1-2	102	3	✓	0008h
41	SAFETY1-3	102	4	✓	0008h
42	SAFETY1-4	102	5	✓	0008h
43	SAFETY1-5	102	6	✓	0008h
44	Blank	0	0		A000h
45	PREIGNITION	84	0	✓	0080h
46	SAFETY 1	102	1	✓	0008h
47	PILOT STAB.	79	0		0008h
48	MAIN TRIAL	68	0	✓	0010h
49	MAIN TRIAL	68	0		0010h
50	STANDBY HOLD: RUN/TEST SWITCH	104	98		4002h
51	STATE	51	31		0 A000h
52	STATE	52	31		0 A000h
53	SAFETY 1: RUN/TEST SWITCH	102	98		4008h
54	STATE	54	31		0 A000h
55	STANDBY HOLD: PURGE FAN SWITCH	104	92		4002h
56	STATE	56	31		0 A000h
57	PURGE HOLD: PURGE FAN SWITCH	93	92		4004h
58	STANDBY HOLD FLAME DETECTED	104	35		4002h
59	STANDBY HOLD COMB. PRESSURE	104	26		4002h
60	VP START	210	0	✓	0100h
61	VP MV2 ON	211	0	✓	0100h
62	VP LOW DLY	212	0	✓	4100h
63	VP LOW TST	213	0	✓	0100h
64	VP MV1 ON	214	0	✓	0100h
65	VP HIGH DLY	215	0	✓	4100h
66	VP HIGH TST	216	0	✓	0100h
67	INITIATE HOLD: AC AC PHASE ERROR	49	10		4001h
68	STANDBY HOLD: PRE-IGNITION ILK	104	85		4002h
69	SETUP NEEDED	217	0		A000h
70	STATE	70	31	0	A000h
71	BURNER OFF: T6 BURNER SWITCH	22	23		4002h
72	STANDBY HOLD: T6 (EA) HOLD MSG	184	30		4002h
73	STANDBY HOLD: (EA) CIRCUIT FAULT	184	25		4002h
74	STANDBY HOLD (EA)	184	Varies		4002h
75	PURGE HOLD (EA)	185	Varies		4004h
76	Unused	0	Varies		0000h
77	Unused	0	Varies		0000h
78	Unused	0	Varies		0000h
79	STANDBY HOLD (EA)	184	Varies		4002h
80	STANDBY HOLD (EA)	184	Varies		4002h
81	STANDBY HOLD (EA): VALVE CLOSURE	184	109		4002h
82	STANDBY HOLD (EA) OTHER PII	184	75		4002h

7800 Series String Codes

Table 26 contains a listing of all string codes provided by the S7810M. The associated string is not implemented in the S7810M; it is a string equivalent to that displayed on the S7800 Keyboard Display Module or similar device.

Table 26: 7800 Series String Codes

CODE	STRING
0	(BLANK)
1	1
2	1-1
3	1-2
4	1-3
5	1-4
6	1-5
7	AC FREQUENCY
8	AC FREQUENCY/NOISE
9	AC LINE DROPOUT
10	AC PHASE
11	ACCESSORY FAULT
12	AIRFLOW SW. ON
13	AIRFLOW SWITCH
14	ATOMIZING SW
15	AUX INTERLOCK #4
16	AUX INTERLOCK #5
17	AUX LIMIT #1
18	AUX LIMIT #2
19	AUX LIMIT #3
20	BLOCK INTAKE
21	BOTH FUELS SELECT
22	BURNER OFF
23	BURNER SWITCH
24	CALL SERVICE
25	CIRCUIT FAULT
26	COMB. PRESSURE
27	CONTROL ON
28	DELAYED MV ON
29	DEVICE SPECIFIC
30	EA HOLD MESSAGE
31	UNKNOWN STATE
32	FLAME AMP TYPE
33	FLAME AMP/SHUTR
34	FLAME AMPLIFIER
35	FLAME DETECTED
36	FLAME TOO STRONG
37	FLAME-OUT TIMER
38	FUEL SELECT OFF
39	HIGH FIRE JUMPERED
40	HIGH FIRE SWITCH
41	HIGH GAS PRESSURE
42	HIGH LIMIT
43	HIGH OIL PRESSURE
44	HIGH OIL TEMP
45	HOLD SWITCH
46	IGNITION
47	IGNITION ON
48	INITIATE
49	INITIATE HOLD
50	JUMPERS CHANGED
51	JUMPERS WRONG
52	LOCKOUT
53	LOCKOUT ILK ON

CODE	STRING
54	LOCKOUT INTERLOCK
55	LOCKOUT SWITCH
56	LOW FIRE JUMPERED
57	LOW FIRE SW OFF
58	LOW FIRE SWITCH
59	LOW GAS PRESSURE
60	LOW LINE VOLTAGE
61	LOW OIL PRESSURE
62	LOW OIL TEMP
63	LWCO
64	MAIN FLAME FAIL
65	MAIN FLAME IGN.
66	MAIN IGN
67	MAIN IGN HOLD
68	MAIN TRIAL
69	MAIN VALVE ON
70	MAN-OPEN SW. OFF
71	MAN-OPEN SW. ON
72	MAN-OPEN SW.
73	NO PURGE CARD
74	OTHER INTERLOCKS
75	OTHER PREIGN ILK
76	PILOT FLAME FAIL
77	PILOT HOLD
78	PILOT IGN
79	PILOT STABILIZE
80	PILOT VALVE 1 ON
81	PILOT VALVE 2 ON
82	POOR FLAME SENSOR
83	POSTPURGE
84	PREIGNITION
85	PREIGNITION ILK
86	PREIGNITION
87	PURGE
88	PURGE CARD ERROR
89	PURGE DELAY
90	PURGE FAN SW OFF
91	PURGE FAN SW ON
92	PURGE FAN SWITCH
93	PURGE HOLD
94	REMOTE CONTROL
95	RUN
96	RUN HOLD
97	RUN/LOWFIRE
98	RUN/TEST SWITCH
99	RUNNING ILK
100	RUNNING ILK ON
101	RUNNING INTERLOCK
102	SAFETY
103	STANDBY
104	STANDBY HOLD
105	START
106	START SWITCH
107	START SWITCH ON

CODE	STRING
108	TEST STATE
109	VALVE CLOSURE
110	ALL SWITCHES ON
111	RESET/ALARM TEST
112	RUN/TEST SWITCH RUN
113	RUN/TEST SWITCH TEST
114	OPERATOR CONTROL T6 = 0
115	OPERATOR CONTROL T6 = 1
116	INTERLOCK T7 = 0
117	INTERLOCK T7 = 1
118	AIRFLOW INTERLOCK T7 = 0
119	AIRFLOW INTERLOCK T7 = 1
120	BLOCK INTAKE T7 = 0
121	BLOCK INTAKE T7 = 1
122	VALVE T8 = 0
123	VALVE T8 = 1
124	INTRPTD PV T8 = 0
125	INTRPTD PV T8 = 1
126	MAIN VALVE T9 = 0
127	MAIN VALVE T9 = 1
128	IGNITION T10 = 0
129	IGNITION T10 = 1
130	PV HOLD T16 = 0
131	PV HOLD T16 = 1
132	INPUT A T16 = 0
133	INPUT A T16 = 1
134	MANOPENSW T17 = 0
135	MANOPENSW T17 = 1
136	INPUT B T17 = 0
137	INPUT B T17 = 1
138	PREIGN ILK T17 = 0
139	PREIGN ILK T17 = 1
140	LOWFIRE SW T18 = 0
141	LOWFIRE SW T18 = 1
142	PURGE FAN T18 = 0
143	PURGE FAN T18 = 1
144	HIGHFIRE SW T19 = 0
145	HIGHFIRE SW T19 = 1
146	PREIGN ILK T20 = 0
147	PREIGN ILK T20 = 1
148	LOCKOUT INP T20 = 0
149	LOCKOUT INP T20 = 1
150	COMB PRESS T20 = 0
151	COMB PRESS T20 = 1
152	VALV/START T21 = 0
153	VALV/START T21 = 1
154	INTMITT PV T21 = 0
155	INTMITT PV T21 = 1
156	TERMINAL T6 = 0
157	TERMINAL T6 = 1
158	TERMINAL T7 = 0
159	TERMINAL T7 = 1
160	TERMINAL T8 = 0
161	TERMINAL T8 = 1
162	TERMINAL T9 = 0
163	TERMINAL T9 = 1
164	TERMINAL T10 = 0
165	TERMINAL T10 = 1
166	TERMINAL T16 = 0
167	TERMINAL T16 = 1
168	TERMINAL T17 = 0
169	TERMINAL T17 = 1

CODE	STRING
170	TERMINAL T18 = 0
171	TERMINAL T18 = 1
172	TERMINAL T19 = 0
173	TERMINAL T19 = 1
174	TERMINAL T20 = 0
175	TERMINAL T20 = 1
176	TERMINAL T21 = 0
177	TERMINAL T21 = 1
178	JUMPER 1 INTACT
179	JUMPER 1 CLIPPED
180	JUMPER 2 INTACT
181	JUMPER 2 CLIPPED
182	JUMPER 3 INTACT
183	JUMPER 3 CLIPPED
184	STANDBY HOLD (EA)
185	PURGE HOLD (EA)
186	PILOT HOLD (EA)
187	MAIN IG HOLD (EA)
188	RUN HOLD (EA)
189	POSTPURGE HOLD (EA)
190	PREIGNITION HOLD (EA)
191	-SKIPPED-
192	DEMAND T6 = 0
193	DEMAND T6 = 1
194	PILOT VALVE T8 = 0
195	PILOT VALVE T8 = 1
196	INTERMIT PV T8 = 0
197	INTERMIT PV T8 = 1
198	MAIN VALVE1 T9 = 0
199	MAIN VALVE1 T9 = 1
200	VP SWITCH T16 = 0
201	VP SWITCH T16 = 1
202	MAIN VALVE2 T17 = 0
203	MAIN VALVE2 T17 = 1
204	INTRUPTD PV T21 = 0
205	INTRUPTD PV T21 = 1
206	DELAYED MV T21 = 0
207	DELAYED MV T21 = 1
208	START SW T21 = 0
209	START SW T21 = 1
210	VP START
211	VP MV2 ON
212	VP LOW DLY
213	VP LOW TST
214	VP MV1 ON
215	VP HIGH DLY
216	VP HIGH TST
217	VP SETUP NEEDED
218	MAIN VALVE 1 OFF
219	MAIN VALVE 2 OFF
220	MAIN VALVE 1 ON
221	MAIN VALVE 2 ON
222	VPS OFF
223	VPS ON
224	HIGH CYCLE RATE

7800 Series Fault Codes

Table 27 is a complete list of fault codes that may appear in the fault code register. The Fault String Code register will contain the corresponding String code identified in the table.

Table 27: 7800 Series Fault Codes

Fault Code (Reg 40001)	Fault Message (NOTE: FAULT n: is not in the Fault and Strings Code)	Fault String Code (Table 26)
0	Blank (no fault)	0
1	FAULT 1: NO PURGE CARD	73
2	FAULT 2: AC FREQUENCY/NOISE	8
3	FAULT 3: AC LINE DROPOUT	9
4	FAULT 4: AC FREQUENCY	7
5	FAULT 5: LOW LINE VOLTAGE	60
6	FAULT 6: PURGE CARD ERROR	88
7	FAULT 7: FLAME AMPLIFIER	34
8	FAULT 8: FLAME AMP/SHUTR	33
9	FAULT 9: FLAME DETECTED	35
10	FAULT 10: PREIGNITION ILK	85
11	FAULT 11: RUNNING ILK ON	100
12	FAULT 12: LOCKOUT ILK ON	53
13	FAULT 13: AIRFLOW SW. ON	12
14	FAULT 14: HIGH FIRE SWITCH	40
15	FAULT 15: FLAME DETECTED	35
16	FAULT 16: FLAME-OUT TIMER	37
17	FAULT 17: MAIN FLAME FAIL	64
18	FAULT 18: FLAME DETECTED	35
19	FAULT 19: MAIN FLAME IGN.	65
20	FAULT 20: LOW FIRE SW OFF	57
21	FAULT 21: RUNNING ILK	99
22	FAULT 22: LOCKOUT ILK	54
23	FAULT 23: AIRFLOW SWITCH	13
24	FAULT 24: CALL SERVICE	24
25	FAULT 25: CALL SERVICE	24
26	FAULT 26: MAN-OPEN SW. OFF	70
27	FAULT 27: START SWITCH ON	71
28	FAULT 28: PILOT FLAME FAIL	76
29	FAULT 29: LOCKOUT ILK	54
30	FAULT 30: RUNNING ILK	101
31	FAULT 31: LOW FIRE SW OFF	57
32	FAULT 32: AIRFLOW SWITCH	13
33	FAULT 33: PREIGNITION ILK	85
34	FAULT 34: CONTROL ON	27
35	FAULT 35: CALL SERVICE	24
36	FAULT 36: CALL SERVICE	24
37	FAULT 37: CALL SERVICE	24
38	FAULT 38: CALL SERVICE	24
39	FAULT 39: CALL SERVICE	24
40	FAULT 40: CALL SERVICE	24
41	FAULT 41: MAIN VALVE ON	69
42	FAULT 42: PILOT VALVE 1 ON	80
43	FAULT 43: IGNITION ON	47
44	FAULT 44: PILOT VALVE 2 ON	81
45	FAULT 45: LOW FIRE SW OFF	57
46	FAULT 46: FLAME AMP TYPE	32
47	FAULT 47: JUMPERS CHANGED	50
48	FAULT 48: DELAYED MV ON	28
49	FAULT 49: MAN-OPEN SW. ON	71
50	FAULT 50: JUMPERS WRONG	51
51	FAULT 51: FLAME TOO STRONG	36
52	FAULT 52: CALL SERVICE	24
53	FAULT 53: LOCKOUT SWITCH	55

Fault Code (Reg 40001)	Fault Message (NOTE: FAULT n: is not in the Fault and Strings Code)	Fault String Code (Table 26)
54	FAULT 54: COMB. PRESSURE	26
55	FAULT 55: PURGE FAN SW ON	91
56	FAULT 56: BLOCK INTAKE	20
57	FAULT 57: PURGE FAN SW OFF	90
58	FAULT 58: COMB.PRESSURE/FLAME	26
59	FAULT 59: CALL SERVICE	24
60	FAULT 60: CALL SERVICE	24
61	FAULT 61: MV1 OFF	218
62	FAULT 62: MV2 OFF	219
63	FAULT 63: MV1 ON	220
64	FAULT 64: MV2 ON	221
65	FAULT 65: VPS OFF	222
66	FAULT 66: VPS ON	223
67	FAULT 67: AC PHASE	10
68	FAULT 68: PREIGNITION ILK	85
69	FAULT 69: CALL SERVICE	24
70	FAULT 70: CALL SERVICE	24
71-75	FAULT 71-75: DEVICE SPECIFIC	29
76-93	FAULT 76-93: ACCESSORY FAULT	11
94-127	FAULT 94-127: CALL SERVICE	24
128	FAULT 128: POOR FLAME SENSOR	82
129-141	FAULT 129-141: CALL SERVICE	24
142	FAULT 68z: OTHER PREIGN ILK ^{EA}	75
143	FAULT 68y: VALVE CLOSURE ^{EA}	109
144	FAULT 33z: OTHER PREIGN ILK ^{EA}	75
145	FAULT 33y: VALVE CLOSURE ^{EA}	109
146	FAULT 32s: OTHER INTERLOCK ^{SEA}	74
147	FAULT 32r: AUX INTERLOCK #5 ^{EA}	16
148	FAULT 32q: AUX INTERLOCK #4 ^{EA}	15
149	FAULT 32p: AIRFLOW SWITCH ^{EA}	13
150	FAULT 32o: LOW GAS PRESSURE ^{EA}	59
151	FAULT 32n: HIGH GAS PRESSURE ^{EA}	41
152	FAULT 32m: ATOMIZING SW ^{EA}	14
153	FAULT 32k: LOW OIL TEMPE ^{EA}	62
154	FAULT 32j: HIGH OIL TEMPE ^{EA}	44
155	FAULT 32i: LOW OIL PRESSURE ^{EA}	61
156	FAULT 32h: HIGH OIL PRESSURE ^{EA}	43
157	FAULT 32g: BOTH FUELS SELECT ^{EA}	21
158	FAULT 32f: FUEL SELECT OFF ^{EA}	38
159	FAULT 32e: AUX LIMIT #3 ^{EA}	19
160	FAULT 32d: HIGH LIMIT ^{EA}	42
161	FAULT 32c: LWCO ^{EA}	63
162	FAULT 32b: AUX LIMIT #2 ^{EA}	18
163	FAULT 32a: AUX LIMIT #1 ^{EA}	17
164	FAULT 30s: OTHER INTERLOCK ^{SEA}	74
165	FAULT 30r: AUX INTERLOCK #5 ^{EA}	16
166	FAULT 30q: AUX INTERLOCK #4 ^{EA}	15
167	FAULT 30p: AIRFLOW SWITCH ^{EA}	13
168	FAULT 30o: LOW GAS PRESSURE ^{EA}	59
169	FAULT 30n: HIGH GAS PRESSURE ^{EA}	41
170	FAULT 30m: ATOMIZING SW ^{EA}	14
171	FAULT 30k: LOW OIL TEMPE ^{EA}	62
172	FAULT 30j: HIGH OIL TEMPE ^{EA}	44
173	FAULT 30i: LOW OIL PRESSURE ^{EA}	61

Fault Code (Reg 40001)	Fault Message (NOTE: FAULT n: is not in the Fault and Strings Code)	Fault String Code (Table 26)
174	FAULT 30h: HIGH OIL PRESSURE ^{EA}	43
175	FAULT 30g: BOTH FUELS SELECT ^{EA}	21
176	FAULT 30f: FUEL SELECT OFF ^{EA}	38
177	FAULT 30e: AUX LIMIT #3 ^{EA}	19
178	FAULT 30d: HIGH LIMIT ^{EA}	42
179	FAULT 30c: LWCO ^{EA}	63
180	FAULT 30b: AUX LIMIT #2 ^{EA}	18
181	FAULT 30a: AUX LIMIT #1 ^{EA}	17
182	FAULT 29s: OTHER INTERLOCK ^{EA}	74
183	FAULT 29r: AUX INTERLOCK #5 ^{EA}	16
184	FAULT 29q: AUX INTERLOCK #4 ^{EA}	15
185	FAULT 29p: AIRFLOW SWITCH ^{EA}	13
186	FAULT 29o: LOW GAS PRESSURE ^{EA}	59
187	FAULT 29n: HIGH GAS PRESSURE ^{EA}	41
188	FAULT 29m: ATOMIZING SW ^{EA}	14
189	FAULT 29k: LOW OIL TEMPE ^{EA}	62
190	FAULT 29j: HIGH OIL TEMPE ^{EA}	44
191	FAULT 29i: LOW OIL PRESSURE ^{EA}	61
192	FAULT 29h: HIGH OIL PRESSURE ^{EA}	43
193	FAULT 29g: BOTH FUELS SELECT ^{EA}	21
194	FAULT 29f: FUEL SELECT OFF ^{EA}	38
195	FAULT 29e: AUX LIMIT #3 ^{EA}	19
196	FAULT 29d: HIGH LIMIT ^{EA}	42
197	FAULT 29c: LWCO ^{EA}	63
198	FAULT 29b: AUX LIMIT #2 ^{EA}	18
199	FAULT 29a: AUX LIMIT #1 ^{EA}	17
200	FAULT 23s: OTHER INTERLOCK ^{EA}	74
201	FAULT 23r: AUX INTERLOCK #5 ^{EA}	16
202	FAULT 23q: AUX INTERLOCK #4 ^{EA}	15
203	FAULT 23p: AIRFLOW SWITCH ^{EA}	13
204	FAULT 23o: LOW GAS PRESSURE ^{EA}	59
205	FAULT 23n: HIGH GAS PRESSURE ^{EA}	41
206	FAULT 23m: ATOMIZING SW ^{EA}	14
207	FAULT 23k: LOW OIL TEMPE ^{EA}	62
208	FAULT 23j: HIGH OIL TEMPE ^{EA}	44
209	FAULT 23i: LOW OIL PRESSURE ^{EA}	61
210	FAULT 23h: HIGH OIL PRESSURE ^{EA}	43
211	FAULT 23g: BOTH FUELS SELECT ^{EA}	21
212	FAULT 23f: FUEL SELECT OFF ^{EA}	38
213	FAULT 23e: AUX LIMIT #3 ^{EA}	19
214	FAULT 23d: HIGH LIMIT ^{EA}	42
215	FAULT 23c: LWCO ^{EA}	63
216	FAULT 23b: AUX LIMIT #2 ^{EA}	18
217	FAULT 23a: AUX LIMIT #1 ^{EA}	17
218	FAULT 22s: OTHER INTERLOCK ^{EA}	74
219	FAULT 22r: AUX INTERLOCK #5 ^{EA}	16
220	FAULT 22q: AUX INTERLOCK #4 ^{EA}	15
221	FAULT 22p: AIRFLOW SWITCH ^{EA}	13
222	FAULT 22o: LOW GAS PRESSURE ^{EA}	59
223	FAULT 22n: HIGH GAS PRESSURE ^{EA}	41
224	FAULT 22m: ATOMIZING SW ^{EA}	14
225	FAULT 22k: LOW OIL TEMPE ^{EA}	62
226	FAULT 22j: HIGH OIL TEMPE ^{EA}	44
227	FAULT 22i: LOW OIL PRESSURE ^{EA}	61
228	FAULT 22h: HIGH OIL PRESSURE ^{EA}	43
229	FAULT 22g: BOTH FUELS SELECT ^{EA}	21
230	FAULT 22f: FUEL SELECT OFF ^{EA}	38
231	FAULT 22e: AUX LIMIT #3 ^{EA}	19
232	FAULT 22d: HIGH LIMIT ^{EA}	42
233	FAULT 22c: LWCO ^{EA}	63
234	FAULT 22b: AUX LIMIT #2 ^{EA}	18
235	FAULT 22a: AUX LIMIT #1 ^{EA}	17

Fault Code (Reg 40001)	Fault Message (NOTE: FAULT n: is not in the Fault and Strings Code)	Fault String Code (Table 26)
236	FAULT 21s: OTHER INTERLOCK ^{EA}	74
237	FAULT 21r: AUX INTERLOCK #5 ^{EA}	16
238	FAULT 21q: AUX INTERLOCK #4 ^{EA}	15
239	FAULT 21p: AIRFLOW SWITCH ^{EA}	13
240	FAULT 21o: LOW GAS PRESSURE ^{EA}	59
241	FAULT 21n: HIGH GAS PRESSURE ^{EA}	41
242	FAULT 21m: ATOMIZING SW ^{EA}	14
243	FAULT 21k: LOW OIL TEMPE ^{EA}	62
244	FAULT 21j: HIGH OIL TEMPE ^{EA}	44
245	FAULT 21i: LOW OIL PRESSURE ^{EA}	61

7800 Series Burner Control Fault History Records

Table 28 describes the registers that are part of a fault history record. To determine the actual register address for a parameter within the record, add the register offset to the start address of the record.

Table 28: Fault History Record Format

Offset	Parameter Name	Access	Format	Notes
0	Fault code	R	U16	See Table 27
1	Fault String	R	U16	See Table 26
2	Sequence State	R	U16	See Table 25
3	First line message	R	U16	See Table 26
4	Second line message	R	U16	See Table 26
5	Sequence time	R	U16	Seconds
6-7	Total cycles	R	U32	
8-9	Total hours	R	U32	

Expanded Annunciator

The codes shown in Table 29 are available in the Expanded Annunciator First Out Code Register. These codes are normally translated to the appropriate fault code by the Burner Control. The fault code will then be translated to the appropriate first and second line messages as shown in Table 27 for use by the UMC800 Operator Interface.

Table 29: Expanded Annunciator First Out Code

EA Status Value (binary)	Status Message	Line 2 String Code (Table 26)
0xx 00000	No Expanded Annunciator	N/A
0xx 00001	Burner Sw.	23
0xx 00010	Control ON	27
0xx 00011	Aux. Limit #1	17
0xx 00100	Aux. Limit #2	18
0xx 00101	LWCO	63
0xx 00110	High Limit	42
0xx 00111	Aux. Limit #3	19
0xx 01000	FuelSelect OFF	38
0xx 01001	BothFuelSelect	21
0xx 01010	High Oil Pres.	43
0xx 01011	Low Oil Pres.	61
0xx 01100	High Oil Temp	44
0xx 01101	Low Oil Temp.	62
0xx 01110	Atomizing Sw.	14
0xx 01111	High Gas Pres.	41
0xx 10000	Low Gas Pres.	59
0xx 10001	Airflow Sw.	13
0xx 10010	Aux. ILK #4	15
0xx 10011	Aux. ILK #5	16
0xx 10100	All Switches ON (or) Other PII (if hold or lockout condition exists)	110
		74
0x1 XXXXX	Valve Closure	109
00XX XXXX	Gas Select	N/A
01XX XXXX	Oil Select	N/A

If the BC is in Standby and the 5LSB value is 1-16, then the cause of the Standby Hold is the 5LSB value; otherwise the hold is "Circuit Fault".

Response Message Format for Function Code 17.

This format is device specific and is only available for the 7800 Series burner control. See [Table 30](#).

Table 30: Response Message Format for function code 17 (11h), (26 bytes).

	Slave Address	Function Code	Byte Count	Slave ID ^a	Run Indicator Status ^b	Device Description ^c	N/A	CRC	CRC
Byte	0	1	2	3	4	5-15	16-23	24	25

^a Slave ID: Always 0x78 when using RM78xx or EC78xx Relay Modules(1 byte) (byte 3).

^b Run Indicator Status: Always FF=ON (one byte)(byte 4).

^c Device Description: ASCII OS number for the Burner Control (11 bytes) (bytes 5-15).

Burner Control Type Codes

The burner control type code indicates the exact model number of the burner control. See [Table 31](#).

Table 31: Burner Control Type Codes

Code	Device Description	Code	Device Description
0	(undefined)	127	RM7895C
100	RM7800E	128	RM7895D
101	RM7800G	129	RM7895E
102	RM7800L	130	RM7895F
103	RM7800M	131	RM7896A
104	RM7838A	132	RM7896B
105	RM7838B	133	RM7896C
106	RM7840E	134	RM7896D
107	RM7840G	135	RM7897A
108	RM7840L	136	RM7897C
109	RM7840M	137	RM7898A
110	RM7885A	138	R7140G
111	RM7888A	139	R7140L
112	RM7890A	140	R7140M
113	RM7895A	199	RM78xx
114	RM7895B	200	EC7810A
115	RM7823A	201	EC7820A
116	RM7824A	202	EC7830A
117	RM7830A	203	EC7850A
118	RM8738C	204	EC7885A
119	RM7845A	205	EC7890A
120	RM7850A	206	EC7895A
121	RM7865A	207	EC7895C
122	RM7865B	208	EC7823A
123	RM7865C	209	EC7840L
124	RM7890B	210	EC7865
125	RM7890C	299	EC78xx
126	RM7890D		

7800 SERIES Burner Control State Bits

The burner control sequence state is translated into State Bit Register as shown in [Table 32](#).

Table 32: Burner Control State Bits

Bit	Description	BC State Bits Register
0	Initiate	0000 0000 0000 0001
1	Standby	0000 0000 0000 0010
2	Purge	0000 0000 0000 0100
3	Pilot Ignition	0000 0000 0000 1000
4	Main Ignition	0000 0000 0001 0000
5	Run	0000 0000 0010 0000
6	Postpurge	0000 0000 0100 0000
7	Pre-Ignition	0000 0000 1000 0000
8	Valve Proving	0000 0001 0000 0000
13	Alarm	1010 0000 xxxx xxxx NOTE: Lockout bit is also set
14	Hold	0100 0000 xxxx xxxx One other bit may be on
15	Lockout	1010 0000 0000 0000 NOTE: Alarm bit is also set

R7999 Profile Data Structure

If an R7999 uses less than 24 indexes for its profile, then the unused index data will be zero (refer to “Number of Profile Points” parameter to get the actual number of profile points). Note that the profile information will be zero for an unconfigured or disconnected R7999. Up to 24 sets of data are used to build the profile. See [Table 33](#).

Table 33: R7999 Profile Data Structure

Offset	Parameter Name	Format	Notes
0	Index	U16H	0-23
	Type	U16L	0×00 = Unused 0×01 = Used 0×02 = Light OFF 0×04 = Minimum 0×08 = Maximum 0×10 = Purge 0×20 = Stop 0×40 = Not Implemented 0×80 = Valid Segment
1	Firing rate for the current point	U16	0-4095
2	Air actuator position for the current point	U16	0-4095
3	Fuel actuator position for the current point	U16	0-4095
4	FGR actuator position for the current point	U16	0-4095
5	Data in the previous 5 registers is current	U16	0-1

R7999 Fault History Data Structure

This information is repeated 5 times for a total of 6 fault history structures. See [Table 34](#).

Table 34: R7999 Fault History Structure

Offset	Parameter Name	Format	Notes
0	Fault Buffer Index	U16H	0-5
	Next Fault Index	U16L	Faults are stored in a circular buffer. This register points to the index of the next fault to be logged. 0-5.
1	Cycle Count at the time the alarm occurred	U32	0-1,000,000
3	Fault Code	U16H	See Table 36.
	Operating State of the device at the time the alarm occurred	U16L	Same text enumeration as “R7999 Status Message 0x0C” byte 5. Register 40132
4	Not implemented	U16H	1-6
	Unused	U16L	255
5	Data in the previous 5 registers is current	U16	0-1

NOTE: The Next Fault Position points to the oldest fault. For example: If the Next Fault Position is 4, then the order of faults from the newest to the oldest is: 3, 2, 1, 0, 5, 4.

R7999 Status Message

The R7999 Status Message is added to an indexed circular buffer once a second. An 8-second history of the data is available in registers 40160-40208. Table 35 identifies the register data structure which is the same for each buffer, 0-7. Register 40160, bits 0-2, points to the oldest buffer information, so if the Buffer Index is 3, then buffer order from oldest to newest would be: 3, 4, 5, 6, 7, 0, 1, 2.

In a byte, bits are identified as bit 7 (MSBit) through bit 0 (LSBit). In a word consisting of two bytes, all values are bigendian, that is, bit 15 of the word is the MSBit of the first (lowest numbered) byte, bit 8 is the LSBit of this byte, bit 7 is the MSBit of the next byte, and bit 0 is the LSBit.

Table 35: R7999 Status Message

Byte(s)	Description
	R7999 circular buffer data structure of registers 40161-40208. Some of this data is interpreted by the S7810M and is available in registers 40129-40144.
0	Program Mode/Selected Fuel Bits Description 7 Selected Fuel 0 = Fuel 1, 1 = Fuel 2 6 Fuel select input 2 5 Fuel select input 1 4 Active hold (4-20 mA Aux. Input is below its threshold) 0-3 Program Mode—Enumerated 0 Initiate State 1 Normal Operation 2 Alarm Initiate State 3 Lockout 4 Not Configured 5 Factory Test 6 Low Voltage 7 Commissioning 8 Reset
1	Current Fault—See Table 36.
2	Current Operating Status—Enumerated: 0 Standby Hold 1 Standby Programmed Standby 2 Standby Main Valve 3 Standby Low Fire Main Valve 4 Standby Purge 5 Fault 1 6 Standby High Fire Main Valve 7 Fault 2 8 Processing Demand 9 Light OFF 10 Modulate 11 Light OFF Low Fire Main Valve 12 Purge 13 Fault 3 14 Purge Main Valve 15 Fault 4 16 Initialize 17 Post Purge
3-4	Air Actuator Position/Terminal States Bits Description 15 LCO State 14 HFP State 13 LFP State 12 ALARM State 11-0 Current position of the Air Actuator (0-4095)
5-6	Active Fuel Actuator Position/Terminal States Bits Description 15 LCI State 14 HF State 13 MV State 12 LF State 11-0 Current position of the active Fuel Actuator (0-4095)

Byte(s)	Description
	R7999 circular buffer data structure of registers 40161-40208. Some of this data is interpreted by the S7810M and is available in registers 40129-40144.
7-8	FGR Actuator Position/Terminal States Bits Description 15 LCO Relay Drive 2 feedback 14 LCO Relay Drive 1 feedback 13 LCM State—the LCM state is the feedback in between LCI and LCO 12 Auto/Manual select—Auto mode when it is 0 and Manual when it is 1 11-0 Current position of the FGR Actuator (0-4095)
9	Firing Rate Input — The current non-filtered analog-to-digital reading of the CmA (SSLC) 4-20 mA firing rate input. (0-255 = 0-21.1 mA)
10	Manual Pot Input — The current non-filtered analog-to-digital reading of the Manual Potentiometer firing rate input. (0-255 = 2.1-44.1 mA)
11	Auxiliary Input — The current non-filtered analog-to-digital reading of the XmA (Auxiliary) 4-20 mA firing rate input. (0-255 = 0-21.1 mA)

R7999 Fault Text

The R7999 Fault Text is shown indexed by hexadecimal values. A value of 0×11 means there is currently no fault.

Table 36: R7999 Fault Text

Fault Code (hexadecimal)	Fault Text
0×11	No Fault
0×13	MV On
0×14	HF and LF on
0×15	Burner Control Transition
0×25	Move Limit Test
0×26	Target Move Test
0×36	Fuel Selection
0×37	HFP/LFP Output
0×41	Air Pot Feedback
0×42	F1 Pot Feedback
0×43	F2 Pot Feedback
0×44	FGR Pot Feedback
0×45	Air Wiper Resistance
0×46	F1 Wiper Resistance
0×47	F2 Wiper Resistance
0×48	FGR Wiper Resistance
0×49	Air Total Resistance
0×51	F1 Total Resistance
0×52	F2 Total Resistance
0×53	FGR Total Resistance
0×58	Stuck Reset
0×61	Initiate Timeout
0×67	Fuel Off Curve
0×68	FGR Off Curve
0×69	Air Off Curve
0×71	Air Offline
0×72	F1 Offline
0×73	F1 Offline
0×74	FGR Offline
0×82	Motor Speed
0×83	Air No Response
0×84	F1 No Response
0×85	F2 No Response
0×86	FGR No Response
0×91	CmA Out of Range - Less than 3mA or greater than 20mA
0×92	Manual Pot Range
0×93	XmA Out of Range
0×94	Demand Too Long
0×99	Error Reading Fuel Selection

Gas Pressure Regulators

The unit comes with a unit mounted gas pressure regulator sized for 5 psig. If the building pressure is higher than 5 psig an additional high-pressure regulator is required. The high-pressure regulator can be field, or factory supplied but will not be attached to the unit. Field installation of the optional high gas pressure regulator is required.

Optional High Gas Pressure Regulator

For units that will be connected to a building gas pressure greater than 5psig, a high gas pressure regulator is required. This regulator is to be adjusted to setpoint before the manual valve inside the Daikin Applied burner closet is opened.

Set-Point Adjustment

**WARNING**

Warning: Start-up should only be done by properly trained personnel.

See gas heater nameplate or project submittals for gas pressure settings.

1. Hook up pressure gauge to the pressure tap downstream of the regulator.
 - a. Check the ratings given in the instructions and marked on the product to make sure the product is suitable for your application.
2. Remove the black adjustment cover.
3. Slowly open the inlet manual shutoff valve just enough to allow inlet pressure to gradually build up to the inlet of the regulator until the system is fully pressurized. Wiring must comply with all applicable codes, ordinances and regulations.

**WARNING**

Warning: Quickly opening the inlet manual shut off valve can permanently rupture the internal, balancing diaphragm.

4. Measure outlet gas pressure and compare set point required pressure.
 - a. To increase the outlet pressure set point turn the adjustment spindle clockwise with a screwdriver.
 - b. To decrease the outlet pressure set point turn the adjustment spindle counterclockwise with a screwdriver.
5. Re-install black adjustment cover.
6. After adjusting the set point for normal operation verify that the gas pressure regulator operates as intended.

**WARNING**

Warning: During start-up, a pressure gauge must be used to read the setpoint of the regulator outlet pressure.

Burner Test Preparation Checklist

Unit ID: _____

1. _____ Verify Fan rotation on fan(s)
2. _____ Pilot Orifice should be 3 turns from the bottom (turn it all the way in, then back out 3 turns).
3. _____ Pilot Gas Regulator should be 1/8 inches from the top (just enough room to screw the cap on)
4. _____ Main Gas Regulator should be 1 3/4 inches from the top (use a tape measure)
5. Modulating Valve
 - a. _____ Low fire dial (the left one with the locking screw) should be set to about 75%
 - b. _____ High fire (on the right side) should be 1 turn from the bottom (turn all the way in, and back out one full turn)
6. _____ Valve Control Board (right of the blue box) should have all 3 switches in the down position
7. _____ Time Delay Relay should be set to 1 min and the dial set to 5
8. _____ Digital Pressure gauge; all switches should be to the Left except the very bottom. Very bottom should be to the Right.
9. _____ Heater thermostat should be set to approximately 32 degrees F (0 degrees C)
10. _____ Cooling thermostat should be set to approximately 100 degrees F (38 degrees C)
11. _____ Confirm that the Bypass Damper is closing as the Pressure Signal increases. If not, flip the direction switch.
12. _____ The Modbus card on the Honeywell needs to be set to "01"
13. _____ The Auto Reset Limit should be set to 190 degrees F
14. _____ The Manual Reset Limit should be set to 175 degrees F
15. _____ The High-Pressure Gas Switch should be set to 45 in w.c.
16. _____ The Low-Pressure Gas Switch should be set to 15 in w.c.
17. _____ Change the damper output signal to 2-10Vdc in Factory Settings
18. _____ Change the Damper Control to AUTO in Factory Settings



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