

Operator: Save these instructions for future use!

FAILURE TO READ AND FOLLOW ALL INSTRUCTIONS CAREFULLY BEFORE INSTALLING OR OPERATING THIS CONTROL COULD CAUSE PERSONAL INJURY AND/OR PROPERTY DAMAGE.

DESCRIPTION

Kit Includes:

- 50M51-843 Ignition Control Module
- 21D64-2 Ignitor Kit

The 50M51-843 is a universal replacement control for two-stage automatic gas ignition controls employing a microprocessor to continually monitor, analyze, and control the proper operation of the gas burner and inducer. The 50M51-843 controls a multiple tapped induction circulation blower.

Signals interpreted during continual surveillance of the two-stage thermostat and flame sensing element initiate automatic ignition of the burner, sensing of the flame, and system shutoff during normal operation.

The control incorporates system fault analysis for quick gas flow shutoff, coupled with automatic ignition retry upon sensing a fault correction.

The 50M51-843 quickly and easily replaces White-Rodgers 50M51-XXX controls.

PRECAUTIONS

Installation should be done by a qualified heating and air conditioning contractor or licensed electrician.

Do not exceed the specification ratings.

All wiring must conform to local and national electrical codes and ordinances.

This control is a precision instrument, and should be handled carefully. Rough handling or distorting components could cause the control to malfunction.

Following installation or replacement, follow manufacturer's recommended installation/service instructions to ensure proper operation.

⚠ CAUTION

Do not short out terminals on gas valve or primary control. Short or incorrect wiring may damage the thermostat.

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⚠ WARNING

Failure to comply with the following warnings could result in personal injury or property damage.

FIRE HAZARD

- Do not exceed the specified voltage.
- Protect the control from direct contact with water (dripping, spraying, rain, etc.)
- If the control has been in direct contact with water, replace the control.
- Label all wired before disconnection when servicing controls. Wiring error can cause improper and dangerous operation.
- Route and secure wiring away from flame.

SHOCK HAZARD

- Disconnect electric power before servicing.
- Ensure proper earth grounding of appliance.
- Ensure proper connection of line neutral and line hot wires.

EXPLOSION HAZARD

- Shut off main gas to appliance until installation is complete.

SPECIFICATIONS

ELECTRICAL RATINGS [@ 77 °F (25 °C)]:

Input Voltage: 120 VAC, 60 Hz (Class II transformer required)

Max. Input Current @ 24 VAC: 800mA + MV

Relay & Triac Load Ratings:

Gas Valve Relays: 1.5 amps @ 24 VAC, 60 Hz

Ignitor: 4.0 amps @ 132 VAC, 60 Hz

Inducer Relays: 2.2 FLA - 3.5 LRA @ 120 VAC

Circulator Relays: 14.5 FLA - 25.0 LRA @ 120 VAC

Humidifier Load: 1.0 A max @ 120 VAC

Electronic Air Cleaner Load: 1.0 A max @ 120 VAC

Flame Current Requirements:

Minimum current to ensure flame detection: 0.3 µA DC*

OPERATING TEMPERATURE RANGE:

-40° to 175°F (-40° to 80°C)

HUMIDITY RANGE:

5% to 93% relative humidity (non-condensing)

Timing Specs: (@ 60 Hz**)

Flame Failure Response Time: **maximum** 2.0 sec

Gases Approved: Natural, Manufactured, Mixed, Liquid Petroleum, and LP Gas Air Mixtures are all approved for use.

50M51-843 TIMING TABLE

(All times are in seconds, unless noted otherwise)

Event	Definition	50M51-843
Pre-purge Time	The period of time intended to allow for the dissipation of any unburned gas or residual products of combustion at the beginning of a furnace operating cycle prior to initiating ignition	15
Igniter Warm-up Time	The length of time allowed for the igniter to heat up prior to the initiation of gas flow.	17
Trial for Ignition Period (TFI)	The period of time between initiation of gas flow and the action to shut off the gas flow in the event of failure to establish proof of the supervised ignition source or the supervised main burner flame.	4
Ignition Activation Period (IAP)	The period of time between energizing the main gas valve and deactivation of the ignition means prior to the end of TFI	3
Retries	The additional attempts within the same thermostat cycle for ignition when the supervised main burner flame is not proven within the first trial for ignition period.	2 times
Valve Sequence period	Valve sequence period equals 4 seconds trial for ignition period x (1 initial try + 2 retries) + 12 seconds.	12
Inter-purge	The period of time intended to allow for the dissipation of any unburned gas or residual products of combustion between the failed trial for ignition and the retry period.	60
Post-purge Time	The period of time intended to allow for the dissipation of any unburned gas or residual products of combustion at the end of a furnace burner operating cycle. Post-purge begins at the loss of flame sense.	15
Lock-Out Time	ANSI standard rated module timing.	300
Heat Delay-To-Fan-On	The period of time between proof of the supervised main burner flame and the activation of the blower motor at Heat speed.	45
Heat Delay-To-Fan-Off*	The period of time between the loss of a call for heat and the deactivation of the blower motor at Heat speed.	90/120/150/180
Cool Delay-To-Fan-On	The period of time after a thermostat demand for cool before energizing the circulator blower motor at Cool speed.	5
Cool Delay-To-Fan-Off	The period of time between the loss of a call for cool and the deactivation of the blower motor at Cool speed.	60
Automatic Reset Time	After one (1) hour of internal or external lockout, the control will automatically reset itself and go into an auto restart purge for 60 seconds.	60 minutes

*These times will vary depending on option switch position.

MOUNTING AND WIRING

Refer to Typical System Wiring Diagram on page 4 and Typical System Wiring Table on page 5

All wiring should be installed according to local and national electrical codes and ordinances.

The control must be secured to an area that will experience a minimum of vibration and remain below the maximum ambient temperature rating of 175°F. The control is approved for minimum ambient temperatures of -40°F.

When mounting the control, any orientation is acceptable. Choose a location that will not damage, obstruct or place stress on the control terminations, system wiring harness or system components.

Refer to the wiring diagram and wiring table when connecting the 50M51 control to other components of the system.

UL approved, 105°C rated 18 gauge min., stranded, 1/32" thick insulation wire is recommended for all low voltage safety circuit connections.

UL approved, 105°C rated 16 gauge min., stranded, 1/16" thick insulation wire is recommended for all line voltage connections.

After installation or replacement, follow appliance manufacturer's recommended installation or service instructions to insure proper operation.

The 50M51 has only one serviceable part – an automotive type fuse, which protects the low voltage transformer from damage if its output is short-circuited. If the fuse has opened up, correct whatever caused the short circuit and replace the fuse with only a 3 amp automotive type fuse. If the fuse is not the cause of the control's problem, replace the entire 50M51 control. There are no other user serviceable parts.

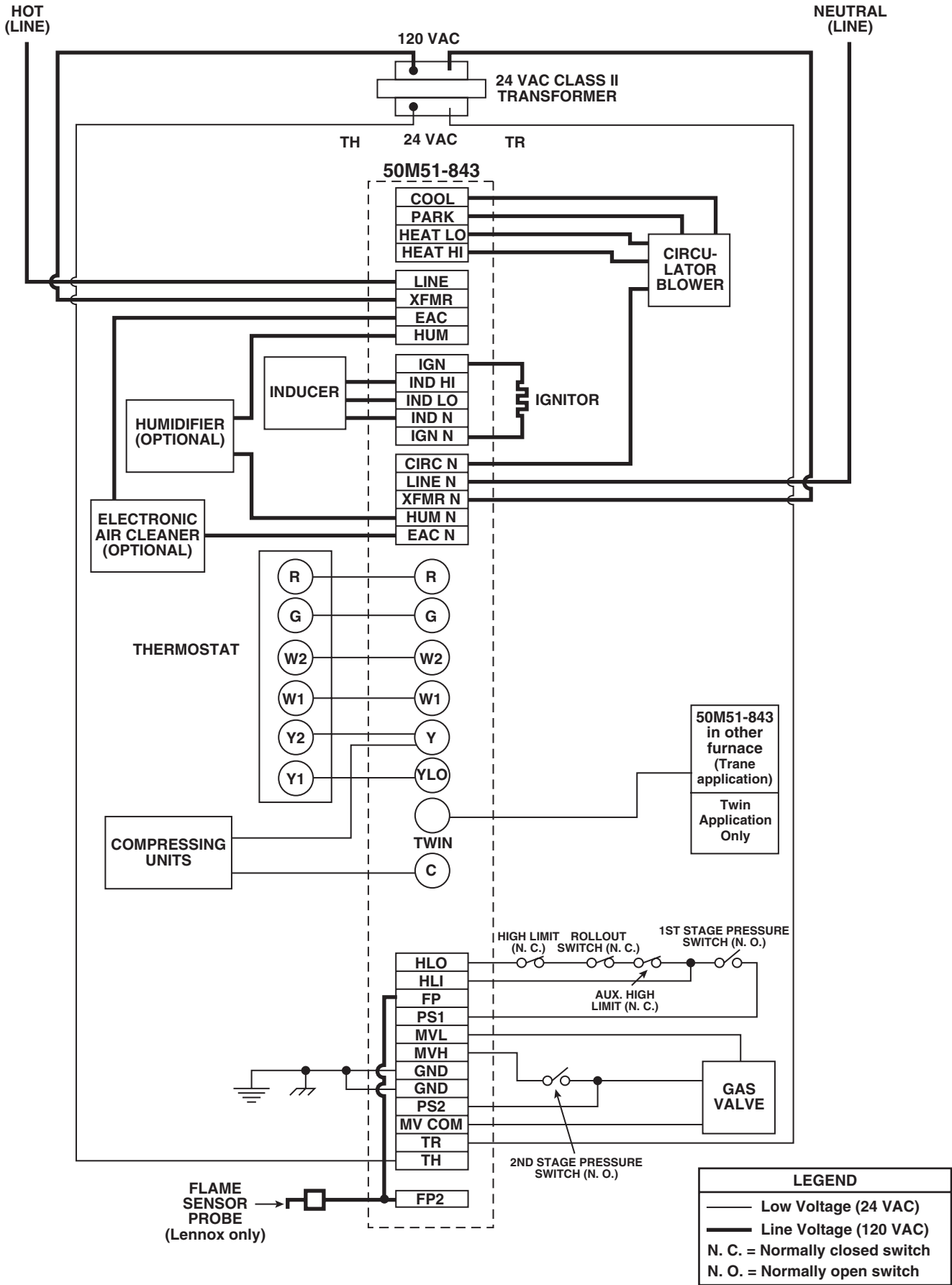
Additional jumper wires are included to be used if the original wiring does not reach the control after mounting. Refer to the furnace wiring diagram for proper connection of wires.

Some applications will require connection to terminal FP2. If the control being replaced does not have this connections, it is not needed in the application and connection to terminal FP2 is not required.

The installer may have to modify existing ignitor hole to accommodate the larger 21D64-2 (ceramic diameter 0.394")

WIRING

50M51-843 TYPICAL WIRING DIAGRAM



LEGEND	
	Low Voltage (24 VAC)
	Line Voltage (120 VAC)
	N. C. = Normally closed switch
	N. O. = Normally open switch

50M51-843 TYPICAL WIRING TABLE

50M51-843 TERMINAL	TERMINAL TYPE	SYSTEM COMPONENT CONNECTION
W1 W2 G R YLO C Y TWIN	8 -screw terminal block	two-stage thermostat W1 terminal (or equivalent) two-stage thermostat W2 terminal (or equivalent) two-stage thermostat G terminal (or equivalent) two-stage thermostat R terminal (or equivalent) two-stage thermostat Y1 terminal (or equivalent) two-stage thermostat C terminal (or equivalent) two-stage thermostat Y2 terminal (or equivalent) one wire twinning terminal*
MVH (1) PS2 (2) FP (3) GND (4) TH (5) HLI (6) MVL (7) MV COM (8) TR (9) GND (10) HLO (11) PS1 (12)	12-pin connector & harness	gas valve SECOND STAGE 2nd stage pressure switch INPUT flame sensor probe** MUST BE RELIABLY GROUNDED TO CHASSIS 24 VAC transformer (low voltage HIGH SIDE) high limit INPUT gas valve FIRST STAGE gas valve COMMON 24 VAC transformer (low voltage COMMON SIDE) MUST BE RELIABLY GROUNDED TO CHASSIS high limit OUTPUT 1st stage pressure switch INPUT
IGN (1) IND HI (2) IND LO (3) IND N (4) IGN N (5)	5-pin connector & harness	ignitor HOT side inducer HIGH SPEED HOT side inducer LOW SPEED HOT side inducer NEUTRAL side ignitor NEUTRAL side
PARK	1/4" spade terminal	unused circulator blower terminal
COOL	1/4" spade terminal	circulator blower COOL SPEED terminal
HEAT LO	1/4" spade terminal	circulator blower HEAT/FAN LOW SPEED terminal
HEAT HI	1/4" spade terminal	circulator blower HEAT HIGH SPEED terminal
LINE	1/4" spade terminal	input voltage (120 VAC) HOT SIDE
XFMR	1/4" spade terminal	24 VAC transformer line voltage HOT SIDE
EAC (optional)	1/4" spade terminal	air cleaner HOT side
HUM (optional)	1/4" spade terminal	humidifier HOT side
CIRC N	1/4" spade terminal	circulator blower NEUTRAL terminal
LINE N	1/4" spade terminal	input voltage (120 VAC) NEUTRAL SIDE
XFMR N	1/4" spade terminal	24 VAC transformer line voltage NEUTRAL SIDE
HUM N (optional)	1/4" spade terminal	humidifier NEUTRAL side
EAC N (optional)	1/4" spade terminal	air cleaner NEUTRAL side
FP2	3/16" spade terminal	flame sensor probe** (Lennox applications only)

* For TWINNING applications, use only 50M51-843 Controls

** Maximum recommended flame probe wire length is 36 inches.

OPERATION

OPTION SWITCHES

Option switches on the 50M51-843 control are used to determine the length of the delay-to-fan-off periods. The following tables show the time periods that will result from the various switch positions.

OPTION SWITCHES S1-3 & S1-4 POSITIONS

HEAT delay-to-fan-off:	On "S1," set switch #:	
	3	4
90 sec.*	Off	Off
120 sec.	Off	On
150 sec.	On	Off
180 sec.	On	On

*Factory default setting

When using a single stage thermostat, second stage delay is based on the setting of switch S1-1, S1-2 shown below.

OPTION SWITCHES S1-1 & S1-2 POSITIONS

2nd Stage delay for single stage thermostats		
Delay Time:	On "S1" set switch #	
	1	2
Off*	Off	Off
10 min	On	Off
Auto min	Off	On
20 min	On	On

*Factory default setting— two stage thermostat

HEAT MODE

In a typical system, a call for first stage heat is initiated by closing the W1 thermostat contacts. The inducer blower is energized at high speed and the control waits for the low pressure switch contacts to close. The humidifier (optional) is also energized at this time. Once the low pressure switch contacts close, a 15-second pre-purge is initiated. Then the inducer changes to low speed and the 120V ignitor is powered.

At the end of the ignitor warm-up time, the first stage of the two stage manifold gas valve is energized (low fire). Flame must be detected within 4 seconds. If flame is detected, the 45-second HEAT delay-to-fan-on period begins. After the delay-to-fan-on period ends, the 50M51 control will energize the circulator fan at low heat speed. The electronic air cleaner (optional) will also energize at this time.

For a two-stage thermostat, a call for **second stage** heat (W1 and W2) after a call for first stage heat will energize the inducer at high speed and the circulator at high heat speed. The second stage pressure switch contacts will close and energize the second stage gas valve (high fire).

For a single-stage thermostat, when a call for heat occurs (W1), a 10, 20 minute or auto mode heat staging timer will be activated (timing is selectable with option switches S1-1 and S1-2 positions). Following this delay, the second stage heat is energized as above.

The AUTO model algorithm is a method of energizing the second stage gas valve based on the recent average of the heating duty

cycle. During a typical heating day, the low to high stage delay is determined by using the average calculated duty cycle from the table below.

Once the specified delay time has expired the second stage valve will be energized.

See the table below for the different duty cycles.

Average Calculated Duty Cycle % Equals	Or less than	Low to High Stage Delay	Demand
0	38	12 minutes	Light
38	50	10 minutes	Light to Average
50	62	7 minutes	Average
62	75	5 minutes	Average to Heavy
75	88	3 minutes	Heavy Light
88	100	1 minute	Heavy

When the second stage of the thermostat is satisfied, the inducer motor is reduced to low speed and the second stage gas valve is de-energized.

On the 50M51 control, the circulator will remain at high heat speed for 30 seconds following the opening of the second stage gas valve and then is reduced to low heat speed.

When the first stage of the thermostat is satisfied, the first stage gas valve is de-energized and the HEAT delay-to-fan-off begins timing. The inducer will postpurge for an additional 15 seconds, then the inducer and humidifier will turn off. Upon completion of the HEAT delay-to-fan-off period, the 50M51 circulator is turned off. The electronic air cleaner on the control is also de-energized at this time.

If flame is not detected during the trial-for-ignition period or if the flame is detected/sensed and then lost before completion of 10 seconds of establishment, the gas valve is de-energized, the ignitor is turned off, and the control goes into the "retry" sequence.

The "retry" sequence provides a 60-second wait with the inducer interpurge following an unsuccessful ignition attempt (flame not detected). After this wait, the ignition attempt is restarted. Two retries will be attempted before the control goes into system lockout.

If flame is established for more than 10 seconds after ignition, the 50M51 controller will clear the ignition attempt (or retry) counter. If flame is lost after 10 seconds, the control will restart the ignition sequence.

A momentary loss of gas supply, flame blowout, or a shorted or open condition in the flame probe circuit will be sensed within 2.0 seconds. The gas valve will de-energize and the control will restart the ignition sequence. Recycles will begin and the burner will operate normally if the gas supply returns, or the fault condition is corrected, before the last ignition attempt. Otherwise, the control will go into system lockout.

If the control has gone into system lockout, it may be possible to reset the control by a momentary power interruption of 10 seconds or longer. Refer to SYSTEM LOCKOUT AND DIAGNOSTIC FEATURES.

COOL MODE

In a typical single stage cooling system (Y connection), a call for cool is initiated by closing the thermostat contacts. This energizes the compressor and the electronic air cleaner (optional).

The circulator will be energized at cool speed after the COOL delay-to-fan-on period. After the thermostat is satisfied, the compressor is de-energized and the COOL delay-to-fan-off period begins. After the COOL delay-to-fan-off period ends, the circulator and the electronic air cleaner are de-energized.

MANUAL FAN ON MODE

If the thermostat fan switch is moved to the ON position, the circulator fan (low heat speed) and the electronic air cleaner (optional) are energized. When the fan switch is returned to the AUTO position, the circulator and electronic air cleaner are de-energized.

TWINNING INTERFACE

The 50M51 is equipped with a single wire twinning interface. If twinning is used, either control will process a call for heat, cool or fan as described previously. However, after the heat- or cool-on delay time expires, both units will energize the circulator blowers at the same time. Likewise, after the heat- or cool-off delay time expires, both units will de-energize the circulator at the same time. This allows for the proper air flow to be obtained. In a twinned application, the controls are able to communicate no matter how the transformers are phased.

To enable twinning, connect the TWIN screw terminals on the 50M51 controls of the furnaces to be twinned to each other using a single wire (14-22 AWG).

SYSTEM LOCKOUT AND DIAGNOSTIC FEATURES

SYSTEM LOCKOUT

When system lockout occurs, the gas valve is de-energized and the low speed inducer blower and the low heat speed circulator are energized. The electronic air cleaner (optional) will also energize at this time. The diagnostic indicator light will flash to indicate the system status.

To reset the control after system lockout, do one of the following:

1. Interrupt the call for heat at the thermostat for at least one second but less than 20 seconds (if flame is sensed with the gas valve de-energized, interrupting the call for heat at the thermostat will not reset the control).
2. Interrupt the 24 VAC power at the control for at least 20 seconds. You may also need to reset the flame rollout sensor switch.
3. After one hour in lockout, the control will automatically reset itself.

LAST FAULT MODE

To retrieve fault codes, push and release the "LAST ERROR" button for more than 1/5 second and less than 5 seconds. (Control will indicate this period by solid GREEN for 1/5 to 5 seconds). The LED will flash up to five stored fault codes, beginning with the most recent. If there are no fault codes in memory, the LED will flash two green flashes. The control will flash the most recent error first and the oldest error last (last in first out). There shall be 2 seconds between codes. Solid LED error codes will not be displayed.

FAULT CODE RESET

To clear the fault code memory, push and hold the "LAST ERROR" button for more than 5 seconds and less than 10 seconds. (Control will indicate this period by RAPID GREEN FLASH for 5 seconds to 10 seconds.) The LED will flash three green flashes when the memory has been cleared.

DIAGNOSTIC FEATURES

The 50M51 control continuously monitors its own operation and the operation of the system. If a failure occurs, the red LED on the control will flash a failure code. **If the failure is internal to the control, the light will stay on. In this case, the entire control should be replaced, as the control is not field-repairable.**

If the sensed failure is in the system (external to control), the LED will flash in the following flash-pause sequences to indicate failure status (each flash will last approximately 0.25 seconds, and each pause will last approximately 2 seconds.)

During a second-stage error condition, the red LED when in lockout will flash groups of double pulses. The red LED will flash on for approximately 1/15 second then off for 1/15 second then on for 1/15 second, then off for 3/10 second. The pause between groups of flashes is approximately 2 seconds.

The diagnostics will indicate the specific fault through the following codes:

TROUBLESHOOTING

DIAGNOSTIC TABLE

Green LED Flash	Amber LED Flash	Red LED Flash	Error/Condition	Comments/Troubleshooting
		1	Flame sensed when no flame should be present	Verify the gas valve is operating and shutting down properly. Flame in burner assemble should extinguish promptly at the end of the cycle. Check orifices and gas pressure.
		2	Pressure switch stuck closed/ inducer error	Pressure switch stuck closed. Check switch function, verify inducer is turning off.
		3	1st-stage pressure switch stuck open/ inducer error	Check pressure switch function and tubing. Verify inducer is turning on the pulling sufficient vacuum to engage switch.
		4	Open limit switch	Verify continuity through rollout switch circuit.
		5	Open rollout/open fuse detect	Verify continuity through rollout switch circuit, check fuse.
		6	1st-stage pressure switch cycle lockout	if the first stage pressure switch cycles 5 times (open, closed) during one call for heat from the thermostat the control will lockout. Check pressure switch for fluttering, inconsistent closure or poor vacuum pressure.
		7	External lockout (retries)	Failure to sense flame is often caused by carbon deposits on the flame sensor, a disconnected or shorted flame sensor lead or a poorly grounded furnace. Carbon deposits can be cleaned with emery cloth. Verify sensor is not contacting the burner and is located in a good position to sense flame. Check sensor lead for shorting and verify furnace is grounded properly.
		8	External lockout (ignition recycles exceeded where flame is established and then lost)	Check items for exceeded retries listed above and verify valve is not dropping out allowing flame to be established and then lost.
		9	Grounding or Reversed polarity	Verify the control and furnace are properly grounded. Check and reverse polarity (primary) if incorrect.
		10	Module gas valve contacts energized with no call for heat	Verify valve is not receiving voltage from a short. If a valve wiring is correct and condition persists, replace module.
		11	Limit switch open – possible blower failure overheating limit	Possible blower failure, restricted air flow through appliance or duct work. Verify continuity through limit switch circuit and correct overheating cause.
		12	Module Ignitor contact failure	Fault code indicates the module ignitor contacts are not functioning properly. Replace module.
		Solid	Module - internal fault condition	Module contacts for gas valve not operating or processor fault. Reset control. if condition persists replace module.
		Rapid	Twinning error	Check wire connections. If condition persists, replace module.
		3 double	2nd-stage Pressure Switch Stuck Open/Inducer Error	Check pressure switch function and tubing. Verify inducer is turning on and pulling sufficient vacuum to engage switch.
	1		Normal Operation with call for first stage heat	Normal operation - first stage
	2		Normal Operation with call for second stage heat	Normal operation - first stage
	3		W2 present with no W1	Second stage call for heat on thermostat circuit with no call for first stage. Verify dip switches are set for two stage thermostat and check thermostat first stage circuit. Configured for a multi-stage thermostat the Module will not initiate heating unless first stage call from thermostat is received.
	4		Y present with no G call	Module will allow cooling to operate with only a "Y signal from the thermostat but will also trigger this code. Verify thermostat is energizing both "Y" and "G" on call for cool. Check "G" terminal connections.
	Rapid		Low flame sense current	Low flame sense current is often caused by carbon deposits on the flame sensor, a poorly grounded furnace or a mis-aligned flame sense probe. Carbon deposits can be cleaned with emery cloth. Check for improve furnace and module ground. Verify sensor is located in or very near flame as specified by the appliance manufacturer.
1			Standby or Call for Cool	Normal operation. Waiting for call from thermostat or receiving thermostat call for cool.

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