

SERVICE AND APPLICATION NOTES

October 10, 2000

H-00-3

G32Q3-75-9 Trial Units

We have recently produced 175 G32Q3-75-9 units which include a White-Rodgers 50M61-120 two-stage integrated control board. White-Rodgers has published a specification sheet on these control boards. An electronic file of that document is attached.

This Service and Application Note is being released electronically only. Paper copies of this document will not be released.



WHITE-RODGERS

50M61-120

Integrated Two-Stage
Hot Surface Ignition Controls
INSTALLATION INSTRUCTIONS

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

The 50M61-120 is a two-stage automatic gas interrupted ignition control employing a microprocessor to continually monitor, analyze, and control the proper operation of the gas burner and inducer. The 50M61-120 also 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.

PRECAUTIONS

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

If in doubt about whether your wiring is millivolt, line, or low voltage, have it inspected 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.
- Replace existing control with exact model and dash number.
- 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 wires before disconnection when servicing controls. Wiring errors 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.



WHITE-RODGERS DIVISION
EMERSON ELECTRIC CO.
9797 REAVIS ROAD
ST. LOUIS, MISSOURI 63123-5398

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0032

SPECIFICATIONS

ELECTRICAL RATINGS [@ 77°F (25°C)]:

Input Voltage: 25 VAC, 60 Hz (Class II transformer required)

Max. Input Current @ 25 VAC: 500mA + MV

Relay & Triac Load Ratings:

Gas Valve Relays: 1.5 amps @ 25 VAC, 60 Hz, 0.6 pf

Ignitor Triac: 2.0 amps @ 120 VAC, 60 Hz, (resistive)

Inducer Relays: 2.2 FLA - 3.5 LRA @ 120 VAC

Circulator Relays: 14.5 FLA - 25.0 LRA @ 120 VAC

Flame Current Requirements:

Minimum current to insure flame detection: 0.3 µA DC*

Maximum current for non-detection: 0.1 µA DC*

Maximum allowable leakage resistance: 100 M ohms

*Measured with a DC microammeter in the flame probe lead

OPERATING TEMPERATURE RANGE:

-40° to 175°F (-40° to 80°C)

HUMIDITY RANGE:

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

Timing Specs: (@ 60 Hz)

	maximum
Flame Establishing Time:	0.8 sec
Flame Failure Response Time:	2.0 sec

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

TIMING SPECIFICATIONS

(All times are in seconds, unless noted otherwise)

	50M61-120
PRE-PURGE	15
IGNITOR WARM-UP	20
TRIAL FOR IGNITION PERIOD	4
IGNITION ACTIVATION PERIOD	4
RETRIES	4 times
VALVE SEQUENCE PERIOD	12
INTERPURGE	15
POST-PURGE	15
LOCKOUT TIME	300
DELAY TO HEAT ON	45
DELAY TO HEAT OFF*	60/90/ 120/180
DELAY TO COOL ON	0
DELAY TO COOL OFF	2
DELAY TO FAN ON	0
ELECTRONIC AIR CLEANER	YES
HUMIDIFIER	YES
AUTOMATIC RESET TIME	60 minutes

* These times will vary depending on option switch position. See OPERATION section for further information.

INSTALLATION

! WARNING



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- Route and secure wiring away from flame.

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- 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.

CAUTION

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

MOUNTING AND WIRING

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.

Any orientation is acceptable.

Refer to the wiring diagram and wiring table when connecting the 50M61 control to other components of the system.

UL approved, 105°C rated 18 gauge min., stranded, 3/64" thick insulation wire is recommended for all low voltage safety circuit connections. Refer to 50M61 specification sheet for recommended terminals to mate with those on the control.

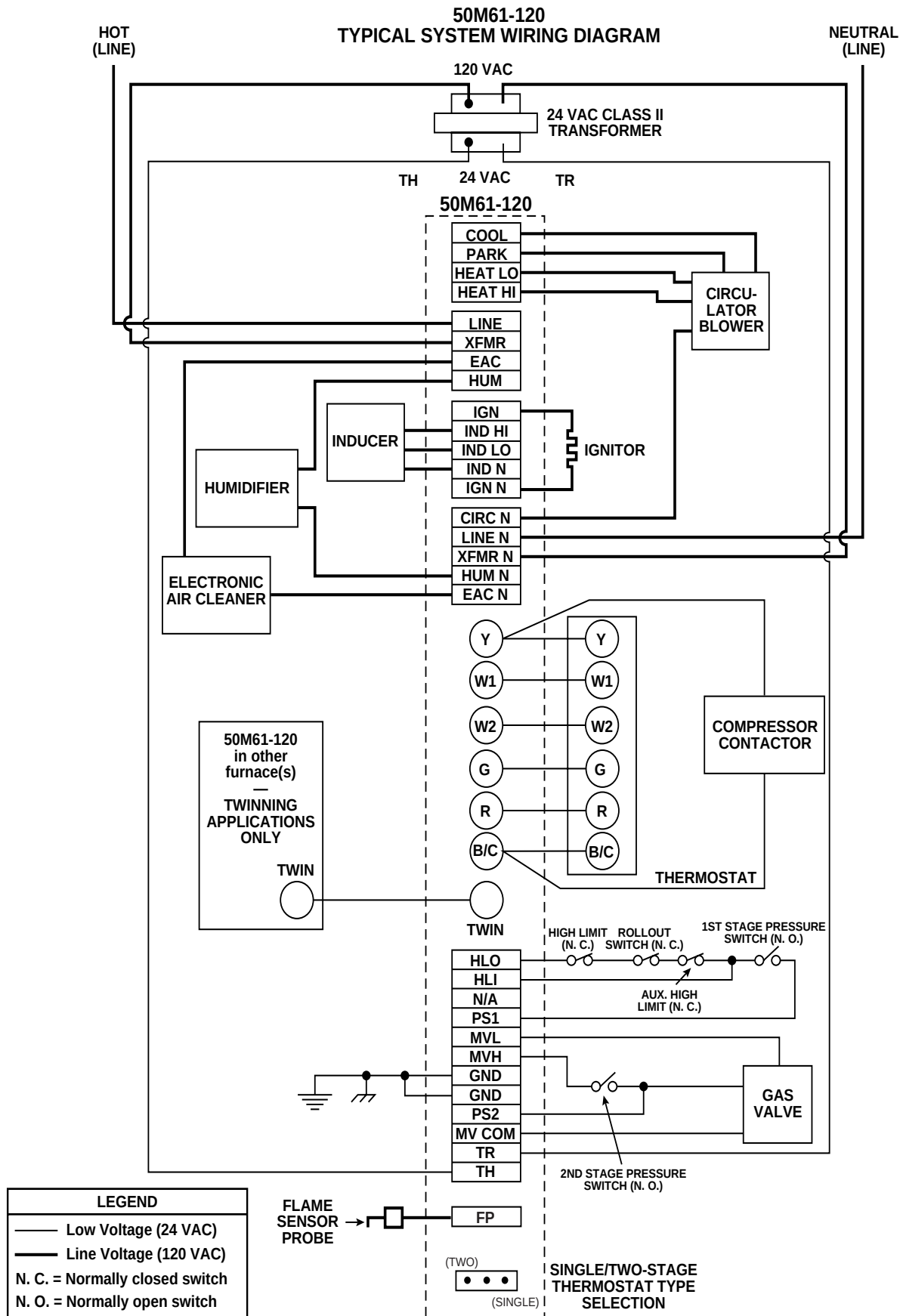
UL approved, 105°C rated 16 gauge min., stranded, 1/64" thick insulation wire is recommended for all line voltage connections. Refer to 50M61 specification sheet for recommended terminals to mate with those on the control.

(Installation instructions continue on page 3.)

The 50M61 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, remove 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 50M61 control. There are no other user serviceable parts.

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



50M61-120 TYPICAL SYSTEM WIRING TABLE

50M61-120 TERMINAL	TERMINAL TYPE	SYSTEM COMPONENT CONNECTION
W1 W2 G R Y B/C TWIN	7-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 Y terminal (or equivalent) 2nd wire from Y terminal goes to 24 VAC HOT side of compressor contactor coil two-stage thermostat B/C terminal (or equivalent) 2nd wire from B/C terminal goes to 24 VAC COMMON side of compressor contactor coil one wire twinning terminal
MV COM MVH MVL TR TH N/A PS1 PS2 HLI HLO GND (2 terminals)	12-pin connector & harness	gas valve COMMON gas valve SECOND STAGE gas valve FIRST STAGE 24 VAC transformer (low voltage COMMON SIDE) 24 VAC transformer (low voltage HIGH SIDE) terminal not used 1st stage pressure switch INPUT 2nd stage pressure switch INPUT high limit INPUT high limit OUTPUT MUST BE RELIABLY GROUNDED TO CHASSIS
IND HI IND LO IND N IGN IGN N	5-pin connector & harness	inducer HIGH SPEED HOT side inducer LOW SPEED HOT side inducer NEUTRAL side ignitor HOT side ignitor NEUTRAL side
PARK	1/4" spade term.	unused circulator blower terminal
COOL	1/4" spade term.	circulator blower COOL SPEED terminal
HEAT LO	1/4" spade term.	circulator blower HEAT LOW SPEED terminal
HEAT HI	1/4" spade term.	circulator blower HEAT HIGH SPEED terminal
LINE	1/4" spade term.	input voltage (120 VAC) HOT SIDE
XFMR	1/4" spade term.	24 VAC transformer line voltage HOT SIDE
EAC (optional)	1/4" spade term.	air cleaner HOT side
HUM (optional)	1/4" spade term.	humidifier HOT side
CIRC N	1/4" spade term.	circulator blower NEUTRAL terminal
LINE N	1/4" spade term.	input voltage (120 VAC) NEUTRAL SIDE
XFMR N	1/4" spade term.	24 VAC transformer line voltage NEUTRAL SIDE
HUM N (optional)	1/4" spade term.	humidifier NEUTRAL side
EAC N (optional)	1/4" spade term.	air cleaner NEUTRAL side
FP	3/16" spade term.	flame sensor probe**

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

OPERATION

OPTION SWITCHES

Option switches #1 and #2 on the 50M61-120 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 #1 & #2 POSITIONS

HEAT delay-to-fan-off:	On "S1," set switch #:	
	1	2
60 sec.	On	On
90 sec.	Off	On
120 sec.	On	Off
180 sec.	Off	Off

To indicate the use of a single-stage thermostat, place a jumper across pins labeled **SINGLE** on E20. The control will then activate second stage based on the setting of switch #3 as shown below. For two-stage thermostats, place a jumper across pins labeled **TWO** on E20. The thermostat will then control second stage operation.

OPTION SWITCH #3 POSITION

2nd stage delay for single stage thermostats:	
Delay Time:	On "S1," set switch #3:
10 minutes	On
5 minutes	Off

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 silicon nitride ignitor is powered.

These controls have an adaptive algorithm that reduces the ignitor temperature to slightly greater than the minimum temperature required to ignite gas in each particular application. The control measures the line voltage and determines an initial ignitor temperature setting based on the measurement. After each successful ignition, the control lowers the ignitor temperature slightly for the next ignition attempt. The control continues to lower the ignitor temperature until ignition does not occur, and the control goes into retry mode. For the second attempt to ignite gas within the same call for heat, the control increases the ignitor temperature to the value it was on the third previous successful ignition. After ignition is successful, the control sets the ignition temperature at this value for the next 255 calls for heat, after which the control repeats the adaptive algorithm. The control is constantly making adjustments to the ignitor modulation routine to compensate for changes in the line voltage.

The Silicon Nitride ignitor manufactured by White-Rodgers must be used. These ignitors are especially designed to operate with the adaptive ignition routine used by the 50M61-120 control to ensure the most efficient ignitor temperature.

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 50M61-120 control will energize the circulator fan at low heat speed.

Control operation with a two-stage thermostat (E20 jumper in location TWO)

Call Mode	Output states
Control has a call for W1 established and a call for W2 is initiated	The inducer is energized at high speed. The control will energize the circulator at high heat speed. The second stage pressure switch contacts will close and energize the second stage gas valve (high fire).
A call for W1 and W2 are received at the same time.	The control will establish first stage heating. After this is accomplished the inducer will be energized at high speed. The second stage pressure switch contacts will close and second stage of the gas valve will be energized (high fire). After the heat on delay time has expired the circulator will be energized at high heat speed.
Call for W2 satisfied. Call for W1 still present.	The inducer speed is switched to low speed and the second stage of the gas valve is de-energized. After the 30-second high heat speed off delay time expires the circulator will be switched to low speed.
Call for W1 satisfied	A 15-second post-purge will be started with the low inducer speed energized. After the 15-second postpurge time has expired, the inducer and humidifier will be de-energized. When the heat off delay time expires the circulator will be turned off.

Control operation with a single-stage thermostat E20 jumper in location SINGLE)

Call Mode	Output states
Call for W1.	First stage heat will be established and a 5 or 10 minute 2nd stage recognition timer will be activated (timing is selectable with option switch #3). Following this delay, the inducer will be energized at high speed. The second stage pressure switch contacts will close and second stage of the gas valve will be energized (high fire). The circulator will be energized at high heat speed.
Call for W1 satisfied.	A 15-second postpurge will be started with the low inducer speed energized. After the 15-second postpurge time has expired, the inducer and humidifier will be de-energized. If a call for second stage heat was activated a 30-second high heat off delay time will be initiated. When this time expires the circulator will be switched to low speed for the remainder of the heat off delay period.

(Operation information continues on page 8.)

If flame is not detected during the trial-for-ignition period, the gas valve is de-energized, the ignitor is turned off, and the control goes into the "retry" sequence.

The "retry" sequence provides a 15-second wait with the inducer interpurge following an unsuccessful ignition attempt (flame not detected). After this wait, the ignition attempt is restarted. Four retries will be attempted before the control goes into system lockout.

If flame is established for more than 10 seconds after ignition, the 50M61-120 controller will clear the ignition attempt (or retry) counter. If flame is lost after 10 seconds, the control will restart the ignition sequence. This can occur a maximum of 5 times before the control goes into system lockout.

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 system, a call for cool is initiated by closing the thermostat contacts. This energizes the compressor and the electronic air cleaner (optional).

On the 50M61-120 control, the circulator will be energized at cool speed. 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 50M61-120 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 above. 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 allow for the proper air flow to be obtained. To assure proper control operation, both controls must share a common transformer ground (TR).

To enable twinning, do the following:

1. Power supplied to both furnaces must be from the same phase of the incoming 120 VAC power.
2. Connect the **TWIN** screw terminals on the 50M61-120 of the furnaces to be twinned to each other using a single wire (14-22 AWG).

SYSTEM LOCKOUT FEATURES AND DIAGNOSTIC FEATURES

SYSTEM LOCKOUT FEATURES

When system lockout occurs, the gas valve is de-energized and the low speed inducer blower is energized. On the 50M61-120 control the low heat speed circulator is also energized. The electronic air cleaner (optional) will also energize at this time. The diagnostic indicator light will flash twice 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 ten seconds. You may also need to reset the flame rollout sensor switch.
3. After one hour in lockout, the control will automatically reset itself.

DIAGNOSTIC FEATURES

The 50M61-120 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 continuously. In this case, the entire control should be replaced, as the control is not field-repairable.** If the LED is continuously **off**, there may be no power to the control; the fuse on the control may be open; or there may be a failure in the control.

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.)

1 flash, then pause	System lockout (retries or recycles exceeded)
2 flashes, then pause	Low pressure switch stuck closed
3 flashes, then pause	Low pressure switch stuck open
4 flashes, then pause	Open high temperature limit switch (not used)
5 flashes, then pause	115 Volt AC power's polarity is reversed
6 flashes, then pause	Low flame sense signal
7 flashes, then pause	Check ignitor or improper grounding
8 flashes, then pause	High pressure switch stuck open
9 flashes, then pause	Flame sensed with gas valve off
Continuous flash	

The LED will also flash once at power-up.