

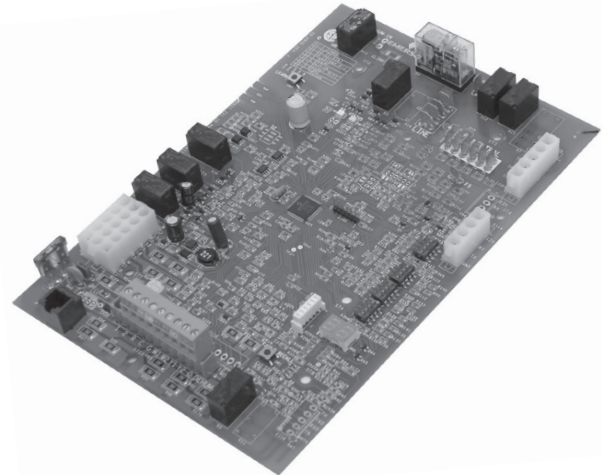
Operator: Save these instructions for future use!

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

DESCRIPTION

This control is for a multi-stage ignition system, based on a solid-state, digital microcomputer. This control is designed for direct burner ignition, starting and timing all system components, operating multi-stage heat and supervision of all gases used in a gas fired furnace equipped with a two speed draft inducer, variable speed indoor blower motor, and discrete pressure switches with a capacity of 150,000 BTU/hr or less. The control has circuitry and software to control a two stage gas valve.

Input to the control is received by way of a 24VAC legacy/traditional thermostat or by way of a serially communicating thermostat. The control monitors safety inputs from high temperature limit, auxiliary limit switch(es), rollout limit switches, discrete pressure switches, and the flame sensor. The control in turn initiates the starting and precise microcomputer controlled timing of the indoor blower motor, inducer fan motor, ignition means, gas valve, air cleaner, and humidifier. The control provides ignition, proof of ignition via remote sense, internal and external system diagnostics indicators, and dual relays in series with the primary gas valve coil.



PRECAUTIONS

⚠ CAUTION

Application of this type of control may cause flame rollout on initial startup and could cause personal injury and/or property damage.

Replace only with exact model number, including dash number. Failure to use exact replacement control could cause personal injury and/or property damage.

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.

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⚠ CAUTION

To prevent electrical shock and/or equipment damage, disconnect electric power to system at main fuse or circuit breaker box until installation is complete.

This control is not intended for use in locations where it may come in direct contact with water. Suitable protection must be provided to shield the control from exposure to water (dripping, spraying, rain, etc.).

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation.

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

Do not use on circuits exceeding specified voltage. Higher voltage will damage control and could cause shock or fire hazard.

⚠ WARNING

Do not short out terminals on gas valve or primary control to test. Short or incorrect wiring will damage control and could cause personal injury and/or property damage.



SPECIFICATIONS

ELECTRICAL RATINGS [@ 77°F (25°C)]:

Input Voltage: 24 VAC, 60 Hz (Class II transformer required)

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

Relay Load Ratings:

Gas Valve Relays: 1.5 amps @ 24 VAC, 60 Hz, 0.6 pf

Ignitor: 4.0 amps @ 120 VAC, 60 Hz, (resistive)

Inducer Relays: 2.2 FLA - 3.5 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 95% relative humidity (non-condensing)

Timing Specs: (@ 60 Hz)

maximum

Flame Establishing Time: 0.8 sec

Flame Failure Response Time: 2.0 secs

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)

	PCBKF103
PRE-PURGE	15
IGNITOR WARM-UP	17 to 19
TRIAL FOR IGNITION PERIOD	4
IGNITION ACTIVATION PERIOD	3
RETRIES	2 times
VALVE SEQUENCE PERIOD	12
INTERPURGE	30
POST-PURGE	15
LOCKOUT TIME	270
HEAT DELAY-TO-FAN-ON	30
HEAT DELAY-TO-FAN-OFF*	90/120/150/180
COOL DELAY-TO-FAN-ON	5
COOL DELAY-TO-FAN-OFF	45
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

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 furnace wiring diagram and wiring table when connecting the PCBKF103 control to other components of the system. Refer to the furnace wiring diagram if any furnace wiring needs to be replaced.

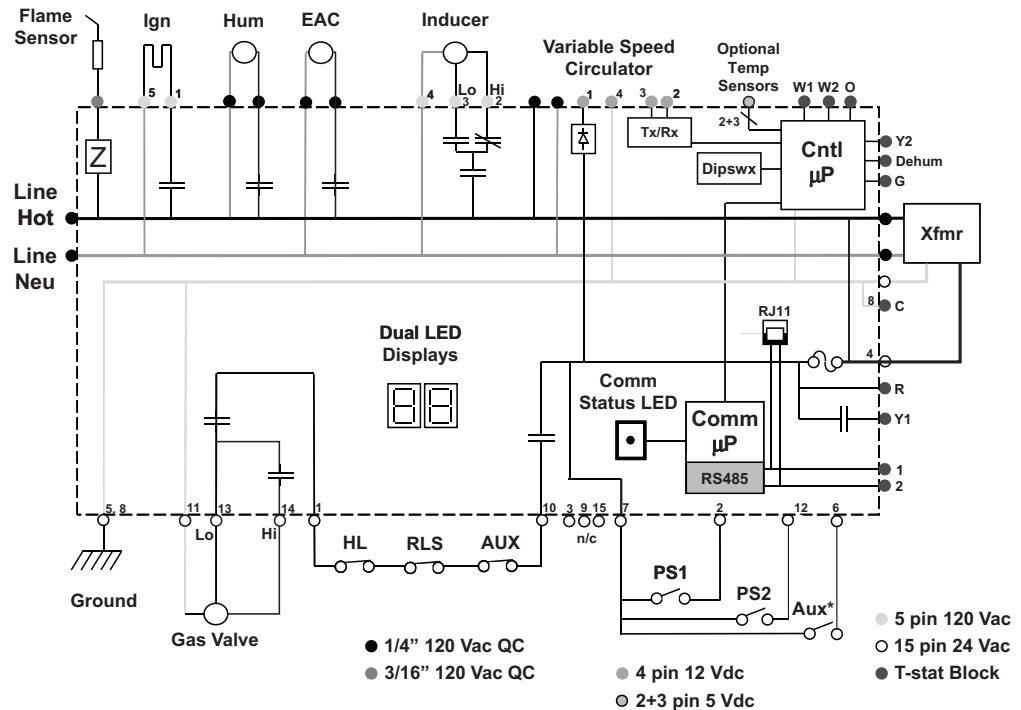
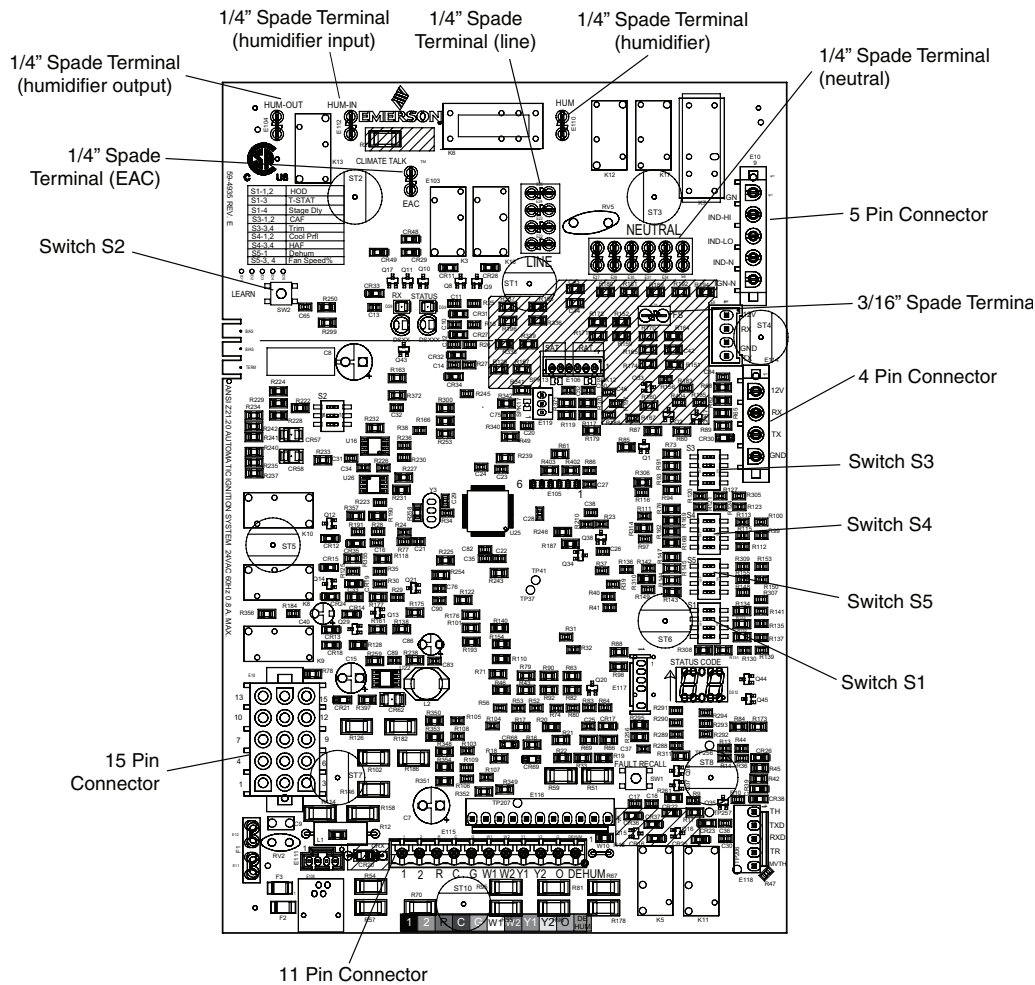
PCBKF103 TYPICAL SYSTEM WIRING TABLE

TERMINAL	TERMINAL TYPE	DESCRIPTION
1	11 Pin Connector	Climate Talk™ positive terminal
2		Climate Talk™ negative terminal
R		24 volt TH
C		24 volt common TR
G		Continuous fan input
W1		First Stage Heat Input
W2		Second Stage Heat Input
Y1		Single Stage Compressor Output or Tstat Input
Y2		Two Stage Compressor Input
O		Reversing valve
Dehum		De-humidification input
HLI (1)	15 Pin Connector	Limit Switch Input
PSI (2)		First Stage Pressure Switch Input
NC (3)		No Connect
TH (4)		High Side of Secondary of Transformer
GND (5)		Connected to Chassis and Earth Ground
Aux (6)*		Aux input for N.C. switch
PSO (7)		Pressure Switch Output
MVC (8)		Main Valve Common
NC (9)		No Connect
HLO (10)		R out to the Limit Switches
TR (11)		24V Common, Connected to GND
PS2 (12)		Second Stage Pressure Switch Input
MVL (13)		Low Gas Valve Main
MVH (14)		High Gas Valve Main
NC (15)		No Connect
12V (1)	4 Pin Connector	+12 volt DC
RX (2)		Motor to Furnace Control Data
TX (3)		Furnace to Motor Control Data
GND (4)		12 Volt DC GND
IGN (1)	5 Pin Connector	IGNITER HOT
IND HI (2)		INDUCER HIGH
IND LO (3)		INDUCER LOW
IND N (4)		INDUCER NEUTRAL
IGN N (5)		IGNITER NEUTRAL
Line	Spade Terminals (4)	Input Voltage 120 VAC HOT Side
EAC	Spade Terminal	Electronic Air Cleaner HOT Side
HUM	Spade Terminal	Humidifier HOT Side
HUM-In*	Spade Terminal	120/24V dedicated humidifier Input
HUM-Out*	Spade Terminal	120/24V dedicated humidifier Output
LINE Neutral	Spade Terminals (6)	Input Voltage (120 VAC) Neutral Side
FS	3/16" Spade Terminal	Flame Sensor

Notes: Connector pin numbers are shown in “()”

*Not supported when replacing a PCBKF101 or PCBKF102 furnace control

WIRING SCHEMATIC



Schematic Wiring

*Not supported when replacing a PCBKF101 or PCBKF102 furnace control

DIPSWITCHES

Switch Bank: S3		
Cooling Airflow	DIP Switch No.	
	1	2
A	OFF	OFF
B	ON	OFF
C	OFF	ON
D*	ON	ON
(*Indicates factory setting)		

Switch Bank: S3		
Trim %	DIP Switch No.	
	3	4
+5%*	OFF	OFF
-5%	ON	OFF
+10%	OFF	ON
-10%	ON	ON
(*Indicates factory setting)		

Switch Bank: S4		
Ramping Profiles	DIP Switch No.	
	1	2
A*	OFF	OFF
B	ON	OFF
C	OFF	ON
D	ON	ON
(*Indicate factory settings)		

Switch Bank: S4		
Heating Airflow	DIP Switch No.	
	3	4
A	OFF	OFF
B*	ON	OFF
C	OFF	ON
D	ON	ON
(*Indicates factory setting)		

Switch Bank: S5		
Dehum	DIP Switch No.	
	1	2
Dehum Disabled*	OFF	
Dehum Enabled	ON	
(*Indicates factory setting)		

Switch Bank: S5		
Trim	DIP Switch No.	
	1	2
Enable Trim		ON
Disable Trim*		OFF
(*Indicates factory setting)		

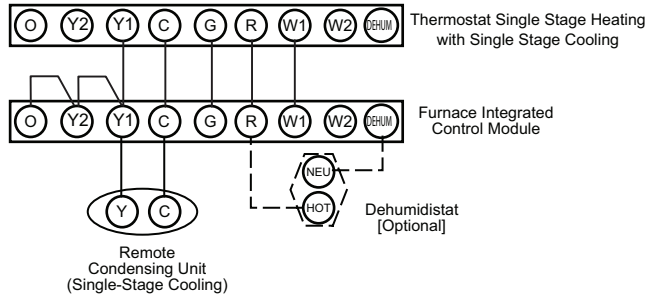
Switch Bank: S5		
Legacy Continous Fan	DIP Switch No.	
	3	4
25%	OFF	OFF
50%*	ON	OFF
75%	OFF	ON
100%	ON	ON
(*Indicates factory setting)		

Switch Bank: S1		
Heat OFF Delay	DIP Switch No.	
	1	2
90 seconds	OFF	OFF
120 seconds	ON	OFF
150 seconds*	OFF	ON
180 seconds	ON	ON
(*Indicates factory setting)		

Switch Bank: S1		
Thermostat	DIP Switch No.	
	3	4
2-Stg T-Stat*	ON	ON
2-Stg T-Stat	ON	OFF
1-Stg T-Stat, 5 Min Delay	OFF	OFF
1-Stg T-Stat, Auto Delay	OFF	ON
(*Indicate factory settings)		

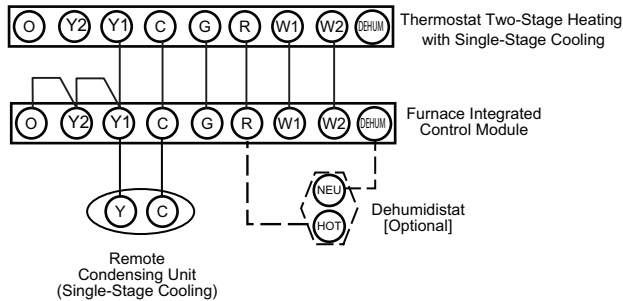
WIRING DIAGRAM

24VAC LEGACY/TRADITIONAL THERMOSTATS

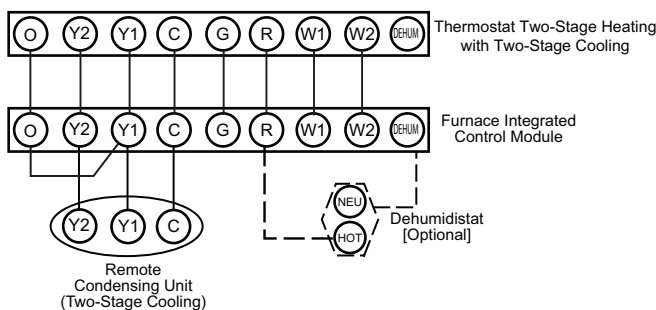


Single Stage Heating with Single Stage Cooling

NOTE: To apply a single-stage Heating Thermostat, the thermostat selector switch on the Integrated Control Module must be set on single-stage.

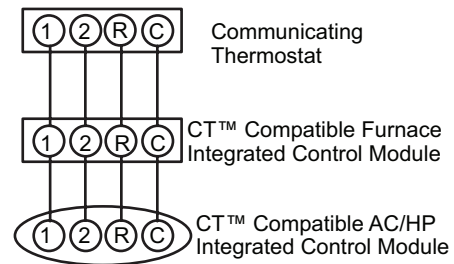


Two-Stage Heating with Single-Stage Cooling

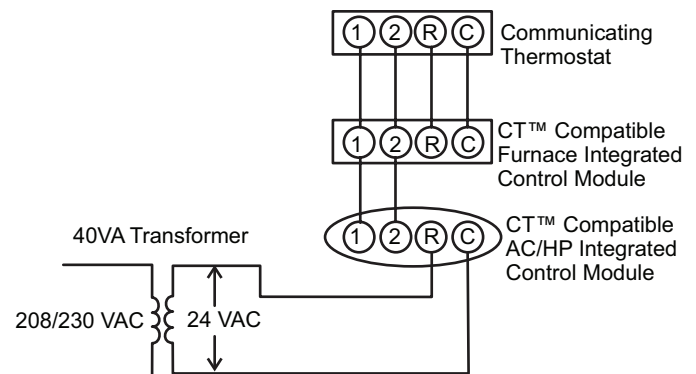


Two-Stage Heating with Two-Stage Cooling

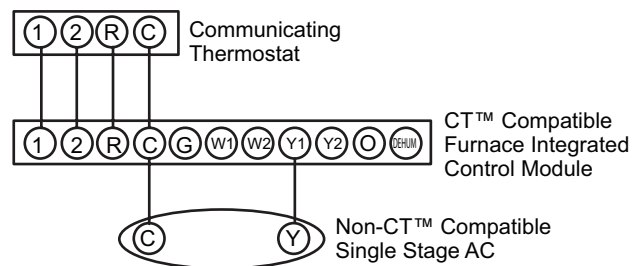
COMMUNICATING SYSTEMS



4 Wire Setup



When Only 2 Wires are Available Between the Furnace and Outdoor Unit



Mixed Mode: Communicating Thermostat and Furnace Paired with a Single Stage Non-Communicating A/C

NORMAL SEQUENCE OF OPERATION

(24 VAC Legacy/Traditional Thermostat)

Power Up

The normal power sequence is as follows:

1. 115 VAC power applied to furnace.
2. Integrated control module performs internal checks.
3. Integrated control module displays 88 on dual 7-segment display LED's.
4. Integrated control module monitors safety circuits continuously.
5. Furnace awaits call from thermostat. Dual 7-segment LED's display On while awaiting call from thermostat.

Heating Mode

The normal operational sequence in heating mode is as follows:

1. R and W1 (or R and W1/W2) thermostat contacts close initiating a call for heat.
2. Integrated control module performs safety circuit checks.
3. Induced draft blower is energized on high speed for a 15-second prepurge. Humidifier terminal is energized with induced draft blower.
4. Induced draft blower steps to low speed following prepurge. Low stage pressure switch contacts are closed.
5. Igniter warm up begins upon step to low speed and presence of closed low stage pressure switch contacts.
6. Gas valve opens at end of igniter warm up period, delivering gas to burners and establishing flame.
7. Integrated control module monitors flame presence. Gas valve will remain open only if flame is detected.
8. If the thermostat call is for low heat, gas valve and induced draft blower will continue on low stage. If the call is for high heat, the gas valve and induced draft blower will change to high stage.
9. Circulator blower is energized on heat speed following a thirty (30) second blower on delay. The circulator blower requires thirty seconds to ramp up to full speed. Electronic air cleaner terminal is energized with circulator blower.
10. Furnace is now operating on the specified stage called for by the two-stage thermostat.
11. Furnace runs, integrated control module monitors safety circuits continuously.
12. If the two-stage thermostat changes the call from low heat to high heat, the integrated control module will immediately switch the induced draft blower, gas valve, and circulator blower to their high stage settings.
13. If the two-stage thermostat changes the call from high heat to low heat, the control will immediately switch the induced draft blower and gas valve to their low stage settings. The circulator blower will remain on high heating speed for thirty (30) seconds before switching to the low heat circulating speed.
14. R and W1 (or R and W1/W2) thermostat contacts open, completing the call for heat.
15. Gas valve closes, extinguishing flame.
16. Induced draft blower is de-energized following a fifteen second post purge. Humidifier terminals are de-energized.
17. Circulator blower continues for the selected heat off delay

period (90, 120, 150 or 180 seconds). The speed run during this period depends on the last heat call provided by the thermostat.

If the last call for heat was a call for low heat, the air circulator motor will run on low heat speed for the duration of the heat off delay period (90, 120, 150 or 180 seconds).

If the last call for heat was a call for high heat, the air circulating motor will run on the high heating speed for thirty (30) seconds and then switch to the low heating speed for the balance of the heat off delay period (60, 90, 120 or 150 seconds).

18. Circulator blower and electronic air cleaner terminal is de-energized
19. Circulator blower ramps down to OFF during the 30 seconds following the heat off delay period.
20. Furnace awaits next call from thermostat.

Cooling Mode

The normal operational sequence in cooling mode is as follows:

1. R and Y1/G or Y2/G thermostat contacts close, initiating a call for cool.
2. Integrated control module performs safety circuit checks.
3. Outdoor fan and compressor are energized to their appropriate speed.
4. Circulator blower is energized on the appropriate cool speed at the level and time determined by the selected ramping profile. Electronic air cleaner terminal is energized with circulator blower.
5. Furnace circulator blower and outdoor cooling unit run their appropriate speeds, integrated control module monitors safety circuits continuously.
6. R and Y1/G or Y2/G thermostat contacts open, completing the call for cool.
7. Outdoor fan and compressor are de-energized.
8. Circulator blower continues running during a cool off delay period. The OFF delay time and airflow level are determined by the selected ramping profile.
9. Electronic air cleaner terminal and circulator blower are de-energized.
10. Furnace awaits next call from thermostat.

Note: To enable dehumidification, dipswitch S5-1 must be placed in the On position.

Fan Only Mode

The normal operational sequence in fan only mode is as follows

1. R and G thermostat contacts close, initiating a call for fan.
2. Integrated control module performs safety circuit checks.
3. Circulator blower is energized on continuous fan speed (Default 50% of the furnace's maximum airflow capability) (Reference Dip Switch Settings). Electronic air cleaner terminal is energized.
4. Circulator blower runs, integrated control module monitors safety circuits continuously.
5. R and G thermostat contacts open, completing the call for fan.
6. Circulator blower is de-energized. Electronic air cleaner terminal is de-energized.

OPTIONAL CONTROL FEATURES

Humidifier

The control is equipped with a dedicated humidifier feature (normally open “Hum-In” and “Hum-Out” ¼ inch terminals used with 120/24 VAC power source)*. Also available is a standard 120 VAC output “Hum” terminal that works off the inducer operation.

Legacy mode use

For legacy heat demands the control shall turn on the humidifier during normal heating operation using the “Hum” 120 VAC output terminal.

Communication mode use

1. If using non-humidification capable thermostat, use “Hum” terminal with humidifier. Functionality will be the same as in legacy mode.
2. *Humidification capable thermostat will have added functionality to run the humidifier independent of a heat call with selectable fan speeds (use Hum-In and Hum-Out terminals).

Selection available in thermostat user menu:

ON: Humidifier is turned on with a heat demand.

OFF: Humidifier relay remains off.

IND: Humidifier will cycle with humidification demand (independent of an active heat demand). (Speed selection options: 25, 50, 75 and 100% located in the thermostat menu)

Auxiliary Alarm Switch*

The control is equipped with a normally closed 24 VAC Auxiliary contact primarily used for condensate switch wiring. (Reference schematic wiring, page 4, Pin 7 to 6)

Communicating mode use

To use this feature, it must be enabled through the thermostat user menus. The typical use of this feature would include a device equipped with normally closed electrical contacts, such as a float switch (field supplied). If the float switch contacts open, the control will respond by turning off the compressor and display EF fault code. The thermostat will display “**Call for Service**”. Once the AUX switch is detected closed for 30 seconds, normal operation resumes and error messages are no longer displayed.

Gas Pressure Test

To be used for field test mode only, and will allow gas valve pressure to be checked at 100% firing rate.

1. In either stand by or during a call for heat, if both FAULT RECALL and LEARN push buttons are pressed for greater than 1 second the display will go blank to indicate the push buttons are pressed. Within 5 seconds, both buttons should be released to begin the test. If either push button is not released, the test mode will not activate. The display will return to normal.
2. Once the push buttons are released, the display will flash “Ft” to indicate the push buttons are released and successfully enter into test mode.
3. The control will force a high capacity demand. If a low capacity demand is already being serviced, it will be forced to high stage.
4. The display will continue to flash “Ft” until high capacity (100%) is achieved. Once achieved, the display shall show “Ft” without flashing. A 5-minute timer will be started to allow sufficient opportunity for the gas pressure to be tested.
5. If a call for heat is given or removed during the test, the system will still operate until the 5-minute test time is complete.
6. During test mode, if both push buttons are pressed for greater than 1 second, the display shall go blank to indicate push buttons are pressed. If both push buttons are released within 5 seconds, the test mode will terminate and the system will return to normal operation. Otherwise, the test mode will continue uninterrupted.
7. After completion of the 5-minute timer or test mode termination, whichever is earlier, the system will return to normal operation. Either continuing an existing heat demand or going to the idle state.
8. Furnace awaits next call from thermostat.

*Not supported when replacing a PCBKF101 or PCBKF102 furnace control

NORMAL SEQUENCE OF OPERATION (Communicating System)

Power Up

The normal power up sequence is as follows:

1. 115 VAC power applied to furnace.
2. Integrated control module performs internal checks.
3. Integrated control module displays 88 on dual 7-segment display LED's.
4. Integrated control module monitors safety circuits continuously.
5. Furnace awaits call from thermostat. Dual 7-segment LED's display On while awaiting call from thermostat.

Heating Mode

The normal operational sequence in heating mode is as follows:

1. Communicating thermostat sends a request for heat (low or high stage) to the furnace control.
2. Control module performs safety circuit checks.
3. Induced draft blower is energized on high speed for a 15-second prepurge. Humidifier terminal is energized with induced draft blower.
4. Igniter warm up begins upon step to low speed and presence of closed low stage pressure switch contacts.
5. Gas valve opens at end of igniter warm up period, delivering gas to burners and establishing flame.
6. Integrated control module monitors flame presence. Gas valve will remain open only if flame is detected.
7. If the thermostat call is for low heat, gas valve and induced draft blower will continue on low stage. If the call is for high heat, the gas valve and induced draft blower will change to high stage.
8. Circulator blower is energized on heat speed following a thirty (30) second blower on delay. The circulator blower requires thirty seconds to ramp up to full speed. Electronic air cleaner terminal is energized with circulator blower.
9. Furnace is now operating on the specified stage called for by the communicating thermostat.
10. Furnace runs, integrated control module monitors safety circuits continuously.
11. If the communicating thermostat changes the call from low heat to high heat, the integrated control module will immediately switch the induced draft blower, gas valve, and circulator blower to their high stage settings.
12. If the communicating thermostat changes the call from high heat to low heat, the control will immediately switch the induced draft blower and gas valve to their low stage settings. The circulator blower will remain on high heating speed for thirty (30) seconds before switching to the low heat circulating speed.
13. Communicating thermostat is satisfied and ends the call for heat and commands the furnace to an off and idle condition.
14. Gas valve closes, extinguishing flame.
15. Induced draft blower is de-energized following a fifteen second post purge. Humidifier terminals are de-energized.
16. Circulator blower continues running for the selected heat off delay period (90, 120, 150 or 180 seconds). The speed run during this period depends on the last heat call provided by the thermostat.
If the last call for heat was a call for low heat, the air circulator motor will run on low heat speed for the duration of the heat off delay period (90, 120, 150 or 180 seconds).

If the last call for heat was a call for high heat, the air circulating motor will run on the high heating speed for thirty (30) seconds and then switch to the low heating speed for the balance of the heat off delay period (60, 90, 120 or 150 seconds).

17. Circulator blower and electronic air cleaner terminal is de-energized.
18. Circulator blower ramps down to OFF during the 30 seconds following the heat off delay period.
19. Communicating system awaits next call from thermostat.

Cooling Mode

The normal operational sequence in cooling mode is as follows:

1. Communicating thermostat sends cooling request to outdoor unit.
2. Outdoor unit energizes fan and compressor to their appropriate speeds.
3. Outdoor unit sends fan request to furnace. Furnace control energizes circulator blower at the appropriate cool speed. Electronic air cleaner terminal is energized with circulator blower.
4. Furnace circulator blower and outdoor unit run at their appropriate speeds, integrated furnace control module monitors safety circuits continuously.
5. Communicating thermostat is satisfied and ends the call for cooling. The outdoor unit and furnace are commanded to an off and idle condition.
6. Outdoor fan and compressor are de-energized.
7. Outdoor unit continues fan request to furnace control until circulator blower completes cool off delay.
8. Electronic air cleaner terminal and circulator blower are de-energized once cool off delay expires.
9. Communicating system awaits next call from thermostat.

Note: To enable dehumidification, use thermostat user menus.

Fan Only Mode

The normal operational sequence in fan only mode is as follows:

1. Communicating thermostat sends fan request to furnace control.
2. Integrated control module performs safety circuit checks.
3. Circulator blower is energized on continuous fan speed. Continuous fan speed is 25%, 50%, or 75% of the furnace's maximum airflow capability. The fan speed is determined by the low, medium, or high fan setting in the communicating thermostat. Electronic air cleaner terminal is energized.
4. Circulator blower runs, integrated control module monitors safety circuits continuously.
5. Communicating thermostat is satisfied and ends the call for continuous fan. The furnace is commanded to an off and idle condition.
6. Circulator blower is de-energized. Electronic air cleaner terminal is de-energized.
7. Communicating system awaits next call from thermostat.

Operational Checks

The burner flames should be inspected with the burner compartment door installed. Flames should be stable, quiet, soft, and blue (dust may cause orange tips but they must not be yellow). Flames should extend directly outward from the burners without curling, floating, or lifting off. Flames must not impinge on the sides of the heat exchanger firing tubes.

TROUBLESHOOTING

SAFETY CIRCUIT DESCRIPTION

A number of safety circuits are employed to ensure safe and proper furnace operation. These circuits serve to control any potential safety hazards and serve as inputs in the monitoring and diagnosis of abnormal function. These circuits are continuously monitored during furnace operation by the integrated control module.

Integrated Control Module

The integrated control module is an electronic device which, if a potential safety concern is detected, will take the necessary precautions and provide diagnostic information through the LED.

Primary Limit

The primary limit control is located on the partition panel and monitors heat exchanger compartment temperatures. It is a normally-closed (electrically), automatic reset, temperature-activated sensor. The limit guards against overheating as a result of insufficient conditioned air passing over the heat exchanger.

Auxiliary Limit

The auxiliary limit controls are located on or near the circulator blower and monitors blower compartment temperatures. They are normally-closed (electrically), manual-reset sensors. These limits guard against overheating as a result of insufficient conditioned air passing over the heat exchanger.

Rollout Limit

The rollout limit controls are mounted on the burner/manifold assembly and monitor the burner flame. They are normally-closed (electrically), manual-reset sensors. These limits guard against burner flames not being properly drawn into the heat exchanger.

Pressure Switches

The pressure switches are normally-open (closed during operation) negative air pressure-activated switches. They monitor the airflow (combustion air and flue products) through the heat exchanger via pressure taps located on the induced draft blower. These switches guard against insufficient air-flow (combustion air and flue products) through the heat exchanger.

Flame Sensor

The flame sensor is a probe mounted to the burner/manifold assembly which uses the principle of flame rectification to determine the presence or absence of flame.

SAFETY CIRCUIT DESCRIPTION

Electrostatic Discharge (ESD) Precautions

NOTE: Discharge body's static electricity before touching unit. An electrostatic discharge can adversely affect electrical components.

Use the following precautions during furnace installation and servicing to protect the integrated control module from damage. By putting the furnace, the control, and the person at the same electrostatic potential, these steps will help avoid exposing the integrated control module to electrostatic discharge. This procedure is applicable to both installed and uninstalled (ungrounded) furnaces.

1. Disconnect all power to the furnace. Do not touch the integrated control module or any wire connected to the control prior to discharging your body's electrostatic charge to ground.
2. Firmly touch a clean, unpainted, metal surface of the furnace away from the control. Any tools held in a person's hand during grounding will be discharged.
3. Service integrated control module or connecting wiring following the discharge process in step 2. Use caution not to recharge your body with static electricity; (i.e., do not move or shuffle your feet, do not touch ungrounded objects, etc.). If you come in contact with an ungrounded object, repeat step 2 before touching control or wires.
4. Discharge your body to ground before removing a new control from its container. Follow steps 1 through 3 if installing the control on a furnace. Return any old or new controls to their containers before touching any ungrounded object.

Resetting from Lockout

Furnace lockout results when a furnace is unable to achieve ignition after three attempts during a single call for heat. It is characterized by a non-functioning furnace and an E0 code displayed on the dual 7-segment display. If the furnace is in "lockout", it will (or can be) reset in any of the following ways.

1. Automatic reset. The integrated control module will automatically reset itself and attempt to resume normal operations following a one hour lockout period.
2. Manual power interruption. Interrupt 115 volt power to the furnace.
3. Manual thermostat cycle. Lower the thermostat so that there is no longer a call for heat for 1-20 seconds then reset to previous setting

NOTE: If the condition which originally caused the lockout still exists, the control will return to lockout. Refer to the Troubleshooting Chart for aid in determining the cause.

Network Troubleshooting

Communications is achieved by monitoring the Data 1 and Data 2 inputs. If the Data 1 and Data 2 inputs are measured relative to “C” while there is no communications traffic, Data 1 would be approximately 2.6 volts DC and Data 2 would be approximately 2.3 volts DC. The voltage difference between Data 1 and Data 2 when there is no communications traffic is typically 0.2 to 0.6 volts DC.

During communications Data 1 will vary between “C” and +5 volts and Data 2 will vary between +5 volts and ground. When Data 1 is going high (towards +5 volts), Data 2 will be going low (towards “C”) and vice versa.

ComfortNet™ system is a fully communicating system, and thus, constitutes a network. Occasionally the need to troubleshoot the network may arise. The integrated control module has some on-board tools that may be used to troubleshoot the network. These tools are: red communications LED, green receive (Rx) LED, and learn button.

Red communications LED - Indicates the status of the network. The table below indicates the LED status and the corresponding potential problem.

Green receive LED - Indicates network traffic. The table below indicates the LED status and the corresponding potential problem

Learn button - Used to reset the network. Depress the button for approximately 2 seconds to reset the network. After pressing the Learn button, it may take several minutes for the network to recognize all systems that are present.

Diagnostic Chart

Refer to the Troubleshooting Chart at the end of this manual for assistance in determining the source of unit operational problems. The dual 7-segment LED display will display an error code that may contain a letter and number. The error code may be used to assist in troubleshooting.

	LED	Description	Possible Cause	Corrective Action	Comments
	Off	Normal condition	None	None	None
Red Communications LED	1 Flash	Communications Failure	Communications Failure	- Depress Learn Button - Verify that bus BIAS and TERM dipswitches are in the ON position.	- Depress once quickly for a power-up reset - Depress and hold for 2 seconds for an out-of-box reset
	2 Flashes	Out-of-box reset	- Control power up - Learn button depressed	None	None
Green Receive LED	Off	- No power - Communications error	- No power to furnace - Open fuse - Communications error	- Check fuses and circuit breakers; replace/reset - Replace blown fuse - Check for shorts in low voltage wiring in furnace/ system - Reset network by depressing learn button - Check data 1/ data 2 voltages	Turn power OFF prior to repair
	1 Steady Flash	No network found	- Broken/ disconnected data wire(s) - Furnace is installed as a legacy/ traditional system	- Check communications wiring (data 1/ data 2 wires) - Check wire connections at terminal block - Verify furnace installation type (legacy/ traditional or communicating) Check data 1/ data 2 voltages	- Turn power OFF prior to repair - Verify wires at terminal blocks are securely twisted together prior to inserting into terminal block - Verify data1 and data voltages as described above
	Rapid Flashing	Normal network traffic	Control is “talking” on network as expected	None	None
	On Solid	Data 1/ Data 2 miss-wire	- Data 1 and data 2 wires reversed at furnace, thermostat, or CT™ compatible outdoor AC/ HP - Short between data 1 and data 2 wires - Short between data 1 or data 2 wires and R (24VAC) or C (24VAC common)	- Check communications wiring (data 1/ data 2 wires) - Check wire connections at terminal block - Check data 1/ data 2 voltages	- Turn power OFF prior to repair - Verify wires at terminal blocks are securely twisted together prior to inserting into terminal block - Verify data1 and data voltages as described above

TROUBLESHOOTING

Additional Notes

1. There are dual 7-segment LEDs on the PCB. See the Troubleshooting Chart at the end of this manual for definitions of the LED status codes.
2. Press "RECALL" push button to retrieve the six most recent faults. The control must be in Standby Mode (no thermostat inputs) to use the feature. Depress the push button for approximately two seconds and less than five seconds. The LEDs will then display the six most recent faults beginning with the most recent fault and decrements to the least recent fault. The faults may be cleared by depressing the button for greater than five seconds. Consecutively repeated faults are displayed a maximum of three times. Refer to the fault code definitions at the end of this manual for more details.
3. "BIAS" and "TERM" dipswitches are used for communications bus configuration. Leave the settings to the factory default "ON" positions.

4. "LEARN" push button is used in communication mode to support device recognition on start-up. As the communication system supports automatic identification of both indoor unit and outdoor unit, this button is not used for normal start-up.

System Troubleshooting

Refer to the Troubleshooting Chart at the end of this manual for a listing of possible furnace error codes, possible causes and corrective actions.

The PCBKF103 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 PCBKF103 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.

Symptoms of Abnormal Operation (Legacy & ComfortNet™ Thermostat)	Diagnostic/Status LED Codes	Fault Description	ComfortNet™ Thermostat Only		Possible Causes	Corrective Actions	Notes & Cautions
			Message	Code			
- Furnace fails to operate - Integrated control module LED display provides no signal. - ComfortNet™ thermostat "Call for Service" icon illuminated - ComfortNet™ thermostat scrolls "Check Furnace" message	None	- No 115 power to furnace or no 24 volt power to integrated control module - Blown fuse or circuit breaker - Integrated control module has an internal fault	INTERNAL FAULT	EE	- Manual disconnect switch OFF, door switch open or 24 volt wire improperly connected or loose - Blown fuse or circuit breaker - Integrated control module has an internal fault	- Assure 115 and 24 volt power to furnace and integrated control module. - Check integrated control module fuse (3A). Replace if necessary. - Check for possible shorts in 115 and 24 volt circuits. Repair as necessary. - Replace bad integrated control module.	- Turn power OFF prior to repair. - Replace integrated control module fuse with 3A automotive fuse. - Read precautions in "Electrostatic Discharge" section of manual. - Replace control with correct replacement part
LED display indicates On	On	Normal operation	None	None	Normal operation	None	Normal operation
- Furnace fails to operate - Integrated control module LED display provides E0 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	E0	Furnace lockout due to an excessive number of ignition "retries" (3 total)	LOCKOUT	E0	- Failure to establish flame. Cause may be no gas to burners, front cover pressure switch stuck open, bad igniter or igniter alignment, improper orifices, or coated/oxidized or improperly connected flame sensor. - Loss of flame after establishment. Cause may be interrupted gas supply, lazy burner flames (improper gas pressure or restriction in flue and/or combustion air piping), front cover pressure switch opening, or improper induced draft blower performance.	- Locate and correct gas interruption. - Check front cover pressure switch operation (hose, wiring, contact operation). Correct if necessary. - Replace or realign igniter. - Check flame sense signal. Sand sensor if coated and/or oxidized. - Check flue piping for blockage, proper length, elbows, and termination. - Verify proper induced draft blower performance.	- Turn power OFF prior to repair. - Igniter is fragile, handle with care. - Sand flame sensor with emery cloth. - See "Vent/Flue Pipe" section for piping details.
- Furnace fails to operate. - Integrated control module LED display provides E1 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	E1	Low stage pressure switch circuit is closed at start of heating cycle.	PS1 CLOSED	E1	- Low stage pressure switch contacts sticking. - Shorts in pressure switch circuit wiring.	- Replace low stage pressure switch. - Repair short in wiring.	- Turn power OFF prior to repair. - Replace pressure switch with proper replacement part.

Symptoms of Abnormal Operation (Legacy & ComfortNet™ Thermostat)	Diagnostic/Status LED Codes	Fault Description	ComfortNet™ Thermostat Only		Possible Causes	Corrective Actions	Notes & Cautions
			Message	Code			
- Induced draft blower runs continuously with no further furnace operation. - Integrated control module LED display provides E2 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	E2	Low stage pressure switch circuit is not closed.	PS1 OPEN	E2	- Pressure switch hose blocked/pinched, or connected improperly. - Blocked flue and/or inlet air pipe, blocked drain system or weak induced draft blower. - Incorrect pressure switch set point or malfunctioning switch contacts. - Loose or improperly connected wiring.	- Inspect pressure switch hose. Repair/replace if necessary. - Inspect flue and/or inlet air piping for blockage, proper length, elbows, and termination. Check drain system. Correct as necessary. - Check induced draft blower performance. Correct as necessary. - Correct pressure switch set point or contact motion. - Tighten or correct wiring connection.	- Turn power OFF prior to repair. - Replace pressure switch with proper replacement part. - Replace induced draft blower with proper replacement part.
- Circulator blower runs continuously. No furnace operation. - Integrated control module LED display provides E3 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	E3	- Primary limit or auxiliary limit circuit is open. - Rollout limit circuit is open.	HIGH LIMIT OPEN	E3	- Insufficient conditioned air over the heat exchanger. Blocked filters, restrictive ductwork, improper circulator blower speed, or failed circulator blower motor. - Flame rollout. - Misaligned burners, blocked flue and/or air inlet pipe, or failed induced draft blower. - Loose or improperly connected wiring.	- Check filters and ductwork for blockage. Clean filters or remove obstruction. - Check circulator blower speed and performance. Correct speed or replace blower motor if necessary. - Check burners for proper alignment. - Check flue and air inlet piping for blockage, proper length, elbows, and termination. Correct as necessary. - Check induced draft blower for proper performance. Replace if necessary. - Tighten or correct wiring connection.	- Turn power OFF prior to repair. - See Specification Sheet applicable to your model for allowable rise range and proper circulator speed. - See "Vent/Flue Pipe" section for piping details.
- Induced draft blower and circulator blower runs continuously. No furnace operation. - Integrated control module LED display provides E4 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	E4	Flame sensed with no call for heat.	IMPROPER FLAME	E4	- Short to ground in flame sense circuit. - Lingering burner flame. - Slow closing gas valve.	- Correct short at flame sensor or in flame sensor wiring. - Check for lingering flame. - Verify proper operation of gas valve.	Turn power OFF prior to repair.
- No furnace operation. - Integrated control module LED display provides E5 error code. - ComfortNet™ thermostat displays "Battery Power"	E5	Open Fuse	Not Displayed	Not Displayed	Short in low voltage wiring	Locate and correct short in low voltage wiring	- Turn power OFF prior to repair. - Replace fuse with 3-amp automotive type
- Normal furnace operation. - Integrated control module LED display provides E6 error code.	E6	Flame sense micro amp signal is low	WEAK FLAME	E6	- Flame sensor is coated/oxidized. - Flame sensor incorrectly positioned in burner flame. - Lazy burner flame due to improper gas pressure or combustion air.	- Sand flame sensor if coated/oxidized. - Inspect for proper sensor alignment. - Check inlet air piping for blockage, proper length, elbows, and termination. - Compare current gas pressure to rating plate. Adjust as needed.	- Turn power OFF prior to repair. - Sand flame sensor with emery cloth. - See "Vent/Flue Pipe" section for piping details. - See rating plate for proper gas pressure.

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Symptoms of Abnormal Operation (Legacy & ComfortNet™ Thermostat)	Diagnostic/Status LED Codes	Fault Description	ComfortNet™ Thermostat Only		Possible Causes	Corrective Actions	Notes & Cautions
			Message	Code			
- Furnace fails to operate. - Integrated control module LED display provides E7 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	E7	Problem with igniter circuit.	IGNITER FAULT	E7	- Improperly connected igniter. - Shorted igniter. - Poor unit ground. - Igniter relay fault on integrated control module.	- Check and correct wiring from integrated control module to igniter. - Replace shorted igniter. - Check and correct unit ground wiring. - Check igniter output from control. Replace if necessary.	- Turn power OFF prior to repair. - Replace igniter with correct replacement part. - Replace control with correct replacement part.
- Furnace fails to operate on high stage; furnace operates normally on low stage. - Integrated control module LED display provides E8 error code.	E8	- High stage pressure switch circuit is closed at start of heating cycle. - Induced draft blower is operating. - Furnace is operating on low stage only	PS2 CLOSED	E8	- High stage pressure switch contacts sticking. - Shorts in pressure switch circuit wiring.	- Replace high stage pressure switch. - Repair short in wiring	- Turn power OFF prior to repair. - Replace pressure switch with proper replacement part.
- Furnace fails to operate on high stage; furnace operates normally on low stage. - Integrated control module LED display provides E9 error code.	E9	- High stage pressure switch circuit is not closed. - Induced draft blower is operating. - Furnace is operating on low stage only	PS2 OPEN	E9	- Pressure switch hose blocked pinched, or connected improperly. - Blocked flue and/or inlet air pipe, blocked drain system or weak induced draft blower. - Incorrect pressure switch set point or malfunctioning switch contacts. - Loose or improperly connected wiring.	- Inspect pressure switch hose. Repair/replace if necessary. - Inspect flue and/or inlet air piping for blockage, proper length, elbows, and termination. Check drain system. Correct as necessary. - Check induced draft blower performance. Correct as necessary. - Correct pressure switch set point or contact motion. - Tighten or correct wiring connection.	- Turn power OFF prior to repair. - Replace pressure switch with proper replacement part. - Replace induced draft blower with proper replacement part.
- Furnace fails to operate. - Integrated control module LED display provides EA error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	EA	Polarity of 115 volt AC is reversed	REVERSED PLTY	EA	- Polarity of 115 volt AC power to furnace or integrated module is reversed. - Poor unit ground	- Review wiring diagram to correct polarity. - Verify proper ground. Correct if necessary. - Check and correct wiring.	Turn power OFF prior to repair.
- Integrated control module LED display EF error code. - ComfortNet™ thermostat "Call for Service" .	EF	Aux switch open	Aux Alarm Fault	EF	High water level in the evaporation coil.	Check overflow pan and service.	Turn power OFF prior to service.
- Furnace fails to operate. - Integrated control module LED display provides d0 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	d0	Data not yet on network.	NO NET DATA	d0	Furnace does not contain any shared data.	Populate shared data set using memory card.	- Turn power OFF prior to repair - Use memory card for the specific model. - Insert memory card BEFORE turning power ON. Memory card may be removed after data is loaded and power is turned off. - Error code will be cleared once data is loaded.

Symptoms of Abnormal Operation (Legacy & ComfortNet™ Thermostat)	Diagnostic/Status LED Codes	Fault Description	ComfortNet™ Thermostat Only		Possible Causes	Corrective Actions	Notes & Cautions
			Message	Code			
- Operation different than expected or no operation. - Integrated control module LED display provides d4 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	d4	Invalid memory card data.	INVALID MC DATA	d4	Shared data set on memory card has been rejected by integrated control module	Verify shared data set is correct for the specific model. Re-populate data using correct memory card if required.	- Turn power OFF prior to repair - Use memory card for the specific model. - Insert memory card BEFORE turning power ON. Memory card may be removed after data is loaded and power is turned off. - Error code will be cleared once data is loaded and power is turned off.
- Furnace fails to operate. - Integrated control module LED display provides b0 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	b0	Circulator blower motor is not running when it should be running.	MOTOR NOT RUN	b0	- Loose wiring connection at circulator motor power leads or circulator motor power leads disconnected. - Open circuit in inductor or loose wiring connection at inductor (3/4 Hp and 1 Hp models only). - Failed circulator blower motor.	- Tighten or correct wiring connection. - Verify continuous circuit through inductor. Replace if open or short circuit. - Check circulator blower motor. Replace if necessary.	- Turn power OFF prior to repair - Replace inductor with correct replacement part. - Replace circulator motor with correct replacement part.
- Furnace fails to operate. - Integrated control module LED display provides b1 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	b1	Integrated control module has lost communications with circulator blower motor.	MOTOR COMM	b1	- Loose wiring connection at circulator motor control leads. - Failed circulator blower motor. - Failed integrated control module.	- Tighten or correct wiring connection. - Check circulator blower motor. Replace if necessary. - Check integrated control module. Replace if necessary.	- Turn power OFF prior to repair - Replace circulator motor with correct replacement part. - Replace integrated control module with correct replacement part.
- Furnace fails to operate. - Integrated control module LED display provides b2 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	b2	Circulator blower motor horse power in shared data set does not match circulator blower motor horse power.	MOTOR MISMATCH	b2	- Incorrect circulator blower motor in furnace. - Incorrect shared data set in integrated control module.	- Verify circulator blower if motor horse power is the same specified for the specific furnace model. Replace if necessary. - Verify shared data set is correct for the specific model. Re-populate data using correct memory card if required.	- Turn power OFF prior to repair - Replace motor with correct replacement part. - Use memory card for the specific model - Insert memory card BEFORE turning power ON. Memory card may be removed after data is loaded and power is turned off. - Error code will be cleared once shared data and motor horse power match.
- Furnace operates at reduced performance. - Airflow delivered is less than expected. - Integrated control module LED display provides b3 error code.	b3	Circulator blower motor is operating in a power, temperature, or speed limiting condition.	MOTOR LIMITS	b3	- Blocked filters. - Restrictive ductwork. - Undersized ductwork. - High ambient temperatures.	- Check filters for blockage. Clean filters or remove obstruction. - Check ductwork for blockage. Remove obstruction. Verify all registers are fully open. - Verify ductwork is appropriately sized for system. Resize/replace ductwork if necessary. - See "III. Product Description" and "IV. Location Requirements & Considerations" furnace installation requirements.	Turn power OFF prior to repair.

TROUBLESHOOTING

Symptoms of Abnormal Operation (Legacy & ComfortNet™ Thermostat)	Diagnostic/Status LED Codes	Fault Description	ComfortNet™ Thermostat Only		Possible Causes	Corrective Actions	Notes & Cautions
			Message	Code			
- Furnace fails to operate. - Integrated control module LED display provides b4 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	b4	- Circulator blower motor senses a loss of rotor control. - Circulator blower motor senses high current.	MOTOR TRIPS	b4	- Abnormal motor loading, sudden change in speed or torque, sudden blockage of furnace air inlet or outlet. - High loading conditions, blocked filters, very restrictive ductwork, blockage of furnace air inlet or outlet.	Check filters, filter grills/registers, duct system, and furnace air inlet/outlet for blockages.	Turn power OFF prior to repair.
- Furnace fails to operate. - Integrated control module LED display provides b5 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	b5	Circulator blower motor fails to start 10 consecutive times.	MTR LCKD ROTOR	b5	- Obstruction in circulator blower housing. - Seized circulator blower motor bearings. - Failed circulator blower motor.	- Check circulator blower for obstructions. Remove and repair/replace wheel/motor if necessary. - Check circulator blower motor shaft rotation and motor. Replace motor if necessary.	- Turn power OFF prior to repair - Replace motor with correct replacement part. - Replace wheel with correct replacement part.
- Furnace fails to operate. - Integrated control module LED display provides b6 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	b6	- Circulator blower motor shuts down for over or under voltage condition. - Circulator blower motor shuts down due to over temperature condition on power module.	MOTOR VOLTS	b6	- High AC line voltage to furnace. - Low AC line voltage to furnace. - High ambient temperatures.	- Check power to furnace. Verify line voltage to furnace is within the range specified on the furnace rating plate. - See "III. Product Description" and "IV. Location Requirements & Considerations" furnace installation requirements.	Turn power OFF prior to repair.
- Furnace fails to operate. - Integrated control module LED display provides b7 error code. - ComfortNet™ thermostat "Call for Service" icon illuminated. - ComfortNet™ thermostat scrolls "Check Furnace" message.	b7	Circulator blower motor does not have enough information to operate properly. Motor fails to start 40 consecutive times.	MOTOR PARAMS	b7	- Error with integrated control module. - Motor has a locked rotor condition.	- Check integrated control module. Verify control is populated with correct shared data set. See data errors above for details. - Check for locked rotor condition (see error code above for details).	- Turn power OFF prior to repair - Replace with correct replacement part(s). - Use memory card for the specific model.
- Furnace operates at reduced performance or operates on low stage when high stage is expected. - Integrated control module LED display provides b9 error code.	b9	Airflow is lower than demanded.	LOW ID AIRFLOW	b9	- Blocked filters. - Restrictive ductwork. - Undersized ductwork.	- Check filters for blockage. Clean filters or remove obstruction. - Check ductwork for blockage. Remove obstruction. Verify all registers are fully open. - Verify ductwork is appropriately sized for system. Resize/replace ductwork if necessary.	Turn power off prior to repair.

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