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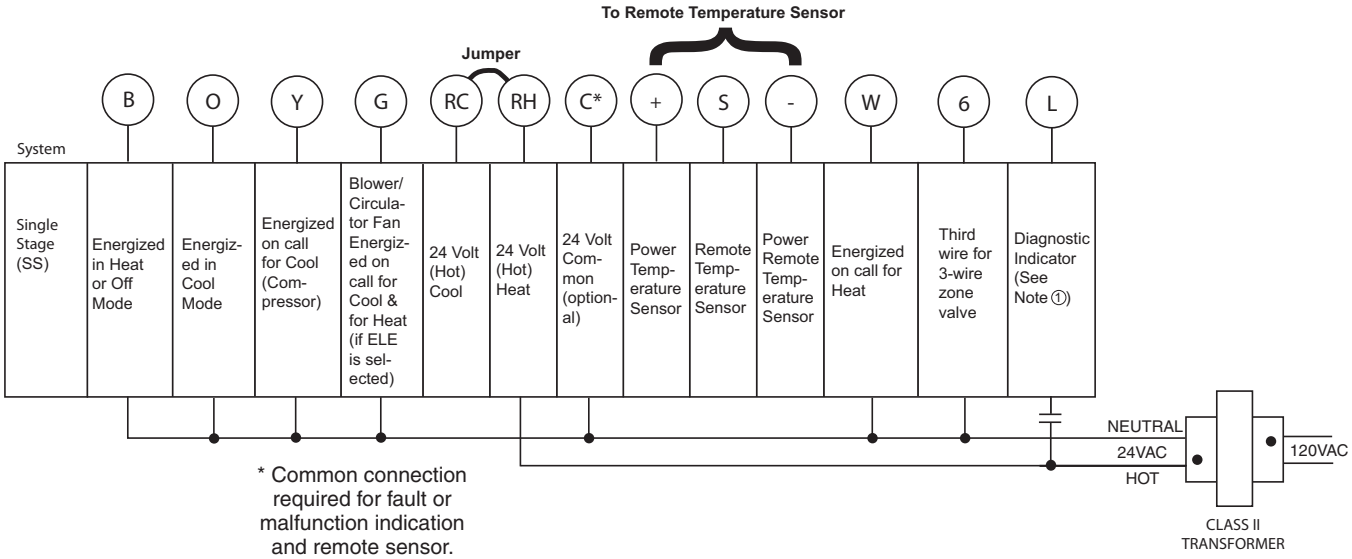
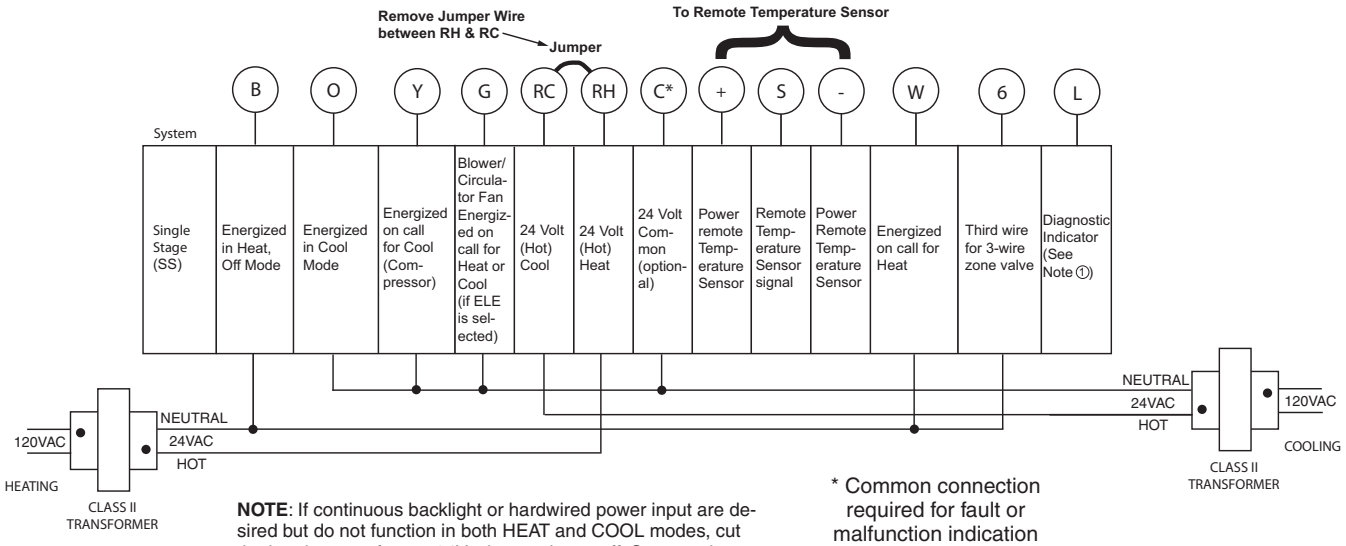
TYPICAL WIRING DIAGRAMS

Single Stage System with Single Transformer



Single Stage with Two Transformers



NOTE: If continuous backlight or hardwired power input are desired but do not function in both HEAT and COOL modes, cut the heating transformer 24V wires and tape off. Connect the neutral circuit disconnected from the heating transformer to the neutral circuit of the cooling transformer. Disconnect the wire to the RH terminal and install a jumper between RH and RC. Depending on the system requirements, replace the cooling transformer with a 75VA class II transformer if needed.

NOTE: Connection for Call for Service diagnostic indicator compatible with mechanical or electronic condenser control with Comfort Alert™.

INSTALLER/CONFIGURATION MENU

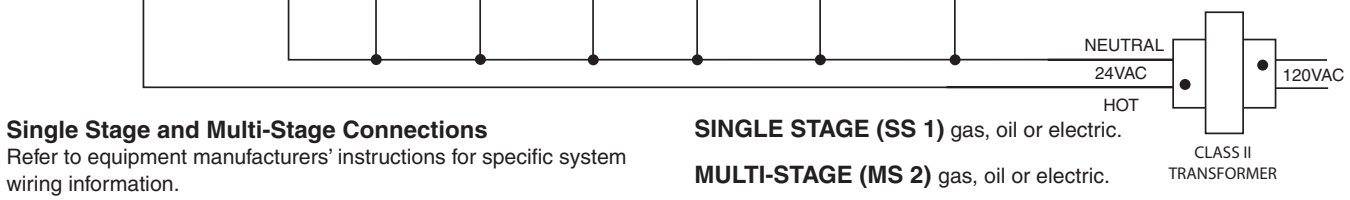
To enter the menu: Press the **Menu** touch key. Press and hold for 5 seconds the **Installer Config** touch key. This displays menu item #1 in the table below. Press ⚠ to advance to the next menu item or ▽ to return to a previous menu item. Press ▷ or ◁ to change a menu item.

CONFIGURATION MENU						
Menu Reference Number	**Program-mable**	**Non-Pro-grammable**	**Press key**	**Displayed Factory (Default)**	**Press ▷ or ◁ to select from listed options**	**COMMENTS**
1	1	1	⚠	(ELE)	GAS	GAS setting: furnace controls blower. ELE setting: thermostat controls blower.
2	2	2	⚠	(**7**) Days, **P**	**5**-1-1 or **0**	Programs per week. (0 = non-programmable)
3	3	NA	⚠	(**4**) **PS**	**2**	Program periods per day. 4 = Morning, Day, Evening, Night 2 = Day, Night
4	4	3	⚠	Cool-Off-Heat-Auto	Cool-Off-Heat, Off-Heat, Cool-Off	System switch configuration.
5	5	NA	⚠	(On) **E**	**OFF**	Selects Energy Management Recovery, E (with programming option on)
6	6	4	⚠	(FA) Heat, Cr	SL	Selects Adjustable Anticipation, cycle rate, Heat
7	7	5	⚠	(FA) Cool, Cr	SL	Selects Adjustable Anticipation, cycle rate, Cool
8	8	6	⚠	(OFF) **CL**	On	Selects Compressor Lockout.
9	9	7	⚠	(On) **dL**	OFF	Selects Continuous Display backlight & intensity.
10	10	8	⚠	(LO) **dL**	HI	Selects Backlight Intensity.
11	11	9	⚠	0 (temperature)	4, LO to 4, HI	Selects Adjustable Ambient Temperature Display [range -4 (LO) to +4 (HI)].
12	12	10	⚠	°**F**	°**C**	Selects °F/°C Display (temperature units in Fahrenheit or Celsius).
13	13	11	⚠	(On) **b**	OFF	Selects audible Beeper On/Off.
14	14	12	⚠	(On) **dS**	OFF	Selects Daylight Saving Time calculation.
15	15	13	⚠	(On) Heat, **AS**	OFF	Selects Automatic Schedule for comfort temperature Programming, heat mode.
16	16	14	⚠	(On) Cool, **AS**	OFF	Selects Automatic Schedule for comfort temperature Programming, cool mode.
17	17	15	⚠	(OFF) **CS**, Cool Savings	1-2-3-4-5-6	Selects Cool Saving Feature & amount.
18	18	16	⚠	(99) Heat, **HL**	62-98	TEMPERATURE LIMIT, HEAT (max. heat set point).
19	19	17	⚠	(45) Cool, **LL**	46-82	TEMPERATURE LIMIT, COOL (min. cool set point).
20	20	18	⚠	OFF, 🔒 **Keypad Lockout**	**L** (total), **P** (partial), **Temperature Limit** (limited temperature range)	Selects Keypad Lockout.
			⚠	000	001-999	Selects Keypad Lockout Combination (active only if keypad Lockout is selected).
21	21	19	⚠	(OFF) Remote	On	Remote temperature sensor, enable/disable.
			⚠	Remote, In	Outdoor Remote	Remote temperature sensor (Indoor/Outdoor).
			⚠	(On) LS	OFF	Local temp. Sensor enable/disable (only when Indoor Remote is selected On).
22	22	20	⚠	Change Filter (OFF)	On	Selects Change filter feature
			⚠	200 Hours	25-1975 (in increments of 25 hours)	Change filter, duration hours.

TYPICAL WIRING DIAGRAMS

Single Stage or Multi-Stage System (No Heat Pump) with Single Transformer

System	RC	RH	C	Y	Y2	W/E	W2	G	O/B	6	L
Single Stage 1 (SS1)	24 volt power for cooling	24 volt power for heating	24 volt common (optional for system operation, required for remote sensor)	Call for cool	No Output	Call for heat	No output	Blower/Circulator fan energized on a call for cool or Fan On (also energized in heating if configured for Electric Heat)	Installer Configuration Menu selects "O" or "B" for changeover function. Set to "O" terminal energized in Cool & Off mode. Set to "B" terminal energized in Heat & emergency mode	Power closed connection for SPDT 3-wire zone valve	"Call for Service" (malfunction indicator) for Heat Pumps with "L" terminal connection. Original production 1F95-1291's do not have this connection
Multi Stage 2 (MS2)				Cool mode-1st stage	Cool mode-2nd stage	Heat mode-1st stage	Heat mode-2nd stage				



Single Stage and Multi-Stage Connections
Refer to equipment manufacturers' instructions for specific system wiring information.

This thermostat is designed to operate a single-transformer or two-transformer system.

You can configure the thermostat for use with the following fossil fuel systems:

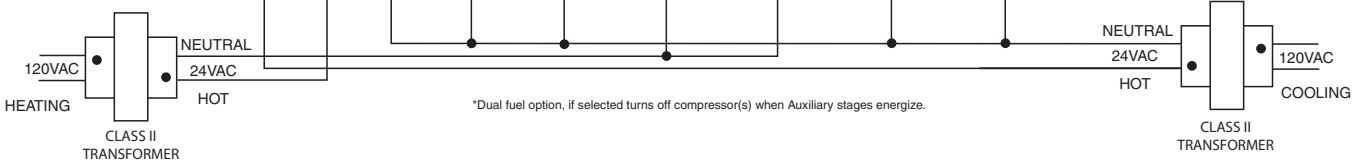
SINGLE STAGE (SS 1) gas, oil or electric.

MULTI-STAGE (MS 2) gas, oil or electric.

After wiring, see INSTALLER CONFIGURATION section for proper thermostat configuration.

Heat Pump Systems

System	RC	RH	C	Y	Y2	*W/E	*W2	G	O	6	L
Heat Pump 1 (HP1)	24 volt power for cooling	24 volt power for heating	24 volt common (optional for system operation, required for remote sensor)	Heat mode-1st stage, Cool mode-1st stage, (Compressor)	No Output	Heat mode-2nd stage, Emergency Mode-1st stage ***Note: Dual Fuel option de-energizes Heat mode stage 1 (compressor) when auxiliary heat is energized**	Heat mode-3rd stage, Emergency Mode-2nd stage ***Note: Dual Fuel option de-energizes Heat mode stage 1 (compressor) when auxiliary heat is energized**	Blower/Circulator fan energized on a call for cool or Fan On (also energized in heating if configured for Electric Heat)	Installer Configuration Menu selects "O" or "B" for changeover function. Set to "O" terminal energized in Cool mode. Set to "B" terminal energized in Heat & emergency mode	Power closed connection for SPDT 3-wire zone valve	"Call for Service" (malfunction indicator) for Heat Pumps with "L" terminal connection. Original production 1F95-1291's do not have this connection
Heat Pump 2 (HP2)					Heat mode-2nd stage, Cool mode-2nd stage, (Compressor)	Heat mode-3rd stage, Emergency Mode-1st stage ***Note: Dual Fuel option de-energizes Heat mode stages 1 and 2 (both compressors) when auxiliary heat is energized**	Heat mode-4th stage, Emergency Mode-2nd stage ***Note: Dual Fuel option de-energizes Heat mode stages 1 and 2 (both compressors) when auxiliary heat is energized**				



*Dual fuel option, if selected turns off compressor(s) when Auxiliary stages energize.

Heat Pump Connections
Refer to equipment manufacturers' instructions for specific system wiring information.

You can configure the thermostat for use with the following heat pump systems.

HEAT PUMP TYPE 1 (HP 1). Single stage compressor system; gas or electric backup.

HEAT PUMP TYPE 2 (HP 2). Multi-stage compressor or two compressor system with gas or electric backup.

After wiring, see INSTALLER CONFIGURATION section for proper thermostat configuration.

Remote Sensor Terminals

+	S	-
Supply voltage to remote temperature sensor	Remote temperature sensor signal	Supply voltage to remote temperature sensor

1F95-1280 Damper Terminal

A1
Damper or Economizer Operation (see configuration menu item 31)

1F95-1291 Humidification/De-humidification Terminals

HM	DHM
Humidification Terminal, Energizes on call for heat if Humidity setpoint is above room humidity. Can also be used to provide humidification independent of a call for heat and/or in cooling mode if Automatic Humidification is selected in Configuration Menu item #34	De-energizes on call for Dehumidification to lower the fan speed. The DHM terminal is only used on systems with a compatible dehumidification feature that have the required terminal connection on the contol module or have a relay installed to lower the fan speed

INSTALLER/CONFIGURATION MENU

To enter the menu: Press the **Menu** touch key. Press and hold for 5 seconds the **Installer Config** touch key. This displays menu item #1 in the table below. Press ⚠ to advance to the next menu item or ▽ to return to a previous menu item. Press ▷ or ◁ to change a menu item option.

CONFIGURATION MENU						
Menu Reference Number	**Program-mable**	**Non-Program-mable**	**Press key**	**Displayed Factory (Default)**	**Press ▷ or ◁ to select from listed options**	**COMMENTS**
1	1	1		MS 2	HP 1, HP 2, SS 1	Selects Multi-Stage (MS2, No Heat Pump), Heat Pump 1 (HP1, 1 compressor), Heat Pump 2 (HP2, 2 compressor or 2 speed compressor), or Single Stage.
2	2	2	⚠	GAS	(ELE)	GAS setting: furnace controls blower. ELE setting: thermostat controls blower.
3	3	3	⚠	OB (O)	b	Selects Reversing Valve (This item is only to appear if HP1 or HP2 is selected above.)
4	4	3	⚠	**(7)** Days, **P**	**5** or **0**	Programs per week. (5=5-1-1 or 0 = non-programmable)
5	5	4	⚠	Cool-Off-Heat-Auto	Cool-Off-Heat, Heat Off, Heat, Coof-Off, Auto Off	System switch configuration in non heat pump mode.
			⚠	Cool-Off-Heat-Em-Auto	Cool-Off-Heat-Em, Off-Emer-Auto	System switch configuration, heat pump mode.
6	6	NA	⚠	(On) **E**	**OFF**	Selects Energy Management Recovery, E (with programming option on)
7	7	5	⚠	(FA) Heat, Cr	SL	Selects Adjustable Anticipation, cycle rate, Heat
8	8	6	⚠	(FA) Cool, Cr	SL	Selects Adjustable Anticipation, cycle rate, Cool
9	9	7	⚠	Cr/AU, Em (FA)	SL	Selects Adjustable Anticipation, cycle rate auxiliary, (This item is only to appear if HP1 or HP2 is selected above).
10	10	8	⚠	(OFF) **CL**	On	Selects Compressor Lockout.
11	11	9	⚠	(On) **dL**	OFF	Selects Continuous Display backlight.
12	12	10	⚠	(LO) **dL**	HI	Selects Backlight Intensity.
13	13	11	⚠	0 (Temperature)	5, LO to 5, HI	Selects Adjustable Ambient Temperature Display [range -5 (LO) to +5 (HI)].
14	14	12	⚠	**°F**	**°C**	Selects °F/°C Display (temperature units in Fahrenheit or Celsius).
15	15	13	⚠	(On) **b**	OFF	Selects audible Beeper On/Off.
16	16	14	⚠	(On) **dS**	OFF	Selects Daylight Saving Time calculation.
17	17	15	⚠	(On) Heat, **AS**	OFF	Selects Automatic Schedule for comfort temperature Programming, heat mode.
18	18	16	⚠	(On) Cool, **AS**	OFF	Selects Automatic Schedule for comfort temperature Programming, cool mode.
19	19	17	⚠	(OFF) **CS**	On	Selects Cool Savings Feature On of Off.
				(3) Cool Savings, **CS**	1-2-3-4-5-6	Selects amount of Cool Savings adjustment.
20	20	18	⚠	(OFF) CO	On	Select Compressor Optimization (not available on earlier models)
21	21	19	⚠	(99) Heat, **HL**	62-98	TEMPERATURE LIMIT, HEAT (max. heat set point).
22	22	20	⚠	(45) Cool, **LL**	46-82	TEMPERATURE LIMIT, COOL (min. cool set point).
23	23	21	⚠	OFF, 🔒 **Keypad Lockout**	**L** (total), **P** (partial), **Temperature Limit** (limited temperature range)	Selects Keypad Lockout.
			⚠	000	001-999	Selects Keypad Lockout Combination (active only if keypad Lockout is selected).
24	24	22	⚠	(On) Heat, FS	OFF	Fast second stage of heat (not available if SS1 is selected above).
25	25	23	⚠	(On) Cool, FS	OFF	Fast second stage of cool (not available if SS1 or HP1 is selectedabove).
26	26	24	⚠	Remote (OFF)	On	Remote temperature sensor, enable/disable.
			⚠	Remote, In	Outdoor Remote	Remote temperature sensor (Indoor/Outdoor).
			⚠	(On) LS	OFF	Local temp. Sensor enable/disable (only when Indoor Remote is selected On).
27	27	25	⚠	(OFF) dF	On	Selects Dual Fuel feature using software logic On or OFF (This item appears if HP1 or HP2 is selected above and no outdoor sensor.
			⚠	(05) dF	0-09	Selects Dual Fuel setpoint (°F) with no outdoor sensor.
			⚠	(60) Cd	0-99	Selects compressor delay in seconds.

1F95-1280 INSTALLER/CONFIGURATION MENU (cont.)

CONFIGURATION MENU						
Menu Reference Number	**Program-mable**	**Non-Program-mable**	**Press key**	**Displayed Factory (Default)**	**Press ▷ or ◁ to select from listed options**	**COMMENTS**
28 (cont.)	28 (cont.)	26 (cont.)	⚠	(OFF) dF	On	Selects Dual Fuel feature using outdoor sensor On or OFF (This item appears if HP1 or HP2 is selected and outdoor sensor is installed and enabled.
28	28	26	⚠	(35) dF	5-50	Selects Dual Fuel setpoint (°F) with outdoor sensor available.
			⚠	(60) Cd	0-99	Selects compressor delay in seconds.
29	29	27	⚠	(80) AO	35-74	Selects Auxiliary Heat cut out temperature. This item appears if HP1 or HP2 is selected and outdoor sensor is installed and enabled.
30	30	28	⚠	(80) bP	79-20	Not used
31	31	NA	⚠	(o) PP	1, 2, 3	Select Pre-occupancy purge.
32	32	NA	⚠	(OFF) EC	ON	Select Economizer or Damper Operation (default)
33	33	29	⚠	(OFF) Change UV Lamp	On	Selects Change UV Lamp feature.
			⚠	350 Days	25-1975	Change UV Lamp duration days.
34	34	30	⚠	OFF Change Filter	On	Selects Change Filter feature.
			⚠	200 Hrs	25-1975	Change Filter duration hours.

1F95-1291 INSTALLER/CONFIGURATION MENU

To enter the menu: Press the **Menu** touch key. Press and hold for 5 seconds the **Installer Config** touch key. This displays menu item #1 in the table below. Press ⚠ to advance to the next menu item or ▽ to return to a previous menu item. Press ▷ or ◁ to change a menu item option.

CONFIGURATION MENU						
Menu Reference Number	**Program-mable**	**Non-Program-mable**	**Press key**	**Displayed Factory (Default)**	**Press ▷ or ◁ to select from listed options**	**COMMENTS**
1	1	1		MS 2	HP 1, HP 2, SS 1	Selects Multi-Stage (MS2, No Heat Pump), Heat Pump 1 (HP1, 1 compressor), Heat Pump 2 (HP2, 2 compressor or 2 speed compressor), or Single Stage.
2	2	2	⚠	GAS	(ELE)	GAS setting: furnace controls blower. ELE setting: thermostat controls blower.
3	3	3	⚠	ob (O)	b	Selects Reversing Valve (This item is only to appear if HP1 or HP2 is selected above.)
4	4	3	⚠	**(7)** Days, **P**	**5** or **0**	Programs per week. (5=5-1-1 or 0 = non-programmable)
5	5	NA	⚠	**(4) PS**	**2**	Programs per day. 4 = Morning, Day, Evening, Night 2 = Day, Night
6	6	4	⚠	Cool-Off-Heat-Auto	Cool-Off-Heat, Heat Off, Heat, Cool-Off, Auto Off	System switch configuration in non heat pump mode.
			⚠	Cool-Off-Heat-Em-Auto	Cool-Off-Heat-Em, Off-Em-Auto	System switch configuration, heat pump mode.
7	7	NA	⚠	(On) **E**	**OFF**	Selects Energy Management Recovery, E (with programming option on)
8	8	5	⚠	(FA) Heat, Cr	SL	Selects Adjustable Anticipation, cycle rate, Heat
9	9	6	⚠	(FA) Cool, Cr	SL	Selects Adjustable Anticipation, cycle rate, Cool
10	10	7	⚠	Cr/AU, Em (FA)	SL	Selects Adjustable Anticipation, cycle rate auxiliary, (This item is only to appear if HP1 or HP2 is selected above).
11	11	8	⚠	(OFF) **CL**	On	Selects Compressor Lockout.
12	12	9	⚠	(On) **dL**	OFF	Selects Continuous Display backlight.
13	13	10	⚠	(LO) **dL**	HI	Selects Backlight Intensity.
14	14	11	⚠	0 (temperature)	5, LO to 5, HI	Selects Adjustable Ambient Temperature Display [range -5 (LO) to +5 (HI)].
15	15	12	⚠	**°F** (temperature)	**°C**	Selects °F/°C Display (temperature units in Fahrenheit or Celsius).
16	16	13	⚠	(On) **b**	OFF	Selects audible Beeper On/Off.

1F95-1291 INSTALLER/CONFIGURATION MENU (cont.)

CONFIGURATION MENU						
Menu Reference Number	**Program-mable**	**Non-Program-mable**	**Press key**	**Displayed Factory (Default)**	**Press ▷ or ◁ to select from listed options**	**COMMENTS**
17	17	14	⚠	(On) **dS**	OFF	Selects Daylight Saving Time calculation.
18	18	15	⚠	(Off) Heat, **AS**	On	Selects Automatic Schedule for comfort temperature Programming, heat mode.
19	19	16	⚠	(On) Cool, **AS**	OFF	Selects Automatic Schedule for comfort temperature Programming, cool mode.
20	20	17	⚠	(OFF) **CS**	On	Selects Cool Savings Feature On of Off.
				CS Cool Savings (3)	1-2-3-4-5-6	Selects amount of Cool Savings adjustment.
21	21	18	⚠	(Off) **CO**	On	Select Compressor Optimization (not available on earlier models)
22	22	19	⚠	(99) Heat, **HL**	62-98	TEMPERATURE LIMIT, HEAT (max. heat set point).
23	23	20	⚠	(45) Cool, **LL**	46-82	TEMPERATURE LIMIT, COOL (min. cool set point).
24	24	21	⚠	OFF, 🔒 **Keypad Lockout**	**L** (total), **P** (partial), **Temperature Limit** (limited temperature range)	Selects Keypad Lockout.
			⚠	000	001-999	Selects Keypad Lockout Combination (active only if keypad Lockout is selected).
25	25	22	⚠	(On) Heat, FS	OFF	Fast second stage of heat (not available if SS1 is selected above).
26	26	23	⚠	(On) Cool, FS	OFF	Fast second stage of cool (not available if SS1 or HP1 is selected above).
27	27	24	⚠	Remote (OFF)	On	Remote temperature sensor, enable/disable.
			⚠	Remote, In	Outdoor Remote	Remote temperature sensor (Indoor/Outdoor).
			⚠	(On) LS	OFF	Local temp. Sensor enable/disable (only when Indoor Remote is selected On).
28	28	25	⚠	(OFF) dF	On	Selects Dual Fuel feature using software logic On or OFF (This item appears if HP1 or HP2 is selected above and no outdoor sensor.
			⚠	(05) dF	0-09	Selects Dual Fuel setpoint (°F) with no outdoor sensor.
			⚠	(60) Cd	0-99	Selects compressor delay in seconds.
29	29	26	⚠	(OFF) dF	On	Selects Dual Fuel feature using outdoor sensor On or OFF (This item appears if HP1 or HP2 is selected and outdoor sensor is installed and enabled.
			⚠	dF (35)	5-50	Selects Dual Fuel setpoint (°F) with outdoor sensor available.
			⚠	Cd (60)	0-99	Selects compressor delay in seconds.
30	30	27	⚠	AO (80)	35-74	Selects Auxiliary Heat cut out temperature. This item appears if HP1 or HP2 is selected and outdoor sensor is installed and enabled.
31	31	28	⚠	bP (80)	79-20	Selects Blower balance point. Selection of 80 disables this feature. This item appears if HP1 or HP2 is selected and outdoor sensor is installed and enabled.
32	32	29	⚠	Hd (OFF)	On	Selects Humidity Display alternate with time.
33	33	30	⚠	Humidity H1, OD	-20-20-18	Selects Humidity Display adjustment.
34	34	31	⚠	HR (OFF)	LO, HI	Selects Auto Humidity reduction.
35	35	32	⚠	AH (OFF)	H, C, A	Selects Automatic Humidification.
36	36	33	⚠	CH (OFF)	On	Selects Cycle Humidifier.
37	37	34	⚠	OC (o)	od, OFF	Selects Optimum Comfort or Optimum Dehumidification.
38	38	35	⚠	Change UV Lamp (OFF)	On	Selects Change UV Lamp feature.
			⚠	350 Days	25-1975	Change UV Lamp duration days.
39	39	36	⚠	Change Pad (OFF)	On	Selects Change Humidifier Pad feature.
			⚠	1000 Hrs	25-1975	Change Humidifier Pad duration hours.
40	40	37	⚠	OFF Change Filter	On	Selects Change Filter feature.
			⚠	200 Hrs	25-1975	Change Filter duration hours.

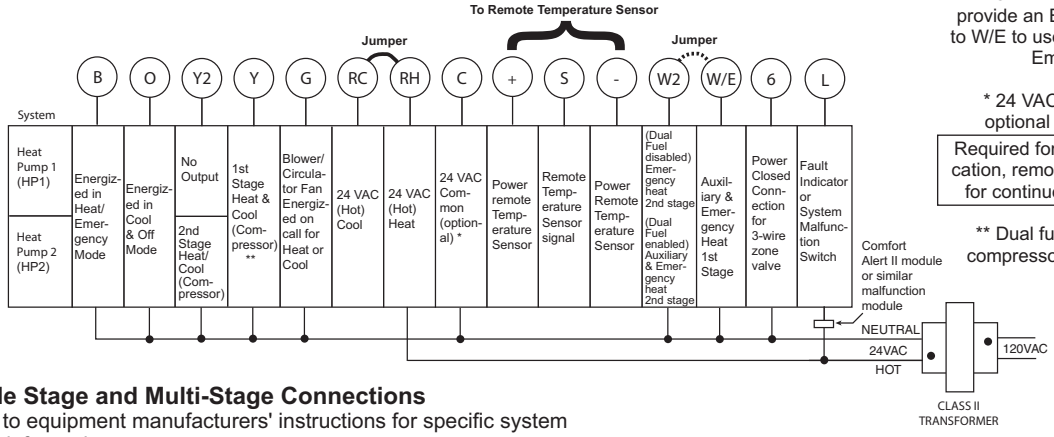
TYPICAL WIRING DIAGRAMS

Heat Pump Connections

If you do not have a heat pump system, refer to figures 2 & 3. Refer to equipment manufacturers' instructions for specific system wiring information.
You can configure the thermostat for use with the following heat pump systems.

HEAT PUMP TYPE 1 (HP 1). Single stage compressor system; gas or electric backup.
HEAT PUMP TYPE 2 (HP 2). Multi-stage compressor or two compressor system with gas or electric backup.
After wiring, see INSTALLER CONFIGURATION section for proper thermostat configuration.

Heat Pump Systems



NOTE: If your system does not provide an E connection, jumper W2 to W/E to use the Auxiliary Heat in the Emergency Mode.

* 24 VAC common connection optional for system operation.

Required for fault or malfunction indication, remote temperature sensor, or for continuous backlight operation.

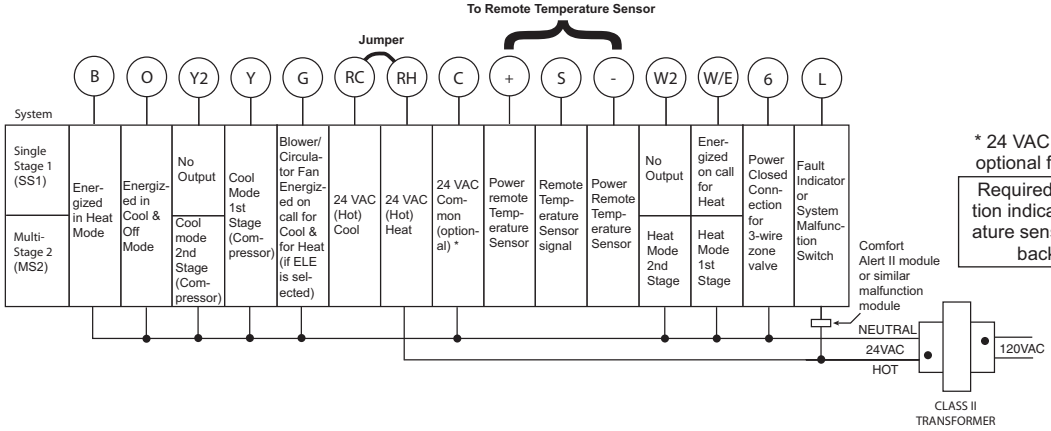
** Dual fuel option de-energizes compressor when auxiliary heat is energized.

Single Stage and Multi-Stage Connections

Refer to equipment manufacturers' instructions for specific system wiring information.
This thermostat is designed to operate a single-transformer or two-transformer system.
You can configure the thermostat for use with the following fossil fuel systems:

SINGLE STAGE (SS 1) gas, oil or electric.
MULTI-STAGE (MS 2) gas, oil or electric.
After wiring, see INSTALLER CONFIGURATION section for proper thermostat configuration.

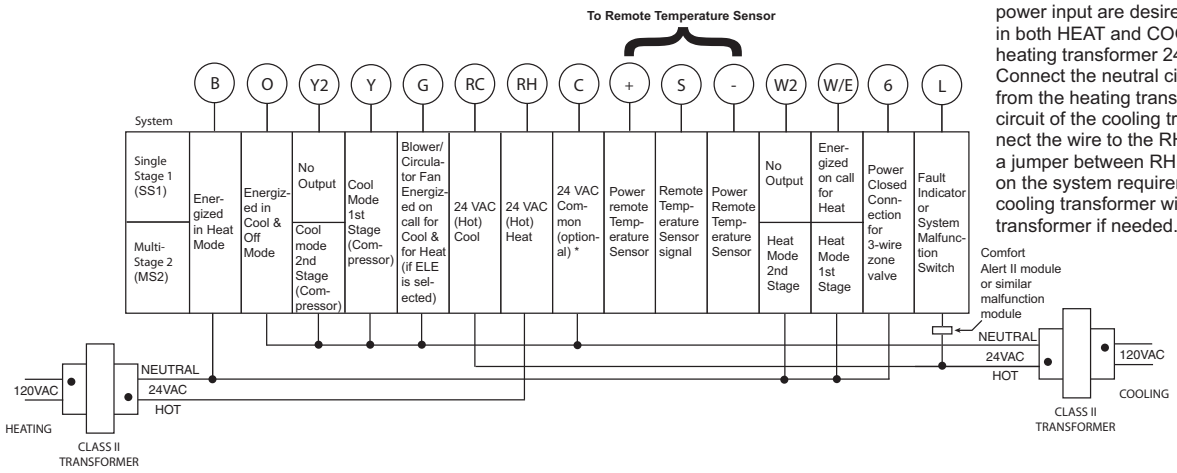
Single Stage or Multi-Stage System (No Heat Pump) with Single Transformer



* 24 VAC common connection optional for system operation.

Required for fault or malfunction indication, remote temperature sensor, or for continuous backlight operation.

Single Stage or Multi-Stage System (No Heat Pump) with Two Transformers



NOTE: If continuous backlight or hardwired power input are desired but do not function in both HEAT and COOL modes, cut the heating transformer 24V wires and tape off. Connect the neutral circuit disconnected from the heating transformer to the neutral circuit of the cooling transformer. Disconnect the wire to the RH terminal and install a jumper between RH and RC. Depending on the system requirements, replace the cooling transformer with a 75VA class II transformer if needed.

INSTALLER/CONFIGURATION MENU

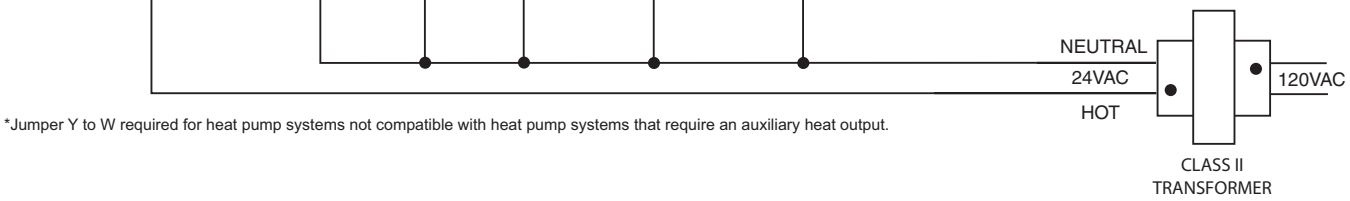
To enter the menu: Press the **Menu** touch key. Press and hold for 5 seconds the **Installer Config** touch key. This displays menu item #1 in the table below. Press ⚠ to advance to the next menu item or ▽ to return to a previous menu item. Press ▷ or ◁ to change a menu item option.

CONFIGURATION MENU						
Menu Reference Number	**Program-mable**	**Non-Program-mable**	**Press key**	**Displayed Factory (Default)**	**Press ▷ or ◁ to select from listed options**	**COMMENTS**
1	1	1		MS 2	HP 1, HP 2, SS 1	Selects Multi-Stage (MS2, No Heat Pump), Heat Pump 1 (HP1, 1 compressor), Heat Pump 2 (HP2, 2 compressor or 2 speed compressor), or Single Stage.
2	2	2	⚠	(ELE)	GAS	GAS setting: furnace controls blower. ELE setting: thermostat controls blower.
3	3	3	⚠	**(7)** Days, **P**	**5-1-1** or **0**	Programs per week. (0 = non-programmable)
4	4	NA	⚠	(4) **PS**	**2**	Programs periods per day. 4 = Morning, Day, Evening, Night 2 = Day, Night
5	5	4	⚠	Cool-Off-Heat-Auto	Cool-Off-Heat, Heat Off, Cool	System switch configuration in non heat pump mode.
			⚠	Cool-Off-Heat-Emer-Auto	Cool-Off-Heat-Emer, Off-Heat-Emer, Cool-Off	System switch configuration, heat pump mode.
6	6	NA	⚠	(On) **E**	**OFF**	Selects Energy Management Recovery, E (with programming option on)
7	7	5	⚠	(FA) Heat, Cr	SL	Selects Adjustable Anticipation, cycle rate, Heat
8	8	6	⚠	(FA) Cool, Cr	SL	Selects Adjustable Anticipation, cycle rate, Cool
9	9	7	⚠	(FA) Em, Cr/AU	SL	Selects Adjustable Anticipation, cycle rate auxiliary, (This item is only to appear if HP1 or HP2 is selected above).
10	10	8	⚠	(OFF) **CL**	On	Selects Compressor Lockout.
11	11	9	⚠	(On) **dL**	OFF	Selects Continuous Display backlight and intensity.
12	12	10	⚠	(LO) **dL**	HI	Selects Backlight Intensity.
13	13	11	⚠	0 (temperature)	4, LO to 4, HI	Selects Adjustable Ambient Temperature Display [range -4 (LO) to +4 (HI)].
14	14	12	⚠	**°F**	**°C**	Selects °F/°C Display (temperature units in Fahrenheit or Celsius).
15	15	13	⚠	(On) **b**	OFF	Selects audible Beeper On/Off.
16	16	14	⚠	(On) **dS**	OFF	Selects Daylight Saving Time calculation.
17	17	15	⚠	(On) Heat, **AS**	OFF	Selects Automatic Schedule for comfort temperature Programming, heat mode.
18	18	16	⚠	(On) Cool, **AS**	OFF	Selects Automatic Schedule for comfort temperature Programming, cool mode.
19	19	17	⚠	(OFF) **CS**, Cool Savings	1-2-3-4-5-6	Selects Cool Saving Feature and amount.
20	20	18	⚠	(99) Heat, **HL**	62-98	TEMPERATURE LIMIT, HEAT (max. heat set point).
21	21	19	⚠	(45) Cool, **LL**	46-82	TEMPERATURE LIMIT, COOL (min. cool set point).
22	22	20	⚠	OFF, 🔒 **Keypad Lockout**	**L** (total), **P** (partial), **Temperature Limit** (limited temperature range)	Selects Keypad Lockout.
			⚠	000	001-999	Selects Keypad Lockout Combination (active only if keypad Lockout is selected).
23	23	21	⚠	(On) Heat, FS	OFF	Fast second stage of heat (not available if SS1 is selected above).
24	24	22	⚠	(On) Cool, FS	OFF	Fast second stage of cool (not available if SS1 or HP1 is selected above).
25	25	23	⚠	Remote (OFF)	On	Remote temperature sensor, enable/disable.
			⚠	Remote, In	Outdoor Remote	Remote temperature sensor (Indoor/Outdoor).
			⚠	(On) LS	OFF	Local temp. Sensor enable/disable (only when Indoor Remote is selected On).
26	26	24	⚠	(05) dF	5-50	Selects Dual Fuel Feature and set point (in Fahrenheit) (applicable only when HP1 or HP2 is selected).
			⚠	(60) Cd	0-99	Selects Compressor delay in seconds (only when **dF** is selected >5).
27	27	25	⚠	(OFF) Change Filter	On	Selects Change filter feature.
			⚠	200 Hours	25-1975 (in increments of 25 hours)	Change filter, duration hours.

TYPICAL WIRING DIAGRAMS

Single Stage or Heat Pump with no Auxiliary Heat with Single Transformer

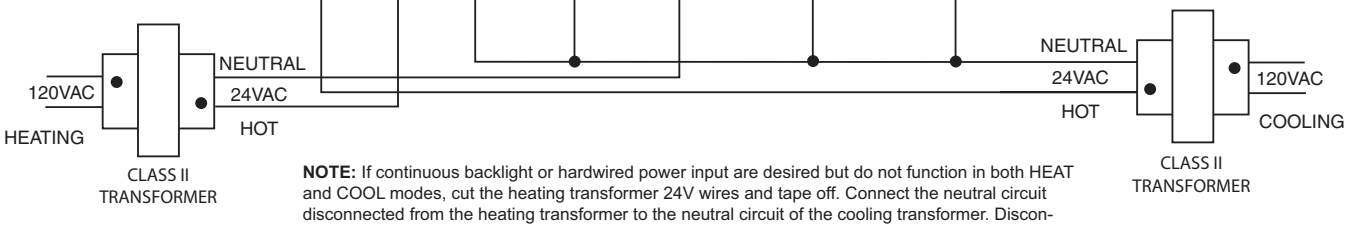
System	RC	RH	C	Y*	W*	G	O/B	6	L
Single Stage	24 volt power for cooling	24 volt power for heating	24 volt common (optional for system operation, required for remote sensor and system status indicator)	Call for cool	Call for heat	Blower/Circulator fan energized on a call for cool or Fan On (also energized in heating if configured for Electric Heat)	Installer Configuration Menu selects "O" or "B" for changeover function. Set to "O" terminal energized in Cool & Off mode. Set to "B" terminal energized in Heat	Power closed connection for SPDT 3-wire zone valve	System status Indicator for sytems with "L" terminal connection



*Jumper Y to W required for heat pump systems not compatible with heat pump systems that require an auxiliary heat output.

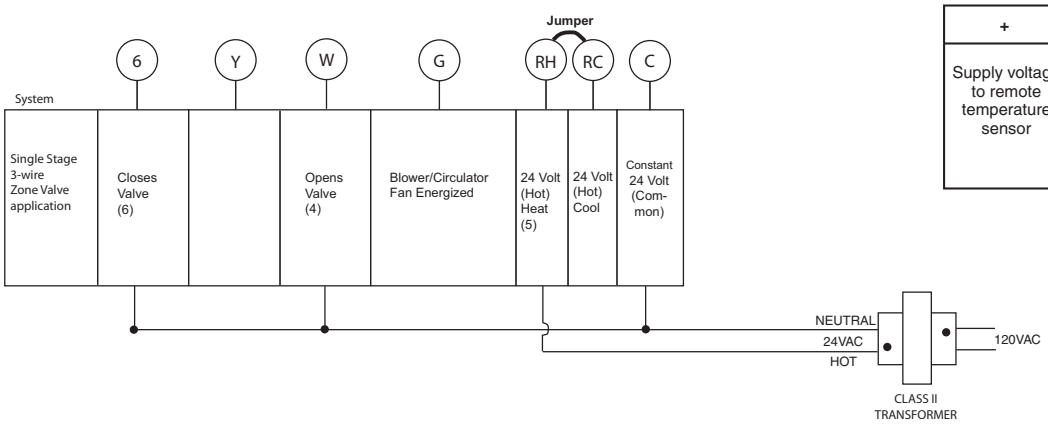
Single Stage System (No Heat Pump) with Two Transformers

System	RC	RH	C	Y	W	G	O	6	L
Single Stage	24 volt power for cooling	24 volt power for heating	24 volt common (optional for system operation, required for remote sensor)	Heat mode-1st stage, Cool mode-1st stage, (Compressor)	Call for heat	Blower/Circulator fan energized on a call for cool or Fan On (also energized in heating if configured for Electric Heat)	Installer Configuration Menu selects "O" or "B" for changeover function. Set to "O" terminal energized in Cool & Off mode. Set to "B" terminal energized in Heat	Power closed connection for SPDT 3-wire zone valve	System status Indicator for sytems with "L" terminal connection



NOTE: If continuous backlight or hardwired power input are desired but do not function in both HEAT and COOL modes, cut the heating transformer 24V wires and tape off. Connect the neutral circuit disconnected from the heating transformer to the neutral circuit of the cooling transformer. Disconnect the wire to the RH terminal and install a jumper between RH and RC. Depending on the system requirements, replace the cooling transformer with a 75VA class II transformer if needed.

3-Wire (SPDT) Heat Only Zone Valve Wiring



Remote Sensor Terminals

+	S	-
Supply voltage to remote temperature sensor	Remote temperature sensor signal	Supply voltage to remote temperature sensor

TECHNICAL HELP

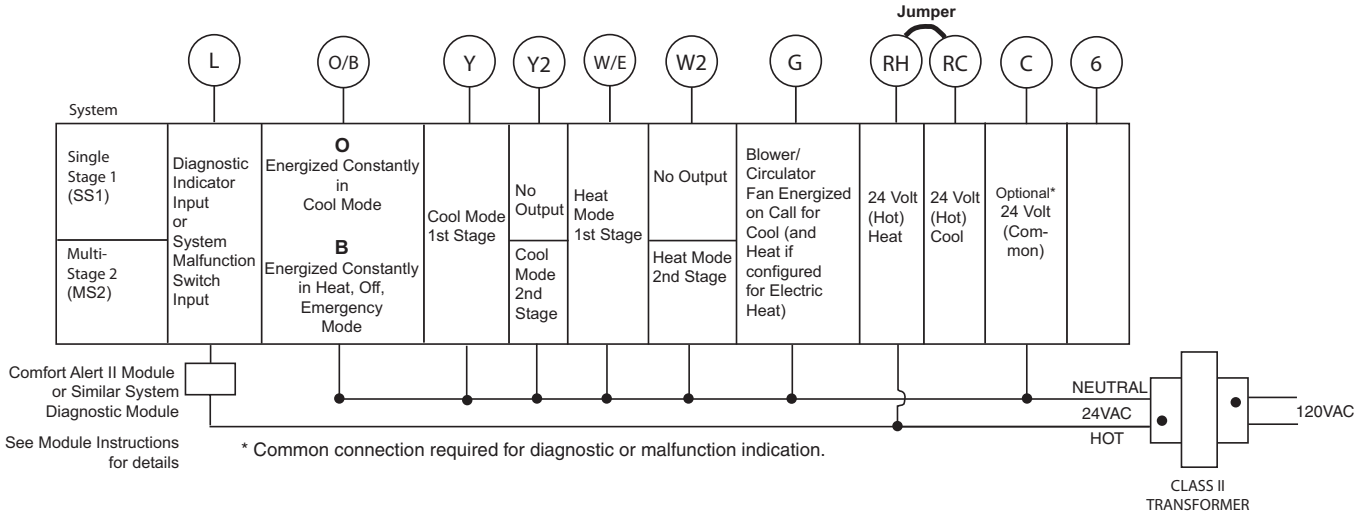
INSTALLER/CONFIGURATION MENU

Press and hold the Menu button for at least 5 seconds. The display will show item #1 in the table below. Press Menu to advance to the next menu item. Press ⌃ or ⌄ to change a menu item options.

CONFIGURATION MENU				
Menu Ref.	**Press Button**	**Displayed Factory (Default)**	**Press ⌃ or ⌄ to select from listed options**	**COMMENTS**
1	MENU	(GAS)	ELE	GAS setting: furnace controls the blower ELE setting: thermostat controls the blower
2	MENU	(3) CS	0, 1, 2, 4, 5, 6	Selects Cool Savings Value 1 (low) to 6 (high), Value 0 disables feature
3	MENU	(On) E	OFF	Selects Energy Management Recovery (EMR) On or OFF.
4	MENU	(ME) CR Heat	SL, FA	Adjustable Anticipation: Selects heating cycle rate for MS or SS in #1 only
5	MENU	(ME) CR Cool	SL, FA	Adjustable Anticipation: Selects the cycle rate for cooling
6	MENU	(OFF) CL	CL On	Compressor Lockout Time
7	MENU	Cool Off, Heat Auto	Heat Auto Cool Off, Heat Off with Fan icon, Heat Off without Fan icon Cool Off, Auto Off	System Mode Configuration with Automatic Changeover capability
8	MENU	(On) dL	dL OFF	Selects Display Light On or OFF
9	MENU	0 (current temperature)	1 HI, 2 HI, 3HI, 4 HI, 1 LO, 2 LO, 3 LO, 4 LO	Adjustable Ambient Temperature Display
10	MENU	°F	°C	Selects Fahrenheit/Celsius Temperature Display
11	MENU	(On) b	OFF	May select Beeper OFF to stop audible key feedback
12	MENU	(7) P	3, 0	Defaults 7-day programming (P7) but non-programmable (0) or 5/1/1 programming (P3) is available on most models.
13	MENU	(4) PS	2	Selects Program periods per day: 4 = Morn, Day, Eve, Night 2 = Day, Night
14	MENU	(On) Heat AS	OFF	Automatic Schedule for heat mode
15	MENU	(On) Cool AS	OFF	Automatic Schedule for cool mode
16	MENU	Remote (OFF)	On	Selects Remote Sensor On/OFF
	MENU	Remote (In)	Outdoor	Selects Remote Sensor to outdoor NA is Remote Sensor OFF
	MENU	Indoor (On) Loc	OFF	Selects Local Sensor (in thermostat) to OFF. N/A if Remote is selected to Outdoor
17	MENU	(On) dS	Off	Selects Automatic Daylight Saving Time option
18	MENU	(OFF) Keypad Lockout	L, P, Limit	Selects one of 3 Keypad Lockout configurations L - Total Keypad Lockout P - Partial Keypad Lockout (Up and Keys still work) Limit - Limited Temperature RANGE
	MENU	(000) Keypad Lockout	1-999	Selects personal lockout code. 000 is NOT A VALID CODE.
19	MENU	(99) HL Heat	L 62 to L 98	Selects Limited HEAT Range Temperature
20	MENU	(45) Ll Cool	L 46 to L 82	Selects Limited COOL Range Temperature
21	MENU	(OFF) Change Filter	On	Selects Filter Change-Out Indicator On or OFF
	MENU	Change Filter (200 h)	25-1975 h	Change Filter time in 25 hour increments. This menu only appears if On is selected in above.
22	MENU	(OFF) Change UV Lamp	On	Selects UV Lamp Timer: On/OFF
	MENU	(350) Change UV Lamp	25-1975	Selects number of Days between changing UV Lamp.
23	MENU	(o) On Cool	Heat On (b)	Selects operation of the reversing valve terminal (O/B) output as an O or B terminal
24	MENU			Returns to Normal Operation

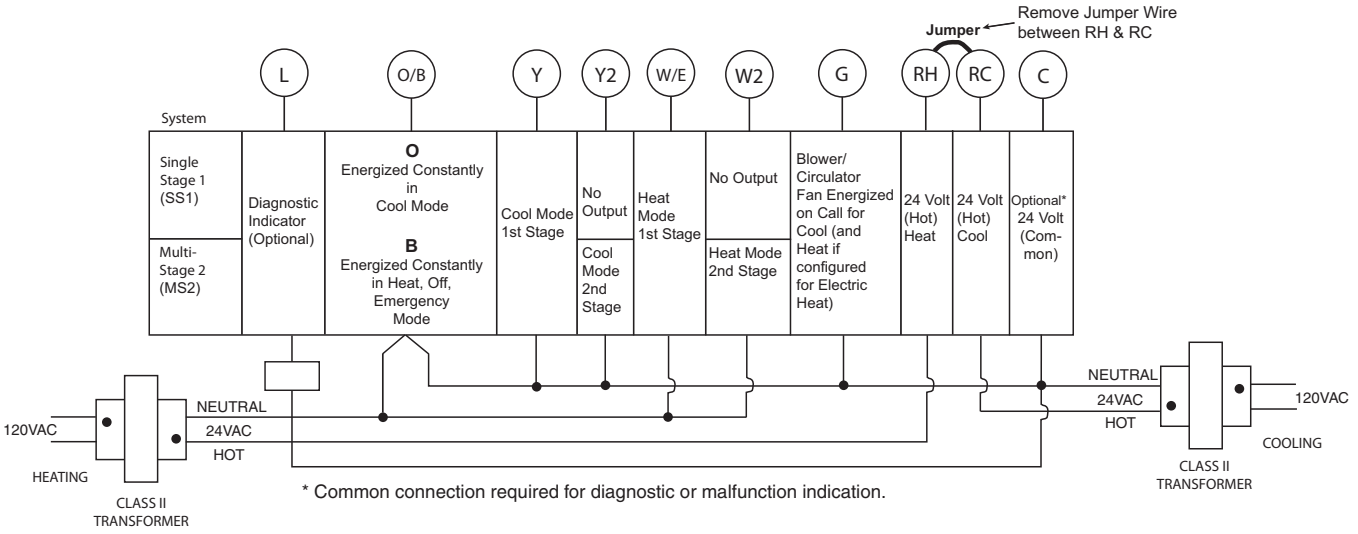
TYPICAL WIRING DIAGRAMS

Single Stage or Multi-Stage System (No Heat Pump) with Single Transformer



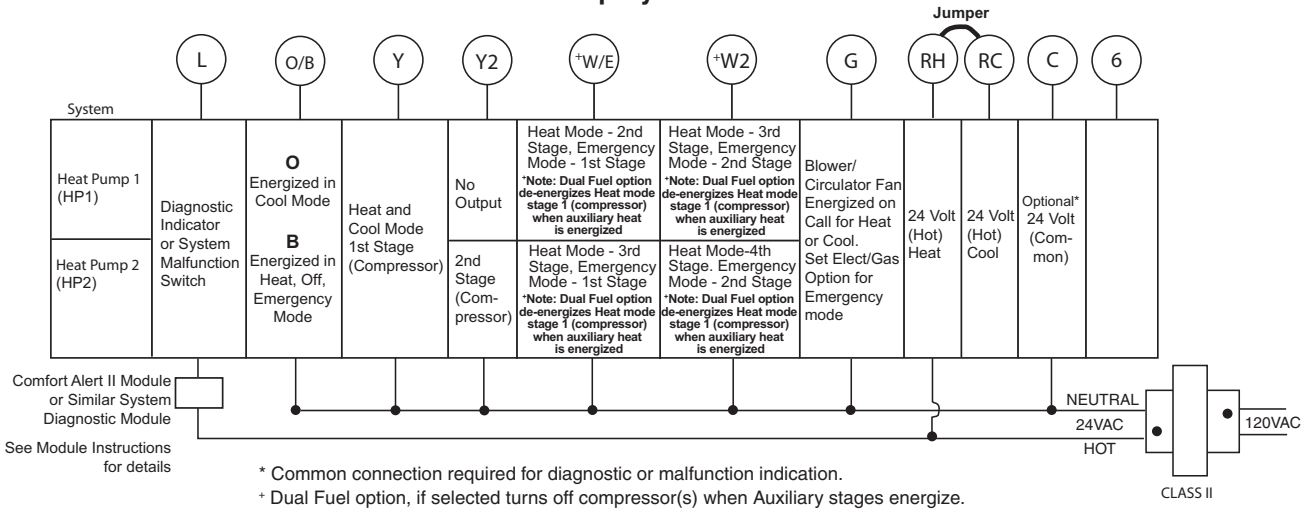
* Common connection required for diagnostic or malfunction indication.

Single Stage or Multi-Stage System (No Heat Pump) with Two Transformers



* Common connection required for diagnostic or malfunction indication.

Heat Pump Systems

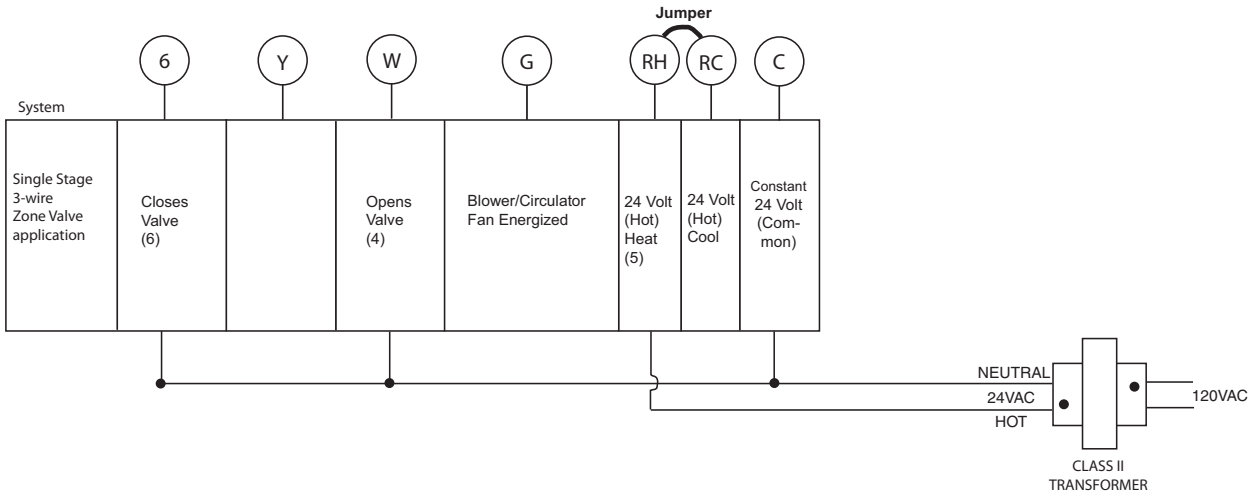


* Common connection required for diagnostic or malfunction indication.

\+ Dual Fuel option, if selected turns off compressor(s) when Auxiliary stages energize.

TECHNICAL HELP

3-Wire (SPDT) Heat Only Zone Valve Wiring



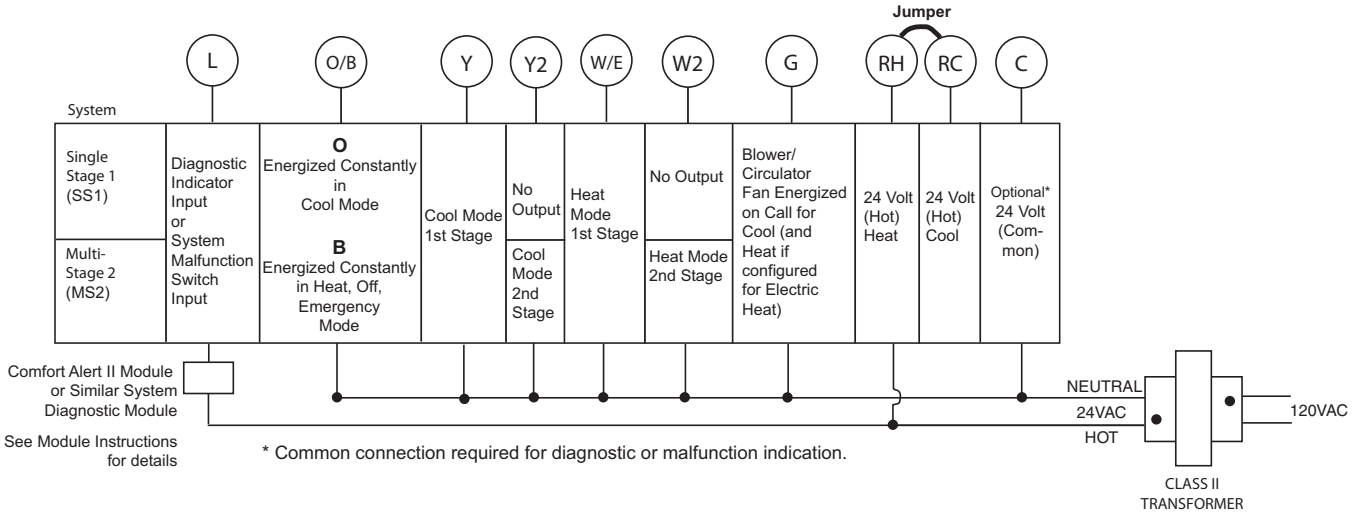
INSTALLER/CONFIGURATION MENU

With Heat or A/C selected, press and hold the Menu button for at least 5 seconds. The display will show item #1 in the table below. Press Menu to advance to the next menu item. Press ⌃ or ⌄ to change a menu item options.

CONFIGURATION MENU						
Menu Ref.	**HP**	**SS**	**PRESS BUTTON**	**Displayed Factory (Default)**	**Press ⌃ or ⌄ to select from listed options**	**COMMENTS**
1	1	1	MENU	(MS 2)	HP 1, HP 2, SS 1	Selects Multi-Stage (MS 2 No Heat Pump), Heat Pump 1 (HP 1, 1 compressor), Heat Pump 2 (HP 2, 2 compressor or 2 speed compressor), or Single Stage (SS 1)
2	2	2	MENU	(GAS) for SS or MS	ELE	GAS setting: furnace controls the blower ELE setting: thermostat controls the blower
3	3	3	MENU	(On) E	OFF	Selects Energy Management Recovery (EMR) On or OFF. (Not available in -non-programmable mode)
4	–	4	MENU	(ME) CR Heat	SL, FA	Selects Adjustable Anticipation, cycle rate, Heat (This item only appears when MS 2 or SS 1 is selected above)
5	4	–	MENU	(ME) CR Heat A/C	SL, FA	Selects Adjustable Compressor Anticipation (Heat Pump). This item only appears when HP 1, HP 2 is selected above
6	5	5	MENU	(ME) CR A/C or (FA) CR Aux Heat	SL, FA SL	Selects Adjustable Anticipation, cycle rate, cool (when MS 2 or SS 1 is selected above.) or Selects the cycle rate for Auxiliary stage (when HP 1 or HP 2 is selected above)
7	6	6	MENU	(OFF) CL	CL On	Compressor Lockout Time
8	7	7	MENU	Heat A/C Off or Aux Heat A/C Off	Heat A/C Off, Heat Off with Fan icon, Heat Off without Fan icon A/C Off	System Mode Configuration
9	8	8	MENU	(OFF) CO	CO On	Selects Compressor Optimization
10	9	9	MENU	(On) dL	dL OFF	Selects Display Light On or OFF
11	10	10	MENU	0 HI (current temperature)	1 HI, 2 HI, 3HI, 4 HI, 1 LO, 2 LO, 3 LO, 4 LO	Adjustable Ambient Temperature Display
12	11	11	MENU	°F	°C	Selects Fahrenheit/Celsius Temperature Display
13	12	12	MENU	(0) P	7	Defaults to P (0) non-programmable P (7) is 7-day programming
14	13	13	MENU	PS (2)	4	Selects Program periods per day: 4 = Morn, Day, Eve, Night 2 = Day, Night
15	14	–	MENU	(On) FA Heat	OFF	Fast Heat option may be disabled by selecting OFF. NA to SS or HP1 config.
16	15	14	MENU	(On) FA A/C	OFF	Fast Cool option may be disabled by selecting OFF. NA to SS or HP1 config.
17	16	15	MENU	(On) dS	Off	Selects Automatic Daylight Saving Time option
18	17	16	MENU	(99) HL Heat	62 to 98	Select's Limited HEAT Range
19	18	17	MENU	(45) LL A/C	46 to 82	Select's Limited A/C Range
20	19	–	MENU	(0) dF	1 to 9	Selects dF (dual Fuel) setting. 0 is Off (If dual Fuel option is required, a selection of 5 is recommended)
			MENU	(60) Cd	0 to 99	Selects compressor delay in seconds when dF is greater than 0
21	20	18	MENU	(o) On A/C	Heat On (b)	Selects operation of the reversing valve terminal (O/B) output as an O or B terminal
22	21	19	MENU			Returns to Normal Operation

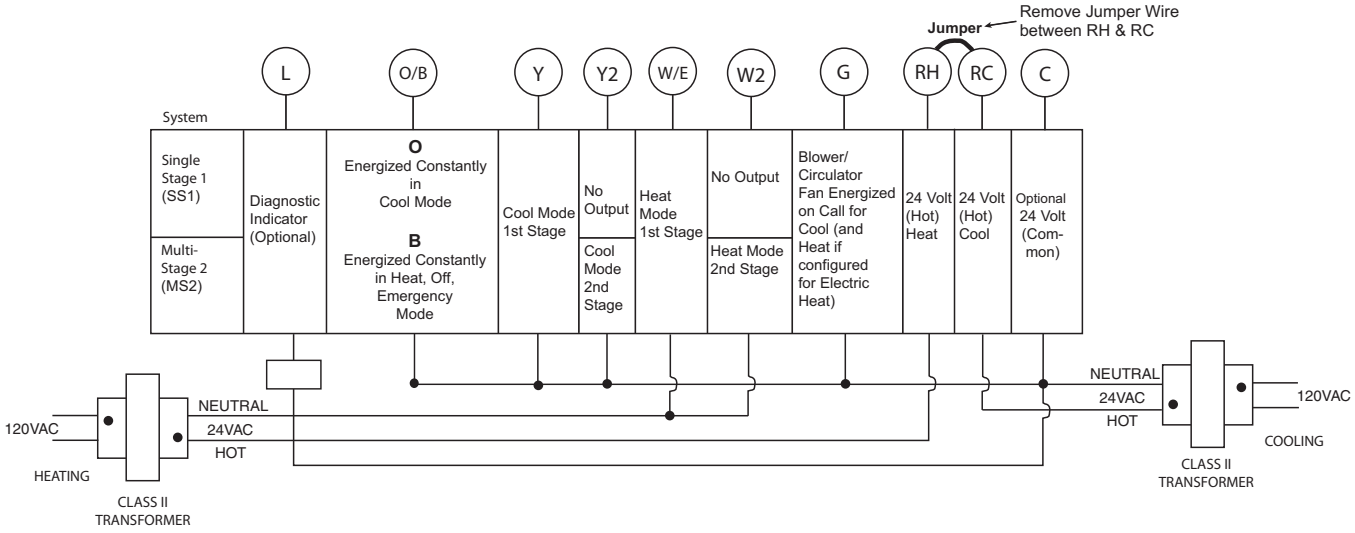
TYPICAL WIRING DIAGRAMS

Single Stage or Multi-Stage System (No Heat Pump) with Single Transformer

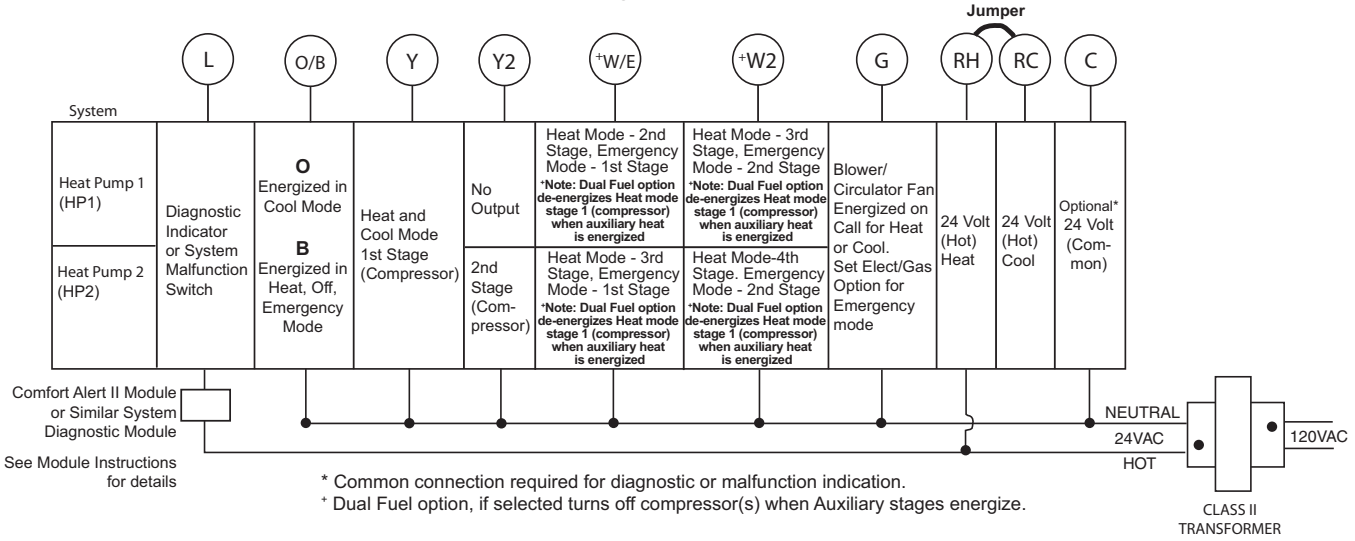


* Common connection required for diagnostic or malfunction indication.

Single Stage or Multi-Stage System (No Heat Pump) with Two Transformers



Heat Pump Systems

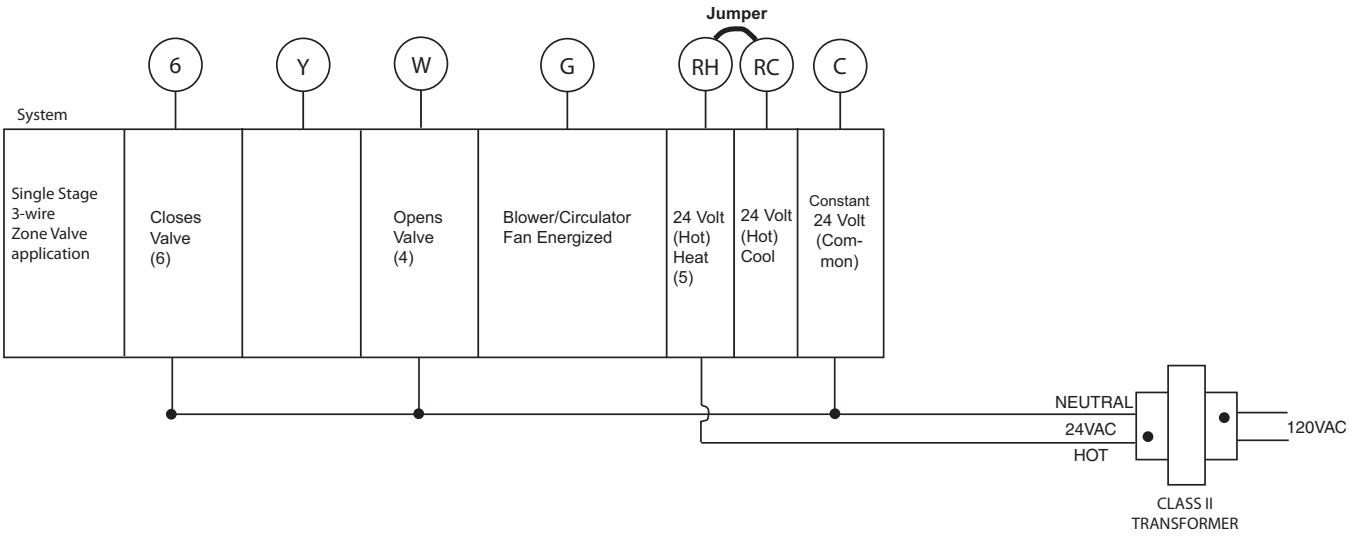


* Common connection required for diagnostic or malfunction indication.
\+ Dual Fuel option, if selected turns off compressor(s) when Auxiliary stages energize.

TECHNICAL HELP

TYPICAL WIRING DIAGRAMS

3-Wire (SPDT) Heat Only Zone Valve Wiring



INSTALLER/CONFIGURATION MENU

Thermostat must be in Heat, Cool or Auto. Press RUN SCHEDULE and then press hold the Menu button for at least 5 seconds. The display will show item #1 in the table below. Press Menu to advance to the next menu item. Press ⌃ or ⌄ to change a menu item options.

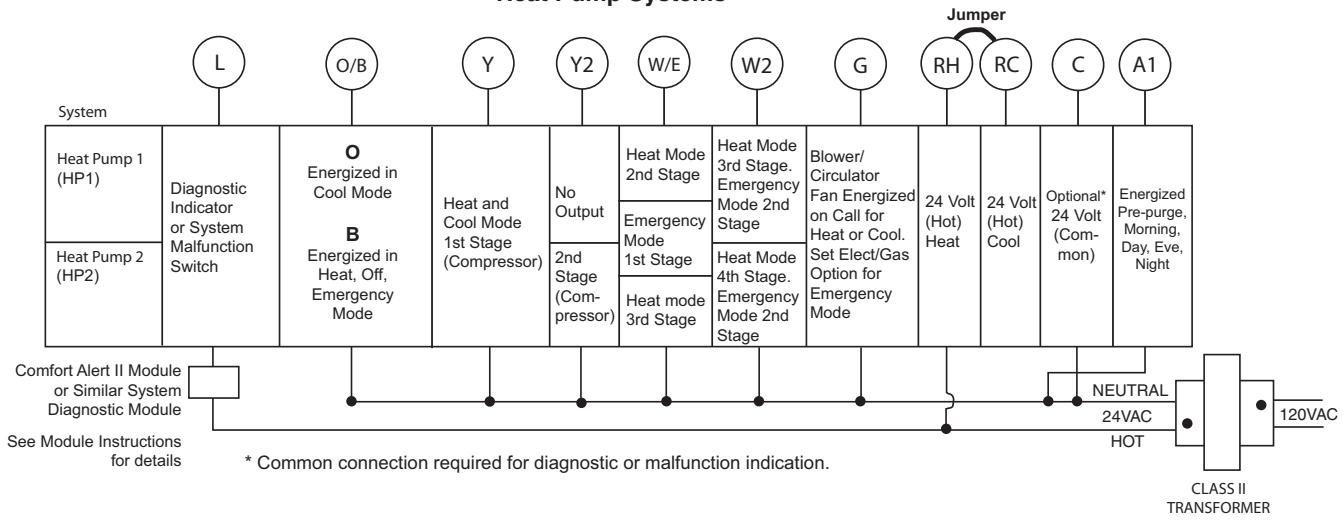
CONFIGURATION MENU						
Menu Ref.	**HP**	**SS**	**Press Button**	**Displayed Factory (Default)**	**Press ⌃ or ⌄ to select from listed options**	**COMMENTS**
1	1	1	MENU	(MS 2)	HP 1, HP 2, SS 1	Selects Multi-Stage (MS 2 No Heat Pump), Heat Pump 1 (HP 1, 1 compressor), Heat Pump 2 (HP 2, 2 compressor or 2 speed compressor), or Single Stage (SS 1)
2	2	2	MENU	(GAS) for SS or MS (ELE) for HP	ELE	GAS setting: furnace controls the blower ELE setting: thermostat controls the blower
3	3	3	MENU	(3) CS	0, 1, 2, 4, 5, 6	Selects Cool Savings Value 1 (low) to 6 (high), Value 0 disables feature
4	4	4	MENU	(On) E	OFF	Selects Energy Management Recovery (EMR) On or OFF.
5	–	5	MENU	(ME) CR Heat	SL, FA	Selects Adjustable Anticipation, cycle rate, Heat (This item only appears when MS 2 or SS 1 is selected above)
6	5	–	MENU	CR Heat Pump (ME)	SL, FA	Selects Adjustable Compressor Anticipation (Heat Pump) This item only appears when HP 1, HP 2 is selected above
7	6	6	MENU	(ME) CR Cool or (FA) CR AU	SL, FA SL	Selects Adjustable Anticipation, cycle rate, cool (when MS 2 or SS 1 is selected above.) or Selects the cycle rate for Auxiliary stage (when HP 1 or HP 2 is selected above)
8	7	7	MENU	(OFF) CL	CL On	Compressor Lockout Time
9	8	8	MENU	Em Heat, Auto Cool Off or Heat, Auto, Cool Off	Heat Cool Off, Heat Off with Fan icon, Heat Off without Fan icon Cool Off, Auto Off	System Mode Configuration with Automatic Changeover capability
10	9	9	MENU	(On) dL	dL OFF	Selects Display Light On or OFF
11	10	10	MENU	0 (current temperature)	1 HI, 2 HI, 3HI, 4 HI, 1 LO, 2 LO, 3 LO, 4 LO	Adjustable Ambient Temperature Display
12	11	11	MENU	°F	°C	Selects Fahrenheit/Celsius Temperature Display

INSTALLER/CONFIGURATION MENU (cont.)

CONFIGURATION MENU						
Menu Ref.	HP	SS	Press Button	Displayed Factory (Default)	Press ▲ or ▼ to select from listed options	COMMENTS
13	12	12	MENU	(On) b	OFF	May select Beeper OFF to stop audible key feedback
14	13	13	MENU	(7) P	3, 0	Defaults 7-day programming (P7) but non-programmable (0) or 5/1/1 programming (P3) is available on most models.
15	14	14	MENU	(4) PS	2	Selects Program periods per day: 4 = Morn, Day, Eve, Night 2 = Day, Night
16	15	15	MENU	(On) Heat AS	OFF	Automatic Schedule for heat mode
17	16	16	MENU	(On) Cool AS	OFF	Automatic Schedule for cool mode
18	17	–	MENU	(On) Heat FA	OFF	Fast Heat option may be disabled by selecting OFF. NA to SS or HP1 config.
19	18	–	MENU	(On) Cool FA	OFF	Fast Cool option may be disabled by selecting OFF. NA to SS or HP1 config.
20	19	17	MENU	Remote (OFF)	On	Selects Remote Sensor On/OFF
			MENU	Remote (In)	Outdoor	Selects Remote Sensor to outdoor NA is Remote Sensor OFF
			MENU	Indoor Loc (On)	OFF	Selects Local Sensor (in thermostat) to OFF. N/A if Remote is selected to Outdoor
21	20	18	MENU	(On) dS	Off	Selects Automatic Daylight Saving Time option
22	21	19	MENU	(OFF) Keypad Lockout	L, P, Limit	Selects one of 3 Keypad Lockout configurations L - Total Keypad Lockout P - Partial Keypad Lockout (Up and Keys still work) Limit - Limited Temperature Range
			MENU	(000) Keypad Lockout	1-999	Selects personal lockout code. 000 is NOT A VALID CODE.
23	22	20	MENU	(99) L Heat	L 62 to L 98	Select Limited HEAT Range Temperature
24	23	21	MENU	(45) L Cool	L 46 to L 82	Select Limited COOL Range Temperature
25	24	–	MENU	CO (05)	06-50	Selects outdoor Compressor OFF temperature (Balance Point temperature). 05 disables feature. Outdoor Remote required
			MENU	(dF)	EA	Selects between dF (dual Fuel) or EA (Electric Aux) only available if CO is greater than 05
			MENU	(60) Cd		Selects Compressor delay OFF time in seconds (only if dF is selected)
26	25	–	MENU	AO (80)		Selects AO (Auxiliary OFF) temperature. Feature disabled if 80 is selected. Outdoor Remote required
27	26	22	MENU	(OFF) Change Filter	On	Selects Filter Change-out Indicator On or OFF.
			MENU	Change Filter (200 h)	25-1975 h	Change Filter time in 25 hour increments. This menu only appears if On is selected in above.
28	27	23	MENU	(OFF) Change UV Lamp	On	Selects UV Lamp Timer: On/OFF
			MENU	(350) Change UV Lamp	25-1975	Selects number of Days between changing UV Lamp
29	28	24	MENU	(o) Cool On	Heat On (b)	Selects operation of the reversing valve terminal (O/B) output as an O or B terminal
30	29	27	MENU			Returns to Normal Operation

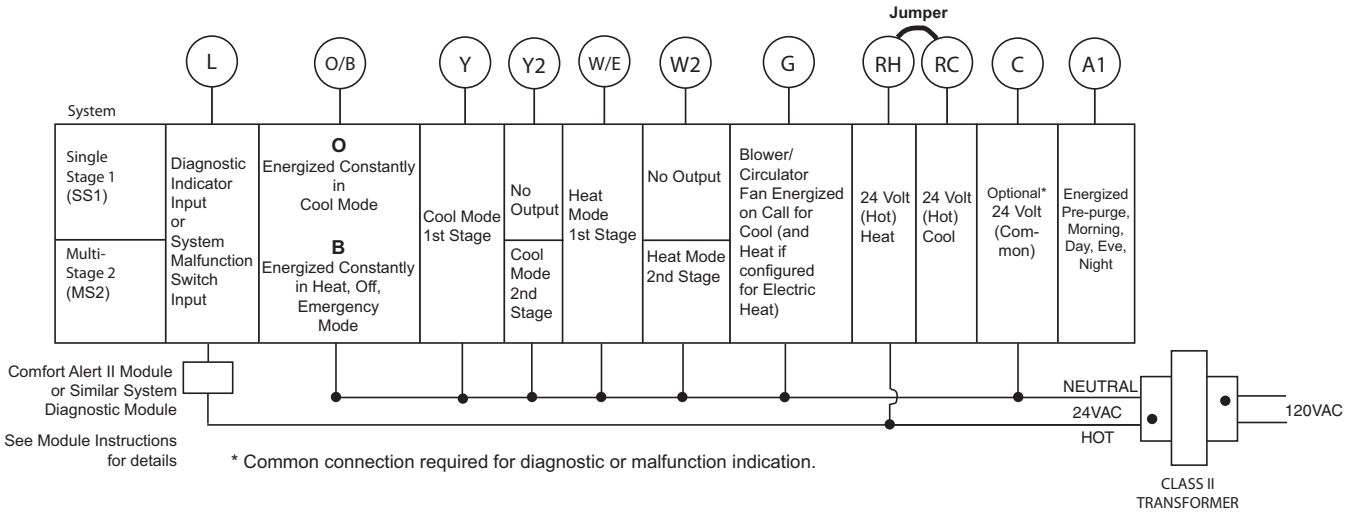
TYPICAL WIRING DIAGRAMS

Heat Pump Systems



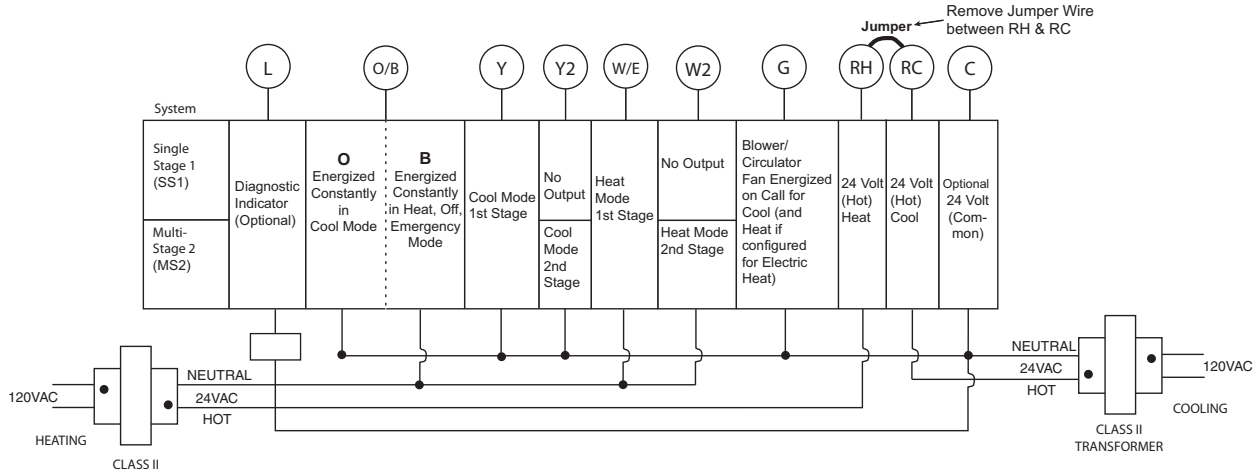
* Common connection required for diagnostic or malfunction indication.

Single Stage or Multi-Stage System (No Heat Pump) with Single Transformer



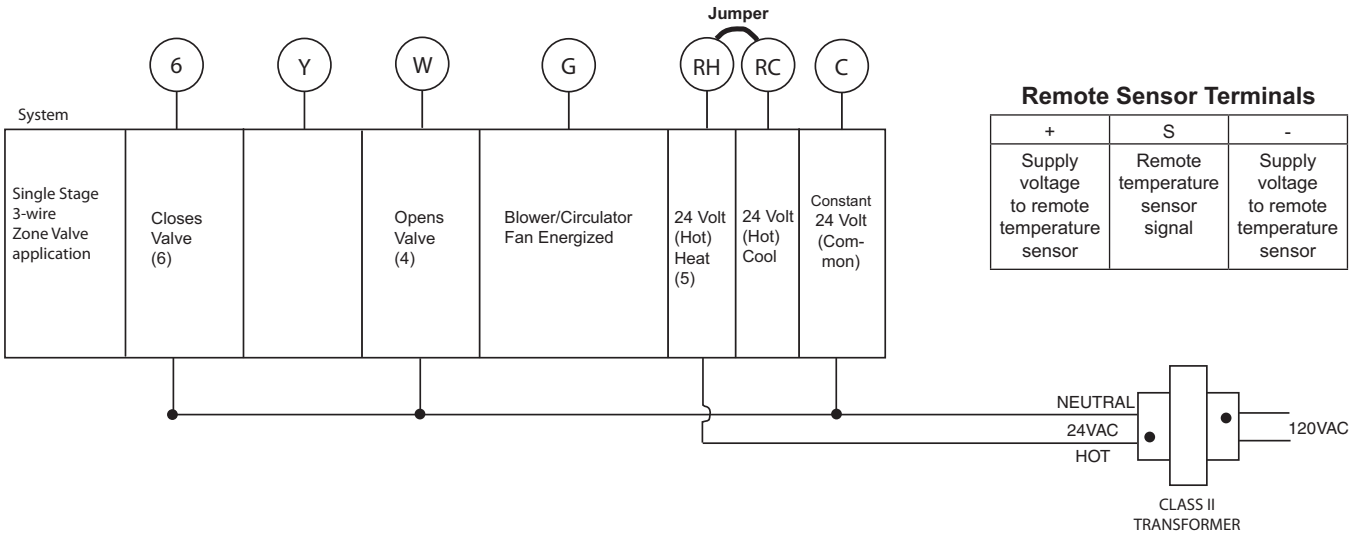
* Common connection required for diagnostic or malfunction indication.

Single Stage or Multi-Stage System (No Heat Pump) with Two Transformers



NOTE: If continuous backlight or hardwired power input are desired but do not function in both HEAT and COOL modes, cut the heating transformer 24V wires and tape off. Connect the neutral circuit disconnected from the heating transformer to the neutral circuit of the cooling transformer. Disconnect the wire to the RH terminal and install a jumper between RH and RC. Depending on the system requirements, replace the cooling transformer with a 75VA class II transformer if needed.

3-Wire (SPDT) Heat Only Zone Valve Wiring



Remote Sensor Terminals

+	S	-
Supply voltage to remote temperature sensor	Remote temperature sensor signal	Supply voltage to remote temperature sensor

INSTALLER/CONFIGURATION MENU

Press and hold the Menu button for at least 5 seconds. The display will show item #1 in the table below. Press Menu to advance to the next menu item. Press ⌃ or ⌄ to change a menu item options.

CONFIGURATION MENU						
Menu Ref.	**HP**	**SS**	**Press Button**	**Displayed Factory (Default)**	**Press ⌃ or ⌄ to select from listed options**	**COMMENTS**
1	1	1	MENU	(MS 2)	HP 1, HP 2, SS 1	Selects Multi-Stage (MS 2 No Heat Pump), Heat Pump 1 (HP 1, 1 compressor), Heat Pump 2 (HP 2, 2 compressor or 2 speed compressor), or Single Stage (SS 1)
2	2	2	MENU	(GAS) for SS or MS	ELE	GAS setting: furnace controls the blower ELE setting: thermostat controls the blower
3	3	3	MENU	(3) CS	0, 1, 2, 4, 5, 6	Selects Cool Savings Value 1 (low) to 6 (high), Value 0 disables feature
4	4	4	MENU	(On) E	OFF	Selects Energy Management Recovery (EMR) On or OFF.
5	–	5	MENU	(ME) Heat CR	SL, FA	Adjustable Anticipation: Selects heating cycle rate for MS or SS in #1 only
6	5	–	MENU	(ME) Heat Pump CR	SL, FA	Adjustable Compressor Anticipation (Heat Pump) [only when HP1 or HP2 is selected in #1]
7	6	6	MENU	(ME) Cool CR or (FA) AU CR	SL, FA SL	Adjustable Anticipation: Selects the cycle rate for cooling (only when MS 2 or SS 1 is selected in item 1.) or Selects the cycle rate for Emergency mode and Auxiliary stage if HP1 or HP2 is selected in item 1.
8	7	7	MENU	(OFF) CL	CL On	Compressor Lockout Time
9	8	8	MENU	Cool Off, Em Heat Auto	Heat Auto Cool Off, Heat Off with Fan icon, Heat Off without Fan icon, Cool Off, Auto Off	System Mode Configuration with Automatic Changeover capability
10	9	9	MENU	(On) dL	dL OFF	Selects Display Light On or OFF
11	10	10	MENU	0 (current temperature)	1 HI, 2 HI, 3HI, 4 HI, 1 LO, 2 LO, 3 LO, 4 LO	Adjustable Ambient Temperature Display
12	11	11	MENU	°F	°C	Selects Fahrenheit/Celsius Temperature Display
13	12	12	MENU	(On) b	OFF	May select Beeper OFF to stop audible key feedback
14	13	13	MENU	(7) P	3, 0	Defaults 7-day programming (P7) but non-programmable (0) or 5/1/1 programming (P3) is available on most models.
15	14	14	MENU	(2) PS	4	Selects Program periods per day: 4 = Morn, Day, Eve, Night 2 = Day, Night
16	15	15	MENU	(OFF) Heat AS	On	Automatic Schedule for heat mode
17	16	16	MENU	(On) Cool AS	OFF	Automatic Schedule for cool mode

INSTALLER/CONFIGURATION MENU (cont.)

CONFIGURATION MENU						
Menu Ref.	**HP**	**SS**	**Press Button**	**Displayed Factory (Default)**	**Press ▲ or ▼ to select from listed options**	**COMMENTS**
18	17	–	MENU	(On) Heat FA	OFF	Fast Heat option may be disabled by selecting OFF. NA to SS or HP1 config.
19	18	–	MENU	(On) Cool FA	OFF	Fast Cool option may be disabled by selecting OFF. NA to SS or HP1 config.
20	19	17	MENU	Remote (OFF)	On	Selects Remote Sensor On/OFF
			MENU	Remote (In)	Outdoor	Selects Remote Sensor to outdoor NA is Remote Sensor OFF
			MENU	Indoor Loc (On)	OFF	Selects Local Sensor (in thermostat) to OFF. N/A if Remote is selected to Outdoor
21	20	18	MENU	(On) dS	Off	Selects Automatic Daylight Saving Time option
22	21	19	MENU	(OFF) Keypad Lockout	L, P, Limit	Selects one of 3 Keypad Lockout configurations L - Total Keypad Lockout P - Partial Keypad Lockout (Up and Keys still work) Limit - Limited Temperature Range
			MENU	(000) Keypad Lockout	1-999	Selects personal lockout code. 000 is NOT A VALID CODE.
23	22	20	MENU	(99) L Heat	L 62 to L 98	Select's Limited HEAT Range
24	23	21	MENU	(45) L Cool	L 46 to L 82	Select's Limited COOL Range
25	24	–	MENU	(05) CO	6-50	Selects outdoor Compressor OFF temperature (Balance Point temperature). 05 disables feature. Outdoor Remote required
			MENU	(dF)	EA	Selects between dF (dual Fuel) or EA (Electric Aux) only available if CO ≥ 6
			MENU	(60) Cd		Selects Compressor delay OFF time in seconds
26	25	–	MENU	(80) AO		Selects AO (Auxiliary OFF) temperature. Feature disabled if 80 is selected. Outdoor Remote required
27	26	22	MENU	(OFF) EC	On	Selects Economizer On/OFF.
28	27	23	MENU	(O) pp	1-3	Selects no. of hours of preoccupancy purge time (hours the Fan runs (C an A1 energized) prior to occupied period)
29	28	24	MENU	(OFF) Change Filter	On	Selects Filter Change-out Indicator On or OFF.
			MENU	Change Filter (200 h)	25-1975 h	Change Filter time in 25 hour increments. This menu only appears if On is selected in above.
30	29	25	MENU	(OFF) Change UV Lamp	On	Selects UV Lamp Timer: On/OFF
			MENU	(350) Change UV Lamp	25-1975	Selects no. of Days between changing UV Lamp
31	30	26	MENU	(o) Cool On	Heat On (b)	Selects operation of the reversing valve terminal (O/B) output as an O or B terminal
32	31	27	MENU			Return to Normal Operation

INSTALLER/CONFIGURATION MENU

With thermostat in Heat, Cool or Auto, in normal operation, press the Menu button for at least 5 seconds. The display will show item #1 in the table below. Press Menu to advance to the next menu item. Press ⌃ or ⌄ to change a menu item option. Shaded items are not available on 1F86.

CONFIGURATION MENU						
Menu Reference Number	**HP**	**SS**	**Press Button**	**Displayed (Factory Default)**	**Press ⌃ or ⌄ to select from listed options**	**COMMENTS**
1	1		MENU	(O) On	b On	Reversing Valve Output (SS/HP switch must be in the Heat Pump HP position)*
2	2	1	MENU	P (2)	P 3, P 0	Selectable Programs Per Week (For programmable thermostat only)
3	3	2	MENU	(OFF) CS	On CS	Select Cool Savings on or off
			MENU	(3)	6, 5, 4, 2, 1	Selects Cool Savings value 1 (low) to 6 (high)
4	4	3	MENU	(On) E	(OFF) E	Selects Energy Management Recovery (EMR) on or off
5		4	MENU	(ME) CR Heat	FA, SL	Adjustable Anticipation (Heat) (only when SS/HP switch is at the SS position)
6		5	MENU	(FA) CR Cool	SL	Adjustable Anticipation (Cool) (only when SS/HP switch is at the SS position)
7	5		MENU	(FA) CR Heat Pump	SL	Adjustable Anticipation (Heat Pump) (only when SS/HP switch is at the HP position)
8	6	6	MENU	(OFF) CL	On CL	Compressor Lockout Time
9	7	7	MENU	Auto Heat Cool Off	Heat Cool Off, Heat Off with Fan icon, Heat Off without Fan icon, Cool Off, Auto Off	System Mode Configuration with Automatic Changeover
10	8	8	MENU	(On) L	OFF L	Selects Display Light on or off
11	9	9	MENU	0 (temperature)	1 HI, 2 HI, 3 HI, 4 HI, 1 LO, 2 LO, 3 LO, 4 LO	Adjustable Ambient Temperature Display
12	10	10	MENU	F	C	Selects Fahrenheit/Celsius Temperature Display
13	11	11	MENU	(OFF) Change Filter	On Change Filter	Selects Filter Change-out Indicator
			MENU	Change Filter 200 h	25 h to 1975 h in 25-hour increment	When on, selects time in 25 hour increments 25-hour increment
14	12	12	RUN			Returns to Normal Operation

***NOTE:** To switch thermostat to Heat Pump, place the SS/HP switch to HP and reset thermostat by pressing FAN button, up and down arrows at the same time.

Single Stage (Gas, Oil, Electric)

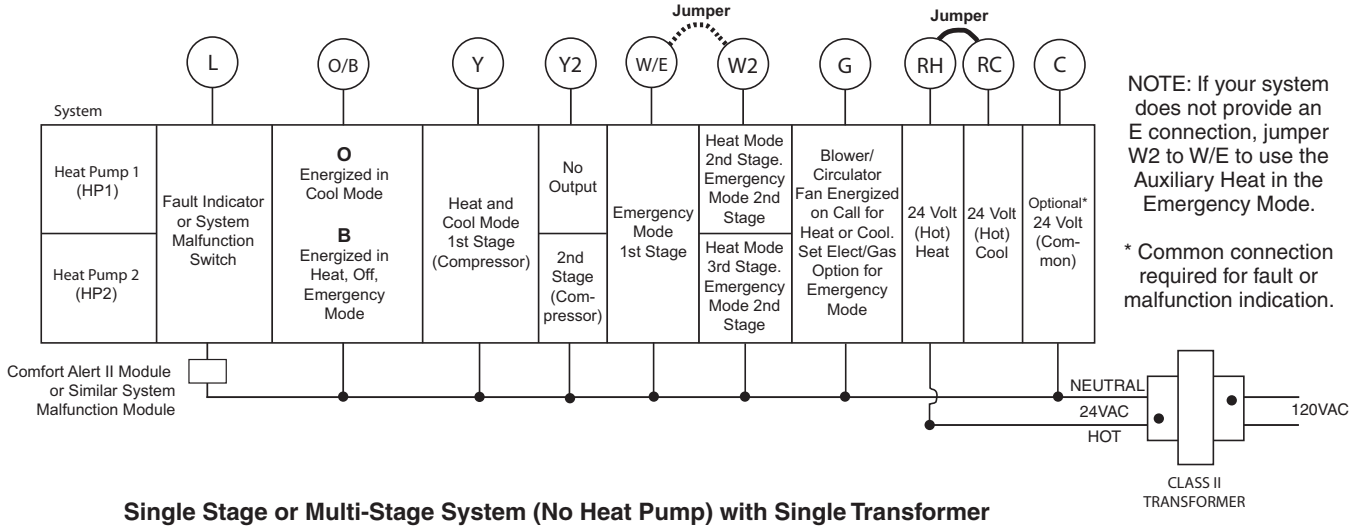
RH	RC	W	G	Y	O/B	C
24 V for Heat	24 V for Cool	Heat Relay	Fan Relay	Compressor Relay	3-wire zone valve	24 V Common

Single Stage Heat Pump (No Auxiliary Heat)

RH	RC	W	G	Y	O/B	C
24 V for Heat	24 V for Cool	Heat Relay (with jumper to Y)	Fan Relay	Compressor Relay (with jumper to W)	Changeover Relay “O” for Cool, “B” for Heat	24 V Common

TYPICAL WIRING DIAGRAMS

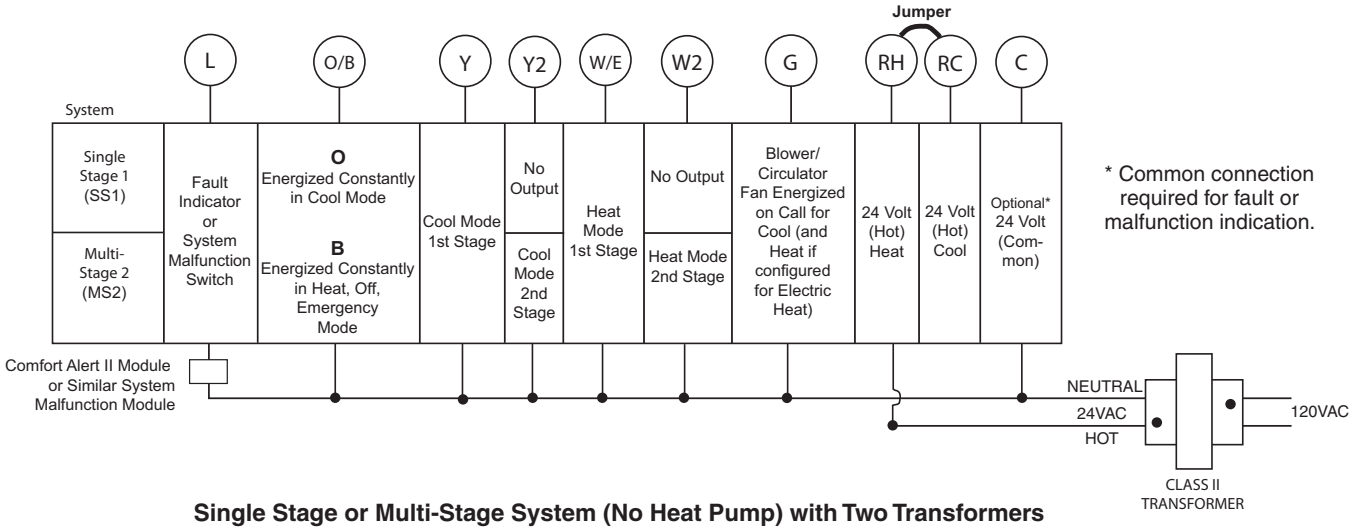
Heat Pump Systems



NOTE: If your system does not provide an E connection, jumper W2 to W/E to use the Auxiliary Heat in the Emergency Mode.

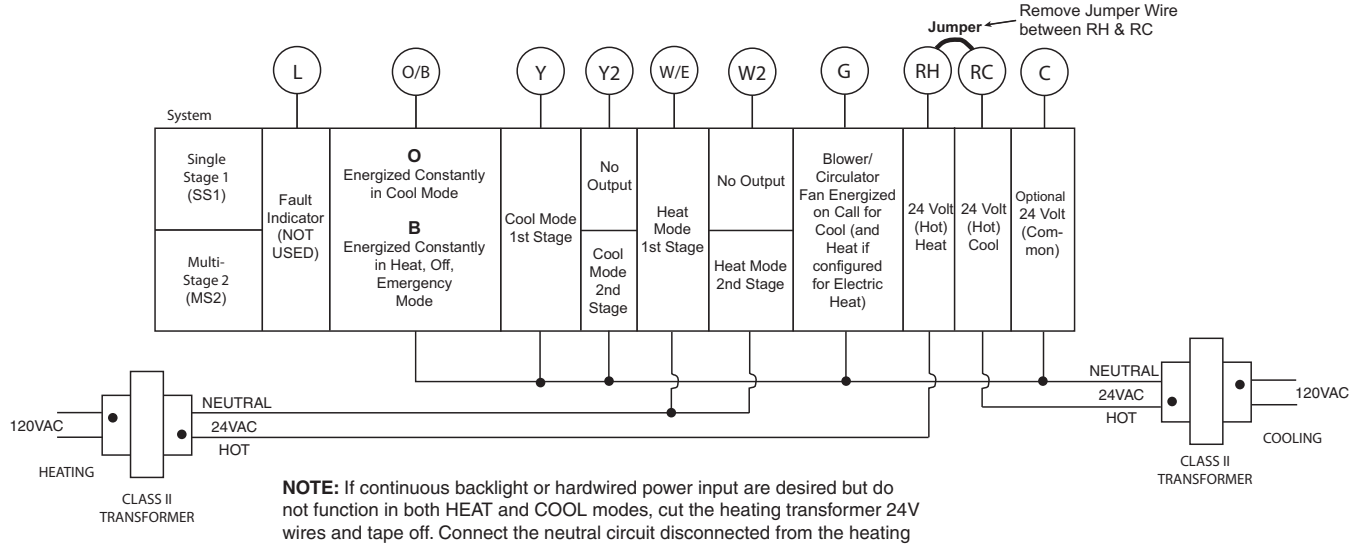
* Common connection required for fault or malfunction indication.

Single Stage or Multi-Stage System (No Heat Pump) with Single Transformer



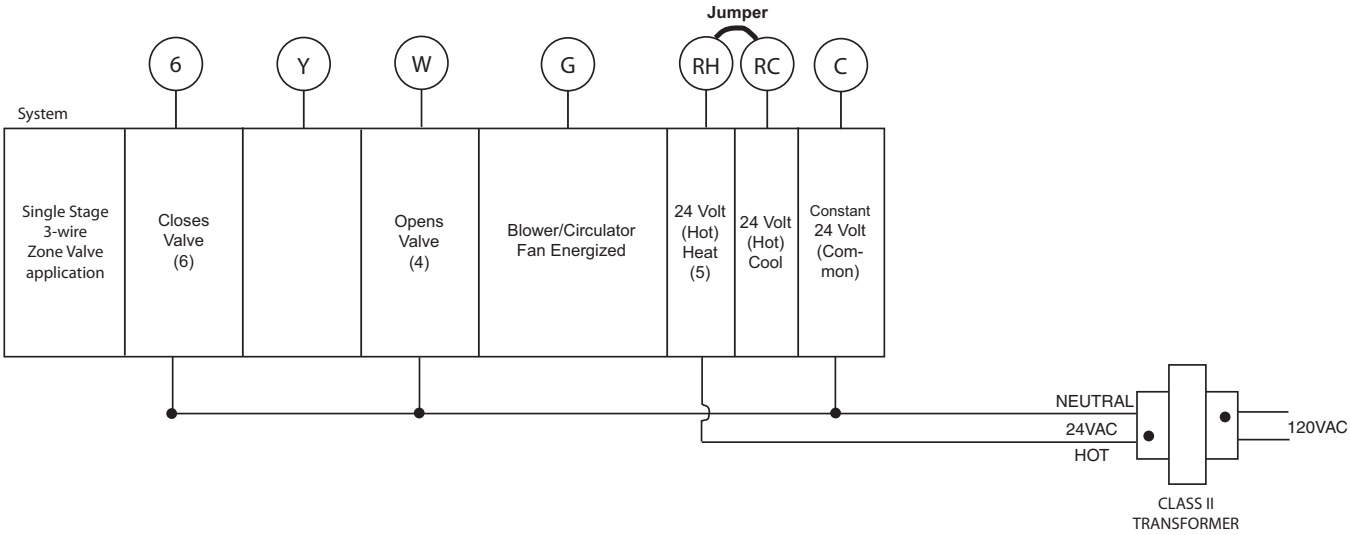
* Common connection required for fault or malfunction indication.

Single Stage or Multi-Stage System (No Heat Pump) with Two Transformers



NOTE: If continuous backlight or hardwired power input are desired but do not function in both HEAT and COOL modes, cut the heating transformer 24V wires and tape off. Connect the neutral circuit disconnected from the heating transformer to the neutral circuit of the cooling transformer. Disconnect the wire to the RH terminal and install a jumper between RH and RC. Depending on the system requirements, replace the cooling transformer with a 75VA class II transformer if needed.

3-Wire (SPDT) Heat Only Zone Valve Wiring



INSTALLER/CONFIGURATION MENU

With thermostat in Heat, Cool of Auto, in normal operation, press the Menu button for at least 5 seconds. The display will show item #1 in the table below. Press Menu button to advance to the next menu item. Press ⌃ or ⌄ to change a menu item. Shaded items are not available on 1F83 model.

CONFIGURATION MENU						
Menu Ref.	**HP**	**SS**	**Press Button**	**Displayed Factory (Default)**	**Press ⌃ or ⌄ to select from listed options**	**COMMENTS**
1	1	1	MENU	(MS 2)	HP 1, HP 2, SS 1	Selects Multi-Stage (MS 2 No Heat Pump), Heat Pump 1 (HP 1, 1 compressor), or Single Stage (SS 1), Heat Pump 2 (HP 2, 2 compressor or 2 speed compressor)
2	2	2	MENU	(GAS) for SS or MS (ELE) for HP	ELE	GAS setting: furnace controls the blower ELE setting: thermostat controls the blower
3	3	3	MENU	(0) CS (Disabled)	1, 2, 3, 4, 5, 6	Selects Cool Savings Value 1 (low) to 6 (high), Value 0 Disables Feature
4	4	4	MENU	(On) E	OFF	Selects Energy Management Recovery (EMR) On or OFF. NA 1F83.
5	–	5	MENU	(ME) CR Heat	SL, FA	Adjustable Anticipation: Selects heating cycle rate for MS or SS
6	5	–	MENU	(ME) CR Heat Pump	SL, FA	Adjustable Anticipation (Heat Pump) (only when heat pump selected in #1)
7	6	6	MENU	(ME) CR Cool or (FA) CR Emer	SL, FA SL	Adjustable Anticipation: Selects the cycle rate for cooling (only when MS 2 or SS 1 is selected in item 1.) or Selects the cycle rate for Emergency mode and Auxiliary stage if Heat Pump is selected in item 1.
8	7	7	MENU	(OFF) CL	CL On	Compressor Lockout Time
9	8	8	MENU	Heat Auto Cool Off	Heat Cool Off, Heat Off with Fan icon, Heat Off without Fan icon Cool Off, Auto Off	System Mode Configuration with Automatic Changeover capability
10	9	9	MENU	(On) dL	dL OFF	Selects Display Light On or OFF
11	10	10	MENU	0 (current temperature)	1 HI, 2 HI, 3 HI, 4 HI, 1 LO, 2 LO, 3 LO, 4 LO	Adjustable Ambient Temperature Display
12	11	11	MENU	°F	°C	Selects Fahrenheit/Celsius Temperature Display
13	12	12	MENU	L (90) Heat	L 62 to L 89	Selects Limited HEAT Range
14	13	13	MENU	L (45) Cool	L 46 to L 82	Selects Limited COOL Range
15	14	14	MENU	P3	P0, P2	Defaults for 5-1-1 programming (P3) but non-programmble (P0) or 5-2 programming (P2) is available on most models. NA 1F83
16	15	15	MENU	(On) AS Heat	OFF	Automatic Schedule for heat mode. NA 1F83. NA to Cool only system.

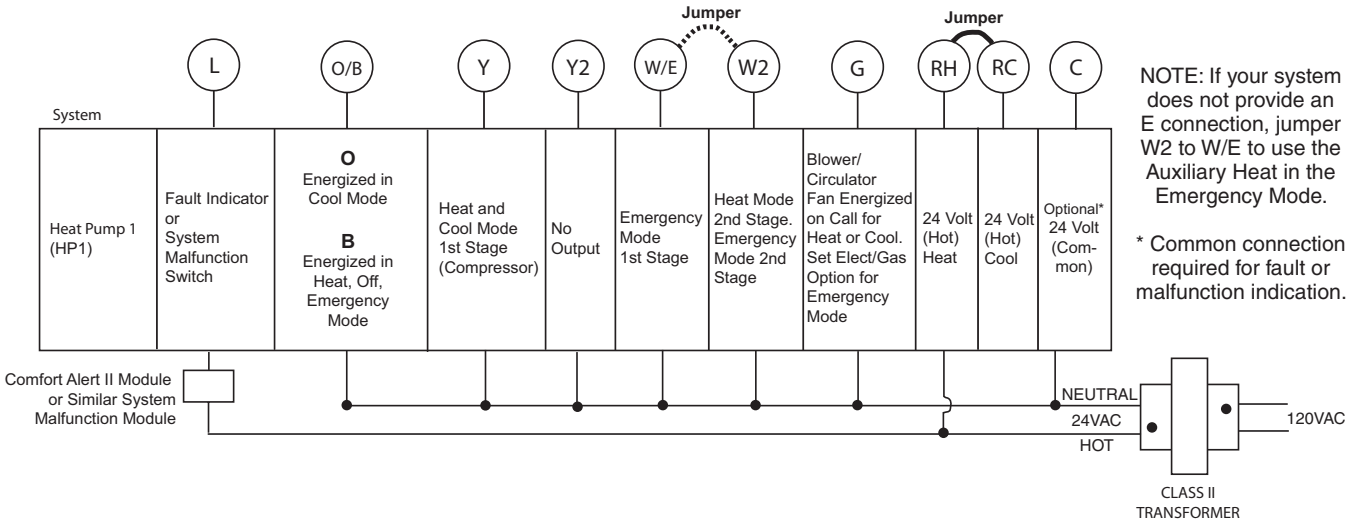
1F83-0471/1F85-0471 INSTALLER/CONFIGURATION MENU (cont.)

CONFIGURATION MENU						
Menu Ref.	**HP**	**SS**	**Press Button**	**Displayed Factory (Default)**	**Press ⌃ or ⌄ to select from listed options**	**COMMENTS**
17	16	16	MENU	(On) AS Cool	OFF	Automatic Schedule for cool mode. NA 1F83. NA to Heat only system.
18	17	_	MENU	(On) FA Heat	OFF	Fast Heat option may be disabled by selecting OFF. NA to SS config. NA to Cool only system.
19	18	_	MENU	(On) FA Cool	OFF	Fast Cool option may be disabled by selecting OFF. NA to SS config. NA to Cool only system
20	19	17	MENU	CA (OFF)	On	Selects active Comfort Alert On or OFF. Requires CA II Module. (1F85CA only)
21	20	18	MENU	(On) dS	OFF	Selects Automatic **d**aylight **S**avings Time option On or OFF. NA 1F83.
22	21	19	MENU	(OFF) Change Filter	On	Selects Filter Change-out Indicator On or OFF.
			MENU	Change Filter (200 h)	25-1975 h	Change Filter time in 25 hour increments. This menu only appears if On is selected in above.
23	22	20	MENU	(o) On Cool	Heat On (b)	Selects operation of the reversing valve terminal (O/B) output as an O or B terminal.
24	23	21	RUN SCHED			Returns to Normal Operation

TYPICAL WIRING 1F83-0422/1F85-0422

TYPICAL WIRING DIAGRAMS

Heat Pump Systems

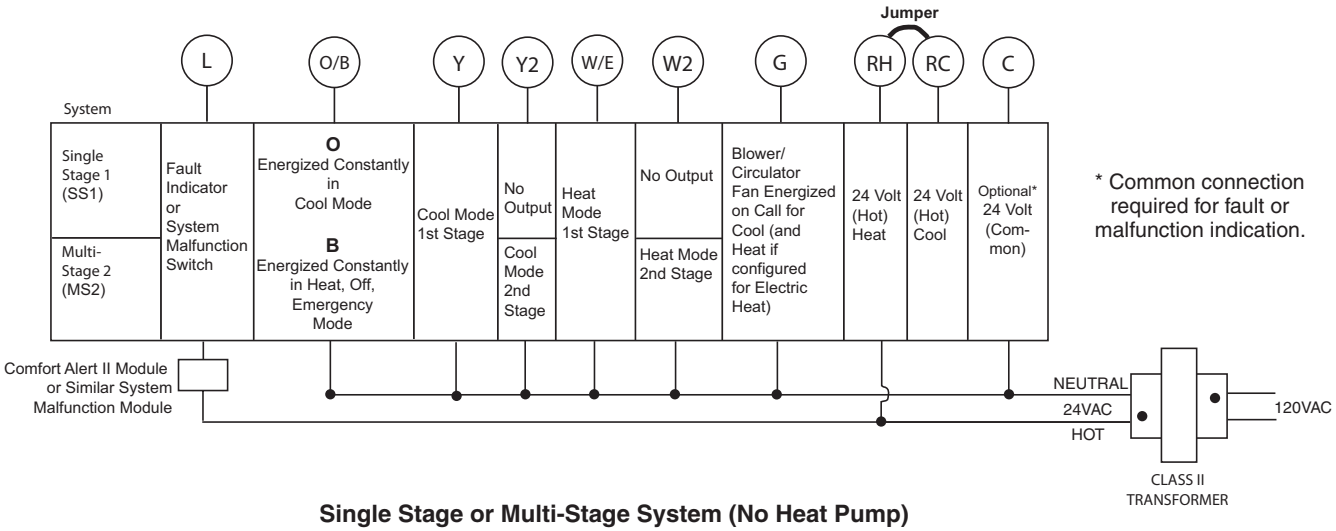


NOTE: If your system does not provide an E connection, jumper W2 to W/E to use the Auxiliary Heat in the Emergency Mode.

* Common connection required for fault or malfunction indication.

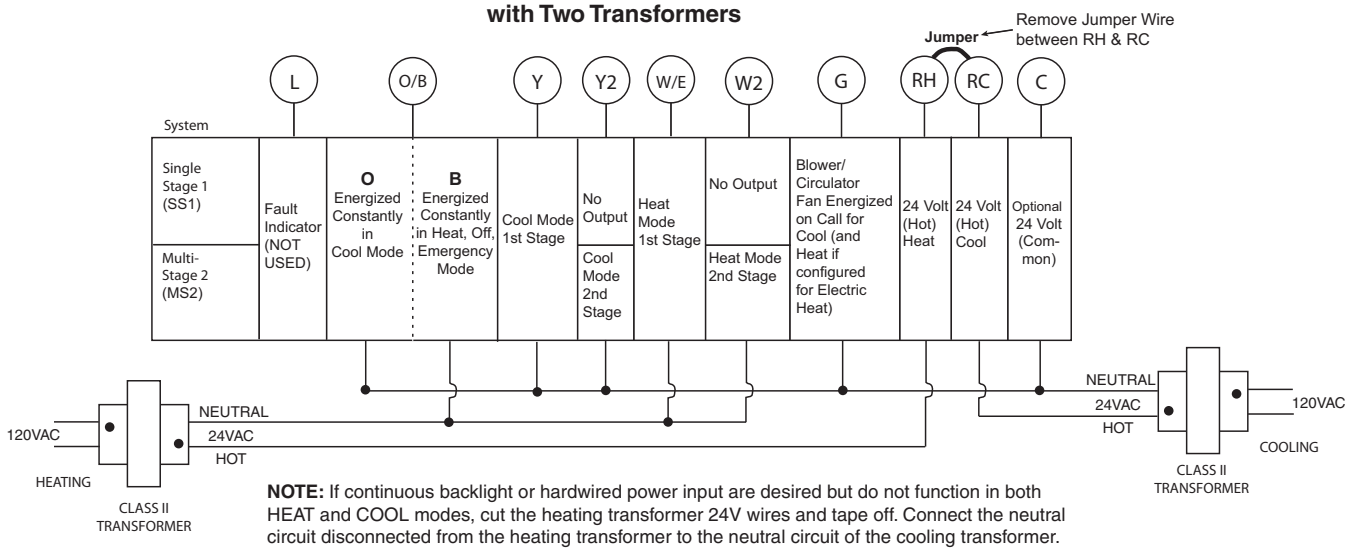
TECHNICAL HELP

Single Stage or Multi-Stage System (No Heat Pump) with Single Transformer



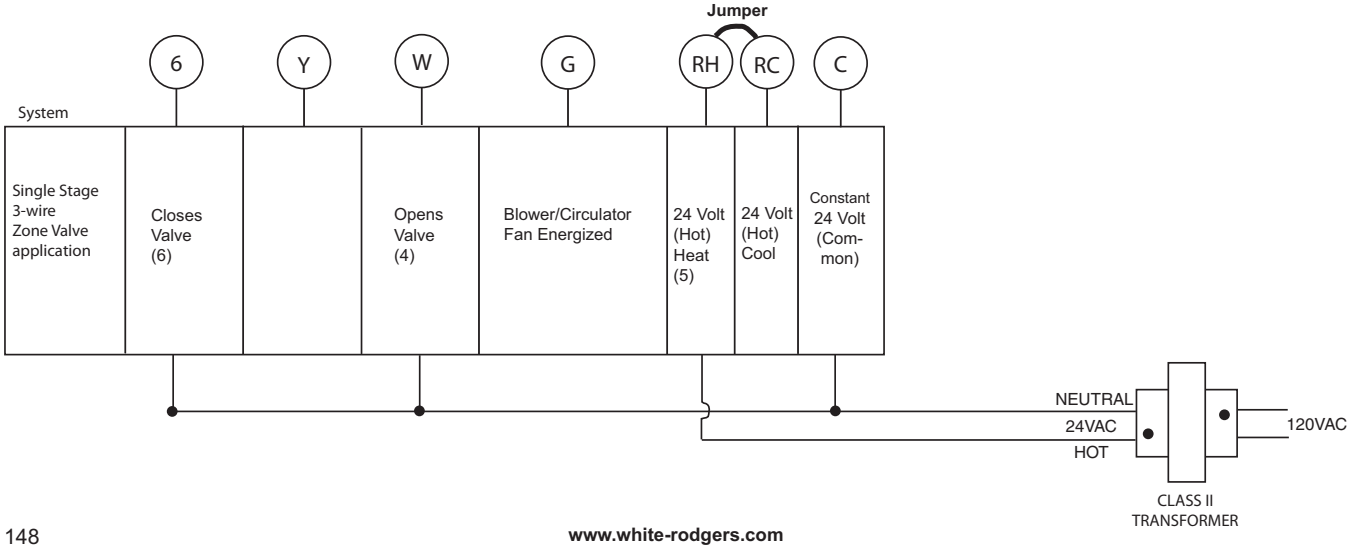
* Common connection required for fault or malfunction indication.

Single Stage or Multi-Stage System (No Heat Pump) with Two Transformers



NOTE: If continuous backlight or hardwired power input are desired but do not function in both HEAT and COOL modes, cut the heating transformer 24V wires and tape off. Connect the neutral circuit disconnected from the heating transformer to the neutral circuit of the cooling transformer. Disconnect the wire to the RH terminal and install a jumper between RH and RC. Depending on the system requirements, replace the cooling transformer with a 75VA class II transformer if needed.

3-Wire (SPDT) Heat Only Zone Valve Wiring



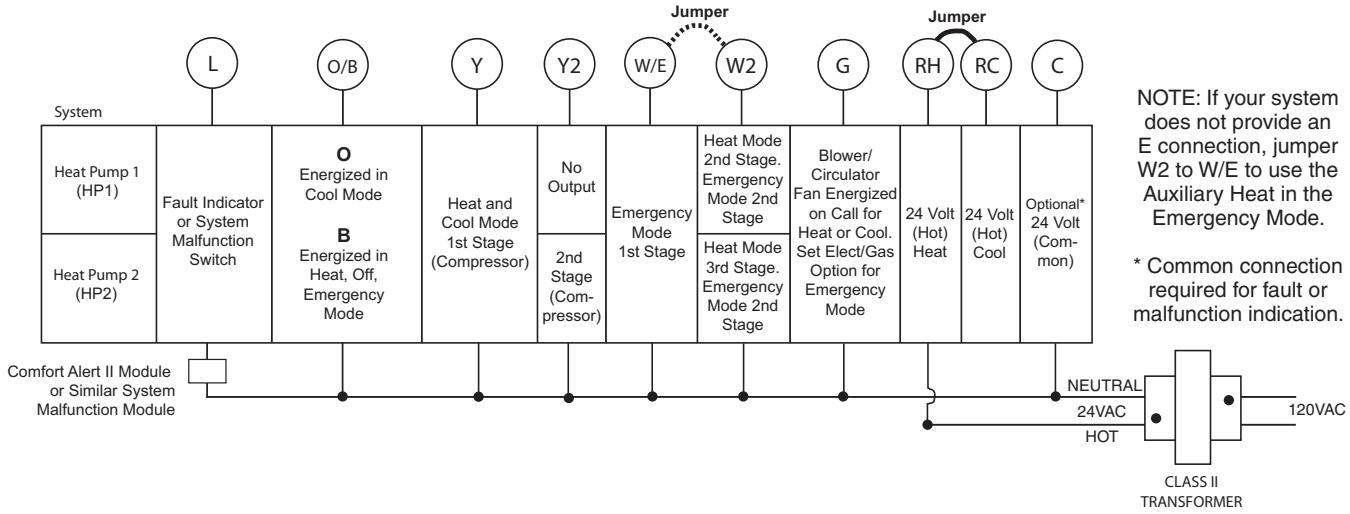
INSTALLER/CONFIGURATION MENU

With thermostat in Heat, Cool or Auto, in normal operation, press the Menu button for at least 5 seconds. The display will show item #1 in the table below. Press Menu to advance to the next menu, Press ⌃ or ⌄ to change an item option. Shaded items are not available to 1F86.

CONFIGURATION MENU						
Menu Ref.	**HP**	**SS**	**Press Button**	**Displayed Factory (Default)**	**Press ⌃ or ⌄ to select from listed options**	**COMMENTS**
1	1	1	MENU	Lk (OFF)	L	Selects Keypad Lockout. (Not available on earlier models)
			MENU	0	001 to 999	Selects Keypad lockout combination number
2	2	2	MENU	(MS 2)	HP 1, SS 1	Selects Multi-Stage (MS 2 No Heat Pump), Heat Pump 1 (HP 1, 1 compressor), or Single Stage (SS 1)
3	3	3	MENU	(GAS) for SS or MS (ELE) for HP	ELE	GAS setting: furnace controls the blower ELE setting: thermostat controls the blower
4	4	4	MENU	CS (0) (Disabled)	1, 2, 4, 5, 6	Selects Cool Savings Value 1 (low) to 6 (high), Value 0 Disables Feature
5	5	5	MENU	E (On)	OFF	Selects Energy Management Recovery (EMR) On or OFF. **1F85 only**
6	–	6	MENU	CR Heat (ME)	SL, FA	Adjustable Anticipation: Selects heating cycle rate for MS or SS
7	6	–	MENU	CR Heat Pump (ME)	SL, FA	Adjustable Anticipation (Heat Pump) (only when heat pump selected in #1)
8	7	7	MENU	CR Cool (ME) or CR Emer (FA)	SL, FA SL	Adjustable Anticipation: Selects the cycle rate for cooling (only when MS 2 or SS 1 is selected in item 1.) or Selects the cycle rate for Emergency mode and Auxiliary stage if Heat Pump is selected in item 1.
9	8	8	MENU	CL (OFF)	CL On	Compressor Lockout Time
10	9	9	MENU	Heat Auto Cool Off	Heat Cool Off, Heat Off with Fan icon, Heat Off without Fan icon Cool Off, Auto Off	System Mode Configuration with Automatic Changeover capability
11	10	10	MENU	dL (On)	dL OFF	Selects Display Light On or OFF
12	11	11	MENU	0 (current temperature)	1 HI, 2 HI, 3 HI, 4 HI, 1 LO, 2 LO, 3 LO, 4 LO	Adjustable Ambient Temperature Display
13	12	12	MENU	°F	°C	Selects Fahrenheit/Celsius Temperature Display
14	13	13	MENU	L Heat (90)	L 62 to L 89	Selects Limited HEAT Range
15	14	14	MENU	L Cool (45)	L 46 to L 82	Selects Limited COOL Range
16	15	15	MENU	P3	P0, P2	Defaults for 5-1-1 programming (P3) but non-programmable (PO) or 5-2 programming (P2) is available on most models. **1F85 only**
17	16	16	MENU	Heat AS (On)	OFF	Automatic Schedule for heat mode. 1F85 only. NA to Cool only system.
18	17	17	MENU	Cool AS (On)	OFF	Automatic Schedule for cool mode. **1F85 only**. NA to Heat only system.
19	18	–	MENU	Heat FA (On)	OFF	Fast Heat option may be disabled by selecting OFF. NA to SS config. NA to Cool only system.
20	19	–	MENU	Cool FA (On)	OFF	Fast Cool option may be disabled by selecting OFF. NA to SS config. NA to Heat only system.
21	20		MENU	CA (OFF)	On	Selects active Comfort Alert On or OFF. Require CA II Module. (Not available on earlier models)
22	21	18	MENU	dS (On)	OFF	Selects Automatic **d**aylight **S**avings Time option On or OFF. **1F85 only**
23	22	19	MENU	Change Filter (OFF)	On	Selects Filter Change-out Indicator On or OFF.
			MENU	Change Filter (200 h)	25-1975 h	Change Filter time in 25 hour increments. This menu only appears if On is selected in above.
24	23	20	MENU	Cool On (o)	Heat On (b)	Selects operation of the reversing valve terminal (O/B) output as an O or B terminal.
	24	21	RUN SCHED			Returns to Normal Operation

TYPICAL WIRING DIAGRAMS

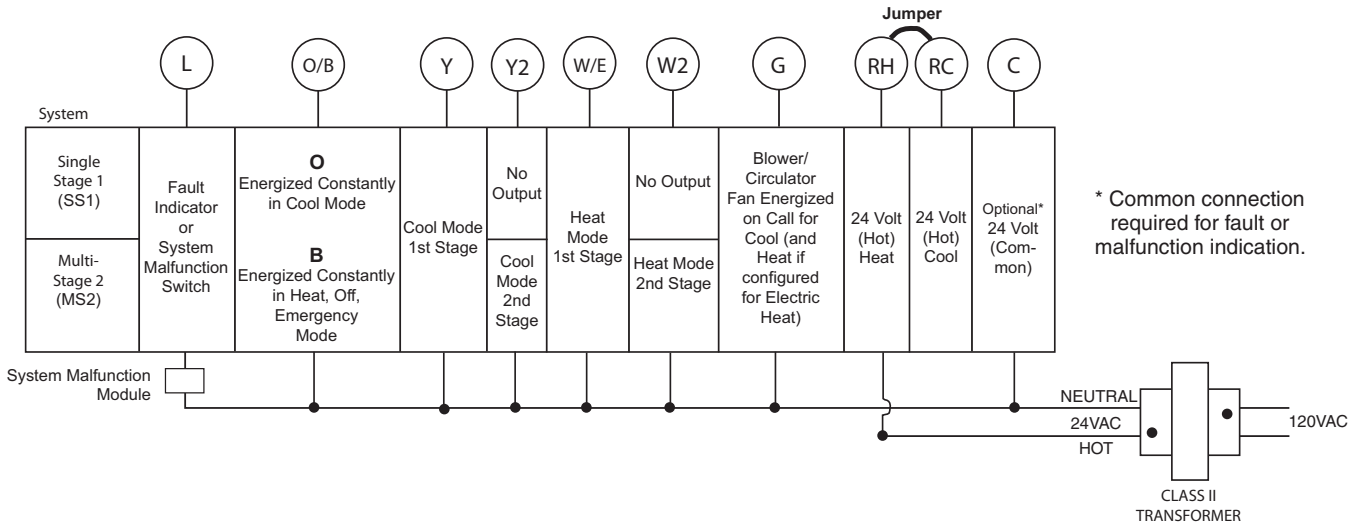
Heat Pump Systems



NOTE: If your system does not provide an E connection, jumper W2 to W/E to use the Auxiliary Heat in the Emergency Mode.

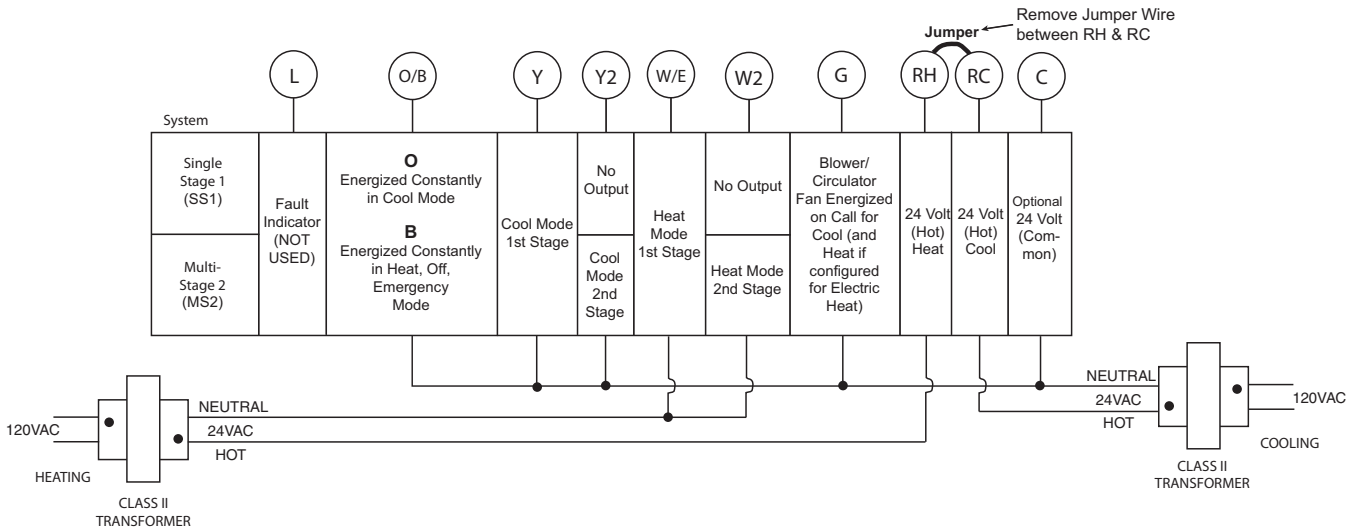
* Common connection required for fault or malfunction indication.

Single Stage or Multi-Stage System (No Heat Pump) with Single Transformer

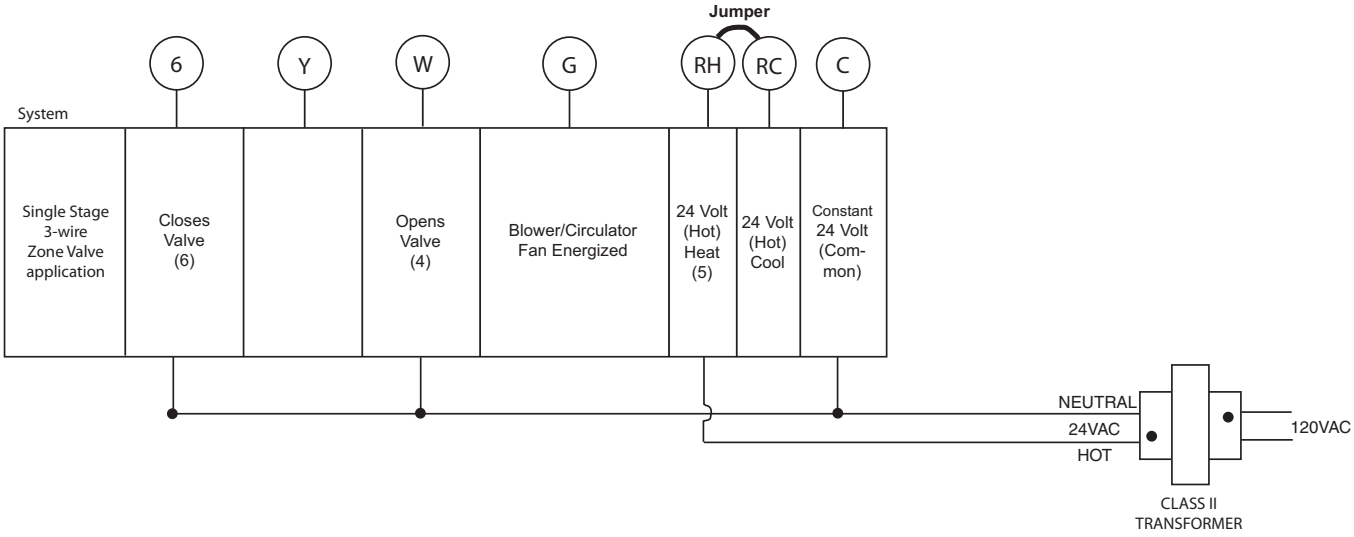


* Common connection required for fault or malfunction indication.

Single Stage or Multi-Stage System (No Heat Pump) with Two Transformers



3-Wire (SPDT) Heat Only Zone Valve Wiring



INSTALLER/CONFIGURATION MENU

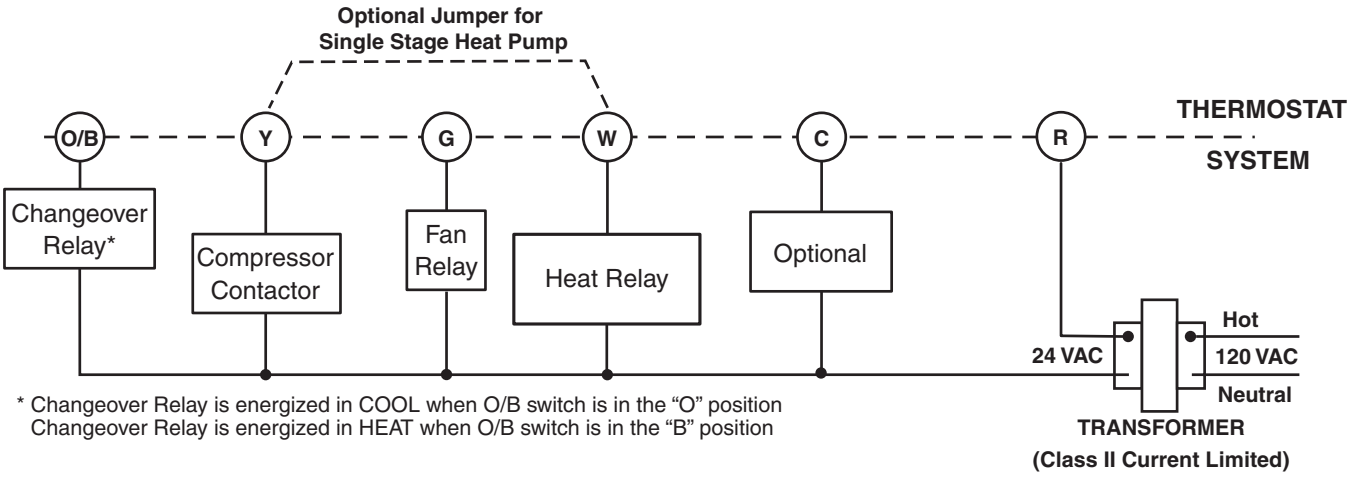
With thermostat in Heat, Cool or Auto, in normal operation, press the Menu button for at least 5 seconds. The display will show item #1 in the table below. Press Menu button to advance to the next menu item. Press ⌃ or ⌄ to change an item option.

CONFIGURATION MENU						
Menu Ref.	**HP**	**SS**	**Press Button**	**Displayed Factory (Default)**	**Press ⌃ or ⌄ to select from listed options**	**COMMENTS**
1	1	1	MENU	Lk (OFF)	L	Selects Keypad Lockout. (Not available on earlier models)
			MENU	0	001 to 999	Selects Keypad lockout combination number
2	2	2	MENU	(MS 2)	HP 1, HP 2, SS 1	Selects Multi-Stage (MS 2 No Heat Pump), Heat Pump 1 (HP 1, 1 compressor), or Single Stage (SS 1), Heat Pump 2 (HP 2, 2 compressor or 2 speed compressor)
3	3	3	MENU	(GAS) for SS or MS (ELE) for HP	ELE	GAS setting: furnace controls the blower ELE setting: thermostat controls the blower
4	4	4	MENU	CS (0) (Disabled)	1, 2, 3, 4, 5, 6	Selects Cool Savings Value 1 (low) to 6 (high), Value 0 Disables Feature
5	5	5	MENU	E (On)	OFF	Selects Energy Management Recovery (EMR) On or OFF.
6	–	6	MENU	CR Heat (ME)	SL, FA	Adjustable Anticipation: Selects heating cycle rate for MS or SS
7	6	–	MENU	CR Heat Pump (ME)	SL, FA	Adjustable Anticipation (Heat Pump) (only when heat pump is selected in #1)
8	7	7	MENU	CR Cool (ME) or CR Emer (FA)	SL, FA SL	Adjustable Anticipation: Selects the cycle rate for cooling (only when MS 2 or SS 1 is selected in item 1.) or Selects the cycle rate for Emergency mode and Auxiliary stage if Heat Pump is selected in item 1.
9	8	8	MENU	CL (OFF)	CL On	Compressor Lockout Time
10	9	9	MENU	Heat Auto Cool Off	Heat Cool Off, Heat Off with Fan icon, Heat Off without Fan icon Cool Off, Auto Off	System Mode Configuration with Automatic Changeover capability
11	10	10	MENU	dL (On)	dL OFF	Selects Display Light On or OFF
12	11	11	MENU	0 (current temperature)	1 HI, 2 HI, 3 HI, 4 HI, 1 LO, 2 LO, 3 LO, 4 LO	Adjustable Ambient Temperature Display
13	12	12	MENU	°F	°C	Selects Fahrenheit/Celsius Temperature Display

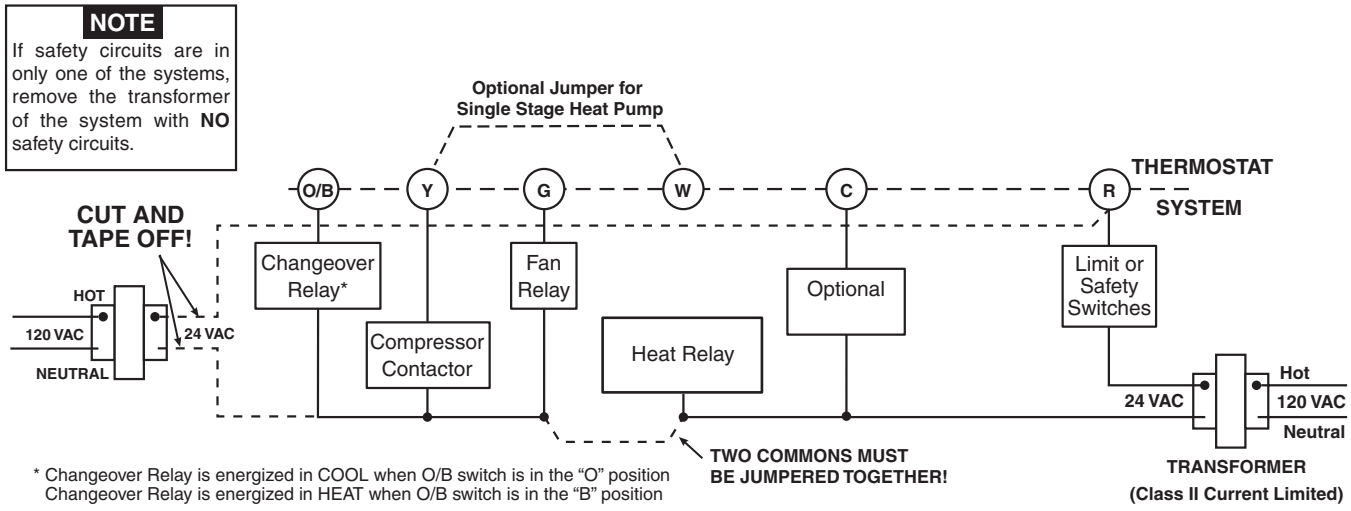
INSTALLER/CONFIGURATION MENU (cont.)

CONFIGURATION MENU						
Menu Ref.	HP	SS	Press Button	Displayed Factory (Default)	Press ▲ or ▼ to select from listed options	COMMENTS
14	13	13	MENU	L Heat (90)	L 62 to L 89	Selects Limited HEAT Range
15	14	14	MENU	L Cool (45)	L 46 to L 82	Selects Limited COOL Range
16	15	15	MENU	P7	P3	Defaults for 7 day programming (P7) or 5/1/1 day programming (P3) is available
17	16	16	MENU	Heat AS (On)	OFF	Automatic Schedule for heat mode.
18	17	17	MENU	Cool AS (On)	OFF	Automatic Schedule for cool mode.
19	18	–	MENU	Heat FA (On)	OFF	Fast Heat option may be disabled by selecting OFF. NA to SS config.
20	19	–	MENU	Cool FA (On)	OFF	Fast Cool option may be disabled by selecting OFF. NA to SS config. NA to Heat only system.
21	20	18	MENU	CA (OFF)	On	Selects active Comfort Alert On or OFF. Require CA II Module. (Not available on earlier models)
22	21	19	MENU	dS (On)	OFF	Selects Automatic **d**aylight **S**avings Time option On or OFF.
23	22	20	MENU	Change Filter (OFF)	On	Selects Filter Change-out Indicator On or OFF.
			MENU	Change Filter (200 h)	25-1975 h	Change Filter time in 25 hour increments. This menu only appears if On is selected in above.
24	23	21	MENU	Cool On (o)	Heat On (b)	Selects operation of the reversing valve terminal (O/B) output as an O or B terminal.
25	24	22	RUN			Returns to Normal Operation

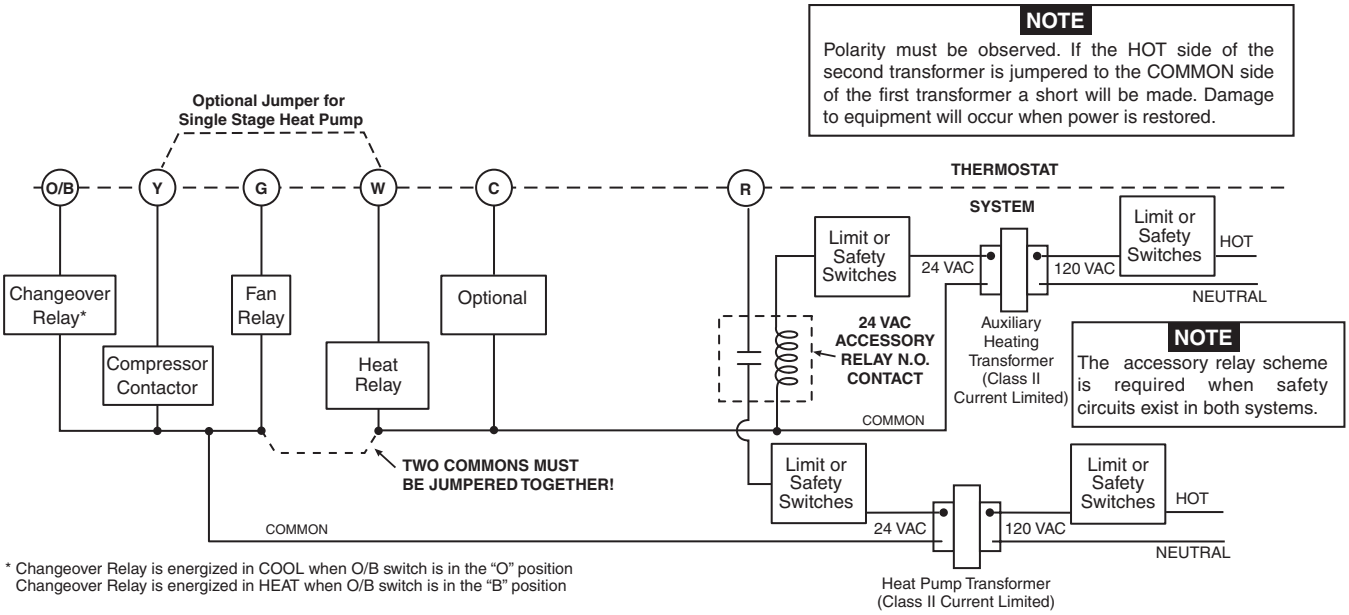
TYPICAL WIRING DIAGRAMS



Typical wiring diagram for single transformer single stage systems



Typical wiring diagram for two transformer single stage systems with NO safety circuits



Typical wiring diagram for two transformer single stage systems with safety circuits in BOTH systems

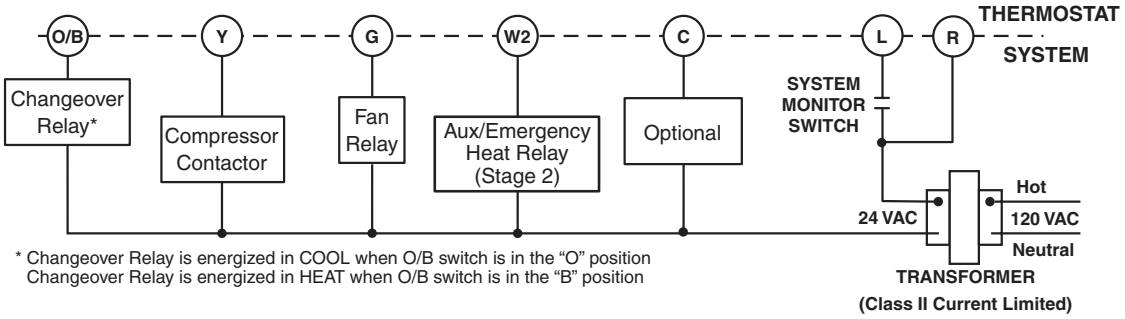
INSTALLER/CONFIGURATION MENU

The configuration menu allows you to set certain thermostat operating characteristics to your system or personal requirements. To enter the menu: Set your thermostat to OFF and press the ⌃ and ⌄ buttons simultaneously. The display will show the first item in the configuration menu. Press RUN/HOLD to change to the next menu item or press TIME to go backwards to the previous item in the menu. To exit the menu and return to the program operation, press PRGM. If no keys are pressed within fifteen minutes, the thermostat will revert to normal operation.

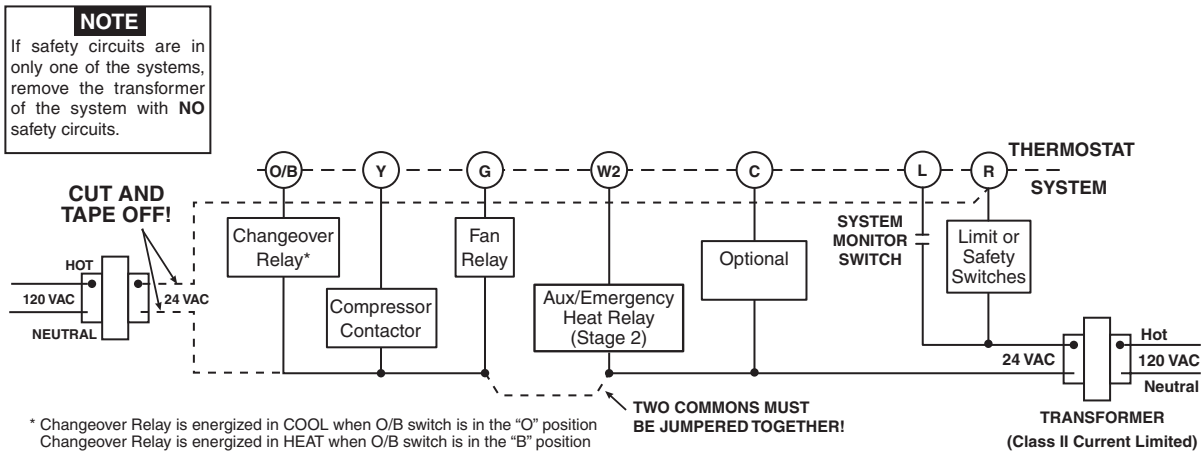
CONFIGURATION MENU				
Menu Reference Number	**Press Key**	**Displayed Factory (Default)**	**Press ⌃ or ⌄ to select from listed options**	**COMMENTS**
1	⌃ and ⌄	SS	HP	Select Single Stage (SS) or Heat Pump (HP, 1 compressor)
2	RUN/HOLD*	(OFF) CS	On	Select Cool Savings Feature On or OFF
	RUN/HOLD*	(3) CS	1, 2, 3, 4, 5, 6	If CS selected On, selects Cool Savings value
3	RUN/HOLD*	(On) E	OFF	Select Energy Management Recovery On or OFF
4	RUN/HOLD*	(ME) CR (🔥)	FA, SL	Select Adjustable Anticipation, cycle rate, Heat Single Stage
5	RUN/HOLD*	(FA) CR (❄)	SL	Select Adjustable Anticipation, cycle rate, Cool Single Stage
6	RUN/HOLD*	(OFF) CL	On	Select Compressor lockout OFF or On
7	RUN/HOLD*	(On) L	OFF	Select Display Light On or OFF
8	RUN/HOLD*	Temp (0 HI)	4 LO to 4 HI	Select temperature display adjustment higher or lower
9	RUN/HOLD*	°F	°C	Select °F / °C Display (temperature units in Fahrenheit or Celsius)
10	RUN/HOLD*	(OFF) Change Filter	On	Select filter replacement indicator OFF or On
	RUN/HOLD*	Change Filter (200 h)	25 to 1975	If Change Filter selected On, selects time interval for Change Filter Indicator. (in 25 hour increments)
11	RUN/HOLD*			Returns to normal operation

*Press **RUN/HOLD** to advance to next item or **TIME** to move backwards to previous item

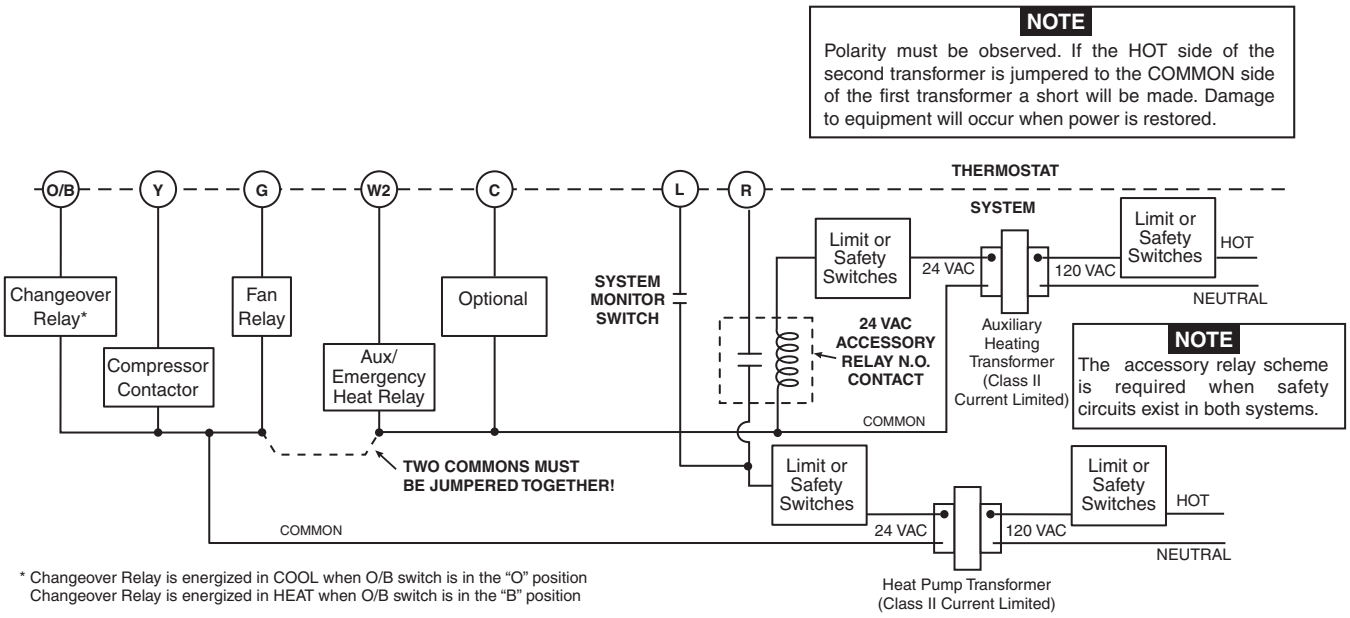
TYPICAL WIRING DIAGRAMS



Typical wiring diagram for single transformer systems



Typical wiring diagram for two transformer systems with NO safety circuits



Typical wiring diagram for two transformer systems with safety circuits in BOTH systems

TECHNICAL HELP

1F82-0261 INSTALLER/CONFIGURATION MENU

The configuration menu allows you to set certain thermostat operating characteristics to your system or personal requirements. To enter the menu: Set your thermostat to OFF and press the ∧ and ∨ buttons simultaneously. The display will show the first item in the configuration menu. Press RUN/HOLD to change to the next menu item or press TIME to go backwards to the previous item in the menu. To exit the menu and return to the program operation, press PRGM. If no keys are pressed within fifteen minutes, the thermostat will revert to normal operation.

CONFIGURATION MENU						
Menu Reference Number	**Heat Pump**	**Single Stage**	**Press Key**	**Displayed (Factory Default)**	**Press ∧ or ∨ to select from listed options**	**COMMENTS**
1	1	1	∧ and ∨	HP	SS	Select Heat Pump (HP, 1 compressor) or Single Stage (SS)
2	2	2	**RUN/HOLD***	CS (OFF)	On	Select Cool Savings Feature On or OFF
			RUN/HOLD*	CS (3)	1, 2, 3, 4, 5, 6	If CS selected On, selects Cool Savings value
3	3	3	**RUN/HOLD***	E (On)	OFF	Select Energy Management Recovery On or OFF
4	4		**RUN/HOLD***	CR HE-PU (FA)	SL	Select Adjustable Anticipation, cycle rate, Heat Pump, Heat and Cool
		4	**RUN/HOLD***	CR Heat (FA)	SL	Select Adjustable Anticipation, cycle rate, Heat Single Stage
5	5		**RUN/HOLD***	CR Aux (FA)	SL	Select Adjustable Anticipation, cycle rate, Heat Pump Aux Stage
		5	**RUN/HOLD***	CR Cool (FA)	SL	Select Adjustable Anticipation, cycle rate, Cool Single Stage
6	6	6	**RUN/HOLD***	CL (OFF)	On	Select Compressor lockout OFF or On
7	7	7	**RUN/HOLD***	L (On)	OFF	Select Display Light On or OFF
8	8	8	**RUN/HOLD***	Temp (0 HI)	4 LO to 4 HI	Select temperature display adjustment higher or lower
9	9	9	**RUN/HOLD***	°F	°C	Select °F / °C Display (temperature units in Fahrenheit or Celsius)
10	10		**RUN/HOLD***	FH (On)	OFF	Select fast second stage On or OFF
11	11	10	**RUN/HOLD***	Change Filter (OFF)	On	Select filter replacement indicator OFF or On
			RUN/HOLD*	Change Filter (200 h)	25 to 1975	If Change Filter selected On, selects time interval for Change Filter Indicator. (in 25 hour increments)
12			**RUN/HOLD***			Returns to normal operation

*Press **RUN/HOLD** to advance to next item or **TIME** to move backwards to previous item

1F89-0211 INSTALLER/CONFIGURATION MENU

CONFIGURATION MENU				
Menu Reference Number	**Press Key**	**Displayed (Factory Default)**	**Press ∧ or ∨ to select from listed options**	**COMMENTS**
1	∧ and ∨	CS (OFF)	On	Select Cool Savings Feature On or OFF
	∧ and ∨	CS (3)	1, 2, 3, 4, 5, 6	If CS selected On, selects Cool Savings value
2	∧ and ∨	CR HE-PU (FA)	SL	Select Adjustable Anticipation, cycle rate, Heat Pump, Heat and Cool
3	∧ and ∨	CR Aux (FA)	SL	Select Adjustable Anticipation, cycle rate, Heat Pump Aux Stage
4	∧ and ∨	CL (OFF)	On	Select Compressor lockout OFF or On
5	∧ and ∨	L (On)	OFF	Select Display Light On or OFF
6	∧ and ∨	Temp (0 HI)	4 LO to 4 HI	Select temperature display adjustment higher or lower
7	∧ and ∨	°F	°C	Select °F / °C Display (temperature units in Fahrenheit or Celsius)
8	∧ and ∨	FH (On)	OFF	Select fast second stage On or OFF
9	∧ and ∨	Change Filter (OFF)	On	Select filter replacement indicator OFF or On
	∧ and ∨	Change Filter (200 h)	25 to 1975	If Change Filter selected On, selects time interval for Change Filter Indicator. (in 25 hour increments)
10	∧ and ∨			Returns to normal operation

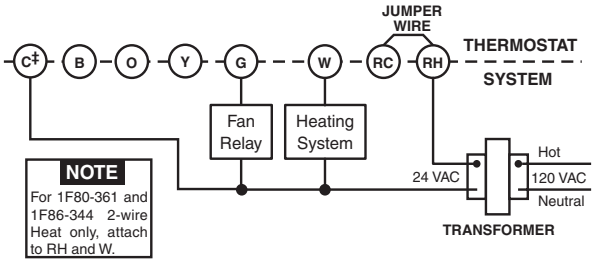
CONFIGURATION

The following table allows you to customize the options on your Comfort-Set thermostat.

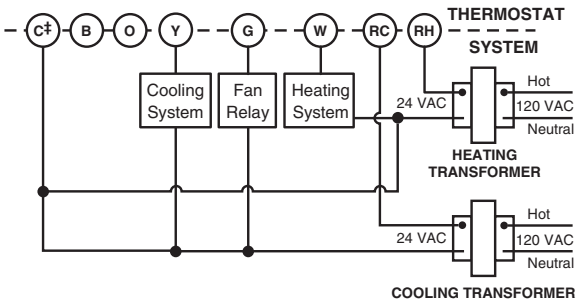
1F80-224	*1F80-240	1F80-241	1F80-361	1F86-241	1F86-344	1F87-361	Configuration Menu			
Step	Step	Step	Step	Step	Step	Press Button(s)	Press Button(s)	Displayed (Factory Default)	Press ▲ or ▼ to select:	COMMENTS
1	1	1	1	N/A	N/A	**1**	**PRGM** and **RUN**	HOLD (0:00)	0 to 8 hrs (in 15 minute increments)	Select temporary Hold time
N/A	N/A	N/A	N/A	1	1	N/A	Set SYSTEM switch to OFF			SYSTEM switch must be OFF to configure thermostat options
2	2	2	2	2	2	HOLD*	*	(FA)	SL	Select FA or SL (Fast or Slow) heating cycle rate
3	3	3	3	3	3	HOLD*	*	d-L (ON)	OFF	Select display backlight OFF or ON
N/A	4	4	4	N/A	N/A	HOLD*	*	E (ON)	OFF	Select Energy Management Recovery OFF or ON
N/A	5	N/A	5	N/A	4	HOLD*	*	Filter (000)	0 to 1950 hours (in 50 hour increments)	Select filter replacement run time
4	N/A	5	6	4	5	HOLD*	*	LOC (OFF)	ON	Select Compressor lockout OFF or ON
5	6	6	7	5	6	HOLD*	*	0 HI (0)	4 LO to 4 HI	Select temperature display adjustment higher or lower
6	7	7	8	6	7	HOLD*	*	°(F)	°C	Select temperature display to °F or °C
7	8	8	9	N/A	N/A	**RUN**	**RUN**			Returns to normal operation
8	*9	N/A	N/A	7	8		Set SYSTEM switch to HEAT or COOL			Returns to normal operation

* 1F80/1F87 - Press **HOLD** to advance to next item or **TIME** to move backwards to previous item
1F86 - Press ▲ and ▼ to advance to next item
1F80-240 is HEAT only

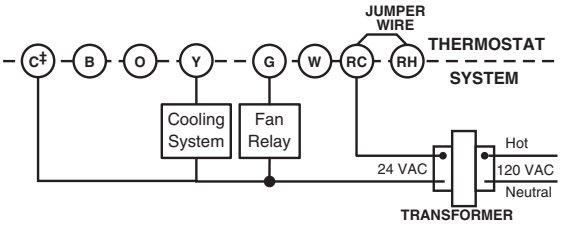
TYPICAL WIRING DIAGRAMS



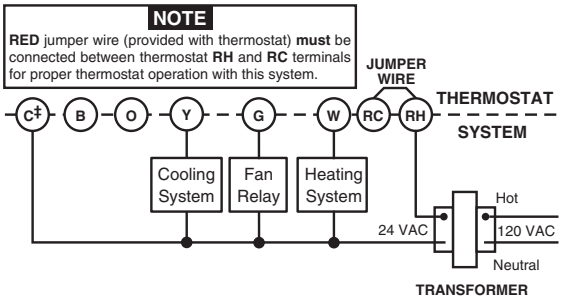
Heat only, 3-wire, single transformer systems



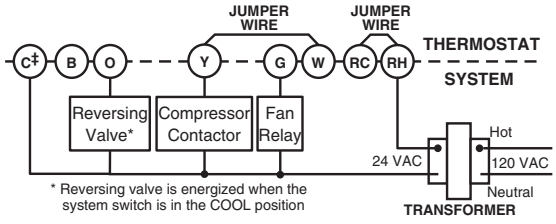
Heat/cool, 5-wire, two-transformer systems



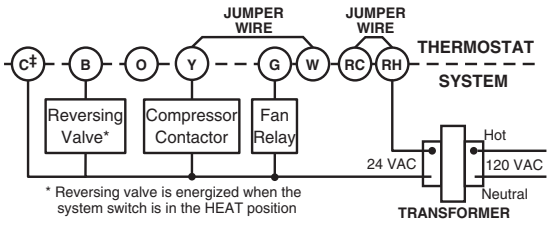
Cool only, 3-wire, single transformer systems



Heat/cool, 4-wire, single transformer systems



Heat pump with reversing valve energized in COOL



Heat pump with reversing valve energized in HEAT

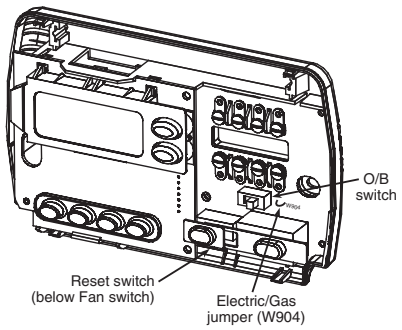
CONFIGURATION

The following table allows you to customize the options on your Comfort-Set thermostat. Begin by pressing simultaneously the two buttons in step 1.

Configuration Menu

Step	1F82-261 Press Button(s)	1F89-211 Press Button(s)	Displayed (Factory Default)	Press ⌃ or ⌄ to select:	COMMENTS
1	**PRGM** and **RUN**	Set **SYSTEM** switch to OFF	HOLD (0:00)	0 to 8 hrs (in 15 minute increments)	Select temporary Hold time
2	**HOLD***	⌃ or ⌄	✻ ◊ (SL)	FA	Select FA or SL (Fast or Slow) pump cycle rate
3	**HOLD***	⌃ or ⌄	EMER (FA)	SL	Select FA or SL (Fast or Slow) Auxiliary and Emergency Aux heating cycle rate
4	**HOLD***	⌃ or ⌄	d-L (on)	OFF	Select display backlight OFF or ON
5	**HOLD***	⌃ or ⌄	E (on)	OFF	Select Energy Management Recovery OFF or ON
6	**HOLD***	⌃ or ⌄	Filter (000)	0 to 1950 hours (in 50 hour increments)	Select filter replacement run time
7	**HOLD***	⌃ or ⌄	LOC (OFF)	on	Select Compressor lockout OFF or ON
8	**HOLD***	⌃ or ⌄	0 HI (0)	4 LO to 4 HI	Select temperature display adjustment higher or lower
9	**HOLD***	⌃ or ⌄	°(F)	°C	Select temperature display to °F or °C
10	**HOLD***	⌃ or ⌄	FA (ON)	OFF	Selects fast second stage ON or OFF
11	**RUN**				Returns to normal operation

* Press **HOLD** to advance to next item or **TIME** to move backwards to previous item



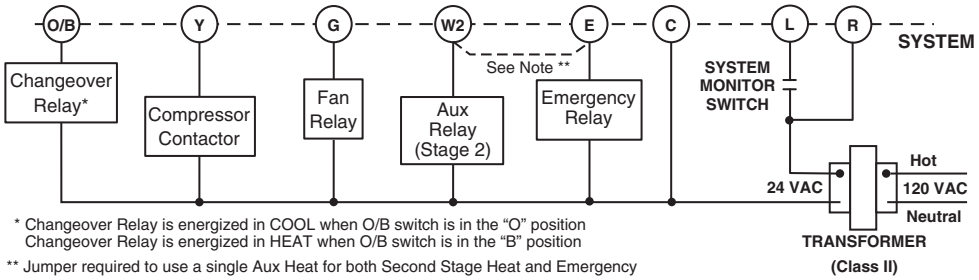
Electric / Gas Jumper (Fan Option)

If your emergency or auxiliary system will energize the blower, then jumper W904, on the thermostat base, must be cut (see figure at left). If your emergency or auxiliary heat system requires that the thermostat energize the fan circuit, do not cut jumper W904.

O/B Terminal Switch Selection

The O/B switch on this thermostat is factory set to the “O” position. This will accommodate the majority of heat pump applications, which require the changeover relay to be energized in COOL. If the thermostat you are replacing or the heat pump being installed with this thermostat requires a “B” terminal, to energize the changeover relay in HEAT, the O/B switch must be moved to the “B” position.

TYPICAL WIRING DIAGRAMS

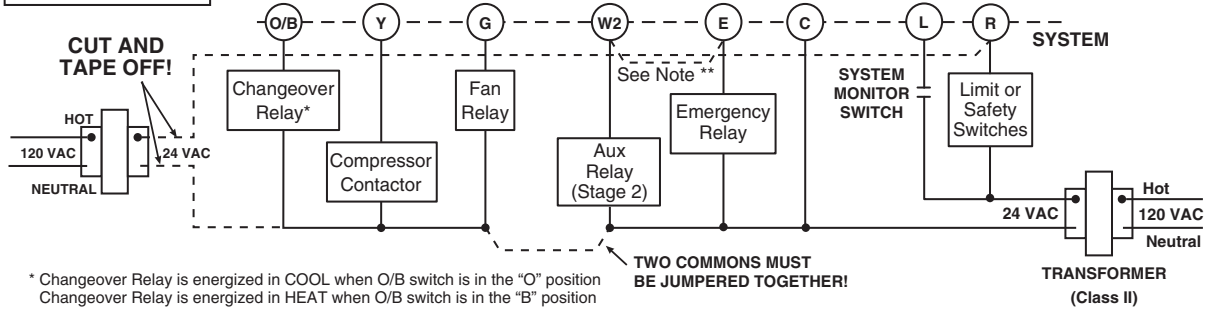


* Changeover Relay is energized in COOL when O/B switch is in the “O” position
Changeover Relay is energized in HEAT when O/B switch is in the “B” position

** Jumper required to use a single Aux Heat for both Second Stage Heat and Emergency

Single transformer systems

NOTE
If safety circuits are in only one of the systems, remove the transformer of the system with **NO** safety circuits.



* Changeover Relay is energized in COOL when O/B switch is in the “O” position
Changeover Relay is energized in HEAT when O/B switch is in the “B” position

** Jumper required to use a single Aux Heat for both Second Stage Heat and Emergency

Two transformer systems with NO safety circuits

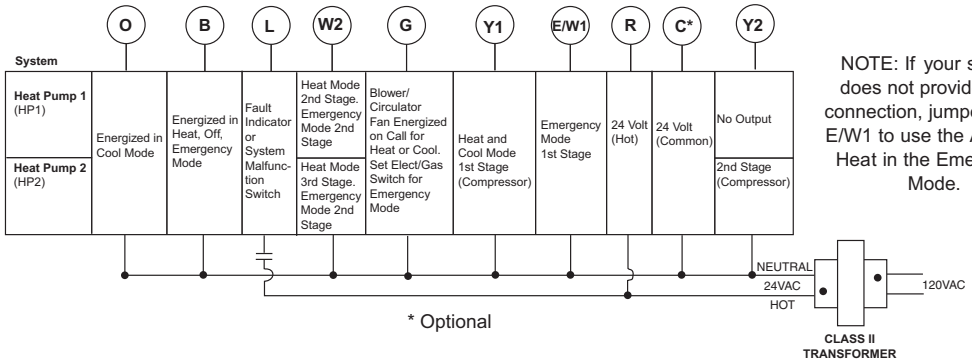
INSTALLER/CONFIGURATION MENU

To enter the menu: Press the **System** button until **OFF** is displayed, then press ▲ and ▼ simultaneously. This displays menu item #1 in the table below.

	Check Box For Your Model Number			CONFIGURATION MENU			
	☐ 1F83-277	☐ 1F85-275	☐ 1F85-277				
Menu Reference Number	Step	Step	Step	Press Button	Displayed (Factory Default)	Press ▲ or ▼ to select from listed options	Comments
1	1	1	1	SYSTEM	MS 2	HP1, HP2, SS1	Selects Multi-Stage, Heat Pump 1 (1 Compressor), Heat Pump 2 (2 Compressor or 2 Speed Compressor), or Single Stage
2	N/A	N/A	2	SYSTEM	(7)	5d, 0d	Selects Number of Programs per Week
3	N/A	2	3	SYSTEM	PRG 4	PRG 2, PRG 0	Selects Programmable Periods
4	N/A	3	4	SYSTEM	4:00 HOLD	0:15 to 8:00 (increments of 15 minutes)	Selects Temporary Program Override Time NOTE: Maximum setting is 4:00 hours for 1F85-277
5	N/A	4	5	SYSTEM	EMR (on)	OFF	Selects Energy Management Recovery OFF or ON
6	2	5	6	SYSTEM	FA	SL	Selects Fast or Slow Cycle Selection
7	3	6	7	SYSTEM	CL (OFF)	CL on	Selects Compressor Lockout CL OFF or ON
8	4	7	8	SYSTEM	CdL (on)	CdL OFF	Selects Backlight Display
9	5	8	9	SYSTEM	FA (on)	FA OFF	Selects Fast Second Stage ON or OFF
10	6	9	10	SYSTEM	0 FLTR	50-1950	Selects filter replacement run time
11	7	10	11	SYSTEM	0 (Room Temp)	4 LO to 4 HI Selects	Selects Temperature Display Adjustment 4 LO to 4 HI
12	8	11	12	SYSTEM	F	C	For Centigrade selection
13	9	12	13	SYSTEM	AU (on)	AU OFF	Selects Auto Mode ON or OFF
14	10	13	14	SYSTEM	LR (90)	LR 62 to LR 89	Selects Limited HEAT range
15	11	14	15	SYSTEM	LR (45)	LR 46 to LR 82	Selects Limited COOL range
16	12	15	16	SYSTEM	(OFF)	on	Selects Keypad Lockout
17	13	16	17		000 If L/O	001 to 999	Selects Keypad Lockout combination number. Press System to set code
18	14	17	18	* RUN ** SYSTEM			Returns to the OFF position

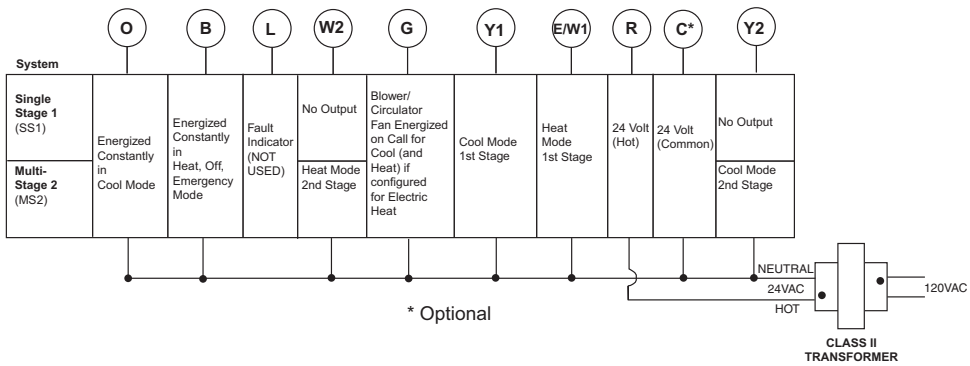
* Programmable Models
** Non-Programmable Models

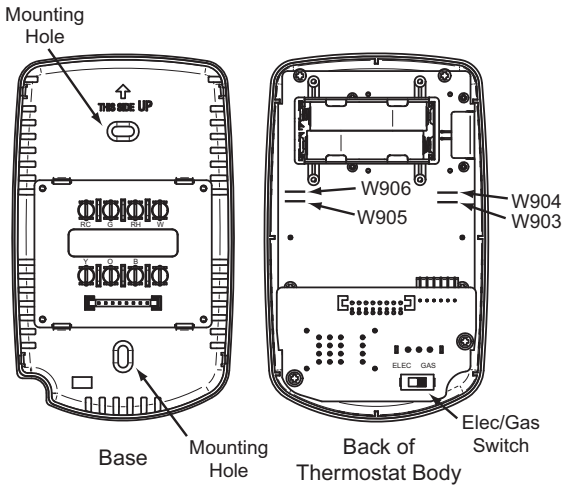
Figure 2 – Heat Pump Systems



NOTE: If your system does not provide an E connection, jumper W2 to E/W1 to use the Auxiliary Heat in the Emergency Mode.

Figure 3 – Single Stage or Multi-Stage System (No Heat Pump)





W903 - clip to disable EMR feature
W904 - clip for Celcius display
W905 - clip for hydronic system
W906 - clip for 5/1/1 day programming

Figure 1

Reset Operation

If a voltage spike or static discharge blanks out the display or causes erratic thermostat operation you can reset the thermostat by pressing ▲ , ▼ and TIME at the same time. This also resets the factory defaults. If the thermostat has power, has been reset and still does not function correctly contact your heating/cooling service person or place of purchase.

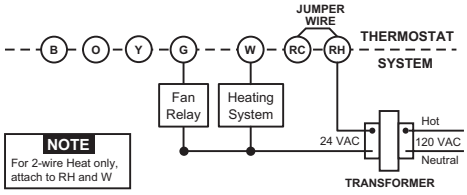


Figure 2. Typical wiring diagram for heat only, 3-wire, single transformer systems

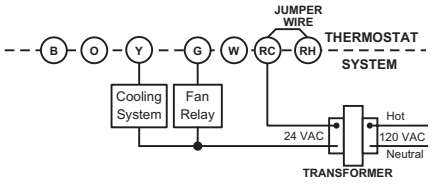


Figure 3. Typical wiring diagram for cool only, 3-wire, single transformer systems

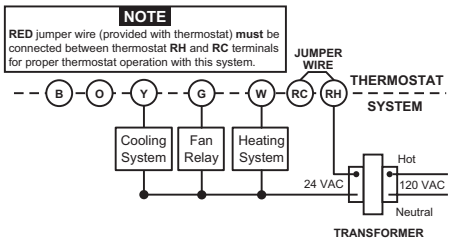


Figure 4. Typical wiring diagram for heat/cool, 4-wire, single transformer systems

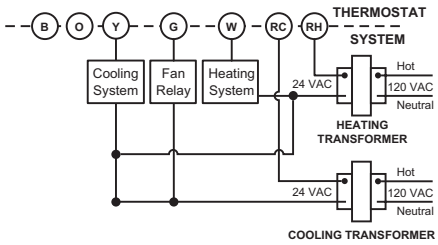


Figure 5. Typical wiring diagram for heat/cool, 5-wire, two-transformer systems

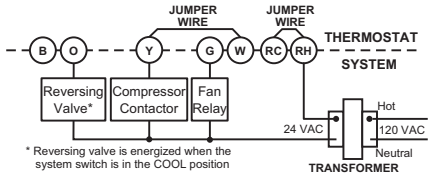


Figure 6. Typical wiring diagram for heat pump with reversing valve energized in COOL

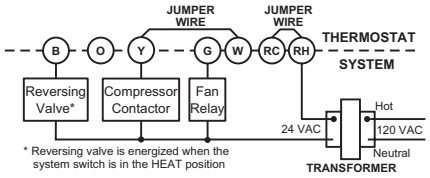
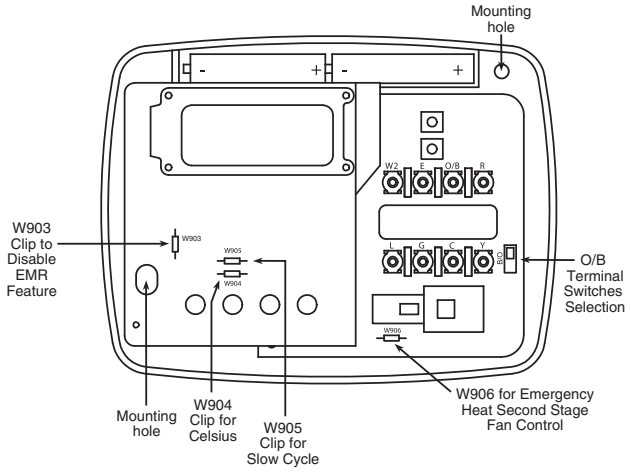


Figure 7. Typical wiring diagram for heat pump with reversing valve energized in HEAT



Thermostat base

Reset Operation 1F72-151

If a voltage spike or static discharge blanks out the display or causes erratic thermostat operation, you can reset the thermostat by pressing ▲, ▼ and TIME at the same time.

Reset Operation 1F79-111

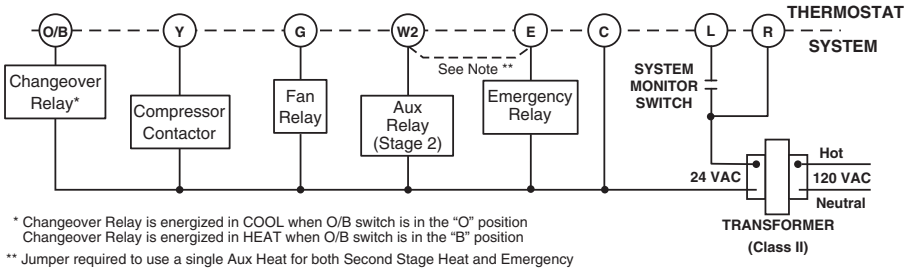
If a voltage spike or static discharge blanks out the display or causes erratic thermostat operation, you can reset the thermostat by pressing ▲, ▼ and at the same time when system is switched from "OFF" to "HEAT" position.

Configuration Menu

1F79-111 Step	1F72-151 Step	1F79-111 Press Button(s)	1F72-151 Press Button(s)	Displayed (Factory Default)	Press ▼ or ▲ to select:	COMMENTS
1		Set SYSTEM switch to OFF				
2	1	▼ and ▲ for at least 2 seconds	**PRGM** and **RUN**	FA (ON)	OFF	Select Fast (on) or slow (off) Second Stage Heat
3	2	▼ and ▲ momentarily	**HOLD** *	CL (OFF)	ON	Select Compressor lockout OFF or ON
4	3	▼ and ▲ momentarily	**HOLD** *	0 HI (0)	3 LO TO 3 HI	Select temperature display adjustment higher or lower
5*	4*	▼ and ▲ momentarily	**HOLD** **	dL (ON)	OFF	Select display backlight OFF or ON
6	5	Move SYSTEM switch from OFF	**RUN**			Return to normal operation

* Not available on earlier models

** Press **HOLD** to advance to next item or **TIME** to move backwards to previous item

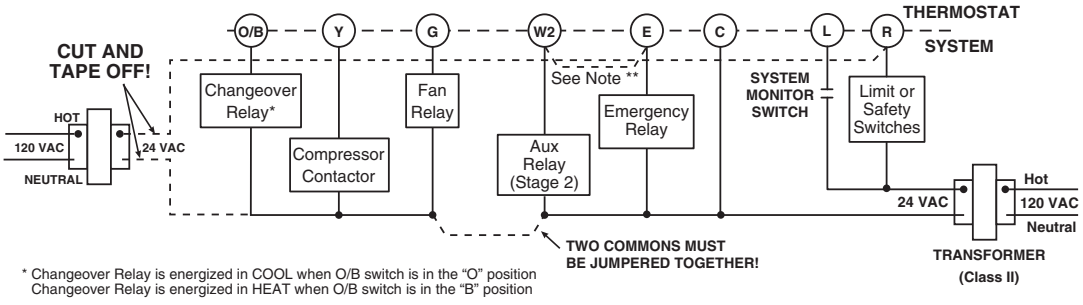


* Changeover Relay is energized in COOL when O/B switch is in the "O" position
Changeover Relay is energized in HEAT when O/B switch is in the "B" position

** Jumper required to use a single Aux Heat for both Second Stage Heat and Emergency

Typical wiring diagram for single transformer systems

NOTE
If safety circuits are in only one of the systems, remove the transformer of the system with **NO** safety circuits.

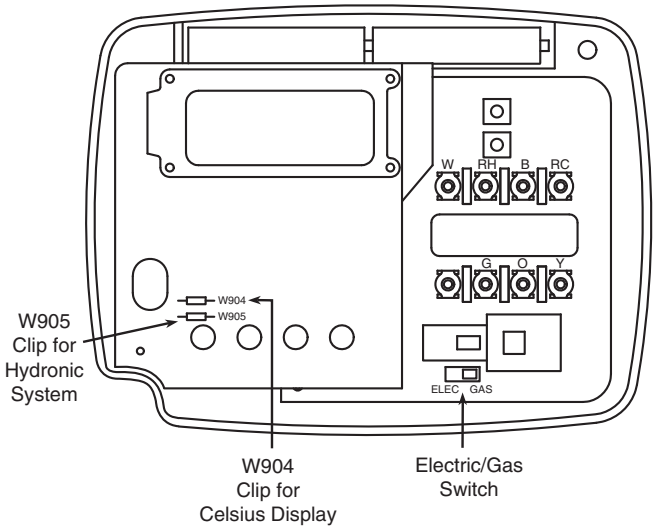


* Changeover Relay is energized in COOL when O/B switch is in the "O" position
Changeover Relay is energized in HEAT when O/B switch is in the "B" position

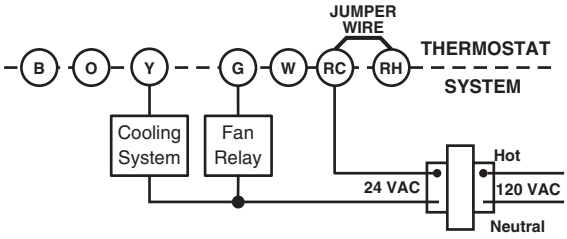
** Jumper required to use a single Aux Heat for both Second Stage Heat and Emergency

Typical wiring diagram for two transformer systems with NO safety circuits

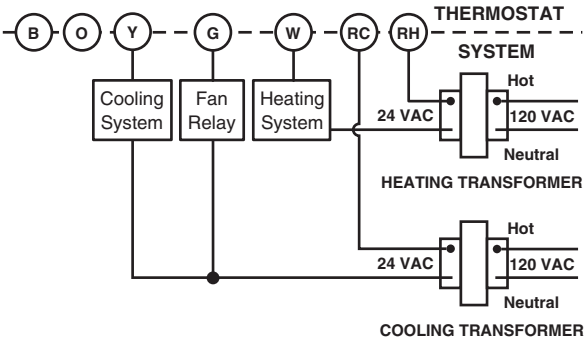
CONFIGURATION



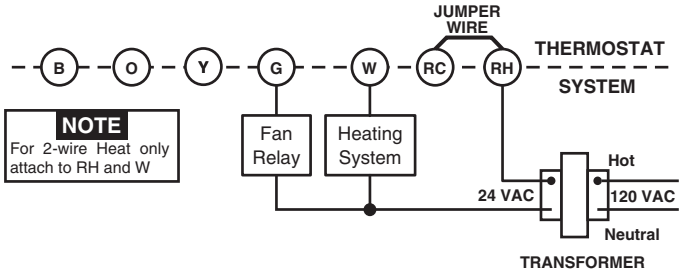
TYPICAL WIRING DIAGRAMS



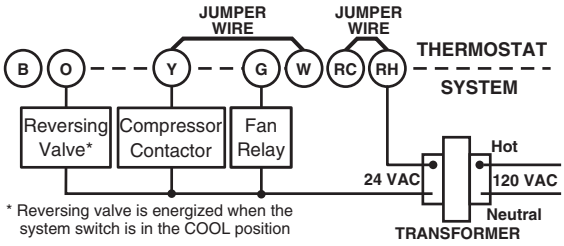
Cool only, 3-wire, single transformer systems



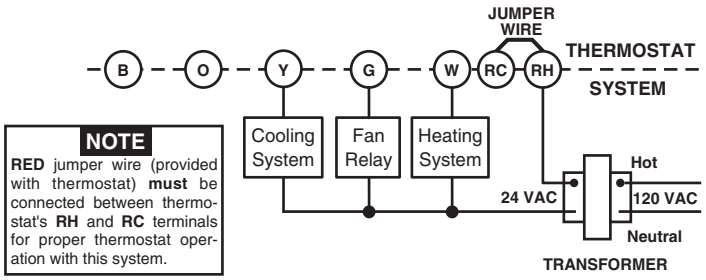
Heat/cool, 5-wire, two-transformer systems



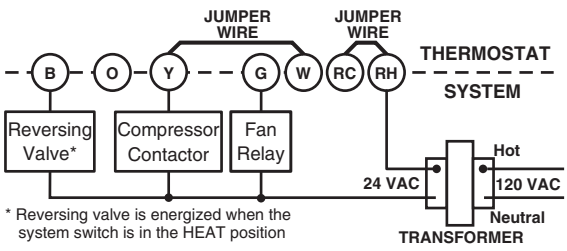
Heat only, 3-wire, single transformer systems



Heat pump with cool active reversing valve



Heat/cool, 4-wire, single transformer systems



Heat pump with heat active reversing valve

CONFIGURATION

Electric Heat Furnaces (Single Transformer Systems Only)

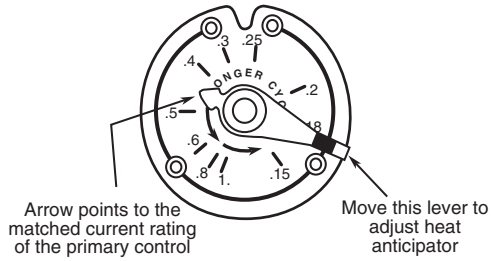
The thermostat as shipped may not operate the fan correctly. If both the heating and cooling system must operate the fan relay, remove the yellow factory-installed jumper wire from the Y terminal and connect it to the A terminal. The fan should now cycle when the thermostat calls for either heat or cool.

Heat Pump Applications

This thermostat WILL NOT provide multi-stage heating or cooling operation. For single-stage heat pump applications, install a short jumper wire across terminals W and Y. If the old thermostat has a terminal that is continuously energized, disconnect the wire from the old thermostat's terminal and connect it either to the: 1) B terminal, if the reversing valve is energized on a call for heat: or to the 2) O terminal, if the reversing valve is energized on a call for cool. If the system heats on a call for cool, or vice versa, this wire has been connected to the wrong terminal.

Special Application Terminals

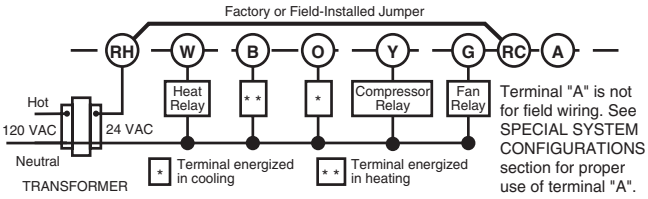
The B and O terminals can provide switching for special functions other than heat pump operation. When the system switch is in the HEAT position, the B terminal is energized. When the system switch is in the COOL position, the O terminal is energized.



Anticipator adjustment

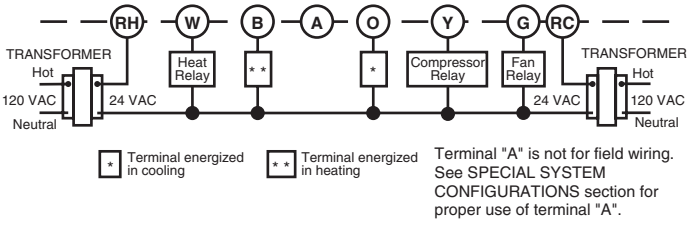
TYPICAL WIRING DIAGRAMS

NOTE: Some thermostat models don't include all terminals as shown here. Heat only models use terminals R and W.

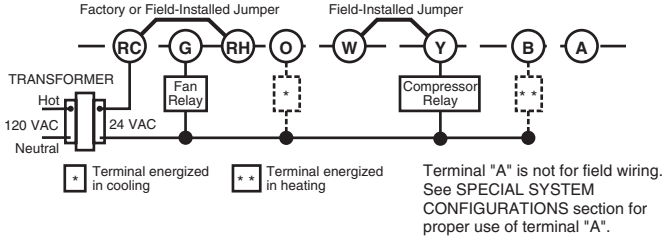


Single transformer heating/cooling system

NOTE: Remove factory-installed jumper between **RC** and **RH** terminals for this application.



Two-transformer heating/cooling system



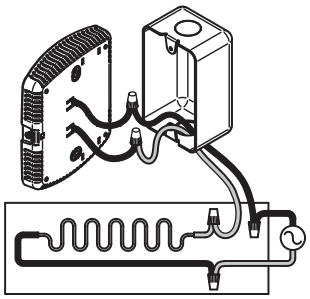
Single transformer, single stage heat pump system

NOTE

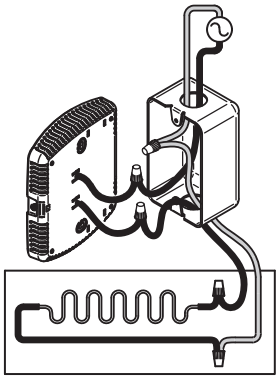
Use with copper conductors only. Use wire connectors approved for 12 AWG only.

Make the appropriate connections to the thermostat as per diagram below. The wires are non-polarized so either wire can be connected to either terminal.

2 Wire Installation



4 Wire Installation



Slide thermostat switch to ● position. The thermostat normally displays the actual ambient temperature.

The thermostat displays the percentage of power usage (in "PC" mode only) required to maintain the desired temperature. For example:

100% power usage

70% power usage

30% power usage

To view the setpoint temperature, press the ⌃ or ⌄ button once. The icon appears and the thermostat displays the setpoint temperature. To change the setpoint, press the ⌃ or ⌄ button to raise or lower the temperature until the desired setpoint is reached.

To turn the backlight on, press the ⓜ button, or the ⌃ or ⌄ button once.

To change the thermostat installer configuration, press and hold the ⓜ button for 5 seconds. The features and (defaults) are selected by pressing the ⓜ button once to scan the installer configuration selections. The defaults are changed with the ⌃ or ⌄ button. (Please refer to the following table for the selections of your choice.)

	Default	Options
Backlight	LO (On)	LF (Off)
Display Reading Adjustment*	H0.0	L3.0 to H3.0
Proportional Control**	PO (On)	PF (Off)
Anticipation***	AL(2000-4000 W)	AS (500-2000 W)
Temperature Scale	SC (Celsius)	SF (Fahrenheit)

* Adjusts room temperature display higher or lower to agree with a previous thermostat.

** Proportional Control allows the thermostat to modulate depending on power usage.

***Adjusts your thermostat anticipation based on the room and baseboard heater size, e.g., in a room with a 3500 W baseboard heater, set your thermostat anticipation to AL.

The thermostat will save the setpoint temperature and installer configuration selections permanently, even after power outages.

To reset the thermostat, press the ⌃, ⌄, and ⓜ buttons simultaneously.

To suspend the thermostat operation, slide the thermostat switch to the ⏻ position. In this position, the thermostat still has power but the display is turned off.

MAXIMUM SENSING LOCATIONS PER THERMOSTAT								
	Thermostat Model Number	Indoor Sensing Locations				Remote Sensor Priority Assignment (LO/AVG/HI)	Allows Outdoor Remote Sensor	Sensor Set Up
		Total (Max.)	Thermostat Onboard Sensor		Remote Sensor			
Single Stage	1F90-371	1	OFF*	With	1*	-	-	Clip Jumper W922 and Enable Sensor in Menu
	1F96-344	1	OFF*	With	1*	-	-	Clip Jumper W922 and Enable Sensor in Menu
	1F97-1277, -0671	2	ON or OFF	+	1	Yes	Yes***	Enable Sensor in Menu
	1F97-371	1	OFF*	With	1*	-	-	Clip Jumper W922 and Enable Sensor in Menu
	1F97-391	1	OFF*	With	1*	-	-	Clip Jumper W922 and Enable Sensor in Menu
Staging	1F93-380	4	ON or OFF	+	Up to 3	Yes**	Yes	Enable Sensor in Menu
	1F94-371	4	ON or OFF	+	Up to 3	Yes**	Yes	Enable Sensor in Menu
	1F95-1277, -0671	2	ON or OFF	+	1	Yes	Yes***	Enable Sensor in Menu
	1F95-371	4	ON or OFF	+	Up to 3	Yes**	Yes	Enable Sensor in Menu
	1F95-377	4	ON or OFF	+	Up to 3	Yes**	Yes	Enable Sensor in Menu
	1F95-391	4	ON or OFF	+	Up to 3	Yes**	Yes	Enable Sensor in Menu

*Using a Remote Sensor On This Model Requires the Onboard Thermostat Sensor To Be Off.
**Allows A Sensor Priority of LO, AVG., or HI To Be Assigned To The Onboard Thermostat Sensor In Addition Remote Sensors.
***Accepts One Remote Sensor, Indoor or Outdoor.

REMOTE SENSOR CALCULATED PRIORITY AVERAGE

Consult Maximum Sensing Locations Per Thermostat chart above to determine how many sensors a thermostat will accept.

Tables 1-3 show how priority (LO, AVG, HI) effects the room temperature calculation. The example below table three shows the calculation of each remote sensor and how it uses them to arrive at room temperature average.

Table 1: Remote Sensor A configured as a LO priority sensor

Remote Sensor	Sensor Priority	Priority Multiplier	Room Temperature	Averaging Calculation
SA	LO	1	70°F (Sensor Temp.)	1 x 70 = 70 (Priority Multiplier x Room Temp.)

Table 2: Remote Sensor B configured as a AVG priority sensor

Remote Sensor	Sensor Priority	Priority Multiplier	Room Temperature	Averaging Calculation
SB	AVERAGE	2	75°F (Sensor Temp.)	2 x 75 = 150 (Priority Multiplier x Room Temp.)

Table 3: Remote Sensor C configured as a HI priority sensor

Remote Sensor	Sensor Priority	Priority Multiplier	Room Temperature	Averaging Calculation
SC	HI	4	80°F (Sensor Temp.)	4 x 80 = 320 (Priority Multiplier x Room Temp.)

The example below lists three sensors each with a different priority and room temperature. All three sensors are combined in the calculation to display the average temperature. The priority multiplier shown in the tables above causes a sensor with low priority to carry less weight in the calculated average. A sensor with a HI priority setting contributes more to the calculated average. Assume that the building in which the thermostat is located has three indoor remote sensors (SA, SB, SC) that have different room temperatures (70, 75, 80). The calculated average will be displayed as the room temperature shown in the example below.

Example: Remote Sensors A, B, and C configured as a LO, AVG, and HI priority sensors

Remote Sensor	Sensor Priority	Priority Multiplier	Room Temperature	Averaging Calculation
SA	LO	1	70°F (Sensor Temp.)	1 x 70 = 70 (Priority Multiplier x Room Temp.)
SB	AVERAGE	2	75°F (Sensor Temp.)	2 x 75 = 150 (Priority Multiplier x Room Temp.)
SC	HI	4	80°F (Sensor Temp.)	4 x 80 = 320 (Priority Multiplier x Room Temp.)
				Avg. Calc. (540)/Sum Priority Mult. (7)
				540/7 = 77°F (Calculated Displayed Temp.)

Troubleshooting Chart

To function correctly and read temperature accurately, the thermostat must have constant 24-volt power. If the thermostat temperature is steadily dropping, reading low, or reads **08°**, or displays – – – (3 dashes) when a remote sensor is installed, it can be traced to one of the three following conditions.

Condition	Test	Comments
1. Loss of 24-volt power.	On models with batteries, remove the batteries and re-install thermostat. If the display is blank, check heating and cooling system to determine why 24-volt power is absent.	For the sensor to read correctly, the 24-volt system power ***must*** be present. Some systems may require an isolation relay* to provide constant power to the thermostat. Limit or safety devices in the equipment can also cause a power interruption.
2. A broken wire on S1, S2 and S3 or (+, SA, -) from the thermostat to the remote.	Disconnect sensor wires at thermostat. Attach a short piece (2') of three-wire shielded cable to S1, S2 and S3 or (+, SA, -) on the subbase. Bring the remote sensor to the thermostat location and attach S1, S2 and S3 or (+, S, -) respectively. Reattach thermostat. If the temperature begins to climb (slowly), it is reading correctly. If it reads correctly with the 2' length but improperly when attached to the wire run, it indicates a fault in the wire run.	Repair or replace the 3 wire shielded cable. Be sure the remote wire run is not parallel to line voltage wires that carry heavy inductive loads, or across fluorescent light ballasts that may cause an inductance to be transmitted to the thermostat.
3. A shorted or damaged remote sensor.	Because it is an electronic sensor, there are no Ohm values to test. If correct conditions as listed in 1 & 2 above and the temperature stays at or near **08°**, it indicates a shorted or damaged remote sensor.	Replace remote sensor.

Note: Digital thermostats and remote sensors acclimate very slowly to temperature change. It may take an hour or more for the temperature to acclimate to the room temperature from a low temperature reading as outlined above. To expedite the room temperature display use the reset instructions listed in the installation instructions for the thermostat model you are working with. When reset, the thermostat will default to a room temperature of 70° and begin sensing room temperature. Be sure to reconfigure the installer menu for a remote sensor because the reset function may cancel remote sensing.

* Isolation Relay Wiring

Note: The diagram below shows how to attach an isolation relay to the "W" or "Y" circuit to provide constant power on power stealing thermostats. This willl allow the thermostat to operate properly with a remote sensor.

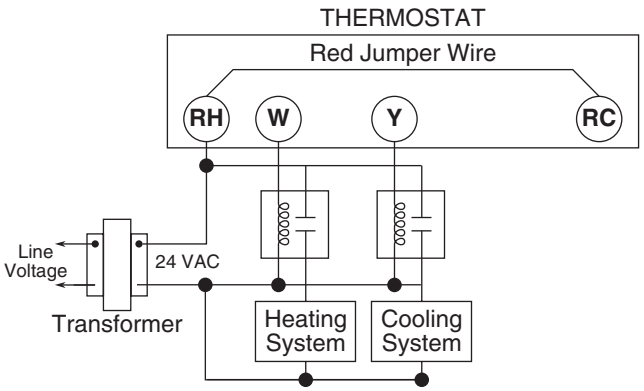
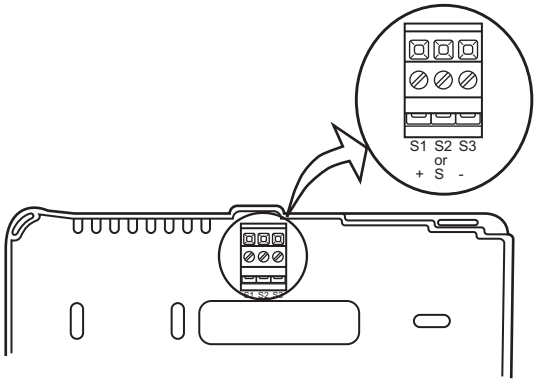


Figure 1. Wiring for single transformer systems

Figure 1 shows a single transformer heating/cooling system, with isolation relays installed in the heating (**W**) and cooling (**Y**) circuits. To simplify the diagram, limit and safety switches are not shown here, although they will be found either in the low or high voltage circuit. Limit and safety switches **must be retained**. Refer to the equipment manufacturer's system wiring diagram for the location of limit and safety switches.

⚠ WARNING

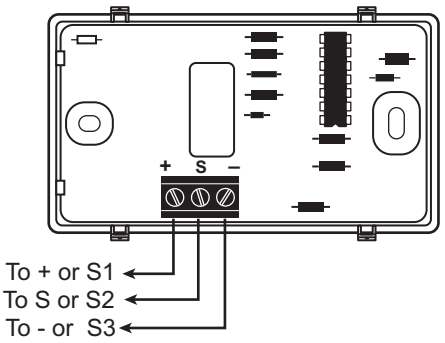
DO NOT REMOVE OR WIRE AROUND LIMIT AND SAFETY SWITCHES WHEN INSTALLING ISOLATION RELAYS.



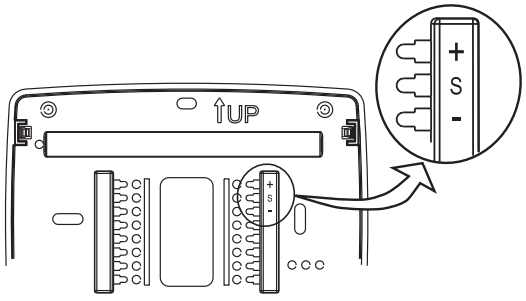
Thermostat Subbase

Note: When using shielded cable, connect shield of 18 or 20 gauge 3 connector cable to - or S3 on thermostat subbase.

Remote Sensor



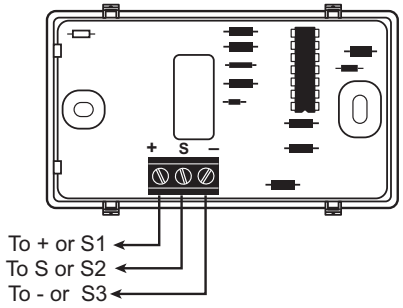
Single Stage Thermostat Remote Sensor Wiring (F145-1328)



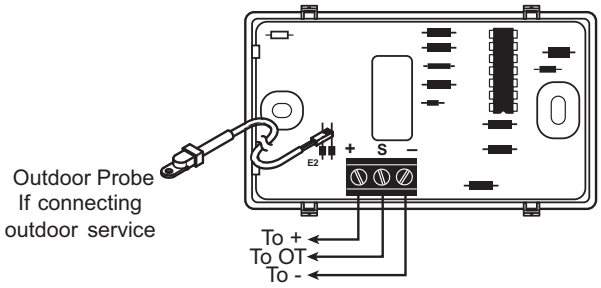
Thermostat Subbase

Note: When using shielded cable, connect shield of 18 or 20 gauge 3 connector cable to - or S3 on thermostat subbase.

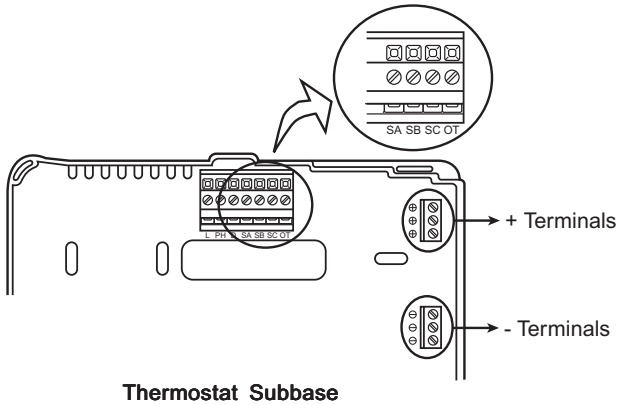
Remote Sensor



Remote Outoor Sensor



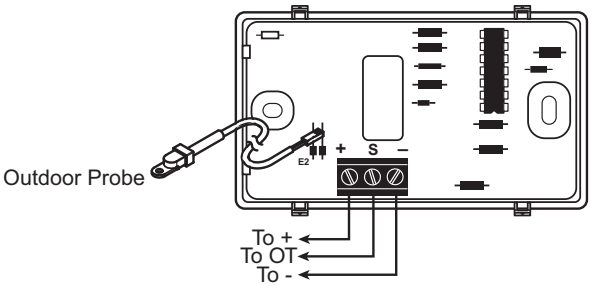
Staging Multi-Stage or Heat Pump Touchscreen Thermostat (1F95-1277) Indoor/Outdoor Remote Sensor Wiring (F145-1328/F145-1378)



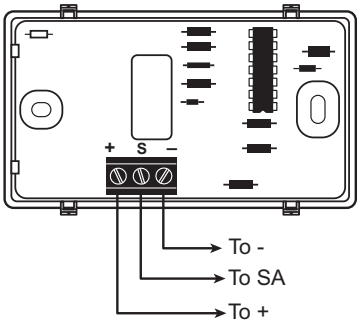
Thermostat Subbase

Note: When using shielded cable, connect shield of 18 or 20 gauge 3 connector cable to - or S3 on thermostat subbase.

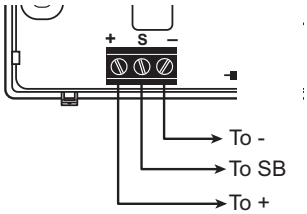
Remote Outdoor Sensor Base



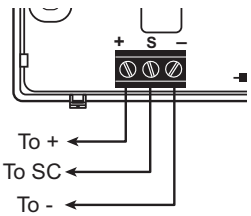
Remote Indoor Sensor A



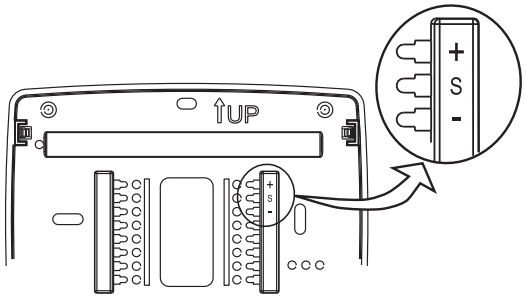
Remote Indoor Sensor B



Remote Indoor Sensor C



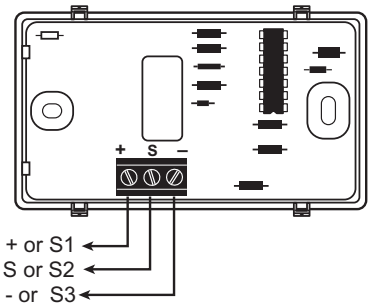
Staging Thermostat Multi-Stage or Heat Pump Indoor/Outdoor Remote Sensor Wiring (F145-1328/F145-1378)



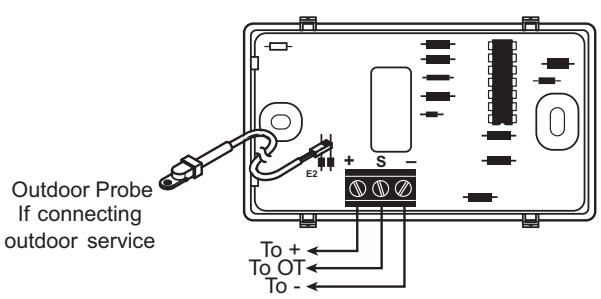
Thermostat Subbase

Note: When using shielded cable, connect shield of 18 or 20 gauge 3 connector cable to - or S3 on thermostat subbase.

Remote Sensor



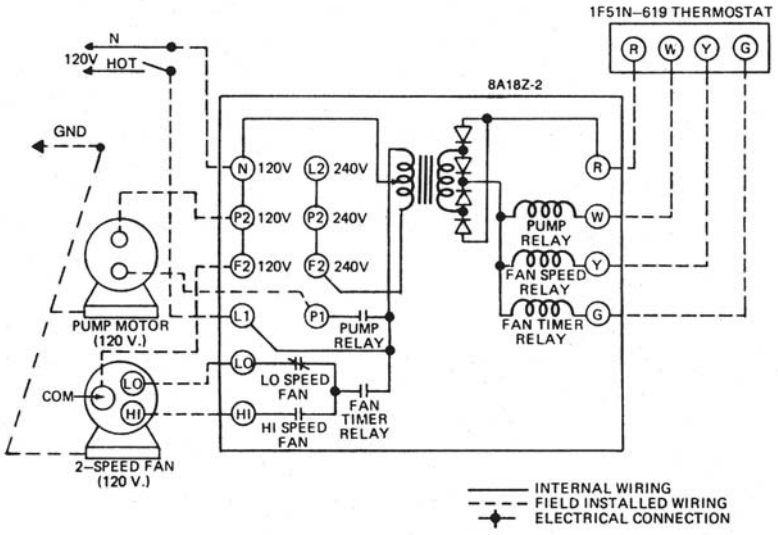
Remote Sensor



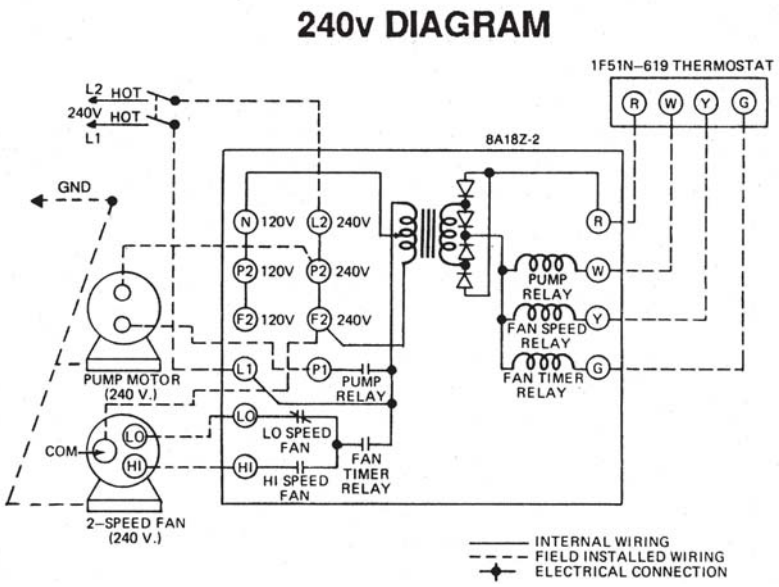
Single Stage (1F97-1277) TouchscreenThermostat Indoor/Outdoor Remote Sensor Wiring (F145-1328/F145-1378)

21D28-3 / 8A18Z-2 / 8A18Z-3 Typical Wiring

120v DIAGRAM



240v DIAGRAM



HEATING

Commonly Used Furnace Control Terms

Auto Reset: If shutoff occurs, the control delays for a specific recycle delay period before beginning another trial for ignition (models with retries only).

Continuous: An ignition source which, once placed in operation, is intended to remain ignited or energized continuously until manually interrupted.

Cool Delay to Fan Off: Timing to allow the fan to run after the call for cool ends. This allows residual cooling capacity to be removed from the cooling coils and distributed to the conditioned space.

Cool Delay to Fan On: Timing to allow the cooling coils to cool off before turning on the fan.

Flame Failure Re-ignition Time: "The period of time between loss of the supervised ignition source or the supervised main burner flame and a re-ignition attempt. During this time period the main burner gas supply is not shut off."

Flame Failure Response Time: "The period of time between loss of the supervised ignition source or the supervised main burner flame and the action to shut off the gas supply."

Flame-Establishing Period: "The period of time between initiation of gas flow and proof of the supervised flame or between the proof of supervised flame and initiation of gas flow. This may be applicable to proof of the ignition source or main burner flame, or both."

Heat Delay to Fan Off: Timing to allow the fan to run after the call for heat ends. This allows residual heat to be removed from the heat exchanger and distributed to the conditioned space.

Heat Delay to Fan On: Timing to allow the heat to build up in the plenum before turning on the fan.

Ignition Activation Period: The period of time between energizing the main gas valve and deactivation of the ignition means prior to the lockout time.

Initial Ignitor Warm-Up: Duration of ignitor warm-up time on the first 64 attempts.

Integrated: Has a microprocessor which monitors and analysis the operation of the continually MV, ignitor, inducer, fan, flame sensor, but it also turns on the humidifier, and air cleaner if those are available in the house. In other words it incorporates the all operations connected to the furnace from one power source.

Intermittent: "An ignition source which is automatically ignited or energized when the equipment is called on to operate and which remains continuously ignited or energized during each period of main burner operation. The ignition source is automatically extinguished or deenergized when each main burner operating cycle is completed."

Intermittent/Continuous: "An ignition source which is ignited or energized upon equipment user initiation of the operation cycle and which remains continuously ignited or energized during the equipment use cycle. The ignition source is extinguished or de-energized when the equipment use cycle is completed."

Intermittent/Interrupted: "An ignition source which is ignited or energized upon equipment user initiation of the operational cycle and which is extinguished or de-energized after the equipment use cycle has been initiated."

Inter-Purge: Period between trials for ignition when both the gas valve and ignition source are deactivated to allow unburned gas to escape before the next trial.

Interrupted: "An ignition source which is automatically ignited or energized when the equipment is called on to operate and which remains ignited or energized during the main burner Flame-Establishing Period. The ignition source is automatically extinguished or deenergized when each main burner Flame-Establishing Period is completed."

Lockout Time: 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. Reinitiating the lighting sequence requires a manual operation.

Non-Integrated: Only controls or sends a signal to the ignitor and the mv and monitor the flame sensor

Post-Purge: "After all ignition cycles are complete, the control will enter post-purge. The combustion fan will remain on to allow unburned gas to escape. After post-purge is complete, the combustion fan will turn off. "

Pre-Purge: Initial time delay between thermostat contact closure and trial for ignition.

Re-cycle: Flame is sensed and then lost causing the control to re-cycle.

Recycle Time: "The period of time between shutoff of the gas supply following loss of the supervised ignition source or the supervised main burner flame and reactivation of the ignition source."

Retries: Additional ignition attempts if the original ignition attempt is unsuccessful.

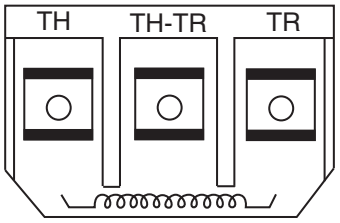
Retry Ignitor Warm-Up: Duration of ignitor warm-up time if the control retries.

Trial for Ignition: Period during which the valve and ignition source is activated, attempting to ignite gas at the burner.

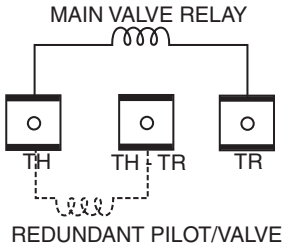
Valve Sequence Period: Valve sequence period is the cumulative total amount of time that the gas valve is energized before entering lockout.

3 terminal panel

Fig. 1



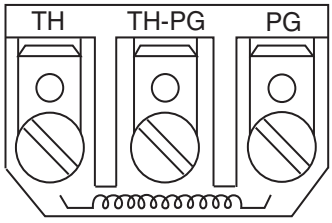
Some models have screw terminals instead of spade terminals shown



Some models may not have redundant valve

Fig. 2

Milivolt 3 Terminal Panel



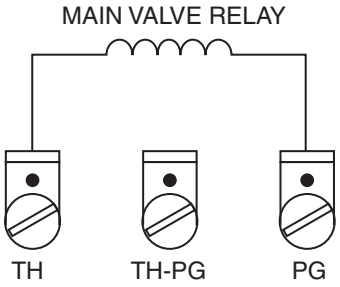
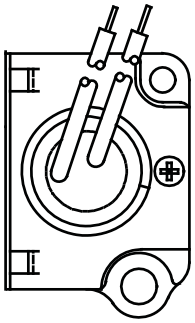


Fig.3



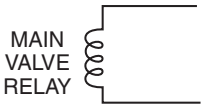
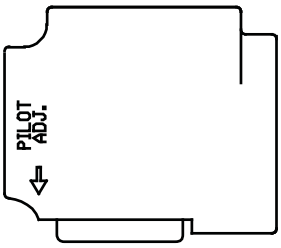
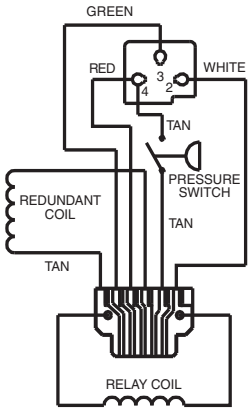


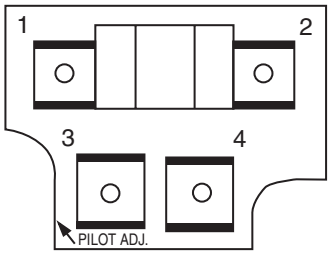
Fig. 4

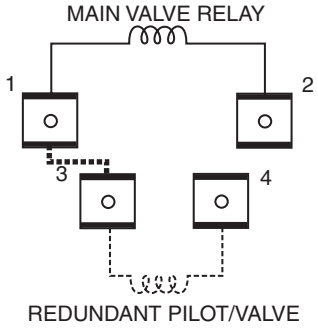




4 terminal panel

Fig. 5

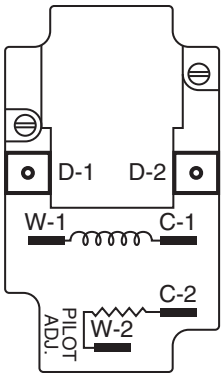


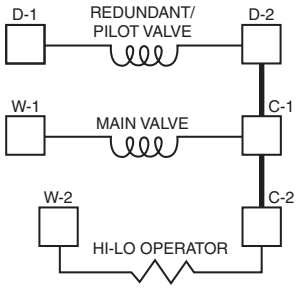


Jumper between 1 and 3 may be moved to 2 and 4 on some models

Bi-metal two stage

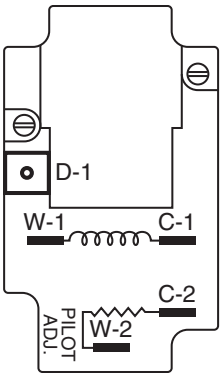
Fig. 6A



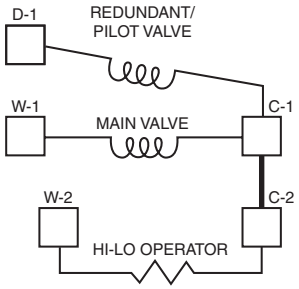


Bi-metal two stage

Fig. 6B

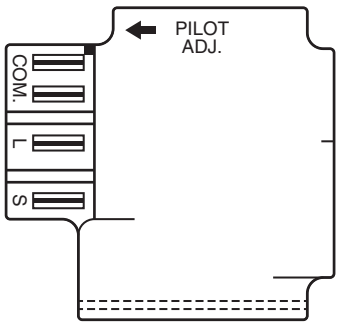


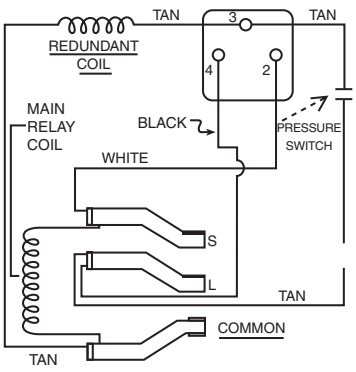
On some models, W1 and W2 are designated GV1 and GV2



Cycle pilot Plug-in

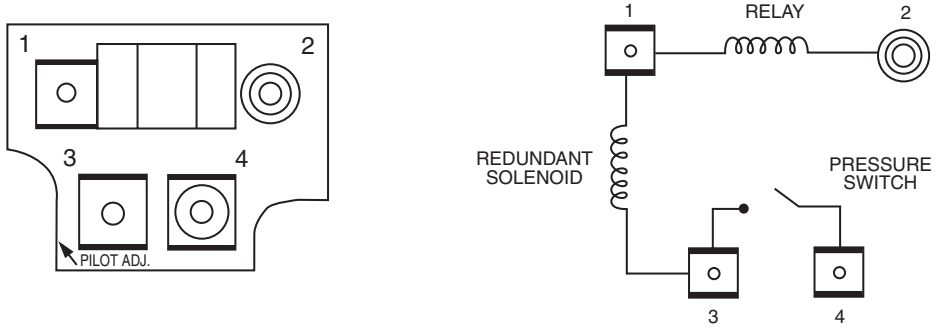
Fig. 7





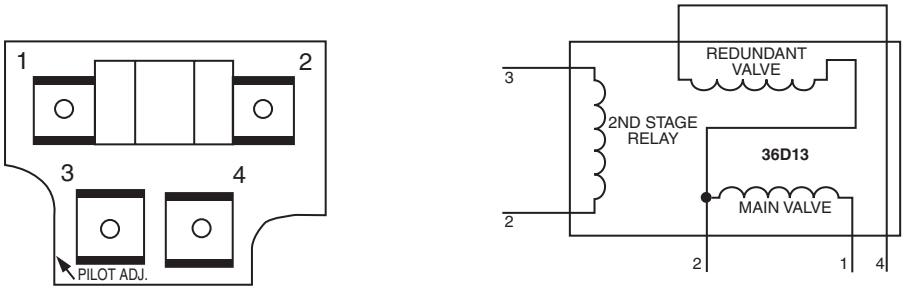
Cycle pilot with 4 terminal panel

Fig. 8



Relay two stage

Fig. 9



2 terminal panel

Fig.10

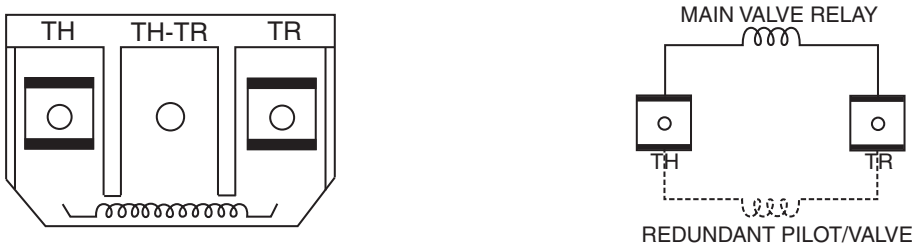


Fig.11

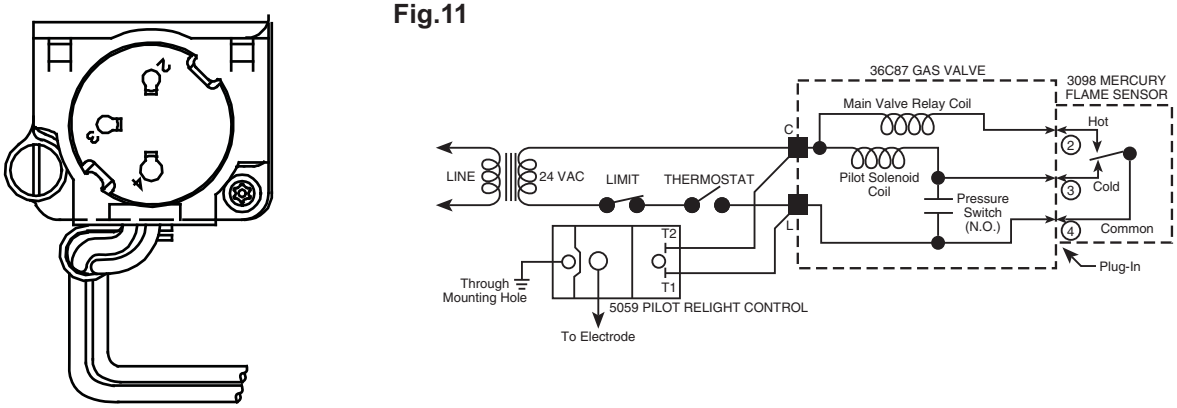
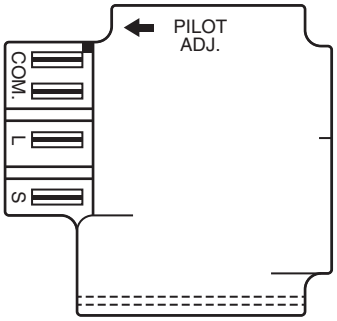


Fig 12



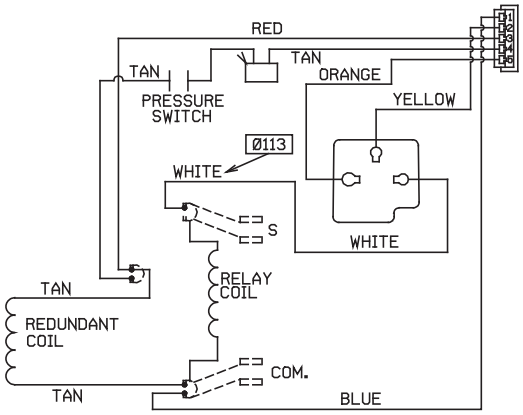
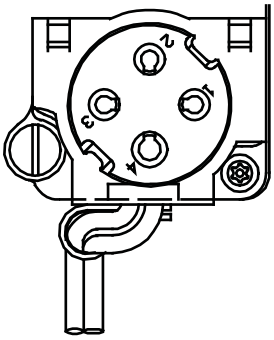
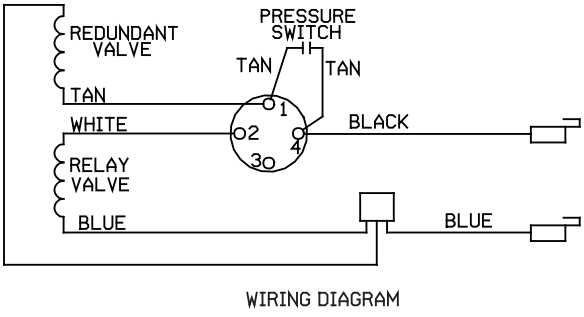


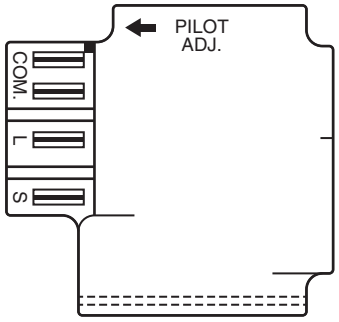
Fig 13





WIRING DIAGRAM

Fig 14



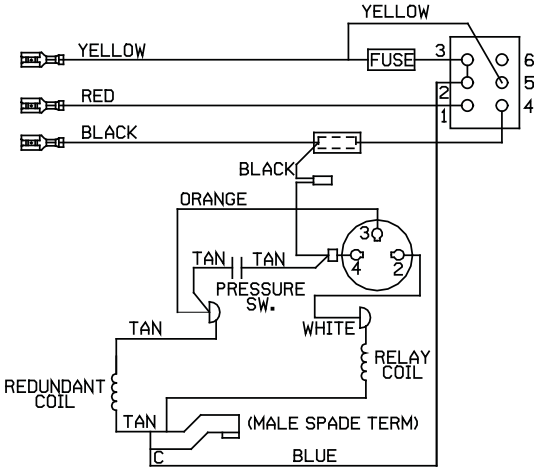
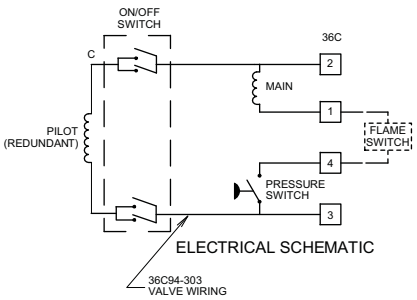
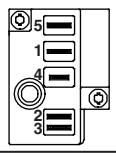
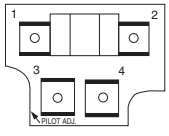


Fig 15





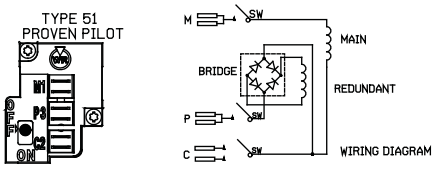
36E93 Terminal Panel



36C94 Terminal Panel

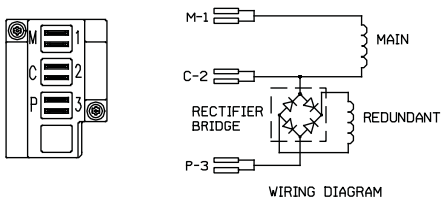
36E93-301 36E93-302 36E93-303 36E93-304 Old Terminals	Description	Term and Size	36C94-303 36C94-302 New Terminals
5	Pilot (Redundant) Coil	1/4" Male Spade	3
1	Main Coil	1/4" Male Spade	1
4	Pressure Switch	1/4" Male Spade with 1/4" x 3/16" adapter installed	4
2 3	Common	1/4" Male Spade	2

Figure 1



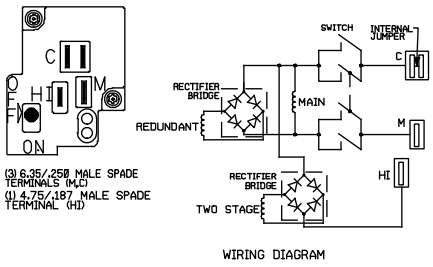
Type 51

Figure 2



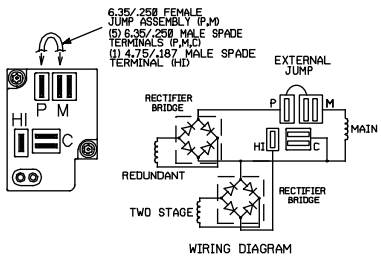
Type 21A

Figure 3



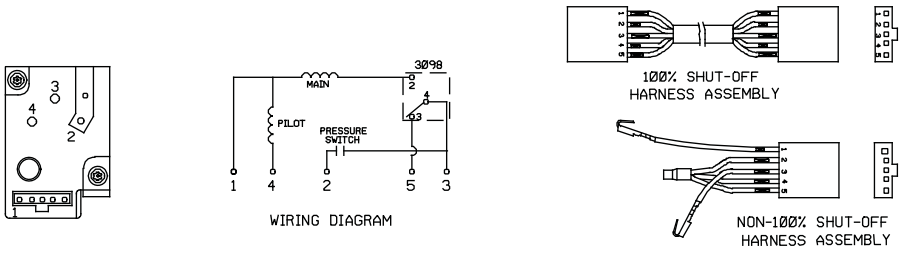
Type 12B

Figure 4



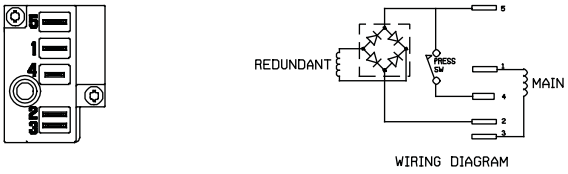
Type 12A

Figure 5



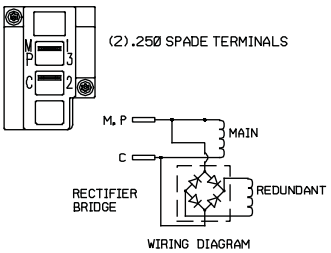
Type 30

Figure 6



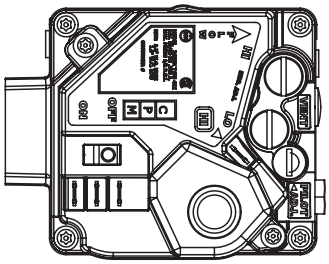
Type 24

Figure 7

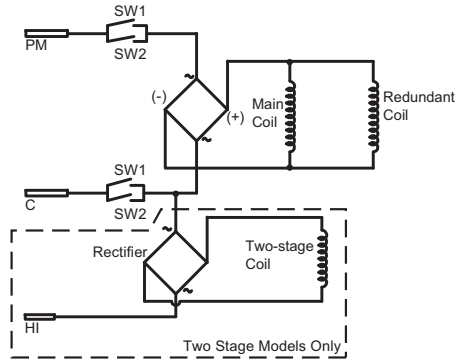


Type 2

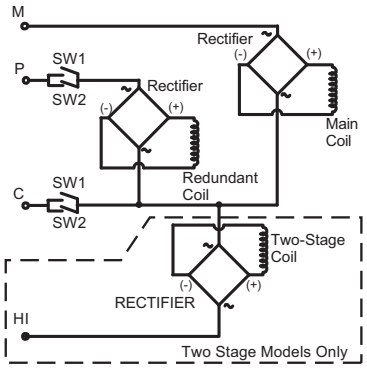
TECHNICAL HELP



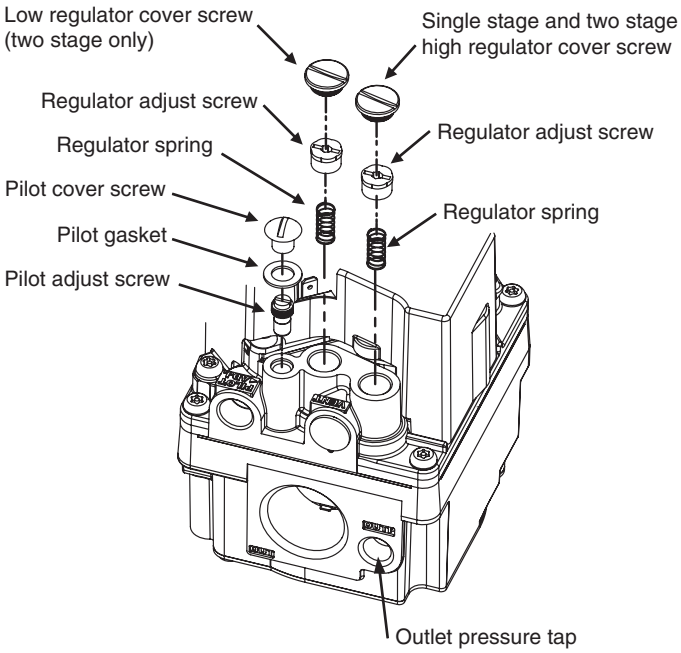
PILOTED MODELS
36H32-423 & 36H64-463



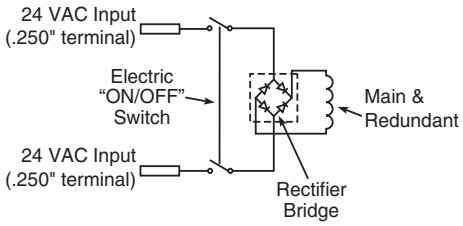
WIRING DIAGRAM - HSI MODELS
36H2X & 36H5X

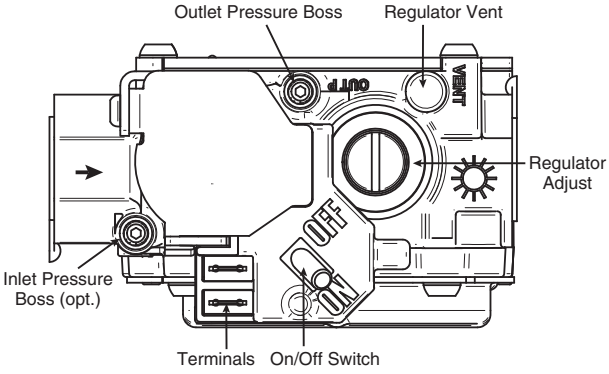


WIRING DIAGRAM - PILOTED MODELS
36H3X & 36H6X

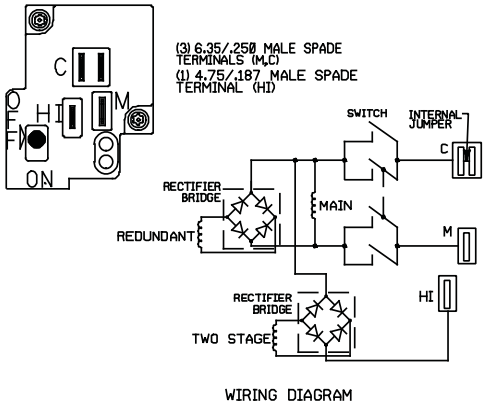


36G/J Series – Single Stage Models

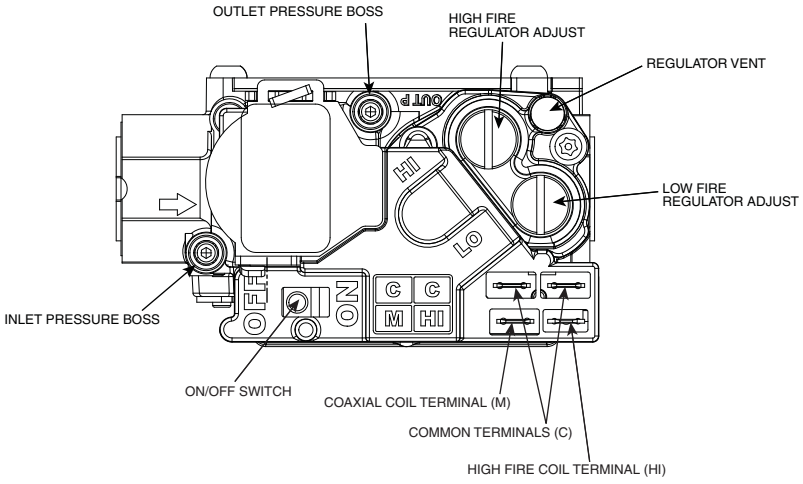




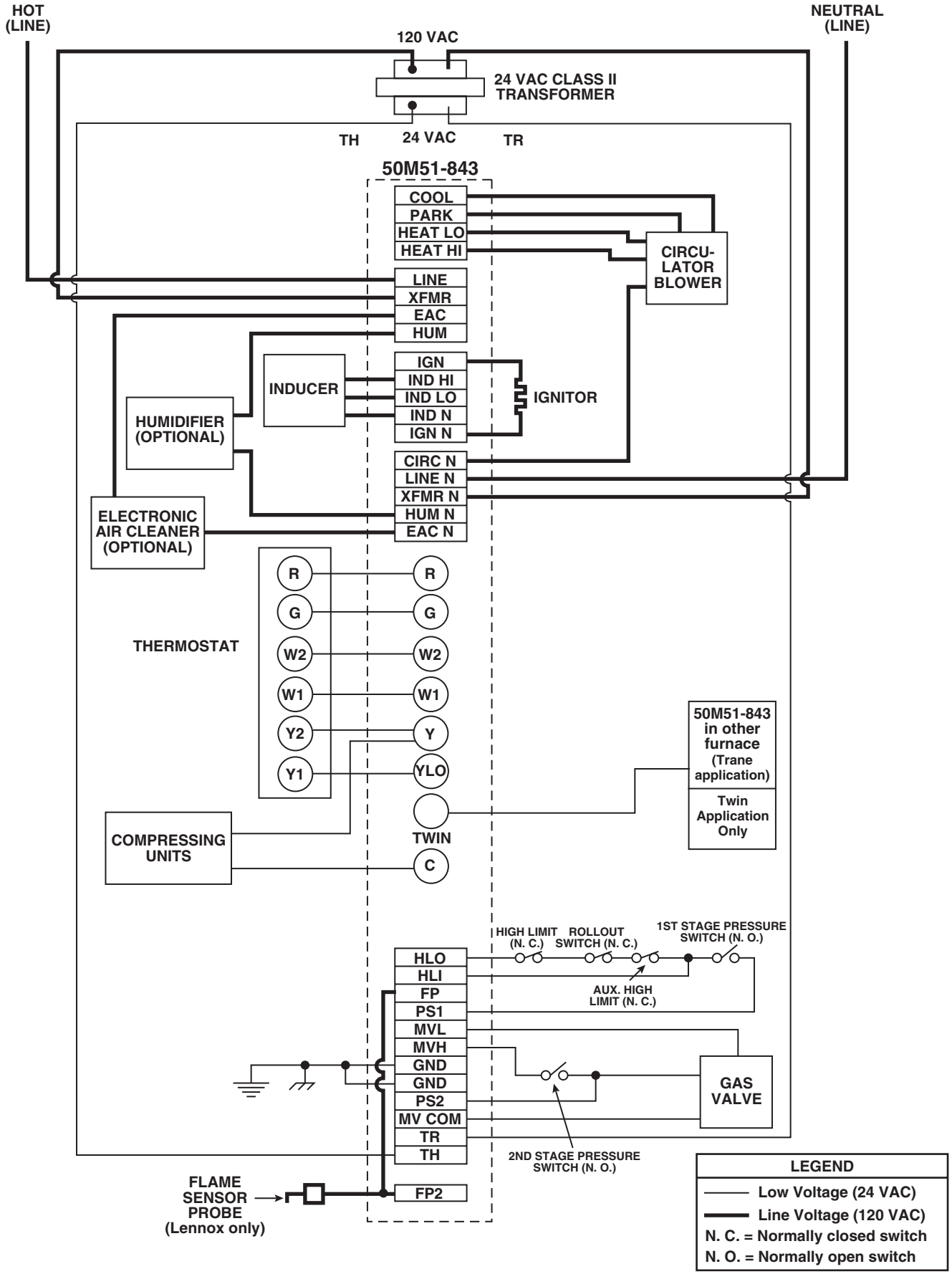
36G/J Series – Two Stage Models



WIRING DIAGRAM



50M51-843 TYPICAL WIRING DIAGRAM



50M51-843 TYPICAL WIRING TABLE

50M51-843 TERMINAL	TERMINAL TYPE	SYSTEM COMPONENT CONNECTION
W1	8 -screw terminal block	two-stage thermostat W1 terminal (or equivalent)
W2		two-stage thermostat W2 terminal (or equivalent)
G		two-stage thermostat G terminal (or equivalent)
R		two-stage thermostat R terminal (or equivalent)
YLO		two-stage thermostat Y1 terminal (or equivalent)
C		two-stage thermostat C terminal (or equivalent)
Y		two-stage thermostat Y2 terminal (or equivalent)
TWIN		one wire twinning terminal*
MVH (1)	12-pin connector & harness	gas valve SECOND STAGE
PS2 (2)		2nd stage pressure switch INPUT
FP (3)		flame sensor probe**
GND (4)		MUST BE RELIABLY GROUNDED TO CHASSIS
TH (5)		24 VAC transformer (low voltage HIGH SIDE)
HLI (6)		high limit INPUT
MVL (7)		gas valve FIRST STAGE
MV COM (8)		gas valve COMMON
TR (9)		24 VAC transformer (low voltage COMMON SIDE)
GND (10)		MUST BE RELIABLY GROUNDED TO CHASSIS
HLO (11)		high limit OUTPUT
PS1 (12)		1st stage pressure switch INPUT
IGN (1)	5-pin connector & harness	ignitor HOT side
IND HI (2)		inducer HIGH SPEED HOT side
IND LO (3)		inducer LOW SPEED HOT side
IND N (4)		inducer NEUTRAL side
IGN N (5)		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.

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:

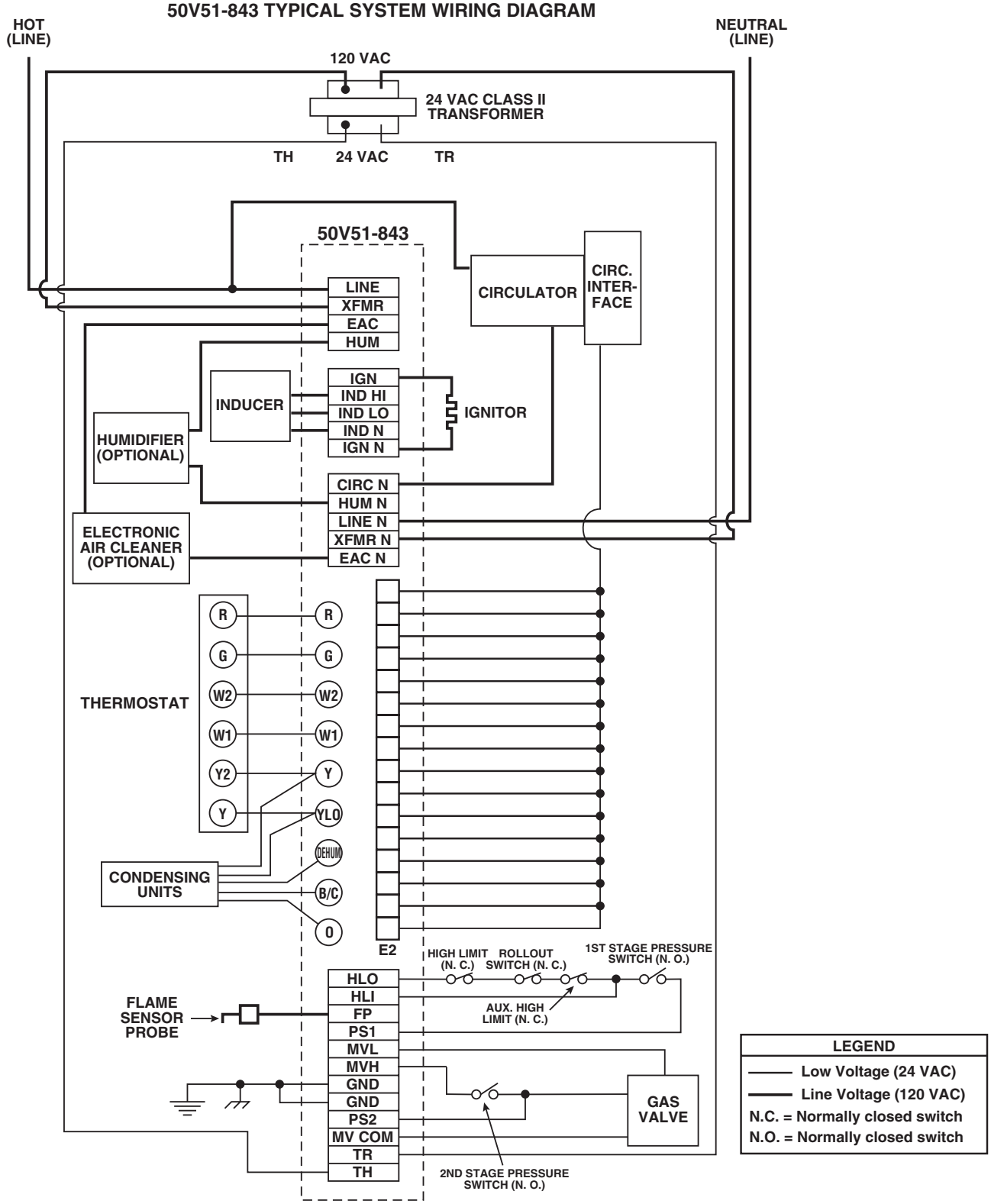
DIAGNOSTIC TABLE

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.

The 50V51-843 has only one serviceable part –an automotive type fuse, which protects the low voltage transformer from damage if the 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 50V51-843 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.

50V51-843 TYPICAL SYSTEM WIRING DIAGRAM



50V51-843 TYPICAL SYSTEM WIRING TABLE

50V51-843 TERMINAL	TERMINAL TYPE	SYSTEM COMPONENT CONNECTION
W1	9-screw terminal block	two-stage thermostat W1 terminal (or equivalent)
W2		two-stage thermostat W2 terminal (or equivalent)
G		two-stage thermostat G terminal (or equivalent)
R		two-stage thermostat R terminal (or equivalent)
B/C		two-stage thermostat B/C terminal (or equivalent)
YLO		two-stage thermostat Y terminal (or equivalent)
Y		two-stage thermostat Y2 terminal (or equivalent)
DEHUM		humidistat enable OUTPUT to circulator
O		H/P or cooling mode OUTPUT to circulator
MVH (1)	12-pin connector & harness	gas valve SECOND STAGE
PS2 (2)		2nd stage pressure switch INPUT
FP (3)		flame sensor probe*
GND (4)		MUST BE RELIABLY GROUNDED TO CHASSIS
TH (5)		24 VAC transformer (low voltage HIGH SIDE)
HLI (6)		high limit INPUT
MVL (7)		gas valve FIRST STAGE
MV COM (8)		gas valve COMMON
TR (9)		24 VAC transformer (low voltage COMMON SIDE)
GND-2 terminals (10)		MUST BE RELIABLY GROUNDED TO CHASSIS
HLO (11)		high limit OUTPUT
PS1(12)		1st stage pressure switch INPUT
IGN (1)	5-pin connector & harness	ignitor HOT side
IND HI (2)		inducer HIGH SPEED HOT side
IND LO (3)		inducer LOW SPEED HOT side
IND N (4)		inducer NEUTRAL side
IGN N (5)		ignitor NEUTRAL side
E2-1	16-pin connector & harness	24 VAC COMMON
E2-2		low heat speed select OUTPUT Circulator Blower
E2-3		24 VAC COMMON
E2-4		Delay tap OUTPUT to circulator
E2-5		Cool tap OUTPUT to circulator
E2-6		“YLO” OUTPUT to circulator
E2-7		adjust tap OUTPUT to circulator
E2-8		24 VAC COMMON
E2-9		“O” OUTPUT to circulator
E2-10		Humidistat/Y-Y2 OUTPUT to Circulator Blower
E2-2		Heat tap OUTPUT to circulator
E2-12		24 VAC OUTPUT to circulator
E2-13		“W2” OUTPUT to circulator
E2-14		“Y” OUTPUT to circulator
E2-15		“G”/YLo OUTPUT to Circulator Blower
E2-16		green CFM indicator
CIRC	spade terminal	circulator blower HOT terminal
LINE	spade terminal	input voltage (120 VAC) HOT side
XFMR	spade terminal	24 VAC transformer line voltage HOT side
EAC (optional)	spade terminal	electronic air cleaner HOT side
HUM (optional)	spade terminal	humidifier HOT side
CIRC N	spade terminal	circulator blower NEUTRAL side
LINE N	spade terminal	input voltage (120 VAC) NEUTRAL side
XFMR N	spade terminal	24 VAC transformer line voltage NEUTRAL side
HUM N (optional)	spade terminal	humidifier NEUTRAL side
EAC N (optional)	spade terminal	electronic air cleaner NEUTRAL side

NOTE: Spade terminals are 0.25” x 0.032”

* maximum recommended flame probe wire length is 36 inches.

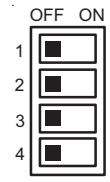
OPTIONS SWITCHES

Option switches are used to determine the length of the delay periods. The following tables show the time periods that will result from the various switch settings.

OPTION SWITCH SETTING - THERMOSTAT TYPE AND HEAT-FAN-OFF-DELAY

DIP Switches

	Switch Settings		Options
Thermostat Type and W2 Delay **S7-1, S7-2**	**S7-1**	**S7-2**	**Time**
	Off	Off	Off*
	On	Off	10 Minutes
	Off	On	Auto
	On	On	20 Minutes
Heat Fan Off Delay **S7-3, S7-4**	**S7-3**	**S7-4**	**Time**
	Off	Off	90 Secs*
	Off	On	120 Secs
	On	Off	150 Secs
	On	On	180 Secs



S7

*Factory Settings

Multi-stage Thermostat Set-up, Factory Default

DIP switches **S7-1** and **S7-2** (see table above) are set to the "Off" position from the factory for use with a multi-stage thermostat. This allows the thermostat to control staging between low and high fire.

Single Stage Thermostat Set-up, Module Controls Staging

DIP switches, **S7-1** and **S7-2** (see table above) configure for a single stage thermostat. Options include a 10 minute delay on second stage, 20 minute delay on second stage or an Auto setting allowing the module to calculate the time delay for second stage based on average demand. The "Average Calculated Duty Cycle" table shows how the module calculates staging based on demand.

Average Calculated Duty Cycle % Equals	or is 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

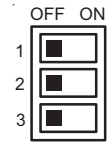
Heat Fan Off Delay Timing

DIP switches **S7-3** and **S7-4** (see table above) configure the number of seconds the blower will run after the call for heat ends. Factory default is 90 seconds.

OPTION SWITCH SETTING – FURNACE MANUFACTURER

DIP Switch Selection for OEM Applications

S2		OEM
1	2	
OFF	OFF	Trane
OFF	ON	Thermo Pride/ Goodman
ON	OFF	Lennox
ON	ON	York



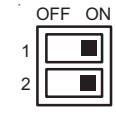
S2

IMPORTANT: Switch selection must match furnace manufacturer for proper motor operation.

Set DIP switches **S2-1** and **S2-2** to match the equipment using the table above. NOTE: DIP switch **S2-3** is not used.

DIP Switches

	Switch Settings	Options
Heat Pump **S5-1**	**S5-1**	
	Off	Installed
	On	Not Installed*
De-humidifier **S5-2**	**S5-2**	
	Off	Installed
	On	Not Installed*



S5

*Factory Settings

OPTION SWITCH SETTING - HEAT PUMP AND DE-HUMIDIFICATION

Heat Pump Systems

DIP switch **S5-1** (see table above) is set to "On" from the factory for use with conventional (non-Heat Pump systems). For heat pump systems move the **S5-1** DIP switch to the "Off" position. This will continuously output an O signal to the motor whenever there is Y signal and run the circulator blower at a constant speed when the pump is operating.

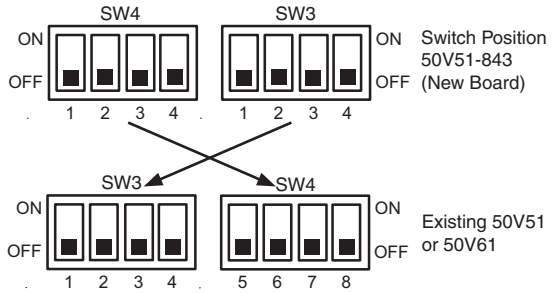
De-Humidification Connection

DIP switch **S5-2** (see table above) is set to "On" from the factory for systems that do not have a dehumidification terminal connection from the thermostat. For systems using a thermostat that provides a De-Humidification option move DIP switch **S5-2** to "Off".

OPTION SWITCH SETTING - MOTOR OPTIMIZATION

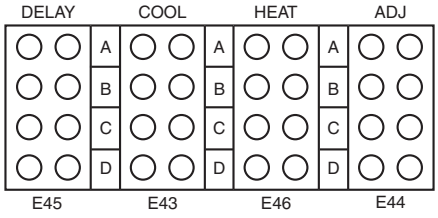
Amana/Goodman/Trane/Lennox/Thermo Pride – The motor configuration DIP switches **S3** and **S4** must be set to match settings of the original furnace settings for proper motor function. To set the new board for the motor function, the DIP switches must be set to match the settings of the board being replace.

IMPORTANT: Be sure to use proper switches for new board settings. Switch locations on old board may not be the same location as on the new board.



York – The existing board has four shunt jumper banks to set motor function configuration. The four jumper banks are designated **DELAY (E45)**, **COOL (E43)**, **HEAT (E46)**, **ADJ. (E44)**. Each jumper bank has four pair of pins to have jumper installed to determine the type of voltage to the motor. These pin pairs are **A** (no signal) **B** (positive Half-wave rectified), **C** (negative Half-wave rectified), **D** (Full-wave unrectified).

On the new board, the motor functions must be duplicated on DIP switched **S3** and **S4** per the following table.



Motor Configuration Settings

		A No Signal	B Positive Half Wave	C Negative Half Wave	D Full Wave
Cool	**S3-1**	OFF	ON	OFF	ON
	S3-2	OFF	OFF	ON	ON
Adjust	**S3-3**	OFF	ON	OFF	ON
	S3-4	OFF	OFF	ON	ON
Delay	**S4-1**	OFF	ON	OFF	ON
	S4-2	OFF	OFF	ON	ON
Heat	**S4-3**	OFF	ON	OFF	ON
	S4-4	OFF	ON	ON	ON

NORMAL OPERATION – HEAT ON

When the thermostat calls for heat the module verifies the pressure switches are open and energizes the inducer (high speed) and optional humidifier contacts. When the low pressure switch contacts close a 15 second pre-purge begins. After 15 seconds the inducer switches to low speed and the 120 VAC ignitor is energized. The ignitor warms up for 17 seconds and the gas valve is energized on low fire. Flame must be detected within 4 seconds. If flame is detected, a 45 second heat, fan on time delay begins. This allows the heat exchanger to warm up before energizing the circulator on low speed and (optional) Electronic Air Cleaner contact. When the thermostat (or module) initiates second stage the inducer is energized at high speed.

This closes the second stage inducer pressure switch then energizes the second stage on the gas valve and then the high heat circulator speed.

NORMAL OPERATION – HEAT OFF

When the thermostat satisfies for second stage, the control will switch high speed inducer and high fire gas valve to low speed inducer and low fire gas valve. After the 30 second high heat fan delay the circulator will drop to low speed. When the thermostat satisfies for first stage the gas valve de-energizes and the inducer will run low speed for a 15 second post-purge. The circulator runs until the heat off delay ends.

Note: If the module is configured for a single stage thermostat and running on second stage when the call for heat ends, the circulator will drop to low speed after 30 seconds and continue until the heat off delay ends.

COOL MODE

In a typical system, a call for cool is initiated by closing **Y** and **G.** This energizes the compressor and the electronic air cleaner (optional). The electronic air cleaner and the **G** and (**Y** or **YLO** outputs to the Circulator motor will energize after the 5 second cool on delay period. After the thermostat is satisfied, the compressor is de-energized and the control starts a 60 second cool circulator speed off delay. After 60 seconds the circulator is de-energized.

MANUAL FAN ON MODE

If the thermostat fan switch is moved to the “ON” position, the electronic air cleaner (optional) and the **G** circulator output to the circulator motor will be energized. When the fan switch is returned to the AUTO position, the **G** circulator output and the electronic air cleaner are de-energized.

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 50V51 control to other components of the system.

UL approved, 105°C rated 18 gauge min., stranded, 2/64" thick insulation wire is recommended for all low voltage safety circuit connections. Refer to 50V51 specification sheet for recommended terminals to mate with those on the control.

UL approved, 105°C rated 16 gauge min., stranded, 4/64" thick insulation wire is recommended for all line voltage connections. Refer to 50V51 specification sheet for recommended terminals to mate with those on the control.

GOODMAN NOTE

FOR GOODMAN 50V51-289 APPLICATION, THERE ARE TWO ADAPTER HARNESSES INCLUDED INTHIS PACKAGE TO COMPLETE THE INSTALLATION.

The 50V51-843 has only one serviceable part –an automotive type fuse, which protects the low voltage transformer from damage if the 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 does not correct the condition, replace the entire 50V51 control. There are not other user serviceable parts.

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

INSTALLER MUST READ FOR PROPER INSTALLATION

- Wiring harnesses are included to complete the installation of the **"UNIVERSAL 50V51-843"** for Goodman applications.
- For replacing the ignitor, a **UNIVERSAL 21D64-2** is included. For proper installation, refer to the instructions included in the 21D64-2 kit.
- **IMPORTANT:** The installer may have to enlarge existing ignitor hole to accommodate 21D64-2 larger (.394") diameter.

SYSTEM LOCKOUT

When a system lockout occurs (1hour), the gas valve is de-energized, the low speed inducer blower is energized for the 60 second interpurge period and the circulator is energized for selected heat off delay if it was previously ON. The diagnostic indicator light will flash the fault that is present (refer to diagnostic table).

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

System Reset

Remove 24 VAC power to the control for twenty (20) seconds or longer to reset the control.

Thermostat Reset

Remove the call for heat from the thermostat for a period of between (1) second and less 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.

Auto Restart

After one (1) hour of internal or external lockout, the control will automatically reset itself and go into an auto restart purge for 15 seconds.

DIAGNOSTIC FEATURES

The control continuously monitors its own operation and the operation of the system. If a failure occurs the diagnostic indicator LED (DSI) will flash a "RED" failure code. **If a failure is internal to the control the "RED" indicator 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 or a failure within the control. If the sensed failure is in the system (external to the control), the LED will flash RED in the sequence listed in the Diagnostic Table. The LED will also indicate "System Status" as per the Amber and Green LED signatures listed in the Diagnostic Table. The LED will flash one RED flash at power up.

CFM INDICATOR

The LED (DS2) CFM flashes when the blower motor is running. The flashing indicates the motor CFM (cubic feet per minute) air flow designated by the furnace manufacturer. Consult the furnace manufacturer for flash code detail.

FAULT CODE RETRIEVAL

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 secs. to 5 secs.). 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.

NOTE

These error codes may be different from furnace label or furnace manual.

TRI-COLOR (DSI LED) 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 exceeded)	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.
		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.

50A55 INTEGRATED FURNACE CONTROL MODULE

Qualified Serviceman's Troubleshooting Guide

TROUBLESHOOTING PROCEDURE

If the light on the module is on continuously, the fault is likely to be internal to the module. To make sure, interrupt line or 24 volt thermostat power for a few seconds and then restore. If internal fault is indicated again, and flame sensor is not shorted to ground, replace control. A flashing light indicates the problem is most likely in the external components or wiring. Proceed as follows:

⚠ WARNING

Turn power off before any troubleshooting or servicing begins.

Line voltage (120 VAC) could be present on the surface of the ignitor, if the system is not correctly wired. Such voltage can cause serious injury or death.

⚠ WARNING

Failure to read and follow all instructions carefully before installing or operating this control, could cause personal injury and/or property damage.

The following steps must be performed first before any troubleshooting begins.

1) Disconnect electric power to system at main fuse or circuit breaker.
2) Visually inspect equipment for apparent damage. Check wiring for loose connections.
3) Check for proper grounding and reversed polarity.
   A. Check continuity for C terminal on module to electrical service ground and connection at the furnace junction box. If ground connection is open, check module ground connection and the electrical service ground connection. Repair and retest.
   B. Re-connect electric power to system.
   C. Check for voltage between the line neutral terminal and furnace ground. If voltage exists, the main power supply lines are improperly connected to the furnace (REVERSED POLARITY). Again disconnect electric power to system; then reverse incoming supply leads to furnace. Repeat step.
   D. Recheck system for proper operation.

If neither apparent damage, loose connection nor reversed polarity is the problem, proceed to troubleshooting chart or fault index chart that is suggested by the actual condition.

NOTE: This troubleshooting guide is not for 50A55-4XX modules found on Trane equipment or 50A55-1XX modules found on Lennox equipment.

FAULT INDEX CHART

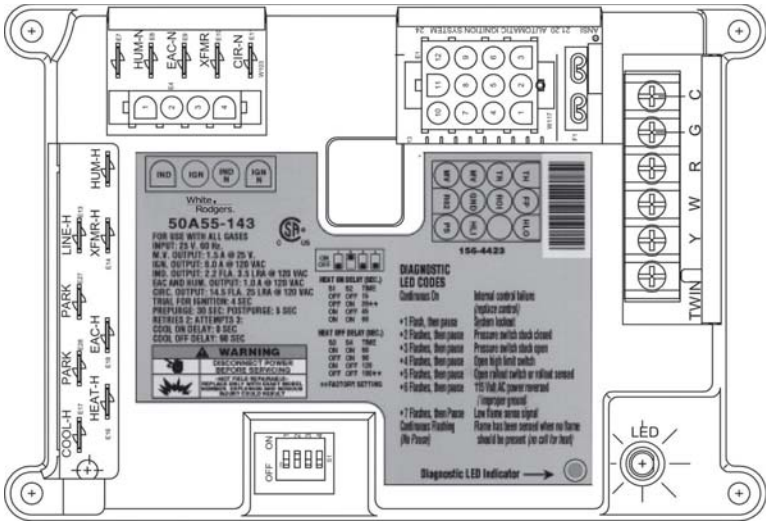
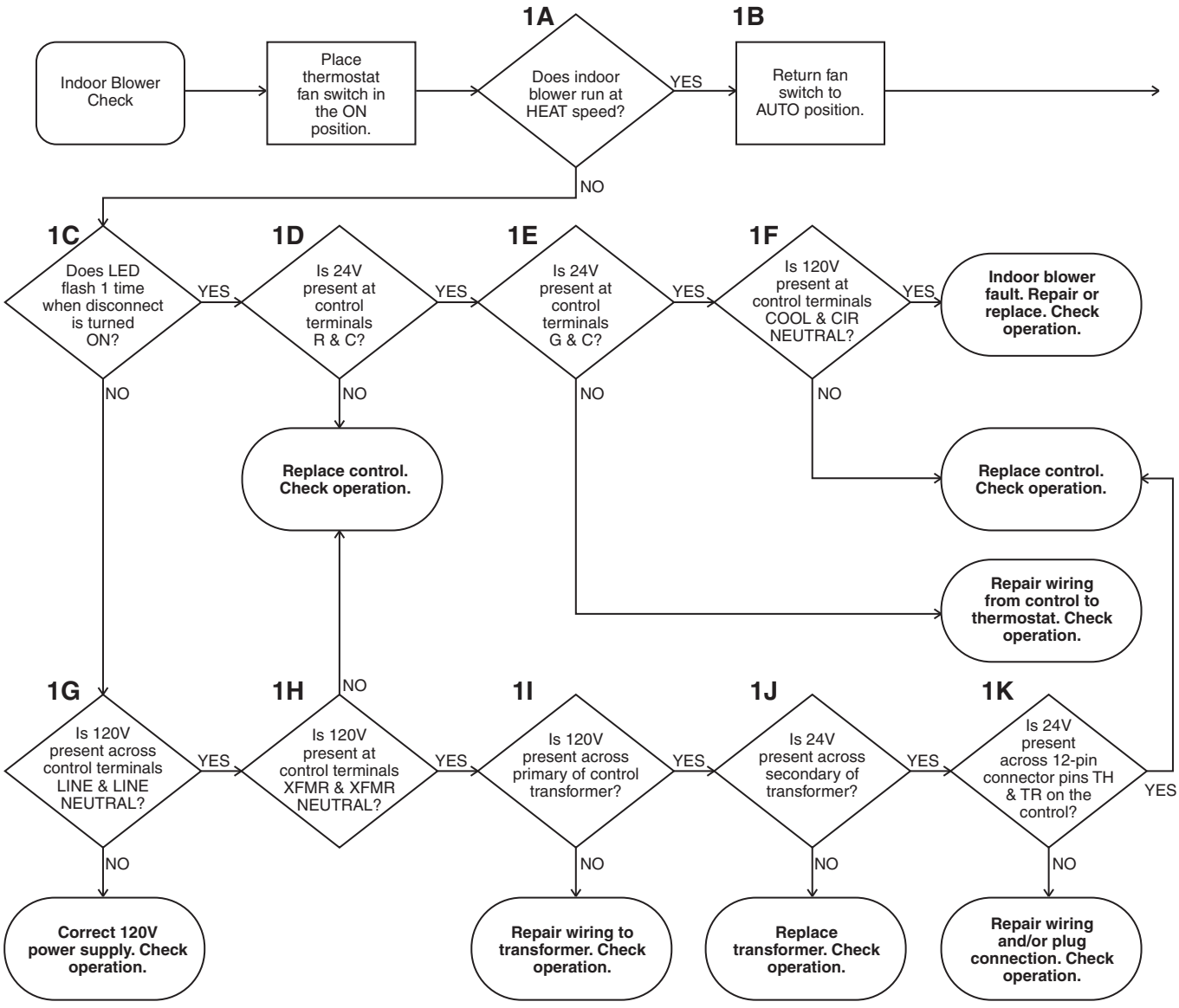


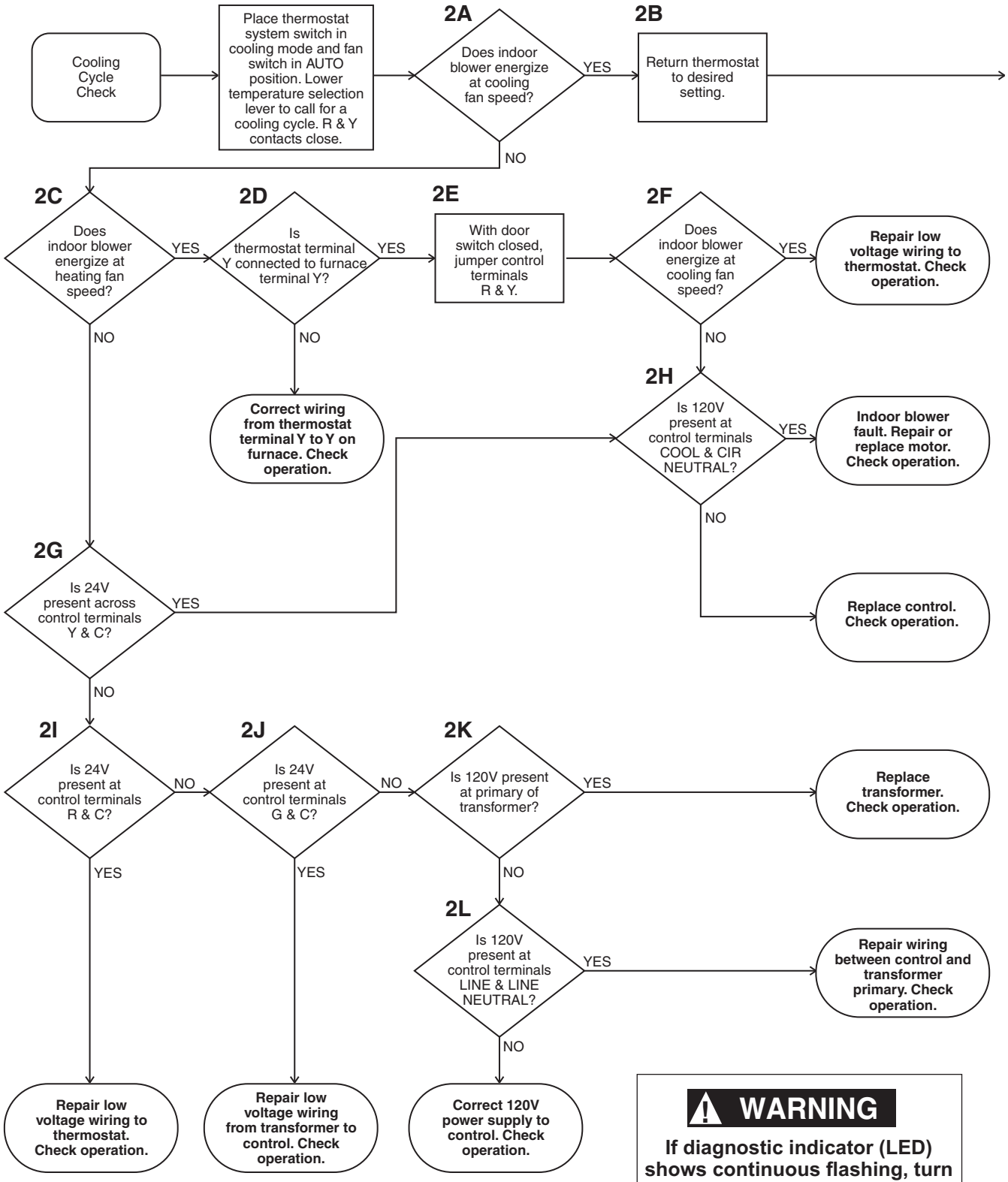
CHART 1



⚠ WARNING

If diagnostic indicator (LED) shows continuous flashing, turn off gas supply at source before disconnecting electrical power!

CHART 2

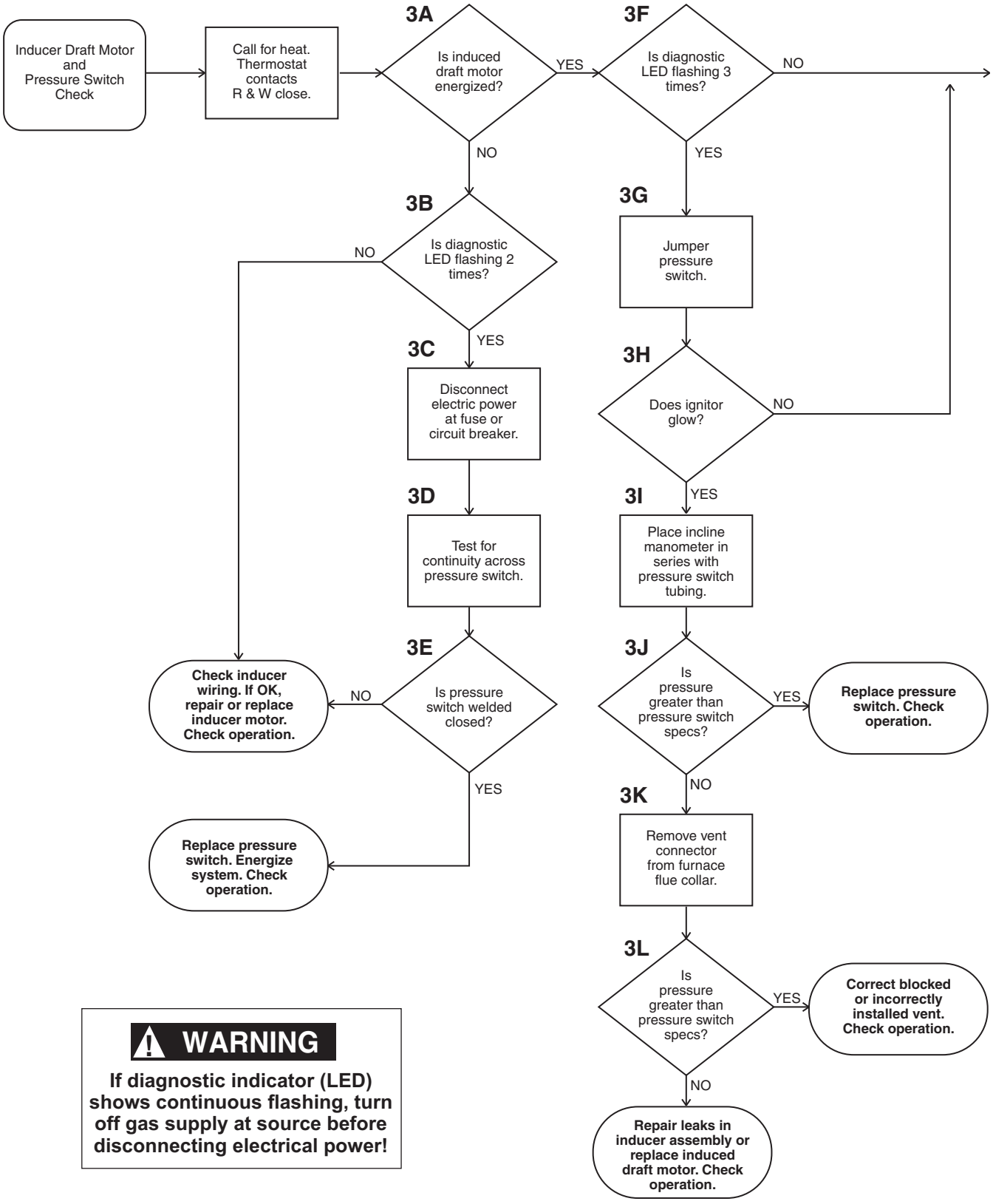


⚠ WARNING

If diagnostic indicator (LED) shows continuous flashing, turn off gas supply at source before disconnecting electrical power!

TECHNICAL HELP

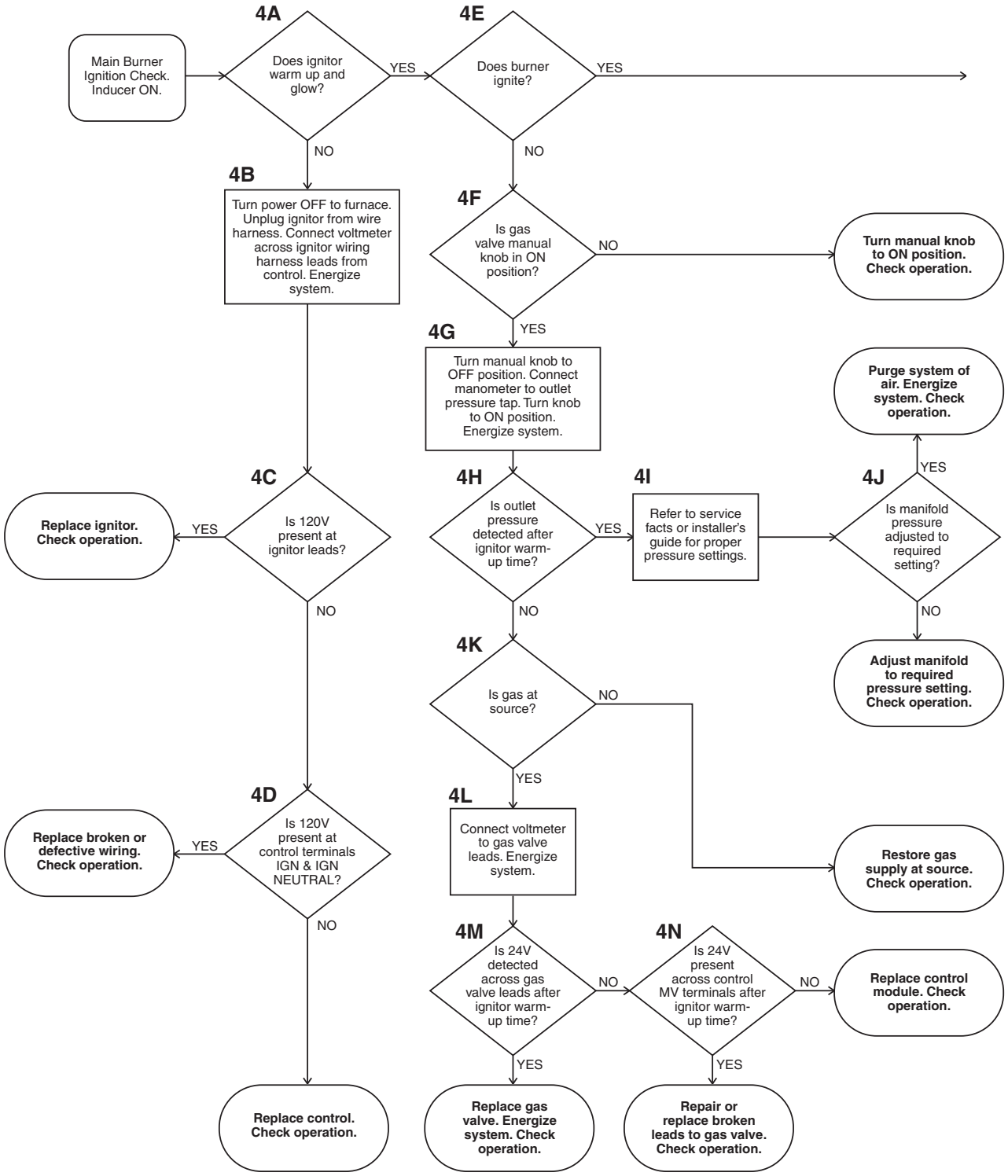
CHART 3



⚠ WARNING

If diagnostic indicator (LED) shows continuous flashing, turn off gas supply at source before disconnecting electrical power!

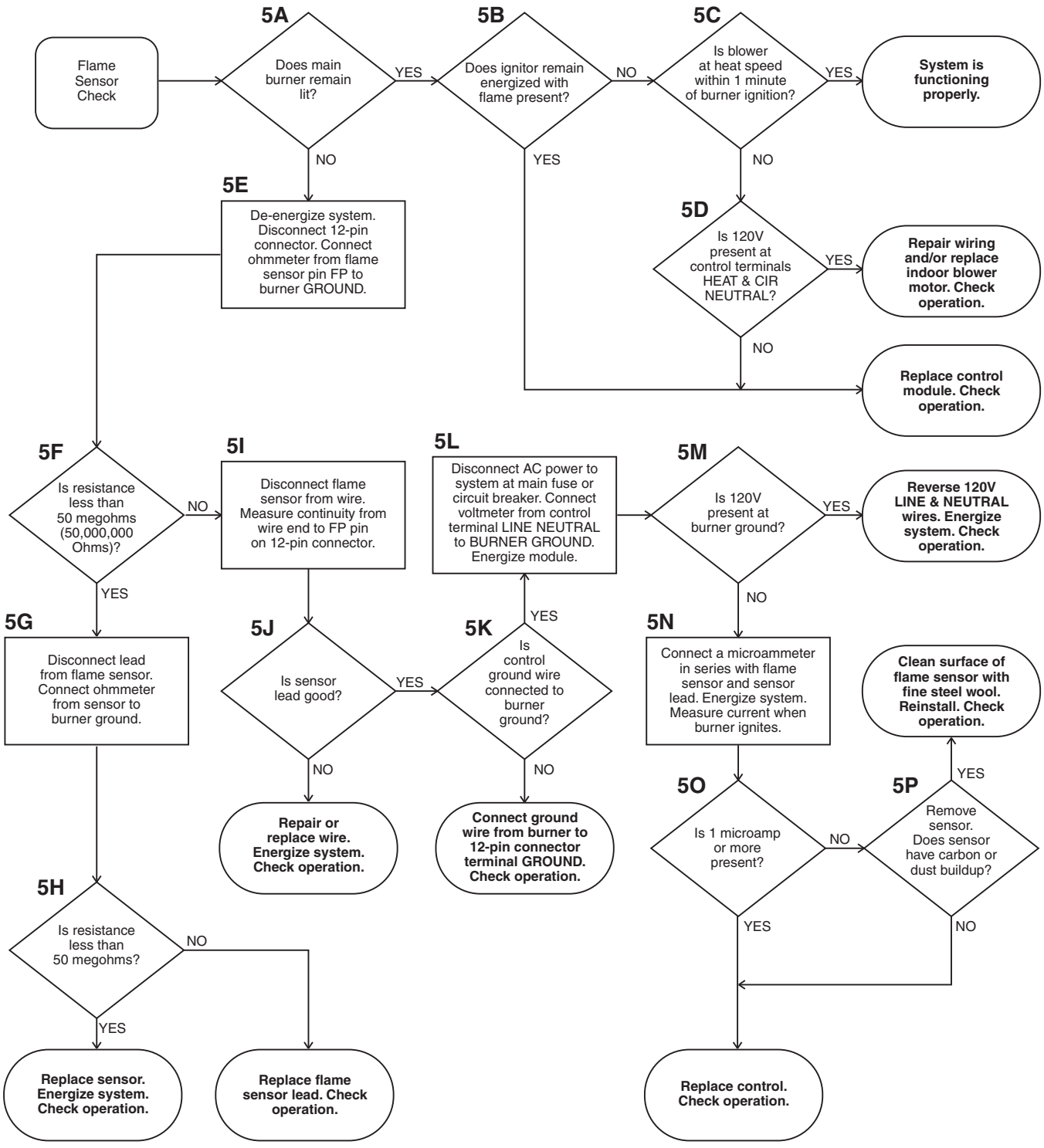
CHART 4



⚠ WARNING

If diagnostic indicator (LED) shows continuous flashing, turn off gas supply at source before disconnecting electrical power!

CHART 5

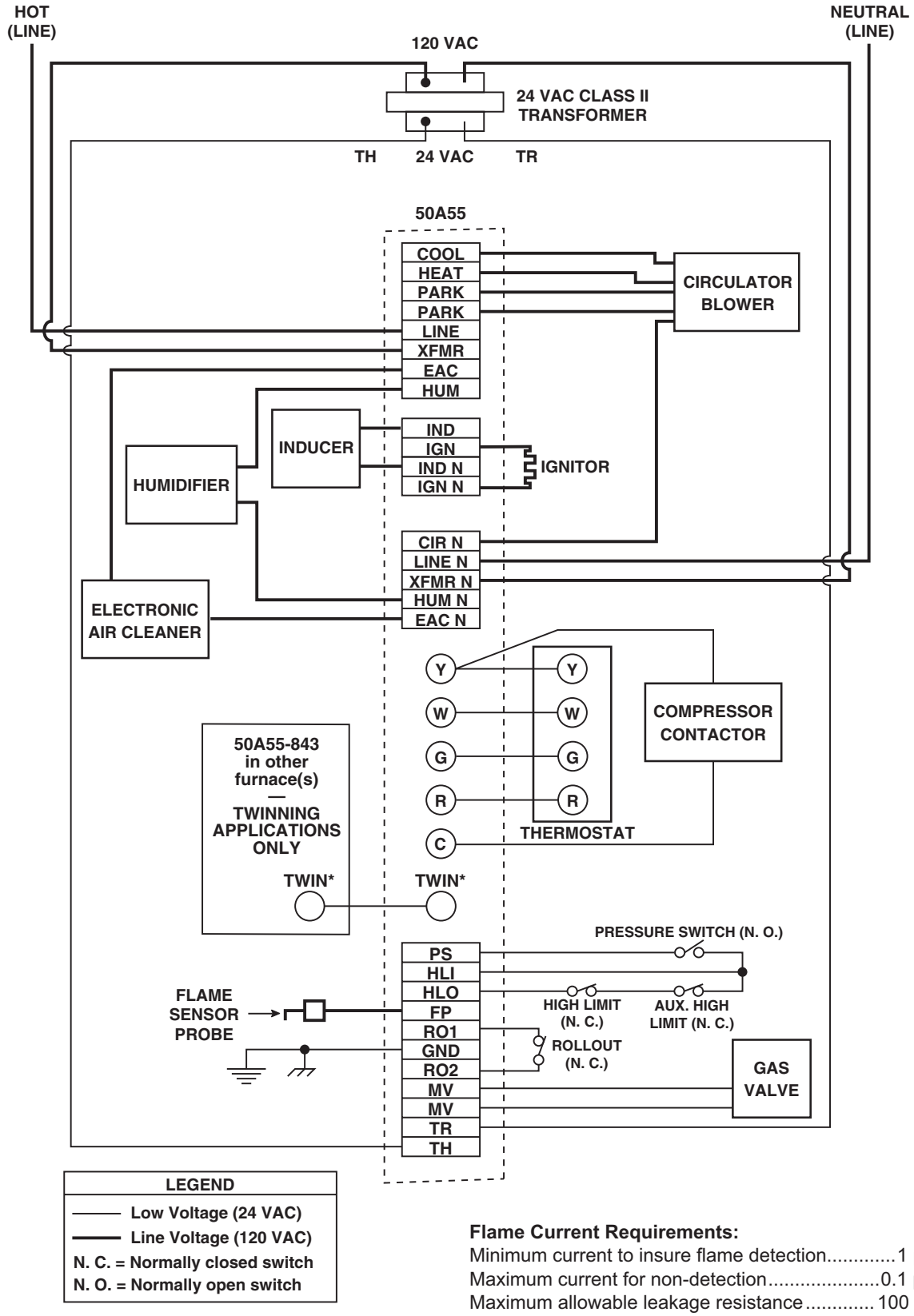


⚠ WARNING

If diagnostic indicator (LED) shows continuous flashing, turn off gas supply at source before disconnecting electrical power!

50A55-843

TYPICAL SYSTEM WIRING DIAGRAM



Flame Current Requirements:

Minimum current to insure flame detection.....1 µa DC①
Maximum current for non-detection.....0.1 µa DC①
Maximum allowable leakage resistance.....100 M ohms
Flame establishing time.....0.8 seconds maximum
Flame failure response time.....2.0 seconds maximum

① Measured with a DC microammeter in the flame probe lead

The 50A55-843 is an automatic gas interrupted ignition control that employs a microprocessor to continually monitor, analyze, and control the proper operation of the gas burner, inducer, and fan.
Signals interpreted during continual surveillance of the thermostat and flame sensing element initiate automatic ignition of the burner, sensing of the flame, and system shut-off during normal operation.

OPTION SWITCHES

The option switches on the 50A55-843 control are used to determine the length of the cool delay-to-fan-off, heat delay-to-fan-on and heat delay-to-fan-off periods. The following table shows the time periods that will result from the various switch positions.

OPTION SWITCH POSITIONS

COOL delay-to-fan-off:	Set switch #1
45 sec.*	On
90 sec.	Off

HEAT delay-to-fan-on:	Set switch #2
30 sec.*	On
45 sec.	Off

HEAT delay-to-fan-off:	Set switch #3	#4
60 sec.	On	On
90 sec.	Off	On
120 sec.	On	Off
180 sec.*	Off	Off

* Factory setting

HEAT MODE

In a typical system, a call for heat is initiated by closing the thermostat contacts. This starts the 50A55 control's heating sequence. The inducer blower and optional humidifier are energized and the ignitor is powered within one second.

This controller has an adaptive algorithm that adjusts the duration of the ignitor warm-up, to extend ignitor life. Upon initial application of power, the warm-up time is 17 seconds. The ignitor on-time will then be increased or decreased depending on whether or not flame is achieved. The warm-up time is limited to a maximum of 21 seconds. During the first 64 warm-up periods following power-up, the warm-up time may not be less than 17 seconds.
Upon a call for heat, if the warm-up time has not been locked, it will be decreased by one second. This reduction of the ignitor on-time will continue until flame fails to be achieved (resulting in a retry).
In the event of a retry, the warm-up time will be increased by two seconds and locked in at that duration. Once the warm-up time is locked, it remains fixed until another call for heat results in a retry, in which case the warm-up time is again increased by two seconds and remains locked.
In the event of two successive retry attempts, the warm-up time will be unlocked and set to 21 seconds. If flame is then achieved, the warm-up time will begin adapting again with the next call for heat. If, however, this third attempt fails to achieve flame, the control will go into system lockout.
At the end of the ignitor warm-up time, both valves in the 36E manifold gas valve are opened. Flame must be detected within 4 seconds.
See installation instructions for more system sequence detail.

COOL MODE

In a typical system, a call for cool is initiated by closing the thermostat contacts. This energizes the 50A55 control and the compressor. The cool delay-to-fan-on period begins. After the delay period ends, the optional electronic air cleaner is energized, and the circulator fan is energized at cool speed. After the thermostat is satisfied, the compressor is de-energized and the cool mode delay-to-fan-off period begins. After the delay-to-fan-off period ends, the circulator fan and electronic air cleaner (optional) are de-energized.

MANUAL FAN ON MODE

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

SYSTEM LOCKOUT FEATURES

When system lockout occurs, the gas valve is de-energized, the circulator blower is energized at heat speed, and, if flame is sensed, the inducer blower is energized. The diagnostic indicator light will flash or glow continuously to indicate system status. (**System lockout will never override the precautionary features**.)

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

1. Interrupt the call for heat or cool 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 one second. 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 50A55-843 control continuously monitors its own operation and the operation of the system. If a failure occurs, the LED will indicate a failure code as shown below. **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 sensed failure is in the system (external to the 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
2 flashes, then pause	Pressure switch stuck closed
3 flashes, then pause	Pressure switch stuck open
4 flashes, then pause	Open limit switch
5 flashes, then pause	Open rollout switch
6 flashes, then pause	115 Volt AC power reversed / Improper ground
7 flashes, then pause	Low flame sense signal
Continuous flashing (no pause)	Flame has been sensed when no flame should be present (no call for heat)

The LED will also flash once at power-up.

TYPICAL SYSTEM WIRING TABLE

50A55 TERMINAL	TERMINAL TYPE	SYSTEM COMPONENT CONNECTION
W	Terminal block with captive screws	low voltage thermostat W terminal (or equivalent)
G		low voltage thermostat G terminal (or equivalent)
R		low voltage thermostat R terminal (or equivalent)
Y		low voltage thermostat Y terminal (or equivalent)
		(2nd wire from Y terminal goes to 24 VAC HOT side of compressor contactor coil)
C		24 VAC COMMON side of compressor contactor coil
TWIN*		one wire twinning terminal
MV (2 terminals)	12-pin connector & harness	gas valve (both gas solenoids are connected in parallel)
TR		24 VAC transformer (low voltage COMMON side)
TH		24 VAC transformer (low voltage HIGH side)
RO1		rollout switch OUTPUT
RO2		rollout switch INPUT
FP		flame sensor probe*
PS		pressure switch INPUT
HLI		high limit INPUT
HLO		high limit OUTPUT
GND		MUST BE RELIABLY GROUNDED TO CHASSIS
(unused terminal)		
IND	4-pin connector & harness	inducer HOT side
IGN		ignitor HOT side
IND N		inducer NEUTRAL side
IGN N		ignitor NEUTRAL side
COOL	spade terminal	circulator blower COOL SPEED terminal
HEAT	spade terminal	circulator blower HEAT SPEED terminal
PARK (2 terminals)	spade terminal	unused circulator blower terminals
LINE	spade terminal	input voltage (120 VAC) HOT side
XFMR	spade terminal	24 VAC transformer line voltage HOT side
EAC (optional)	spade terminal	electronic air cleaner HOT side
HUM (optional)	spade terminal	humidifier HOT side
CIR N	spade terminal	circulator blower NEUTRAL terminal
LINE N	spade terminal	input voltage (120 VAC) NEUTRAL side
XFMR N	spade terminal	24 VAC transformer line voltage NEUTRAL side
EAC N (optional)	spade terminal	electronic air cleaner NEUTRAL side
HUM N (optional)	spade terminal	humidifier NEUTRAL side

* The twinning feature is available only on models with six screw terminals; one of these terminals will be designated “TWIN”. All 50A55-843 controls used in twinning applications must have the “TWIN” terminal.

† Maximum recommended flame probe wire length is 36 inches.

The 50A55 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 50A55 control. There are no other user serviceable parts.
Additional jumper wires are included in this package and should be used if the original wiring does not reach the control after mounting. Refer to the furnace wiring diagram for proper connection of the wires.

An additional wiring harness (WR 115-0223) is included in this package. If the control being replaced has a 2-pin (inducer / ignitor) connector, this wiring harness will adapt the furnace wiring to the 4-pin connector of the replacement control.

Trane application - Jumper wire 151-2906 (provided with control) must be installed on the furnace from R01 to R02 of the 12-pin connector.

The 50A62-820 is an automatic gas interrupted ignition control that employs a microprocessor to continually monitor, analyze, and control the proper operation of the gas burner, inducer, and fan.

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

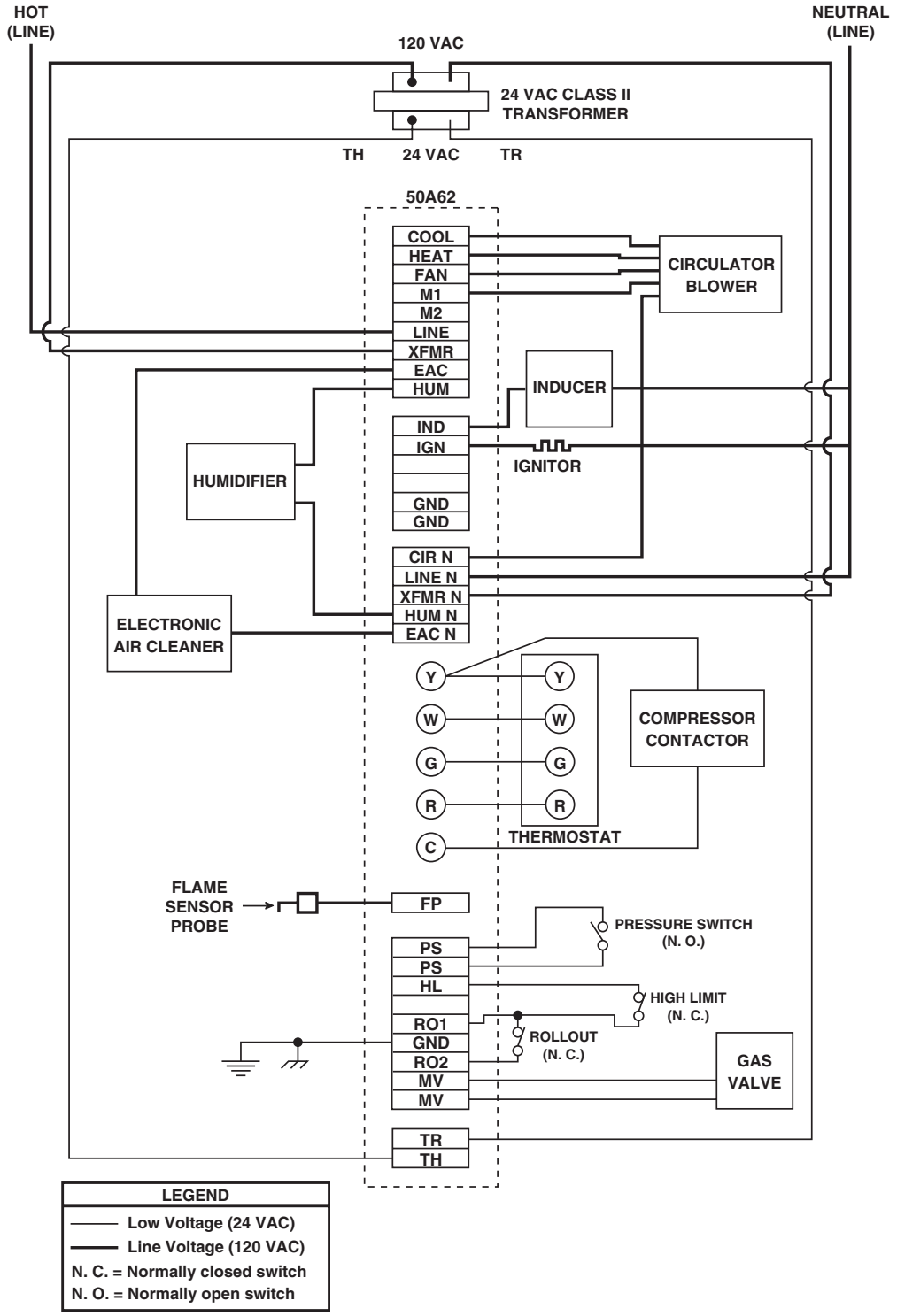
Flame Current Requirements:

Minimum current to insure flame detection.....1 µa DC①
Maximum current for non-detection.....0.1 µa DC①
Maximum allowable leakage resistance.....100 M ohms
Flame establishing time.....0.8 seconds maximum
Flame failure response time.....2.0 seconds maximum

① Measured with a DC microammeter in the flame probe lead

50A62-820

TYPICAL SYSTEM WIRING DIAGRAM



TYPICAL SYSTEM WIRING TABLE

50A62-820 TERMINAL	TERMINAL TYPE	SYSTEM COMPONENT CONNECTION
W	captive screw	low voltage thermostat W terminal (or equivalent)
G	captive screw	low voltage thermostat G terminal (or equivalent)
R	captive screw	low voltage thermostat R terminal (or equivalent)
Y	captive screw	low voltage thermostat Y terminal (or equivalent) 2nd wire from Y terminal goes to 24 VAC HOT side of compressor contactor coil
C	captive screw	24 VAC COMMON side of compressor contactor coil
MV (2 terminals)	9-pin connector & harness	gas valve (both gas solenoids are connected in parallel)
RO1		rollout switch OUTPUT
RO2		rollout switch INPUT
PS		pressure switch INPUT
PS		pressure switch OUTPUT
GND		MUST BE RELIABLY GROUNDED TO CHASSIS
HL		high limit switch input
(unused terminal)		
IND	6-pin connector & harness	inducer HOT side
IGN		ignitor HOT side
GND		inducer NEUTRAL side
GND		ignitor NEUTRAL side
(unused 2 terminals)		
COOL	spade terminal	circulator blower COOL SPEED terminal
HEAT	spade terminal	circulator blower HEAT SPEED terminal
M1	spade terminal	unused circulator blower terminal
M2	spade terminal	unused circulator blower terminal
FAN	spade terminal	circulator blower FAN SPEED terminal
LINE	spade terminal	input voltage (120 VAC) HOT side
XFMR	spade terminal	24 VAC transformer line voltage HOT side
CIR N	spade terminal	circulator blower NEUTRAL terminal
LINE N	spade terminal	input voltage (120 VAC) NEUTRAL side
XFMR N	spade terminal	24 VAC transformer line voltage NEUTRAL side
HUM	spade terminal	humidifier HOT side
EAC (optional)	spade terminal	electronic air cleaner HOT side
HUM N	spade terminal	humidifier NEUTRAL side
EAC N (optional)	spade terminal	electronic air cleaner NEUTRAL side
TR	spade terminal	24 VAC transformer (low voltage COMMON side)
TH	spade terminal	24 VAC transformer (low voltage HIGH side)
FP	spade terminal	flame sensor port*

* maximum recommended flame probe wire length is 36 inches.

OPERATION

OPTION SWITCHES

The option switches on the 50A62-820 control are used to determine the length of the heat delay-to-fan-off period. The following table shows the time periods that will result from the various switch positions.

OPTION SWITCH POSITIONS

HEAT delay-to-fan-off:	Set switch #1	#2
180 sec.	On	On
120 sec.	On	Off
90 sec.	Off	On
60 sec.*	Off	Off

* Factory setting

HEAT MODE

In a typical system, a call for heat is initiated by closing the thermostat contacts. This starts the 50A62 control's heating sequence. The inducer blower and humidifier are energized (if there is an optional electronic air cleaner on the system, the humidifier is **not** energized until the electronic air cleaner is energized). The 768A Silicon Nitride ignitor is powered within one second.

This controller has 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 temperature to compensate for changes in the line voltage.

The 80 VAC Silicon Nitride ignitor manufactured by White-Rodgers must be used. These ignitors are specially designed to operate with the 50A62's adaptive ignition routine to ensure the most efficient ignitor temperature.

COOL MODE

In a typical system, a call for cool is initiated by closing the thermostat contacts. This starts the 50A62 control's cooling sequence. The compressor is energized and the cool mode delay-to-fan-on period begins. After the delay-to-fan-on period ends, the circulator fan is energized at cool speed. The electronic air cleaner (optional) is also energized. After the thermostat is satisfied, the compressor is de-energized and the cool mode delay-to-fan-off period begins. After the delay-to-fan-off period ends, the circulator fan and electronic air cleaner (optional) are de-energized.

MANUAL FAN ON MODE

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

SYSTEM LOCKOUT FEATURES

When system lockout occurs, the gas valve is de-energized, the circulator blower is energized at heat speed, and, if flame is sensed, the inducer blower is energized for 5 seconds. The diagnostic indicator light will flash or glow continuously to indicate system status. **(System lockout will never override the precautionary features described above.)**

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 (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 one second. 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 50A62-820 control continuously monitors its own operation and the operation of the system. If a failure occurs, the DIAG 1 and DIAG 2 LEDs will indicate a failure code as shown below.

SAFETY CIRCUIT	DIAG 1	DIAG 2
Limit Control	Slow Flash	On
Pressure Switch	Off	Slow Flash
Watch Guard - Burners Failed to Ignite	Alternate Slow Flash	Alternate Slow Flash
Flame Sensed Without Valve Energized	Slow Flash	Off
Roll Out Open or 9-Pin Connector Disconnected	On	Slow Flash
Bad Board	On	On
Power On	Simultaneous Slow Flash	Simultaneous Slow Flash
Low Flame	Slow Flash	Slow Flash
Reverse Polarity	Fast Flash	Slow Flash
Low Voltage or Ignitor Disconnected	Alternate Fast Flash	Alternate Fast Flash
Heat Demand	Simultaneous Fast Flash	Simultaneous Fast Flash

The 50A65-843 is an automatic gas interrupted ignition control that employs a microprocessor to continually monitor, analyze, and control the proper operation of the gas burner, inducer, and fan.

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

These controls incorporate system fault analysis for quick gas flow shut-off, coupled with automatic ignition retry upon sensing a fault correction.

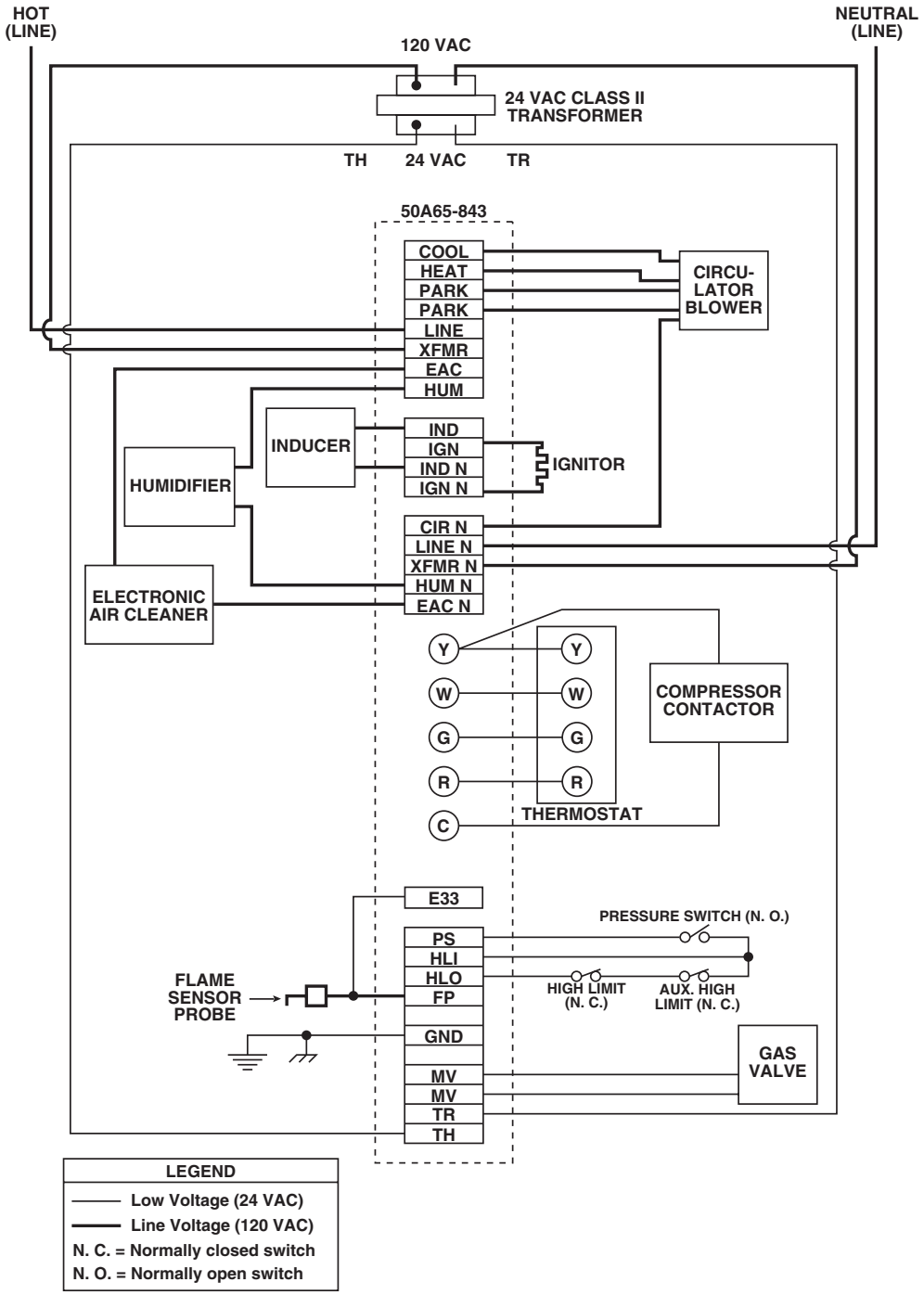
Flame Current Requirements:

Minimum current to insure flame detection.....1 µa DC①
Maximum current for non-detection.....0.1 µa DC①
Maximum allowable leakage resistance.....100 M ohms
Flame establishing time.....0.8 seconds maximum
Flame failure response time.....2.0 seconds maximum

① Measured with a DC microammeter in the flame probe lead

50A65-843

TYPICAL SYSTEM WIRING DIAGRAM



TECHNICAL HELP

TYPICAL SYSTEM WIRING TABLE

50A65 TERMINAL	TERMINAL TYPE	SYSTEM COMPONENT CONNECTION
W	Terminal block with captive screws	low voltage thermostat W terminal (or equivalent)
G		low voltage thermostat G terminal (or equivalent)
R		low voltage thermostat R terminal (or equivalent)
Y		low voltage thermostat Y terminal (or equivalent)
		(2nd wire from Y terminal goes to 24 VAC HOT side of compressor contactor coil)
C		24 VAC COMMON side of compressor contactor coil
MV (2 terminals)	12-pin connector & harness	gas valve (both gas solenoids are connected in parallel)
TR		24 VAC transformer (low voltage COMMON side)
TH		24 VAC transformer (low voltage HIGH side)
FP		flame sensor probe*
PS		pressure switch INPUT
HLI		high limit INPUT
HLO		high limit OUTPUT
GND		MUST BE RELIABLY GROUNDED TO CHASSIS
(3 unused terminal)		
IND	4-pin connector & harness	inducer HOT side
IGN		ignitor HOT side
IND N		inducer NEUTRAL side
IGN N		ignitor NEUTRAL side
COOL	spade terminal	circulator blower COOL SPEED terminal
HEAT	spade terminal	circulator blower HEAT SPEED terminal
PARK (2 terminals)	spade terminal	unused circulator blower terminals
LINE	spade terminal	input voltage (120 VAC) HOT side
XFMR	spade terminal	24 VAC transformer line voltage HOT side
EAC (optional)	spade terminal	electronic air cleaner HOT side
HUM (optional)	spade terminal	humidifier HOT side
CIR N	spade terminal	circulator blower NEUTRAL terminal
LINE N	spade terminal	input voltage (120 VAC) NEUTRAL side
XFMR N	spade terminal	24 VAC transformer line voltage NEUTRAL side
EAC N (optional)	spade terminal	electronic air cleaner NEUTRAL side
HUM N (optional)	spade terminal	humidifier NEUTRAL side
E33	3/16" spade terminal	Auxiliary flame sense

* maximum recommended flame probe wire length is 36 inches.

The 50A65 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 50A65 control. There are no other user serviceable parts.

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

Some applications may require connection to terminal E33 located in the middle of the contol cover. If the control being replaced does not have this connection, it is not needed in the application and connection to terminal E33 is not required.

Trane application - Jumper wire 151-2906 (provided with control) must be installed on the furnace from R01 to R02 of the 12-pin connector.

OPTION SWITCHES

The option switches on the 50A65-843 control are used to determine the length of the cool delay-to-fan-off, heat delay-to-fan-on and heat delay-to-fan-off periods. The following table shows the time periods that will result from the various switch positions.

OPTION SWITCH POSITIONS

COOL delay-to-fan-off:	Set switch #1
45 sec.*	On
90 sec.	Off

HEAT delay-to-fan-on:	Set switch #2
30 sec.*	On
45 sec.	Off

HEAT delay-to-fan-off:	Set switch #3	#4
60 sec.	On	On
90 sec.	Off	On
120 sec.	On	Off
180 sec.*	Off	Off

* Factory setting

HEAT MODE

In a typical system, a call for heat is initiated by closing the thermostat contacts. This starts the 50A65 control's heating sequence. The inducer blower and optional humidifier are energized and the 768A silicon nitride ignitor is powered within one second.

This control has 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 temperature to compensate for changes in the line voltage.

The 80 VAC Silicon Nitride ignitor manufactured by White-Rodgers must be used. These ignitors are specially designed to operate with the 50A65's adaptive ignition routine to ensure the most efficient ignitor temperature.

MANUAL FAN ON MODE

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

COOL MODE

In a typical system, a call for cool is initiated by closing the thermostat contacts. This energizes the 50A65 control and the compressor. The cool delay-to-fan-on period begins. After the delay period ends, the optional electronic air cleaner is energized, and the circulator fan is energized at cool speed. After the thermostat is satisfied, the compressor is de-energized and the cool mode delay-to-fan-off period begins. After the delay-to-fan-off period ends, the circulator fan and electronic air cleaner (optional) are de-energized.

SYSTEM LOCKOUT FEATURES

When system lockout occurs, the gas valve is de-energized, the circulator blower is energized at heat speed, and, if flame is sensed, the inducer blower is energized. The diagnostic indicator light will flash or glow continuously to indicate system status. (**System lockout will never override the precautionary features**.)

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

1. Interrupt the call for heat or cool 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 one second. 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 50A65-843 control continuously monitors its own operation and the operation of the system. If a failure occurs, the LED will indicate a failure code as shown below. **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 sensed failure is in the system (external to the 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
2 flashes, then pause	Pressure switch stuck closed
3 flashes, then pause	Pressure switch stuck open
4 flashes, then pause	Open limit switch
5 flashes, then pause	Open rollout switch
6 flashes, then pause	115 Volt AC power reversed / Improper ground
7 flashes, then pause	Low flame sense signal
8 flashes, then pause	Check ignitor
Continuous flashing (no pause)	Flame has been sensed when no flame should be present (no call for heat)

The LED will also flash once at power-up.

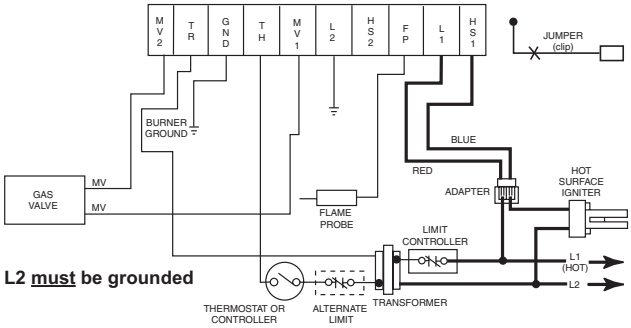


Fig. 1 – Typical hookup for White-Rodgers replacement with indirect sense using flame probe

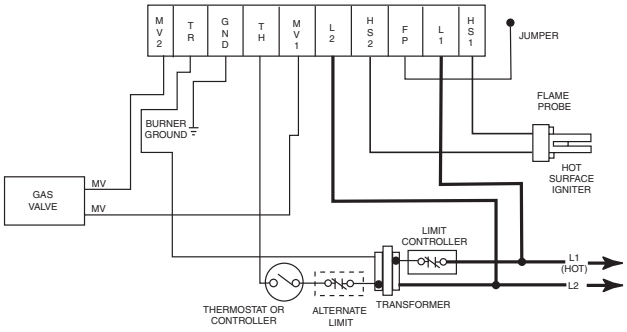


Fig. 2 – Typical hookup for competitive replacement with direct flame sense through ignitor

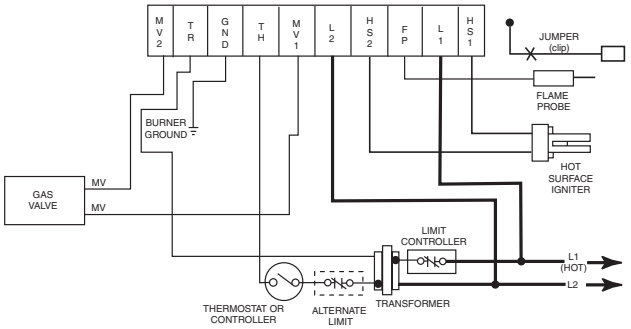


Fig. 3 – Typical hookup for competitive replacement with indirect sense using flame probe

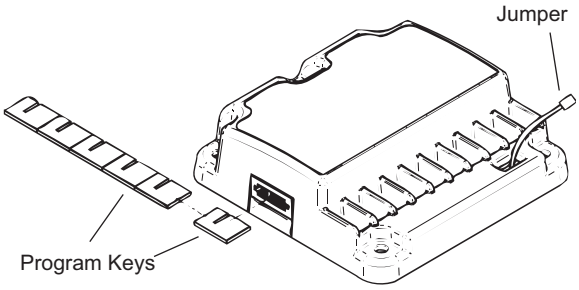


Fig. 4 – Program Key installation/Jumper for models with indirect sense clip jumper

Terminal Wiring Cross Reference

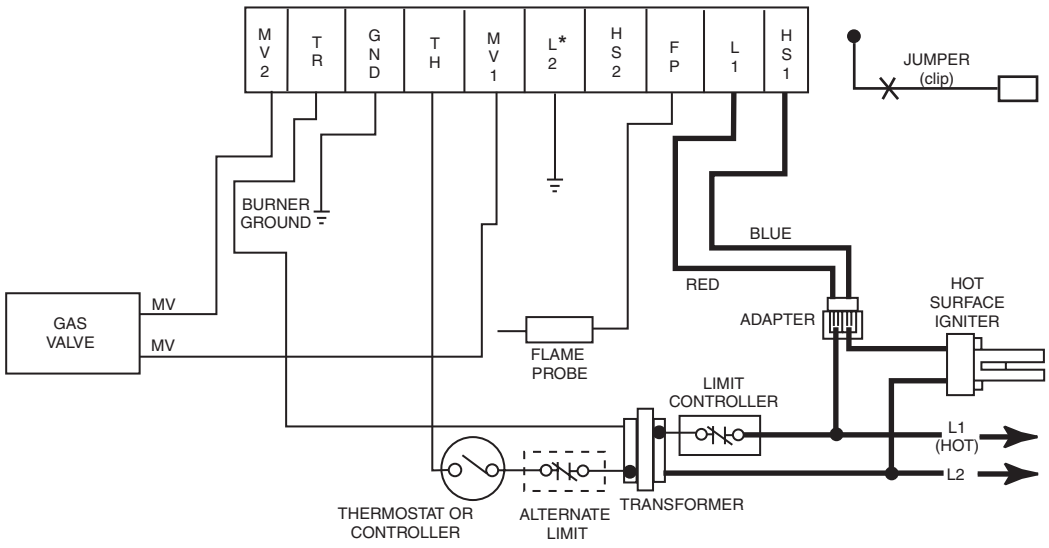
	Original Control			Replacement Control
Terminal Function	**Honeywell S89 / S890 Terminal**	**Robertshaw HS780 Terminal**	**Old White-Rodgers 50E / F47 Terminal**	**50E47-843**
Burner Ground Connection	GND (BURNER) [a]	TR (GND CLIP) [b]	GND	GND
Transformer Secondary (unswitched leg)	24V (GND) [a]	GND	TR	TR
Main Valve Common	VALVE (GND) [a]	— [c]	MV [a] (next to TR terminal)	MV2
Transformer Secondary (switched leg)	24V [a]	TH	TH	TH
Main Valve Operator	VALVE	VALVE [d]	MV [d]	MV1
120 Vac Neutral Leg	L2 120V NEUTRAL	L2	—	L2 [e]
Power Supply				
120 Vac Hot Leg	L1 120V HOT	L1	L [f]	L1 120V HOT
Power Supply				
Hot Surface Igniter Element	HSI 120V	IGN	—	HS2
Hot Surface Igniter Element	HSI 120V	IGN	IGN [g]	HSI
Flame Sensor	SEN [h]	RS [h]	FP [i]	FP [h]

[a] Remove quick-connect and replace with the included 1/4” quick-connect.
[b] Use green adapter cable (provided) to connect terminal to chassis ground.
[c] Do not use the MV2 terminal. MV2 and TR are interconnected in the appliance wiring.
[d] Remove quick-connect and replace with the included 3/16” quick-connect.
[e] Ground this terminal using green adapter cable if model being replaced does not have 120V neutral power supply connection.
[f] Use the red wire on the included adapter cable.
[g] Use the blue wire on the included adapter cable.
[h] On indirect sense models, remove jumper quick-connect from FP terminal, cut jumper wire at circuit board and discard. On direct sense models, jumper connected to FP terminal, see figure 4.
[i] Remove jumper from FP terminal, cut jumper wire at circuit board and discard.

Select and insert the correct program key to match the application.

YELLOW FLASHING INDICATOR: IMPROPER POLARITY LOCKOUT

RED SOLID INDICATOR LIGHT: INTERNAL FAULT OR REVERSED CONNECTIONS AT GAS VALVE



*** NOTE:** Ground this terminal if model being replaced does not have 120V neutral

YELLOW FLASHING INDICATOR (IMPROPER POLARITY LOCKOUT): Yellow indicator will flash if the polarity is not correct as diagrammed above on both the primary and secondary of the system transformer.

To check the polarity on the primary of the transformer it can be tested at the module. The L1 terminal on the module should be 120 volts (Hot) and should measure 120 volts to GND.

To check the secondary of the transformer, module terminal L1 should measure approximately 95 volts to TH. If the reading is approximately 120 to 150 volts the secondary is not phased correctly. To correct this condition, reverse the secondary wires on the system transformer. Note: TR on this module is tied to GND. Some systems may have more than one ground. When you reverse the 24 volt secondary be sure that only the TR and GND leads are grounded.

RED SOLID INDICATOR LIGHT (INTERNAL FAULT OR REVERSED CONNECTIONS AT GAS VALVE): A solid red indicator light means internal module fault or reversed connections at the gas valve. Before replacing the module, reverse low voltage connections to gas valve.

At installation, this module has a self-test and requires all system components (Transformer, Ignitor, Gas Valve and Flame Sensor) to be attached and turned on for it to operate. Gas valves with an Electric “On/Off” switch must be turned “ON”. A lockout condition on this control during self-test will not damage equipment or the control.

OPERATION

In a typical application the 50E47-843 is designed to energize the ignitor and gas valve and monitor the flame sensor. It is a 100% shut off design that locks out the gas valve if the burner does not light within the trial for ignition period. The ignition sequence begins with a call for heat from the room thermostat. The thermostat applies power to the control. After pre-purge interval, the ignitor warms up for the selected time. The control energizes the gas valve for the selected trial for ignition period. If the burner lights within the allowed period the gas valve will remain open until the call for heat is satisfied. During the trial for ignition period the ignitor is turned off. If the burner does not light, the control will either go into lockout or make two more ignition retries depending on the options selected. The control can be reset from lockout by cycling the thermostat to remove power for a minimum of 3 seconds. It includes a system analysis / troubleshooting LED that indicates normal operation, lock-out, weak flame signal or internal control fault.

TROUBLESHOOTING

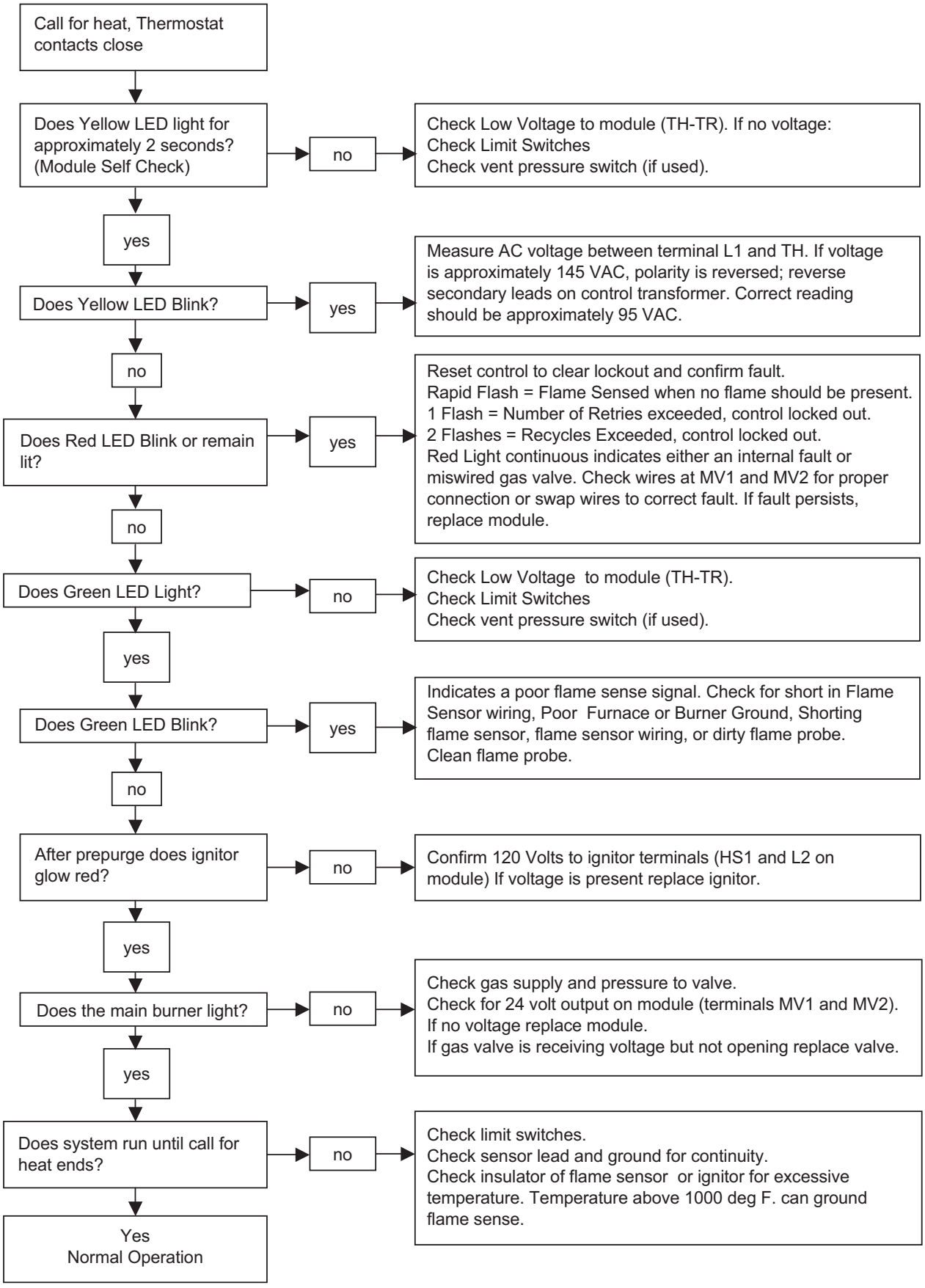
For proper control operation, the control must be electrically connected to the gas valve and all the ignitor wiring connectors plugged in. Gas valves with an electric “ON/OFF” switch must have the switch set to “ON”.

The light on the control provides a self-diagnosis indication. If the red light on the module is on continuously, the fault is likely to be internal to the module. To make sure, interrupt the line or 24 volt thermostat power for a few seconds and then restore. If the internal fault is indicated again, and flame sensor is not shorted to ground, replace the control. A flashing light indicates the problem is most likely in the external components or wiring (see chart below). Proceed as follows:
Three visual checks

1) The ignitor will warm up and glow red
2) The main burner flame will ignite
3) The main burner flame will continue to burn after the ignitor is turned off

Troubleshooting the system consists of checking for these three visual indications. The chart on the next page defines the proper action if any of these indications do not occur.

LED	Condition
Green Solid On	Normal
Green Rapid Flashing	Weak flame signal
Red Rapid Flash	Control in lockout Flame sensed when there should be none
Red 1 Flash	Control in lockout Ignition retries exceeded
Red 2 Flash	Control in lockout Ignition recycles exceeded
Yellow Solid On	Internal self check
Yellow Rapid Flashing	Improper Polarity
OFF	Internal Failure
Red Solid On	Gas valve miswired or Internal error detected


Call for heat, Thermostat contacts close
Does Yellow LED light for approximately 2 seconds? (Module Self Check)
no
Check Low Voltage to module (TH-TR). If no voltage:
Check Limit Switches
Check vent pressure switch (if used).
yes
Does Yellow LED Blink?
yes
Measure AC voltage between terminal L1 and TH. If voltage is approximately 145 VAC, polarity is reversed; reverse secondary leads on control transformer. Correct reading should be approximately 95 VAC.
no
Does Red LED Blink or remain lit?
yes
Reset control to clear lockout and confirm fault.
Rapid Flash = Flame Sensed when no flame should be present.
1 Flash = Number of Retries exceeded, control locked out.
2 Flashes = Recycles Exceeded, control locked out.
Red Light continuous indicates either an internal fault or miswired gas valve. Check wires at MV1 and MV2 for proper connection or swap wires to correct fault. If fault persists, replace module.
no
Does Green LED Light?
no
Check Low Voltage to module (TH-TR).
Check Limit Switches
Check vent pressure switch (if used).
yes
Does Green LED Blink?
yes
Indicates a poor flame sense signal. Check for short in Flame Sensor wiring, Poor Furnace or Burner Ground, Shorting flame sensor, flame sensor wiring, or dirty flame probe.
Clean flame probe.
no
After prepurge does ignitor glow red?
no
Confirm 120 Volts to ignitor terminals (HS1 and L2 on module) If voltage is present replace ignitor.
yes
Does the main burner light?
no
Check gas supply and pressure to valve.
Check for 24 volt output on module (terminals MV1 and MV2).
If no voltage replace module.
If gas valve is receiving voltage but not opening replace valve.
yes
Does system run until call for heat ends?
no
Check limit switches.
Check sensor lead and ground for continuity.
Check insulator of flame sensor or ignitor for excessive temperature. Temperature above 1000 deg F. can ground flame sense.
Yes
Normal Operation

50D50-842 WIRING

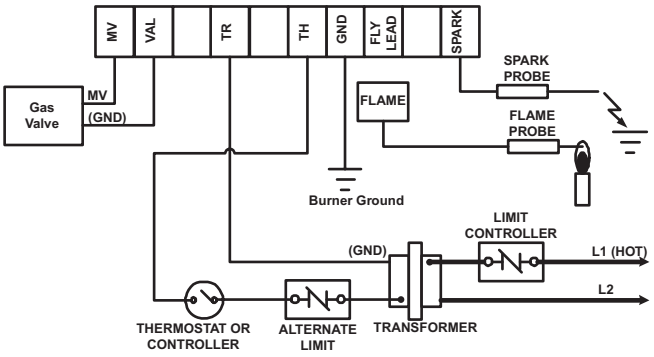


Fig. 1 – Typical hookup for White-Rodgers replacement with separate flame sense and spark probes

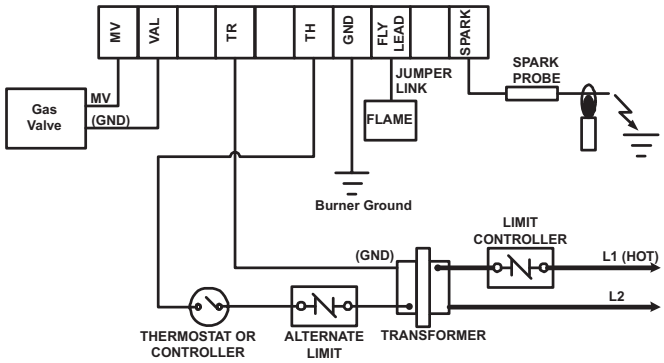


Fig. 2 – Typical hookup for White-Rodgers replacement with direct flame sense through single spark/sense probe

NOTE: Max length of spark cable should be less than 3ft (0.9m) and rated at 15kV. The cable must not run in continuous contact with any metal surface or spark voltage is greatly reduced. Use ceramic or plastic standoff insulators as required. Ensure burner is grounded directly to module for spark return path.

50D50-843 WIRING

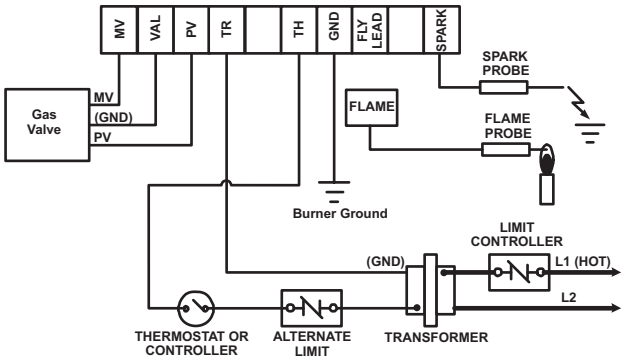


Fig. 3 – Typical hookup for White-Rodgers replacement with separate flame-sense and spark probes

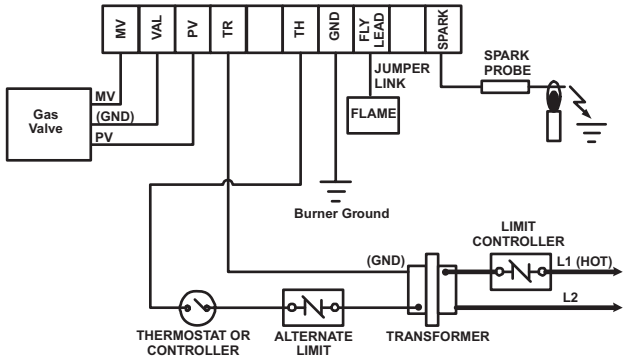


Fig. 4 – Typical hookup for White-Rodgers replacement with direct flame sense through single spark/sense probe

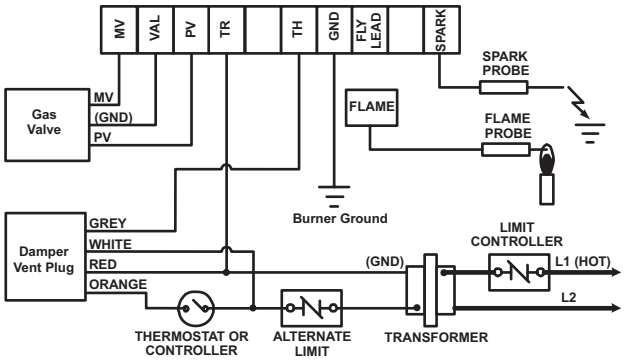


Fig. 5 – Typical hookup for White-Rodgers replacement with damper vent and separate flame-sense and spark probes

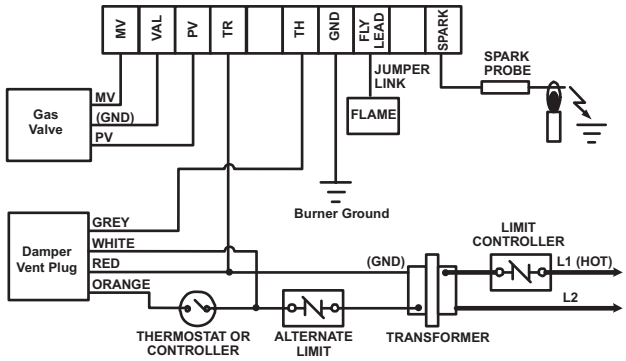
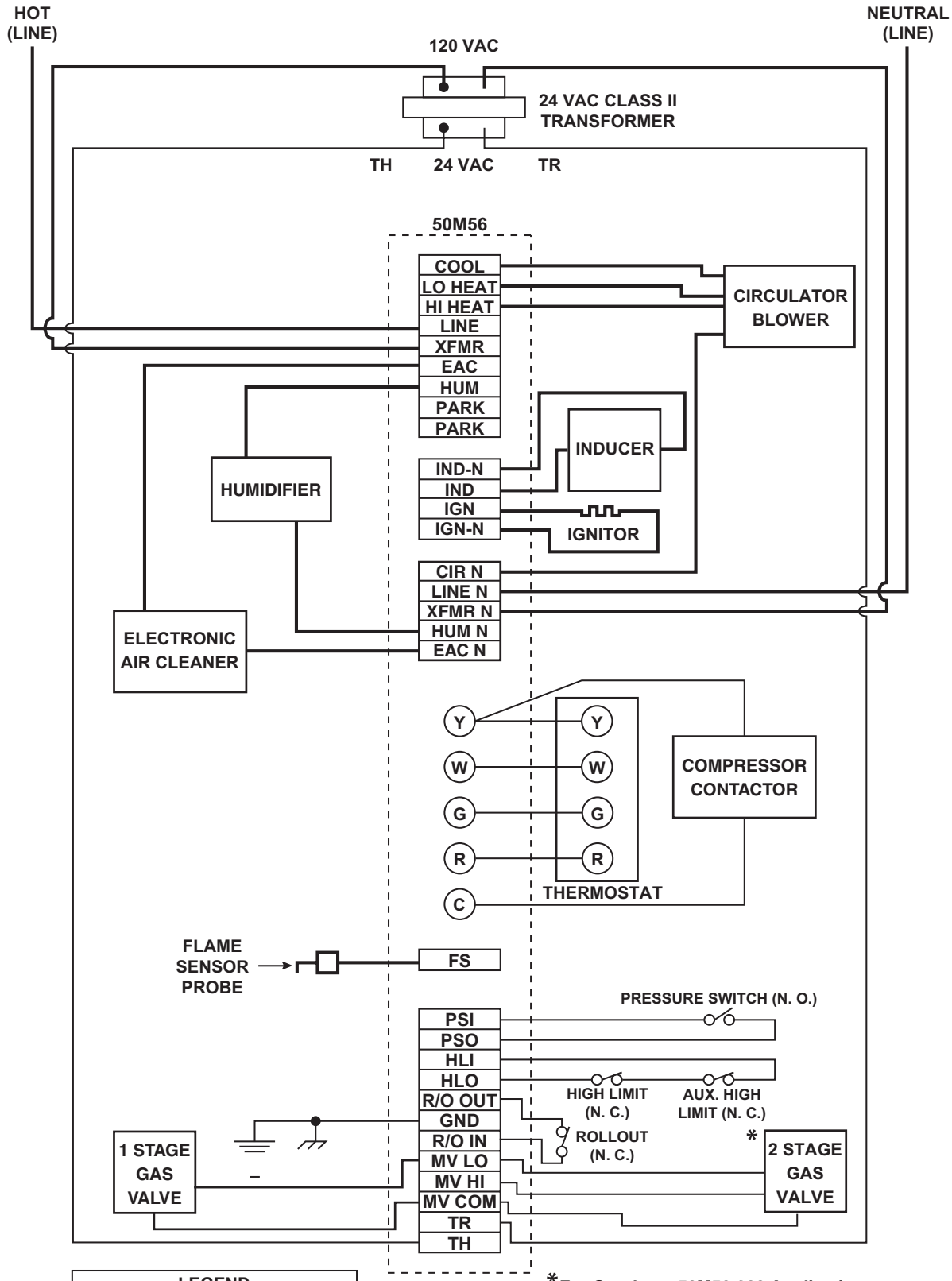


Fig. 6 – Typical hookup for White-Rodgers replacement with damper vent and direct flame sense through single spark/sense probe

NOTE: Max length of spark cable should be less than 3ft (0.9m) and rated at 15kV. The cable must not run in continuous contact with any metal surface or spark voltage is greatly reduced. Use ceramic or plastic standoff insulators as required. Ensure burner is grounded directly to module for spark return path.

50M56U-843 TYPICAL WIRING DIAGRAM



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

*For Goodman 50M56-289 Application

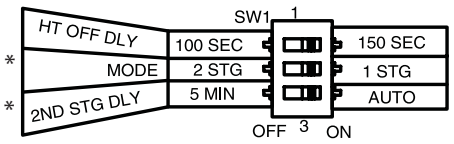
50M56U-843 TYPICAL WIRING DIAGRAM

50M56 TERMINAL	TERMINAL TYPE	SYSTEM COMPONENT CONNECTION
W	Terminal block with captive screws	low voltage thermostat W terminal (or equivalent)
G		low voltage thermostat G terminal (or equivalent)
R		low voltage thermostat R terminal (or equivalent)
Y		low voltage thermostat Y terminal (or equivalent)
		(2nd wire from Y terminal goes to 24 VAC HOT side of compressor contactor coil)
C		24 VAC COMMON side of compressor contactor coil
HLO (1)	12-pin connector & harness	high limit OUTPUT
MV LO (2)		gas valve first stage
TH (3)		24 VAC transformer (low voltage HIGH side)
PSO (4)		pressure switch OUTPUT
R/O OUT (5)		rollout switch OUTPUT
TR (6)		24 VAC transformer (low voltage COMMON side)
HLI (7)		high limit INPUT
GND (8)		MUST BE RELIABLY GROUNDED TO CHASSIS
MV COM (9)		gas valve COMMON
PSI (10)		pressure switch INPUT
R/O IN (11)		rollout switch INPUT
MV HI (12)		gas valve second stage
IND (1)	4-pin connector & harness	inducer HOT side
IGN (2)		ignitor HOT side
IND-N (3)		inducer NEUTRAL side
IGN-N (4)		ignitor NEUTRAL side
COOL	spade terminal	circulator blower COOL SPEED terminal
LO HEAT	spade terminal	circulator blower LO HEAT SPEED terminal
HI HEAT	spade terminal	circulator blower HI HEAT SPEED terminal
PARK (2 terminals)	spade terminal	unused terminals
LINE	spade terminal	input voltage (120 VAC) HOT side
XFMR	spade terminal	24 VAC transformer line voltage HOT side
EAC (optional)	spade terminal	electronic air cleaner HOT side
HUM (optional)	spade terminal	humidifier HOT side
CIR N	spade terminal	circulator blower NEUTRAL terminal
LINE N	spade terminal	input voltage (120 VAC) NEUTRAL side
XFMR N	spade terminal	24 VAC transformer line voltage NEUTRAL side
EAC N (optional)	spade terminal	electronic air cleaner NEUTRAL side
HUM N (optional)	spade terminal	humidifier NEUTRAL side
FS	spade terminal	flame sensor probe†

† Maximum recommended flame probe wire length is 36 inches.

OPTION SWITCHES

The option switches on the 50M56U-843 control are used to determine the length of the heat delay-to-fan-off period, the mode of operation, and the 2nd stage delay period. The following illustration shows the options and the selections of the switch positions. The switches are shown in the factory default positions.



*MODE and 2ND STG DLY for Goodman 50M56-289 only

HEAT MODE

When heat is required, the thermostat will send a call for heat to the control. This starts the controls heating sequence. The ignitor and humidifier (optional) are powered. The ignitor is powered after the pre-purge period.

Upon initial application of power, the warm-up time is 17 seconds. The ignitor on-time will then be increased depending on whether or not flame is achieved. The warm-up time is limited to a maximum of 19 seconds. During the first 64 warm-up periods following power-up, the warm-up time may not be less than 17 seconds.

In the event of a retry, the warm-up time will be increased by one second and locked in at that duration. Once the warm-up time is locked, it remains fixed until another call for heat results in a retry, in which case the warm-up time is again increased by one second and remains locked.

In the event of two successive retry attempts, the warm-up time will be unlocked and set to 19 seconds. If flame is then achieved, the warm-up time will begin adapting again with the next call for heat. If, however, this third attempt fails to achieve flame, the control will go into system lockout.

After the ignitor warm-up period, MV LO (first stage) and MV HI (second stage) are both energized to the gas valve. Flame must be detected within 4 seconds. If flame is detected, the 30-second HEAT delay-to-fan-on period begins. The circulator and electronic air cleaner (optional) will also energize at this time.

1 Stage operation – If the Option Switch MODE (SW1-2) is set to the 1 STG position, both MV LO and MV HI will remain energized.

2 Stage operation (Goodman 50M56-289 Application only) – If the Option Switch MODE is set to 2 STG, MV HI will de-energize after 5 seconds, leaving MV LO energized. If the MODE is in the 2 STG position, 2nd STG DLY (SW1-3) will determine the second stage- on delay as follows:

5 MIN – On call for heat, the 5 minute 2nd stage recognition timer begins. After the 5-minute delay, the second stage heat (MV HI) is energized.

AUTO – On call for heat, the automatic second stage will determine the optimum timing between stages for comfort. Auto will adapt the delay to energize MV HI from instantly to up to 12 minutes.

When the thermostat is satisfied, the gas valve is de-energized. After proof of flame loss, the heat delay-to-fan-off period begins and the inducer blower remains energized to purge the system for 25 seconds. When the purge is complete, the inducer blower is de-energized. After the delay-to-fan-off period ends, the circulator fan and electronic air cleaner are de-energized.

If flame is not detected, both valves are de-energized, the ignitor is turned off, and the 50M56U-843 control goes into the “retry” sequence. The “retry” sequence provides a 60-second wait following an unsuccessful ignition attempt (flame not detected). After this wait, the ignition sequence is restarted with an additional 1 second of ignitor warm-up time.

If flame is established for more than 10 seconds after ignition, the 50M56U-843 controller will clear the ignition attempt (or retry) counter. If flame is lost after 10 seconds, it will restart the ignition sequence.

During burner operation, a momentary loss of power of 50 milliseconds or longer will de-energize the main gas valve. When power is restored, the gas valve will remain de-energized and a restart of the ignition sequence will begin immediately.

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.

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

COOL MODE

In a typical system, a call for cool is initiated by closing the thermostat contacts. This energizes the 50M56U-843 control and the compressor. The cool delay-to-fan-on period begins. After the delay period ends, the optional electronic air cleaner is energized, and the circulator fan is energized at cool speed. After the thermostat is satisfied, the compressor is de-energized and the cool mode delay-to-fan-off period begins. After the delay-to-fan-off period ends, the circulator fan and electronic air cleaner (optional) 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 optional electronic air cleaner are energized. When the fan switch is returned to the AUTO position, the circulator fan and electronic air cleaner (optional) are de-energized.

SYSTEM LOCKOUT AND DIAGNOSTIC FEATURES

SYSTEM LOCKOUT FEATURES

When system lockout occurs, the gas valve is de-energized, the circulator blower is energized at heat speed, and, if flame is sensed, the inducer blower is energized. The diagnostic indicator light will flash or glow continuously to indicate system status. **(System lockout will never override the precautionary features.)**

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

1. Interrupt the call for heat or cool 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 one second. 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 50M56U-843 control continuously monitors its own operation and the operation of the system. If a failure occurs, the LED will indicate a failure code as shown below. **If the failure is internal to the control, the light will stay off. 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 the 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).

DIAGNOSTIC INDICATOR FLASH CODES

FLASH	
1	System Lockout (Retries Exceeded)
2	Pressure Switch Stuck Closed
3	Pressure Switch Stuck Open
4	Open High Temperature Limit Switch
5	Flame Sensed with Gas Valve De-energized
6	Open Rollout Switch
7	Low Flame Sense Signal
8	Ignitor Relay Fault
Rapid Flash	Reverse Polarity
Continuous On	Normal Operation
Off	Control Failure

INSTALLER MUST READ FOR PROPER INSTALLATION

IMPORTANT: For continuous fan speed operation, one of the unused parked motor taps must be connected to the low heat speed terminal. Failure to do this will result in the blower not energizing in the constant fan mode operation. Refer to figure 1.

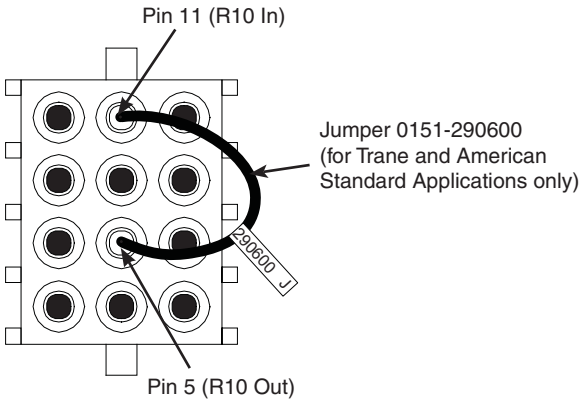
FOR ALL TRANE AND AMERICAN STANDARD APPLICATIONS ONLY: Install jumper 0151 290600 (included in this package) in the furnace 12 pin connector harness, pin 5 and pin 11 positions. Make sure jumper snaps into the connector securely. Refer to figure 1.

FAULT RECALL

The last five fault codes stored can be displayed on the diagnostic LED. When the control is in standby mode (no call for heat or cool), press the FAULT RECALL switch for approximately two seconds or until the diagnostic LED turns off. Release the switch and the LED will remain off for two seconds. Then the fault codes will display beginning with the most recent fault first with a two second pause between codes. After the stored fault codes have all displayed, the LED will remain off for two seconds and then turn on to indicate return to normal status. While displaying the stored fault codes, the control will ignore any new call for heat, cool or fan.

FAULT CODE RESET

The stored fault codes can be erased from memory. When the control is in standby mode (no call for heat or cool), press the FAULT RECALL switch for five to ten seconds or until the diagnostic LED begins to rapid flash. When the switch is released, the LED will turn off for two seconds to indicate the codes are erased. After two seconds the LED will turn on to indicate return to normal status. If the switch is held pressed for over ten seconds the rapid flash will stop and the LED will be on to indicate return to normal status.



DEFINITION OF TERMS

Auto Restart – 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.

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.

Cool Delay-To-Fan-On – The period of time after a thermostat demand for cool before energizing the circulator blower motor at Cool speed.

Flame Failure Response Time (FFRT) – The period of time between loss of the supervised main burner flame and the action to shut off the gas supply.

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.

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.

Igniter Warm-up Time – The length of time allowed for the igniter to heat up prior to the initiation of gas flow.

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.

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.

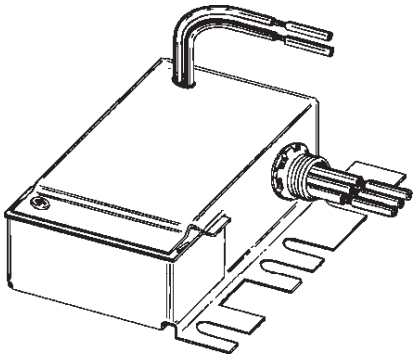
Post-purge Time – The period of time intended to allow for the dissipation of any unburned gas or residual products of combustion at the end of a furnace burner operating cycle. Post-purge begins at the loss of flame sense.

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.

Recycles – The additional attempts within the same thermostat cycle for ignition after loss of the supervised ignition source or the supervised main burner flame.

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.

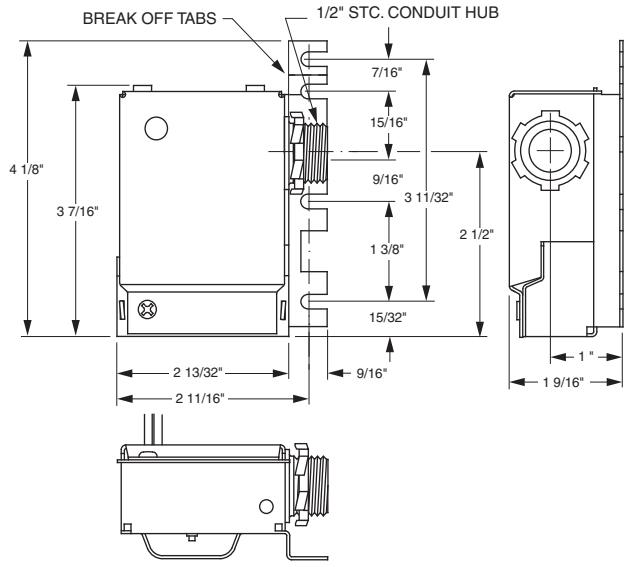
Trial for Ignition Period (TFI) – The period of time between initiation of gas flow and the action to shut off the gas flow in the event of failure to establish proof of the supervised ignition source or the supervised main burner flame.

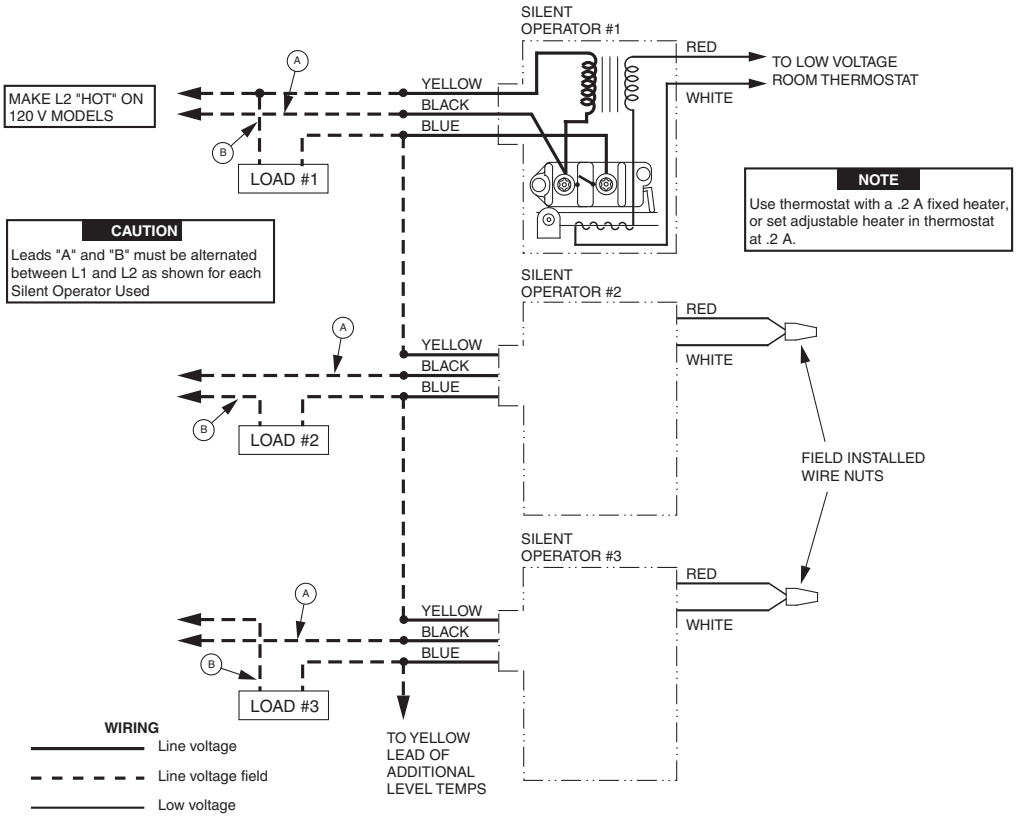


24A01 / 24A05 LEVEL-TEMP SILENT OPERATOR CONTROL

Basic Silent Operator components are a line-to-low voltage transformer, a low voltage bimetal heater, an ambient compensating bimetal, and a normally open SPST line voltage snap-action switch. In operation, a circuit is completed through the bimetal heater as the low voltage room thermostat closes its contacts. In approximately 45 seconds, the warping action of the heater closes the line voltage snap-switch to energize the heating load. When the thermostat opens its contacts, the bimetal heater cools for approximately 45 seconds before the line voltage switch opens to de-energize the heating load.

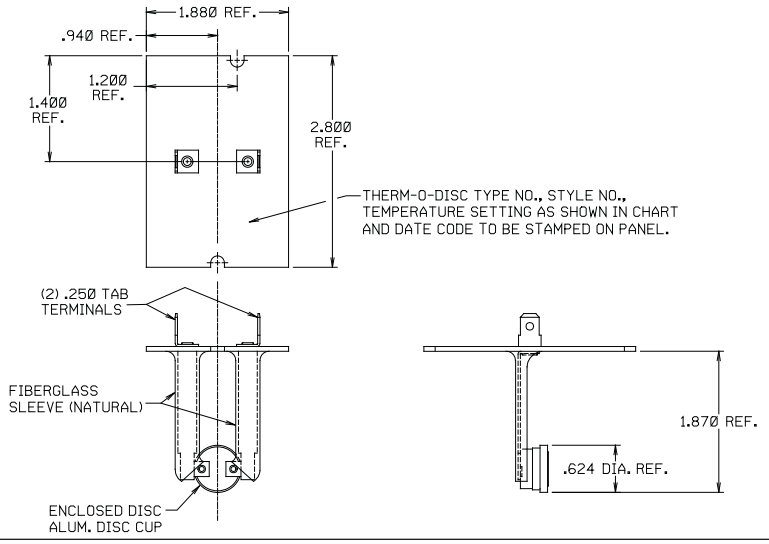
Dimensions of Type 24A01 / 05 Level Temp





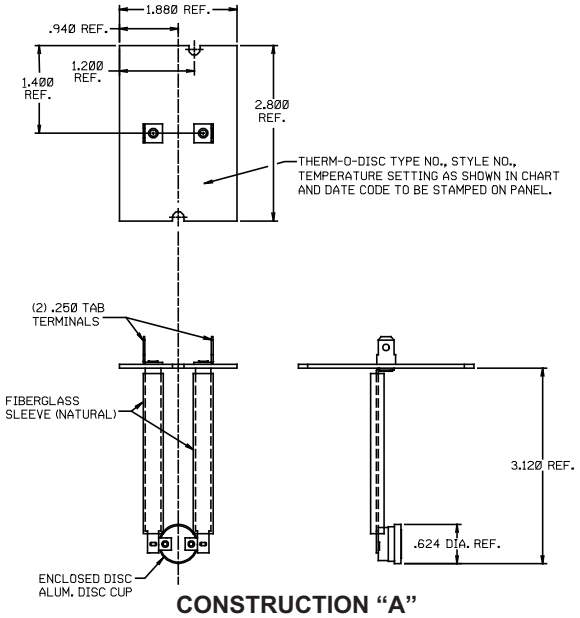
Typical Wiring Diagram To "Sequence" Two Or More Loads

NOTE: All wiring should be done in accordance with local and national electrical codes and ordinances.

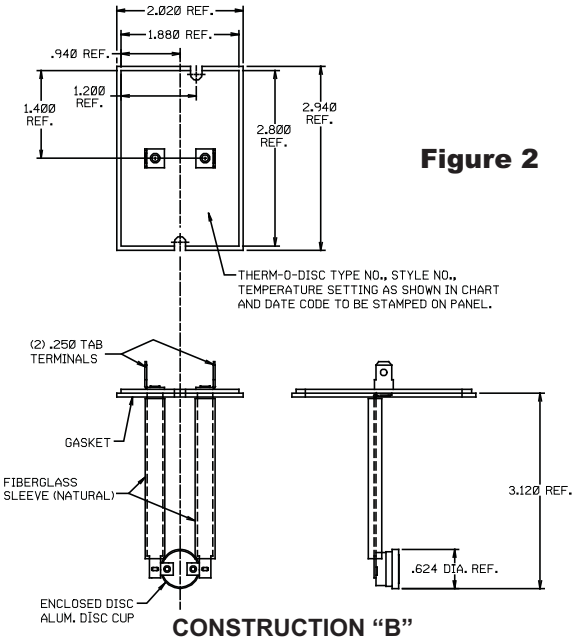


Model Number	Temp. Setting On Panel	Open Temp.	Close Temp.
3L09-1	L140-40	140°F±5°	100°F±8°
3L09-2	L170-40	170°F±5°	130°F±8°

Figure 1

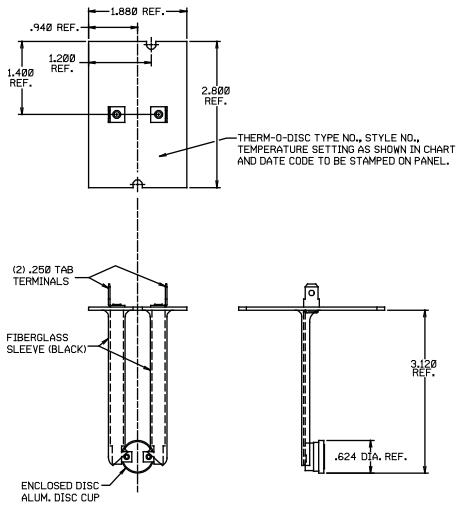


CONSTRUCTION "A"



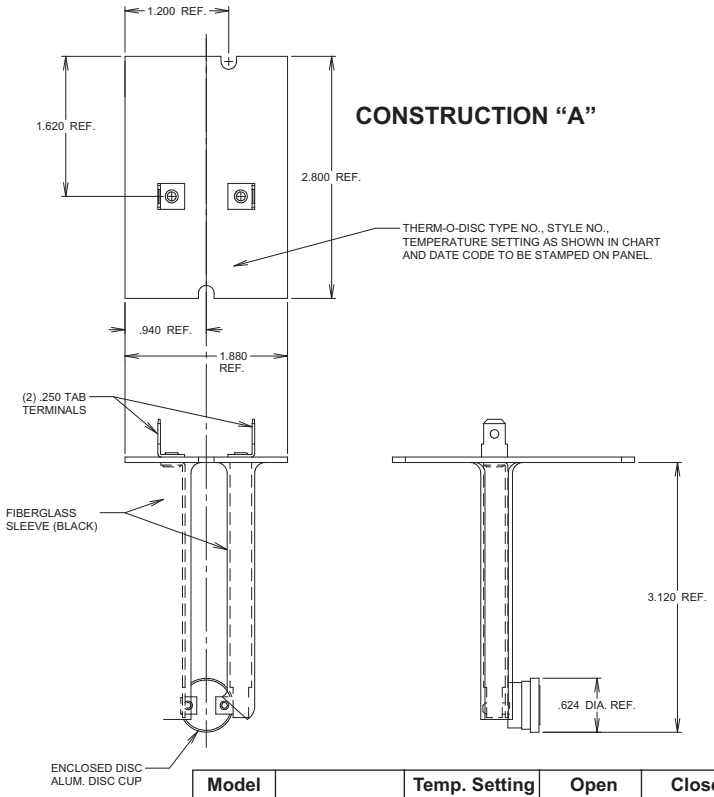
CONSTRUCTION "B"

Figure 2

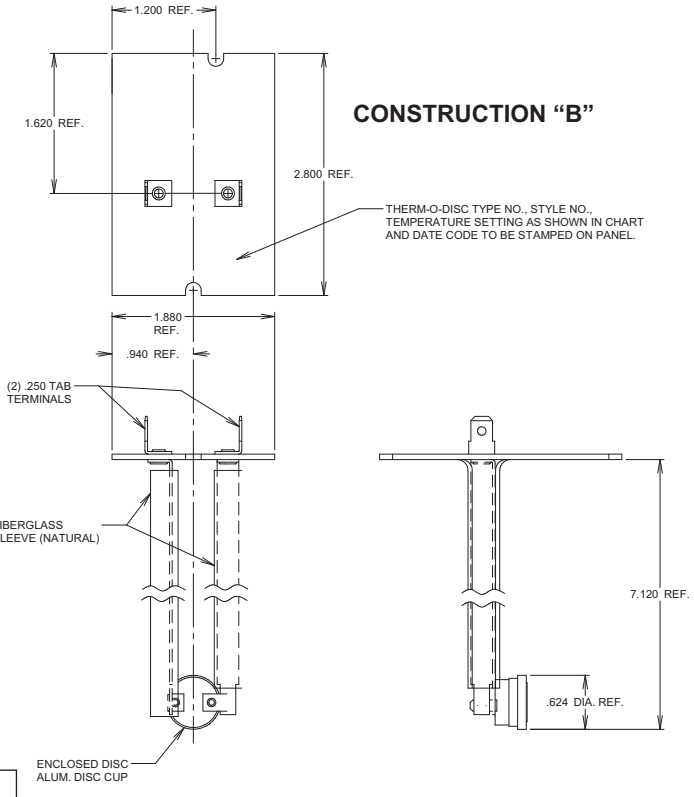


CONSTRUCTION "C"

Model Number	Construction	Temp. Setting On Panel	Open Temp.	Close Temp.
3L09-3	A	L140-30F	140°F±5°	110°F±8°
3L09-4	C	L150-20F	150°F±5°	130°F±8°
3L09-5	C	L160-20F	160°F±5°	140°F±8°
3L09-6	B	L170-40F	170°F±5°	130°F±8°
3L09-7	A	L175-30F	175°F±5°	145°F±8°
3L09-8	B	L180-40F	180°F±6°	140°F±9°
3L09-9	C	L190-20F	190°F±5°	170°F±8°
3L09-10	B	L200-40F	200°F±6°	160°F±9°
3L09-11	B	L210-40F	210°F±6°	170°F±9°
3L09-12	B	L220-40F	220°F±6°	180°F±9°
3L09-13	A	L240-30F	240°F±6°	210°F±10°
3L09-14	B	L250-40F	250°F±7°	210°F±11°
3L09-15	A	L260-30F	260°F±6°	230°F±10°



CONSTRUCTION "A"



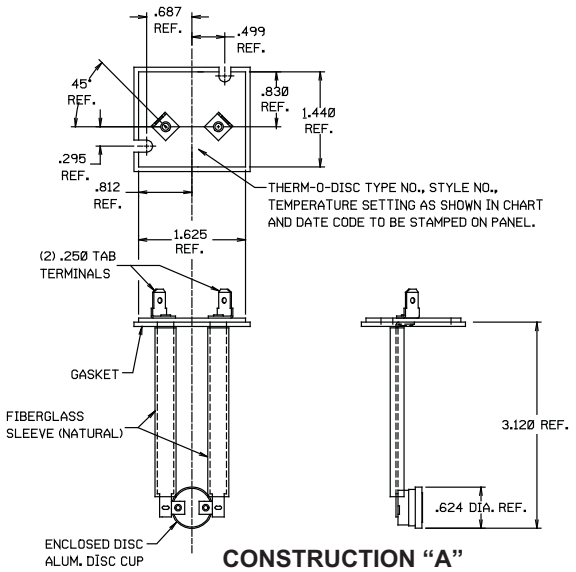
CONSTRUCTION "B"

Model Number	Construction	Temp. Setting On Panel	Open Temp.	Close Temp.
3L09-16	A	L150-20F	150°F±5°	130°F±8°
3L09-17	A	L250-25F	250°F±6°	225°F±9°
3L09-18	B	L155-30F	155°F±5°	125°F±8°
3L09-19	B	L175-30F	175°F±5°	145°F±8°
3L09-20	B	L240-30F	240°F±6°	210°F±10°

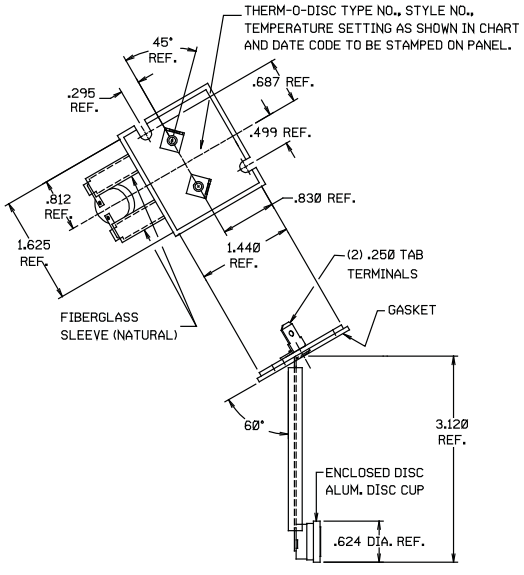
Figure 3

Model Number	Construction	Temp. Setting On Panel	Open Temp.	Close Temp.
3L09-21	A	L150-20F	150°F±5°	130°F±8°
3L09-22	A	L160-20F	160°F±5°	140°F±8°
3L09-23	A	L170-20F	170°F±5°	150°F±8°
3L09-24	B	L190-20F	190°F±5°	170°F±8°
3L09-25	B	L200-20F	200°F±5°	180°F±8°

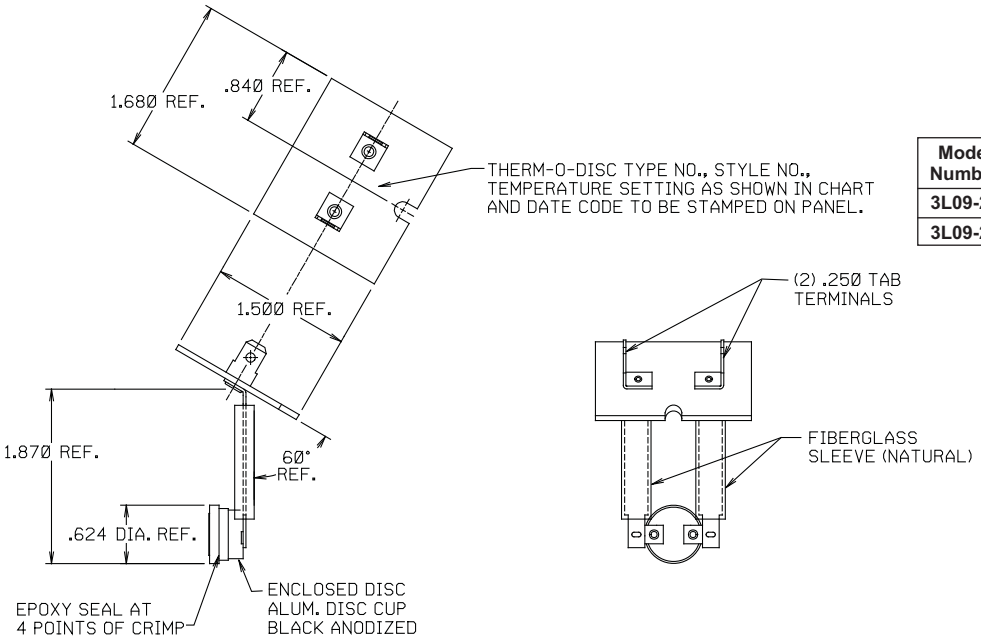
Figure 4



CONSTRUCTION "A"



CONSTRUCTION "B"



Model Number	Temp. Setting On Panel	Open Temp.	Close Temp.
3L09-26	L180-20F	180°F±5°	160°F±8°
3L09-27	L220-20F	220°F±5°	200°F±8°

Figure 5

Model Number	Temp. Setting On Panel	Open Temp.	Close Temp.
3L09-28	L210-30F	210°F±5°	180°F±8°

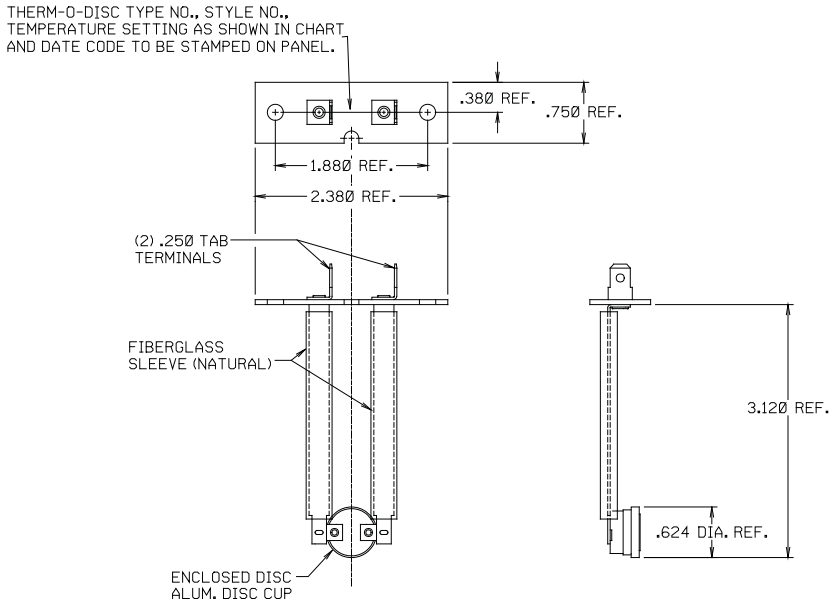


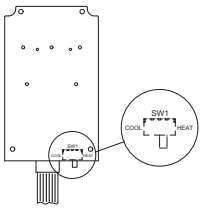
Figure 6

COOLING / REFRIGERATION

Wiring Instruction Notes

Switch Settings

Circuit Board Inside Cover



Switch SW1 must be set for system mode as shown:

	SW1
Refrigeration	Cool
Heating	Heat

Switch SW2 must be set for applications as shown:

	SW2
Line Voltage (Power Stealing)	PS
Line Voltage (Non Power Stealing)	Non PS
24 VAC (Non Power Stealing)	Non PS

Power Stealing

Power Stealing is an electronic design within the control that can eliminate the need to connect a neutral line to power the control. The control receives power from the unit it is controlling. Power Stealing saves time and money by often eliminating the labor to run a neutral wire to the control for power. See compatibility chart below for certain limitations.

Power Stealing Compatibility Chart

Application	Power Stealing	Non-Power Stealing
Line Voltage, replacing existing control that has a common wire	Yes	Yes
Line Voltage, with load greater than 2.5 amps, without Defrost timer or other power interruption circuit, with or without alarm	Yes	Yes
Line Voltage, with load greater than 2.5 amps, with Defrost timer of other power interruption circuit, no alarm	See Note 1	Yes
Line Voltage with load greater than 2.5 amps, with Defrost timer or other power Interruption circuit, with alarm	No	Yes
Line Voltage with load less than 2.5 amps	No	Yes
24 VAC Application	No	Yes

NOTE 1: During defrost or time when load circuit is broke, display will be blank because power has been interrupted to the control. All menu settings and setpoint will be restored when power is returned.

* NTC – Negative Temperature Coefficient
PTC – Positive Temperature Coefficient

NOTE: Only one sensor (PTC or NTC) may be connected. Sensor must meet specific temperature vs. resistance specifications.

Fig. 3 Line Voltage Application (Power Stealing)

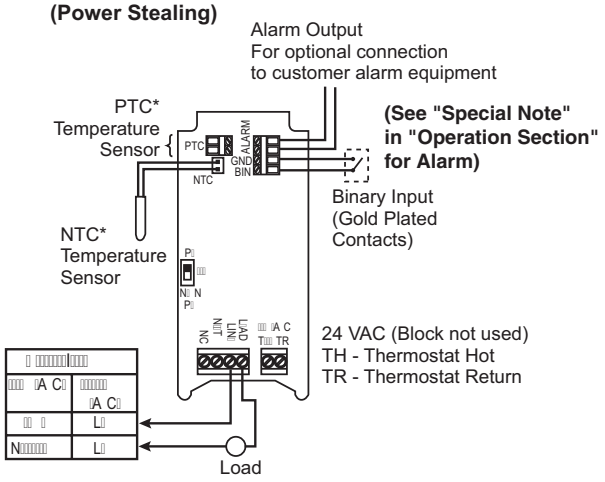


Fig. 4 Line Voltage Application (Non-Power Stealing)

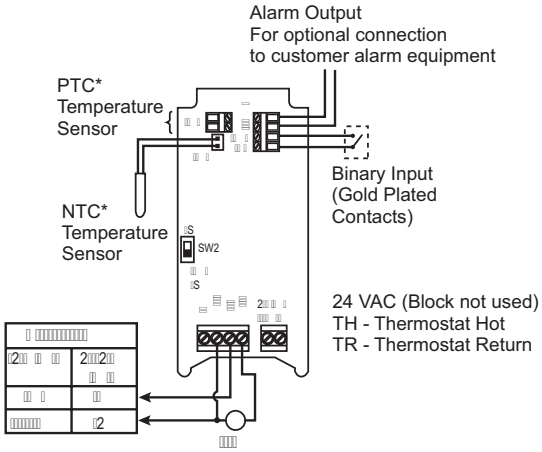
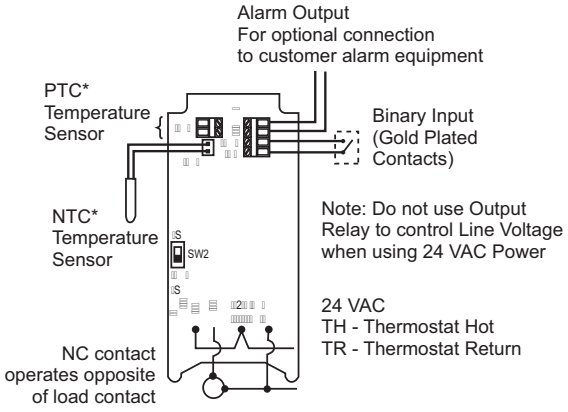


Fig. 5 24 VAC Applications (Non-Power Stealing)



TECHNICAL HELP

USER MENU OPERATION SETTINGS:
The control has user Menu settings that will determine how the control operates. The unit is shipped with factory default settings. The user must change any of the settings as required for the application. To reset all settings to factory defaults, press and hold all 3 buttons simultaneously (MENU, ✚, and ▭ buttons) for approximately 5 seconds.

To view Menu items, press and hold MENU for 5 seconds. The unit will display the first Menu item on the left side of the display. The right side of the display indicates the Menu item settings. To change the setting, momentarily press the ✚ or ▭ key.

A momentary press of the MENU key advances the display to the next Menu item, and continues, till the last menu item is displayed. Pressing the key one more time with the last menu item, (aL) displayed returns the control to the operating mode.

Each press of MENU results in forward movement to the next Menu item. If you need to change an item “passed”, you must repeatedly press MENU, return to the operating mode, then press and hold MENU for 5 seconds to re-enter the Menu mode. Then repeatedly, momentarily press MENU until the desired Menu item is again displayed.

To store any changes made to any Menu items, the Menu must be exited by pressing MENU when the last item is displayed. If no buttons are pressed for ten minutes while in the menu, the control will return to operating mode and any changes that were made will be lost.

The following table shows the menu items, default settings and optional settings.

NOTE: The Heat/ Cool switch (SW1) MUST be in the proper position BEFORE setting options.

Menu Item	Description	Factory Default	Options Press ✚ or ▭ to select	Comments
CF	Temperature Scale	F	C or F	Selects temperature display in Fahrenheit or Celsius
dFF	Differential	5	1 to 30	Selects the range between Cut In and Cut Out.
SP	Set Point Mode Cool Heat	CI CO	CO or CI CI or CO	Selects how the set point temperature will operate the load terminal. CI indicates the setpoint temperature will be the Cut In temperature. CO indicates the temperature will be the Cut Out temperature. See Operation section.
SOF	Sensor Operation Failure Cool Heat	1 0	0 or 1 None	Cooling - Selects the operation of the Control Load relay in the event of a sensor failure in Cool mode. 1 (default) will cause the load contacts of the relay to close and remain closed if the sensor either opens or shorts. 0 causes the load contacts of the relay to open and remain open. Heating has no optional selection. Sensor failure in Heating will result in the relay contacts opening.
dL	Display Light	Off	On or Off	Selects the LCD display light Off or On. With this selected Off, the display light will illuminate any time a keypad button is pressed to provide better viewing in low lighting conditions, and go off after 10 seconds. If On is selected, the display light will be On continuously.
ASd	Anti Short-Cycle Delay	Cool 1 Heat 0	0 to 12	Selects the minimum time (in minutes) that the load contacts will remain open after a cycle before closing again. This will prevent the compressor or other load from being damaged by cycling too soon. A blinking Snowflake or Flame icon indicates that the control has a demand to energize the load, but is waiting for the delay time to elapse. A setting of 0 indicates no time and the feature is disabled. SW1 must be set to the proper position before checking this setting.
LP	Lock Front Panel Keypad	Off	On or Off	When selected Off, the keypad can be used as normal. When selected On, prevents unauthorized access to the control settings by locking out all keys. To unlock the control when it is locked, press and hold the Menu key for 5 seconds.
OFS	Ambient Temperature Offset	0	-4, -3, -2, -1, 0, 1, 2, 3, 4	This control is calibrated at the factory, but the “sensed" temperature may read different because of mounting/installation, or other factors. This item allows the displayed temperature to be shifted the number of degrees set to compensate for this difference
bIn	Binary Input	Off	On or Off	The default setting of Off will have no affect on the operation of the thermostat. When set to On, it allows an external binary input (switch or relay) to start a temperature set back. See Set Back (Sb).

Menu Item	Description	Factory Default	Options Press ✚ or ▭ to select	Comments
Sb	Set Back	0	0 to 50	Selects the number of degrees the thermostat will change the setpoint temperature when the external binary input signal is received. 0 will cause no temperature change to occur. See Binary Input (bin).
AL	Alarm	0	0 to 99	Selects the time delay (in minutes) before a Temperature Out of Range alarm output is sent. A setting of 0 disables the alarm relay.

OPERATION

⚠ **This control is a temperature control and is not to be used as a temperature limit control.**

⚠ **To prevent scald injury, do not use this control to heat water for bathing, washing, hot tub or similar applications.**

The factory default setpoint for this control is 45°F (7°C) for Cool and 120°F (49°C) for Heat. Setpoint temperature can be adjusted using the ✚ or ▭ keys. A power loss does not lose the settings. All menu item selections and setpoint setting are stored in a permanent memory.

The user determines the temperature operating range. To determine the temperature range, the user must select the Set Point (SP) as the Cut Out or Cut In temperature, Differential (dFF) and enter a set point temperature. Cut out is when the load is turned off and cut in is when the load is turned on.

NOTE: The Heat/ Cool switch (SW1) MUST be in the proper position BEFORE setting options.

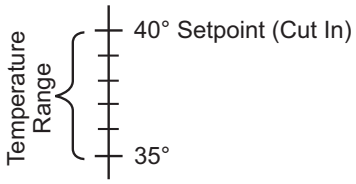
COOL/REFRIGERATION

To use as a Cooling control, SW1 must be set to Cool. The snowflake (❄) icon will display.

If control is in Cool mode, and Set Point is selected as the Cut In:

Temperature Operating Range = Setpoint Temperature – (minus) Differential

SW1 = Cool
Set Point (SP) = Cut In
Differential = 5
Setpoint temperature = 40°

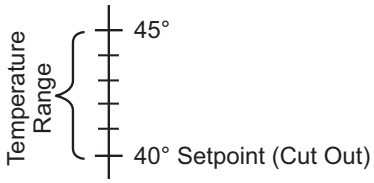


If control is in Cool mode, and Set Point is selected as the Cut Out:

Temperature Operating Range = Setpoint Temperature + (plus) Differential

Example:

SW1 = Cool
Set Point (SP) = Cut Out
Differential = 5
Setpoint temperature = 40°



HEAT

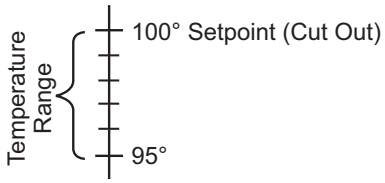
To use as a Heating control, SW1 must be set to Heat. The flame (🔥) icon will display.

If control is in Heat mode, and Set Point is selected as the Cut Out:

Temperature Operating Range = Setpoint Temperature – (minus) Differential

Example:

SW1 = Heat
Set Point (SP) = Cut Out
Differential = 5
Setpoint temperature = 100°

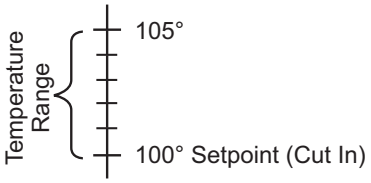


If control is in Heat mode, and Set Point is selected as the Cut In:

Temperature Operating Range = Setpoint Temperature + (plus) Differential

Example:

SW1 = Heat
Set Point (SP) = Cut In
Differential = 5
Setpoint temperature = 100°



TECHNICAL HELP

Lock Panel (LP)

The keypad can be locked to prevent unwanted tampering with the control settings. In the User Menu, change the menu item LP selection to On. When the menu is exited and settings are stored, the + or −, and MENU keys will be disabled from normal use.

To unlock the keypad, press and hold MENU for 5 seconds. The display will change to show LP On. Momentarily press + or − to change to Off and then momentarily press MENU. The control will return to normal operation and the keypad will be unlocked.

Binary Input (bIn) and Set Back (Sb)

Binary Input is an option to allow the setpoint temperature to set back to conserve energy or for other reasons as determined by the user. Set Back determines the number of degrees the setpoint temperature will be changed.

An external switch or N.O. relay can be connected to the BIN and GND terminals of the control. With bIn set to On, when the switch is closed, the control will change the setpoint temperature by the number of degrees set in Sb. In Heat mode, setpoint temperature will change lower or cooler. In Cool mode, setpoint temperature will change higher or warmer.

During the time that the switch is closed, bIn will appear in the lower left corner of the display. If an alarm is connected be sure that the alarm delay time is set long enough to allow for the temperature change to avoid a “false” alarm.

Alarm (AL)

SPECIAL NOTE

Using the Alarm Output and power stealing in combination – When using power stealing mode and the alarm output, it is important for the installer to review the wiring circuit of the installation to insure no device is present that could interrupt electrical power to the temperature control. Such a device could be a defrost timer, as one example, that may be used in some refrigeration applications.

If a device is in the system wiring that can periodically disrupt power to the load and the temperature control, the power stealing mode of the control cannot be used. A neutral wire must be connected to the control and select the non power stealing mode for the control. This keeps power to the control during power interruptions to the load and avoids a “false” alarm output.

This control has an alarm relay that will provide an output to alert of a malfunction. The alarm relay output must be connected to an external light, audible alarm or other device as needed by the user. If AL is set to 0, the alarm relay will not provide any alarm output. If AL is set to a value greater than 0, the alarm relay output provides indication of three error conditions: Temperature Out of Range, Power Loss and Sensor Operation Failure. Although AL must be set to a value greater than 0 for any alarm output to be provided, the value selected is the time delay, in minutes, before a Temperature Out of Range alarm is set. The alarm time delay does not apply to Power Loss or Sensor Operation Failure.

Temperature out of range – If the temperature is more than 5° from the setpoint, continuously for the length of time set in AL, the alarm relay output will close. The delay should be set to allow for conditions that will cause the temperature to vary, such as defrost cycle, opening door for stock removal or replacement or Set Back changes. When setting the AL time, consideration should be given to these events to prevent a false alarm.

If the control set back feature is used to change the setpoint, the delay period set in AL should consider the time it takes for the system to reach the set back temperature to avoid a false alarm.

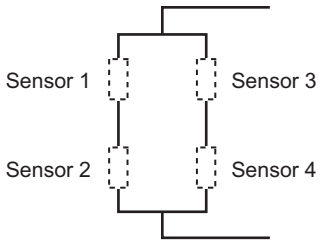
Power Loss – If the temperature control experiences an input power failure, the control will close the alarm relay before total power of the control is lost. The delay time is not used in this event, and the alarm relay will close within seconds of a power failure. In addition, the load relay contact change state per the Sensor Operation Failure (SOF) setting.

When power returns, the alarm contacts will open. The load relay will remain in the SOF position the length of time set in Anti Short-Cycle Delay (ASd) after power resumption. The display will blink the flame or snowflake icon for this time to indicate the load is “locked” out. This is to help protect the user’s equipment from damage by short cycle switching.

Sensor Operation Failure (SOF) – If in operation, the sensor wiring should become open or shorted, the temperature control will begin blinking SOF with SH for shorted or SO for sensor open. However, the control will wait approximately 1 minute before closing the alarm output relay - indicating sensor operation failure. If during the 1 minute, the sensor “resumes” normal operation, the time is reset and the control returns to normal display. The load relay will operate as selected in sensor operation failure (SOF).

Multiple Sensors

The 16E09 is normally operated with one sensor. If an average temperature of an area is required, 4 sensors may be used and wired in the method shown below. If 4 sensors are used, they must all be of the same model.



NOTE: When using multiple sensors, 4 sensors must be used. The control will not operate with 2 or 3 sensors.

LCD display, display back-light and green status indicator LED turn off in Power Stealing mode:
This “off” condition is normal for the control in power stealing mode when wired with a defrost timer or other device that interrupts electrical power to the control.

No control settings will be lost during this time, however, the installer must ensure that applications requiring power stealing are suitable for the control to be off during these periods.

Please note: if the built-in alarm feature of the control is to be used on systems that may interrupt power to the control, the control must be wired with a neutral wire and set in non-power stealing mode. This will keep the control continuously powered unless there is an actual power interruption or loss. In this case, the control will be able to signal an alarm for system power loss.

Display indicates “CaL” on power up.
Control was not calibrated. Return control for replacement.

Unit does not turn on, (LCD does not display anything):
- Check that wiring is correct.
- Make sure power is turned on.
- Check that wiring is under terminal blocks correctly.
- Make sure both switches inside control are set to proper position.
- If in Power Steal mode,
  - Make sure the load draws a minimum of 2.5 amp AC. If not, wire per the Non-Power Stealing diagram.
  - Make sure nothing "breaks/opens the load line, such as a defrost timer or any other device, with the alarm feature enabled. This would cause a false alarm. If the alarm function is enabled, wire per the Non-Power Stealing diagram.

Temperature differential is wider than set:
- Temperature change of customer's unit is fast, and the Anti Short Cycle delay setting may be overriding the “call” to activate the heat or cool. Solution – lower Anti Short Cycle delay.

Installation and Power Up:
False alarm sounds, temperature has not yet reached set-point setting. CUSTOMER must disable alarm (AL = 0), until setpoint temperature is reached, then set alarm delay time.
Customer Changes Setpoint Temperature:
False alarm sounds. CUSTOMER must disable alarm (AL = 0), while unit is adjusting to new temperature. CUSTOMER must then set the alarm delay time when temperature is reached.

Bin/Set Back
False alarm sounds. CUSTOMER must set the delay time with sufficient delay time to assure the Set Back temperature is reached before the alarm delay time has expired.

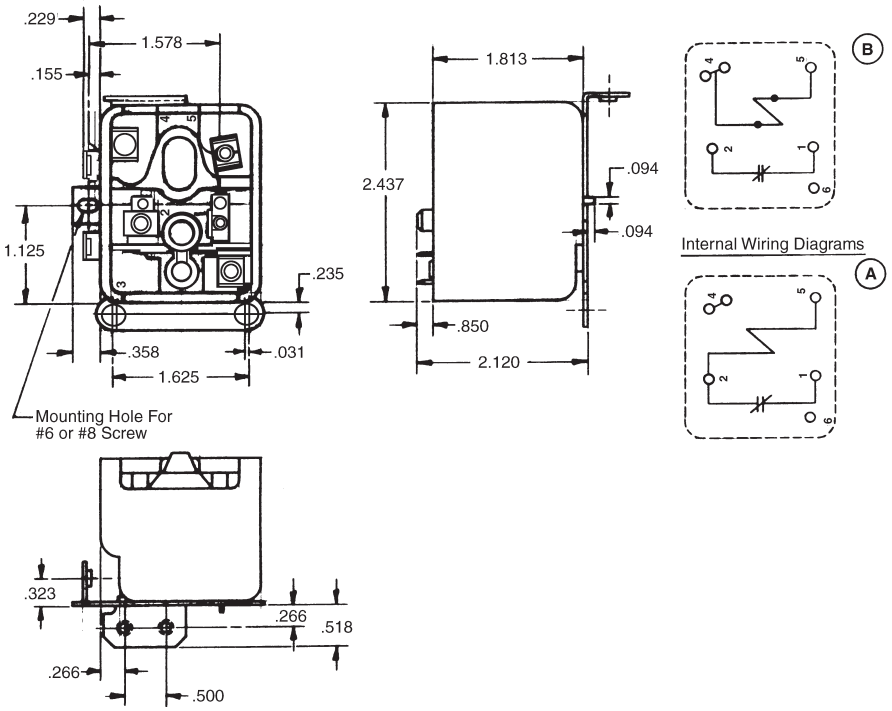
Note: If the Set Back temperature cannot be reached within 99 minutes (the maximum Alarm delay time), change the Set Back value to a lower number of degrees. If a lower set back can not be used, you may not be able to use the alarm feature.

Alarm Sounds, Reason Unknown:
CUSTOMER should make sure the Alarm (AL) delay time is great enough to cover other conditions when the unit temperature may not be able to stay within 5 degrees.
- Loading or unloading of stock and the doors are open. (Add sufficient delay time to the alarm delay).
- Power is lost to the control if the line is broken/open by a defrost timer or other device. (Wire control per the Non Power Stealing line voltage schematic and connect/add a neutral line connection).

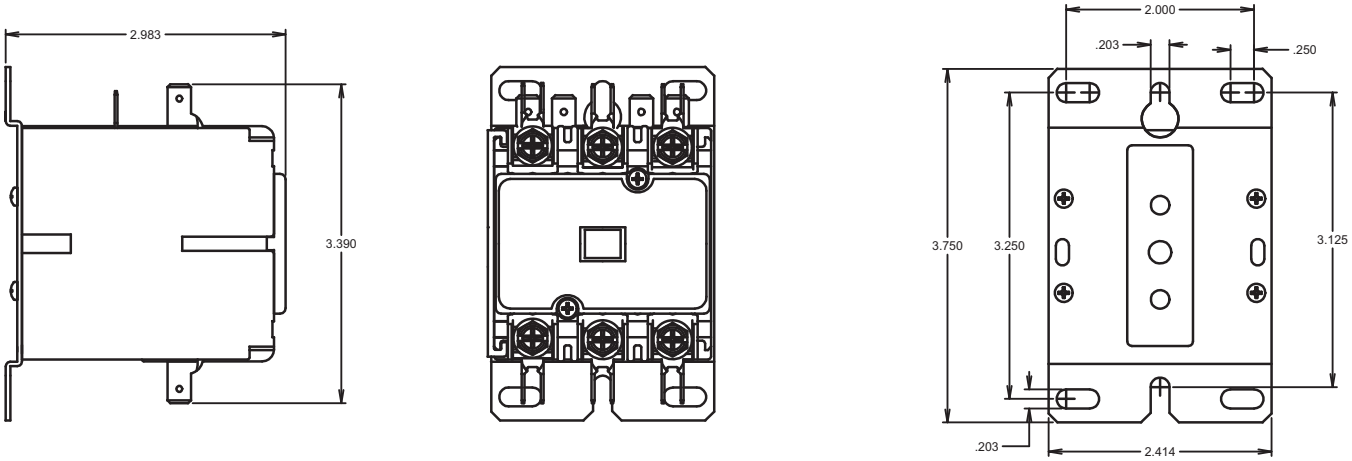
TRANSFORMERS AND RELAYS

RELAY OUTLINE DRAWINGS

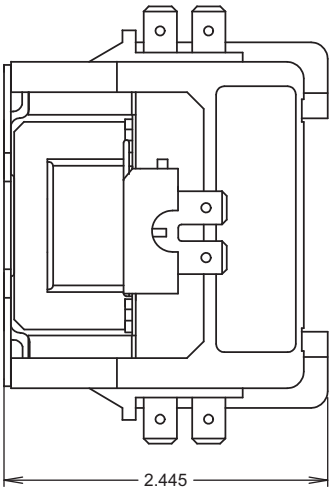
90-63

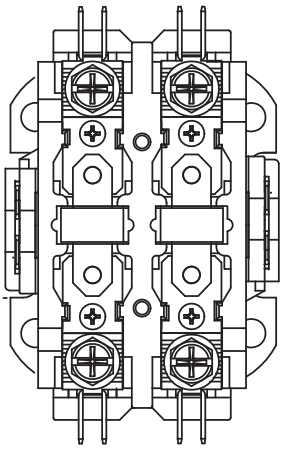


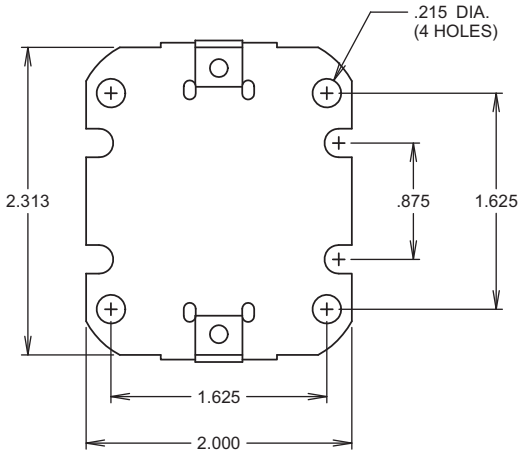
90-160 thru 90-172



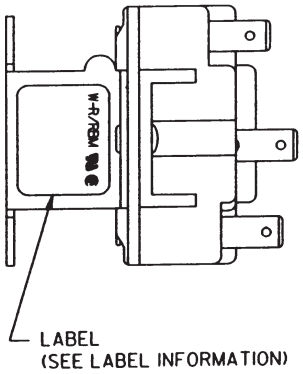
90-244 thru 90-249

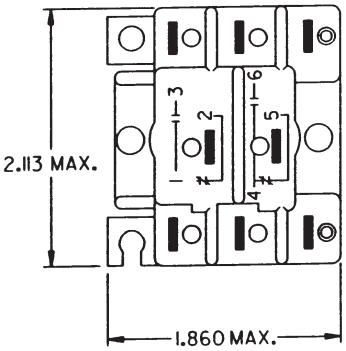


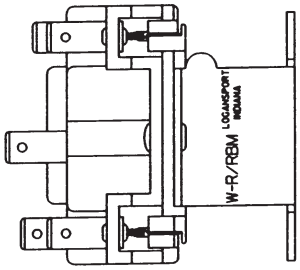


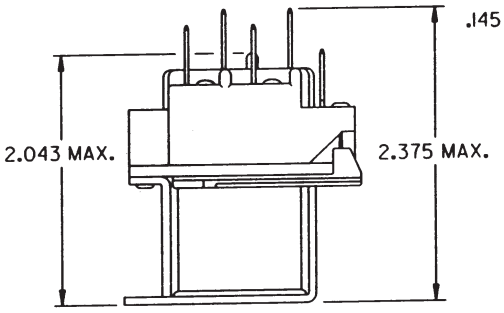


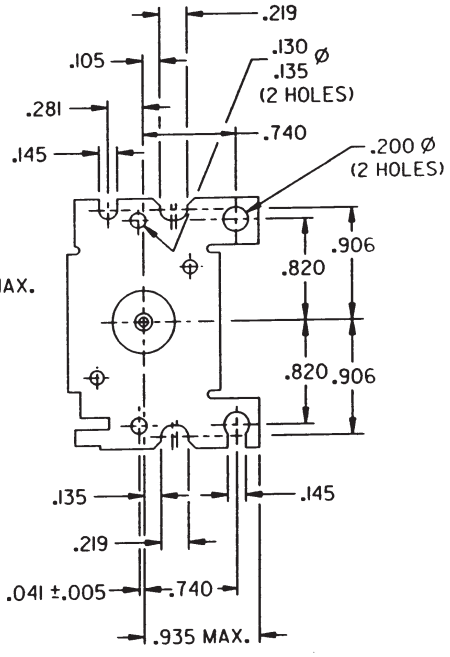
90-340 thru 90-342







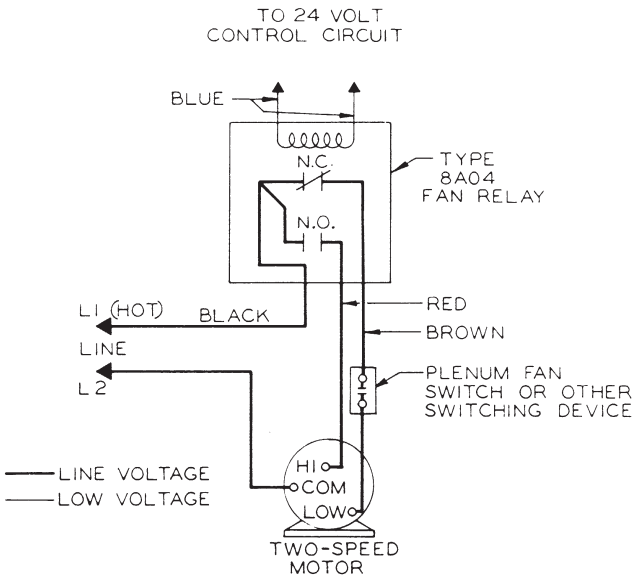




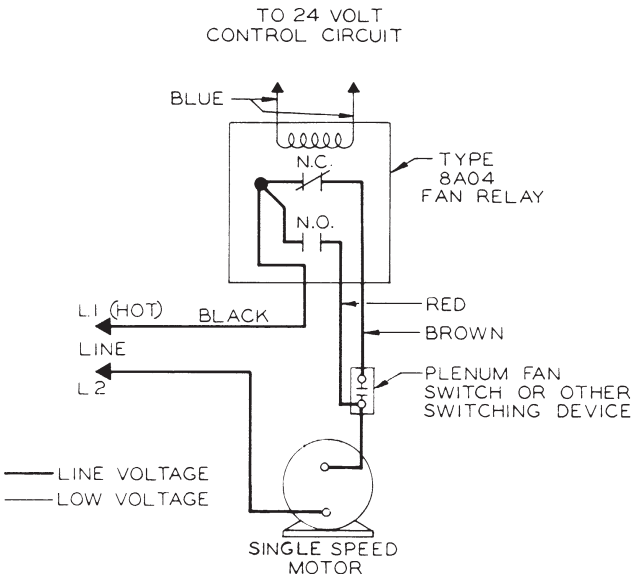
RELAY WIRING DIAGRAMS 8A04-1

8A04-1 Typical Wiring

Using Type 8A04-1 With Two-Speed Motor



Using Type 8A04-1 With Single Speed Motor



NOTE: All wiring should be done according to local and national electrical codes and ordinances.

These wiring diagrams show connections to be made for various types of systems. Wiring to all safety controls (high limit, gas valve, pilot) must be N.E.C. Class 1 wiring or other approved safety wiring.

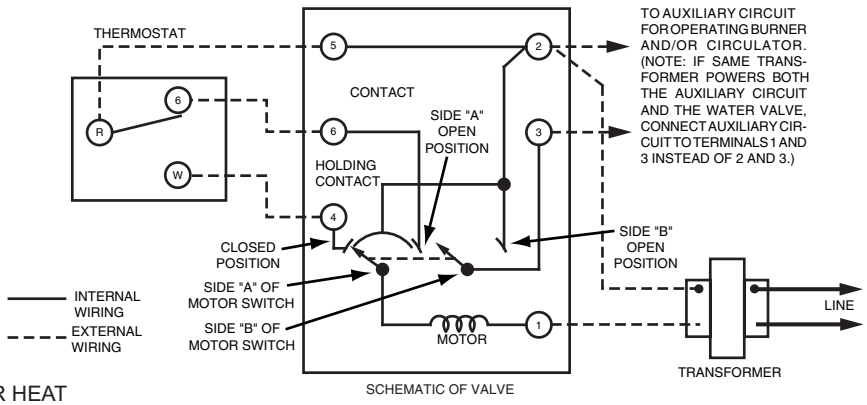
1311 Three Wire Zone Valve

TERMINALS 1, 2 = POWER TO VALVE
1= 24 VAC NEUTRAL
2 = 24 VAC HOT

TERMINALS 5,4,6 = SPDT THERMOSTAT
5 = POWER (SAME AS 2 INTERNALLY)
4 = OPENS VALVE
6 = CLOSES VALVE

TERMINALS 2, 3 = AUXILIARY SWITCH
2, 3 BECOME SAME POINT ON CALL FOR HEAT

TERMINALS 1, 3 = POWER OUT TO AUXILIARY CIRCUIT ON CALL FOR HEAT



TROUBLESHOOTING:

1) Attach a voltmeter to terminals 1 and 2. Power (24 volts) should always be present on 1 and 2. If power is interrupted check transformer or power source.

2) With a voltmeter attached as above, jumper terminals 5 and 4 to verify the valve opens. If power is present on 1 and 2 but the valve fails to open check connections. Replace motor assembly (replacement Motor # F19-0097) if condition persists. When the valve opens, break the connection between 5 and 4 and jumper between 5 and 6. The valve should close. If the valve fails to close replace motor assembly.

3) Terminals 2 and 3 (auxiliary circuit) become the same point electrically when the valve opens. Because terminal 2 is 24 volts hot, a voltmeter should read 24 volts between terminal 3 and terminal 1 (neutral) when the valve is open.

Note: If the auxiliary circuit terminals (2 and 3) are being attached to a control circuit with a separate transformer the transformers must be in phase or one transformer may be damaged. If phasing the transformers is not possible a 24 volt isolation relay can be installed with the coil attached to terminals 1 and 3 and the contacts can be used to operate the control circuit. The relay will energize when the valve opens.

For complete installation instructions visit our website.

TECH
See next page

TECHNICAL HELP

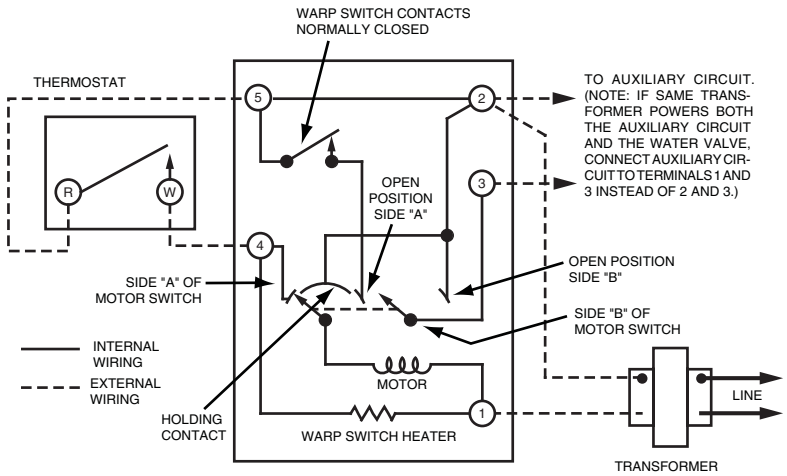
1361 Troubleshooting . . . . . see next page

1361 Two Wire Zone Valve

TERMINALS 1, 2 = POWER TO VALVE
1= 24 VAC NEUTRAL
2 = 24 VAC HOT

TERMINALS 2, 4 = SPST THERMOSTAT
MAKE TO OPEN, BREAK TO CLOSE

TERMINALS 2, 3 = AUXILIARY SWITCH
2, 3 BECOME SAME POINT ON CALL FOR HEAT



TERMINALS 1, 3 = POWER OUT TO AUXILIARY CIRCUIT ON CALL FOR HEAT

TROUBLESHOOTING:

1) Attach a voltmeter to terminals 1 and 2. Power (24 volts) should always be present on 1 and 2. If power is interrupted check transformer or power source.

2) With voltmeter attached as above, jumper terminals 2 and 4 to verify the valve opens. If power is present on 1 and 2 but the valve fails to open check connections. Replace motor assembly (Replacement Motor # F19-0104) if condition persists. When the jumper is removed between 2 and 4 the valve should close. If the valve fails to close replace motor assembly.

3) Terminals 2 and 3 (auxiliary circuit) become the same point electrically when the valve opens. Because terminal 2 is 24 volts hot, a voltmeter should read 24 volts between terminal 3 and terminal 1 (neutral) when the valve is open.

Note: If the auxiliary circuit terminals (2 and 3) are being attached to a control circuit with a separate transformer the transformers must be in phase or one transformer may be damaged. If phasing the transformers is not possible a 24 volt isolation relay can be installed with the coil attached to terminals 1 and 3 and the contacts can be used to operate the control circuit. The relay will energize when the valve opens.

For complete installation instructions visit our website.

TECH
See previous page

TECHNICAL HELP

1311 Troubleshooting . . . . . see previous page

INDOOR AIR QUALITY AND ZONING SYSTEMS

COMMERCIAL OR OFFICE AIR CLEANERS

The correct number of commercial or office electronic air cleaners require for a particular application depends upon:
- Type of contamination
- Use of the room
- Number of occupants

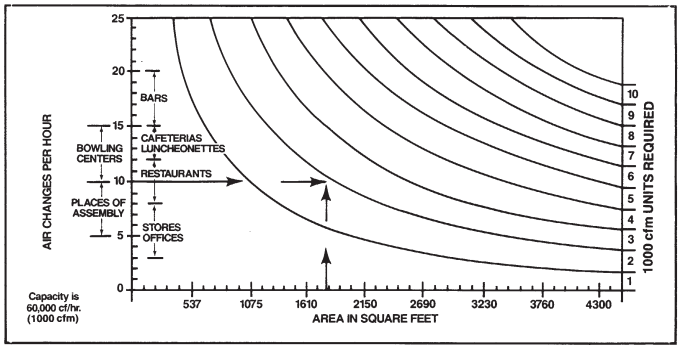
The number of air changes per hour determines the amount of air cleaning obtained. More air changes per hour than recommended in the graph above are usually unnecessary as the ASHRAE data for which it was constructed is conservative. Fewer air changes per hour than recommended in the graph may mean allowing the entrance of more outdoor air to maintain acceptably low containment levels, or tolerating a partially cleaned atmosphere, which may be acceptable to some users.

EXAMPLE 1
Sizing By Air Changes Per Hour And Room Area
Using the graph on this page:
1. Extend a horizontal line from the desired number of air changes per hour until it intersects with a vertical line drawn upward from the area of the room.
2. The intersection point indicates the number of units required.

A restaurant has a 35 x 45 foot dining room. How many air cleaner units would be installed?
Solution:
1. Find floor area, 35 ft. x 45 ft. = 1575 sq. ft.
   Assuming that 10 air changes per hour would be adequate and an 1575 sq. ft. area, the graph indicates a requirement for two thousand cfm. Three 750 cfm units or one 1500 cfm and one 750 cfm units meet this requirement.

EXAMPLE 2
Sizing By Air Changes Per Hour And Room Volume
Restaurant proprietor wants to use electronic air cleaning to remove cigarette and cigar smoke from the air. The dining area is 25 x 40 feet with a 15 ft. ceiling. How many air cleaners will be required on this job?
Solution:
1. Calculate the volume of room, 25 ft. x 40 ft. x 15 ft. = 15,000 cu. ft.
2. Determine the volume of air to be circulated each hour.
   10 air changes per hour is used on the assumption that the intent is to substantially reduce, but not necessarily eliminate smoke.
   15,000 cu. ft. x 10 air changes/hour = 150,000 cu. ft./hr.
   150,000 cu. ft./hr ÷ 60 min./hr = 2,500 cu. ft./min.
3. Determine the number of air cleaners required.
   Desired Circulation ÷ Air Cleaner Capacity = units required 2500 cfm ÷ 750 cfm = 3.3. Three or four 750 cfm units meet this requirement.

SIZING CHART FOR COMMERCIAL AIR CLEANERS



EXAMPLE 3
Sizing By Occupant Load
A cocktail lounge averages 85 occupants. Using the ASHRAE recommended minimum of 35 cfm per person.
Solution:
85 people x 35 cfm/per person = 2975 cfm
2975 cfm ÷ 1000 cfm = 3.9 (Four 750 cfm units or two 1500 cfm units)

SIZING AND OZONE

Ozone is an active, natural form of oxygen produced by electrical discharge, ultraviolet lights and other natural causes. All electronic air cleaners generate small amounts of ozone as a by-product of the particle-charging process. Correctly installed and sized air cleaners do not generate ozone in amounts that are health hazards.

Ozone is always present in the air we breathe. The amounts of ozone vary in different parts of the world. Many scientific research organizations throughout the world have performed and/or continue to perform extensive tests in order to determine the effects of ozone on humans, plants and animals. They have measured the level of ozone in many areas of the world to determine what maximum limits exist in both clean and polluted environments. In general, the latest scientific research established a maximum figure of 0.1 parts per million for humans with no more than eight hours exposure. The United States Department of Health, Food and Drug Administration has established a maximum ozone concentration of 0.050 ppm.

Scientific measurements taken with the most accurate equipment available show the range of ozone emitted from White-Rodgers' electronic air cleaners is between .005 and .02 ppm. This is between 1/20 and 1/5 of the established safe limits of 0.1 ppm. It is a negligible figure, in fact, if this amount of ozone is considered to be harmful it would be dangerous to take an afternoon walk in the park on a summer day.

HOW ELECTRONIC AIR CLEANERS WORK

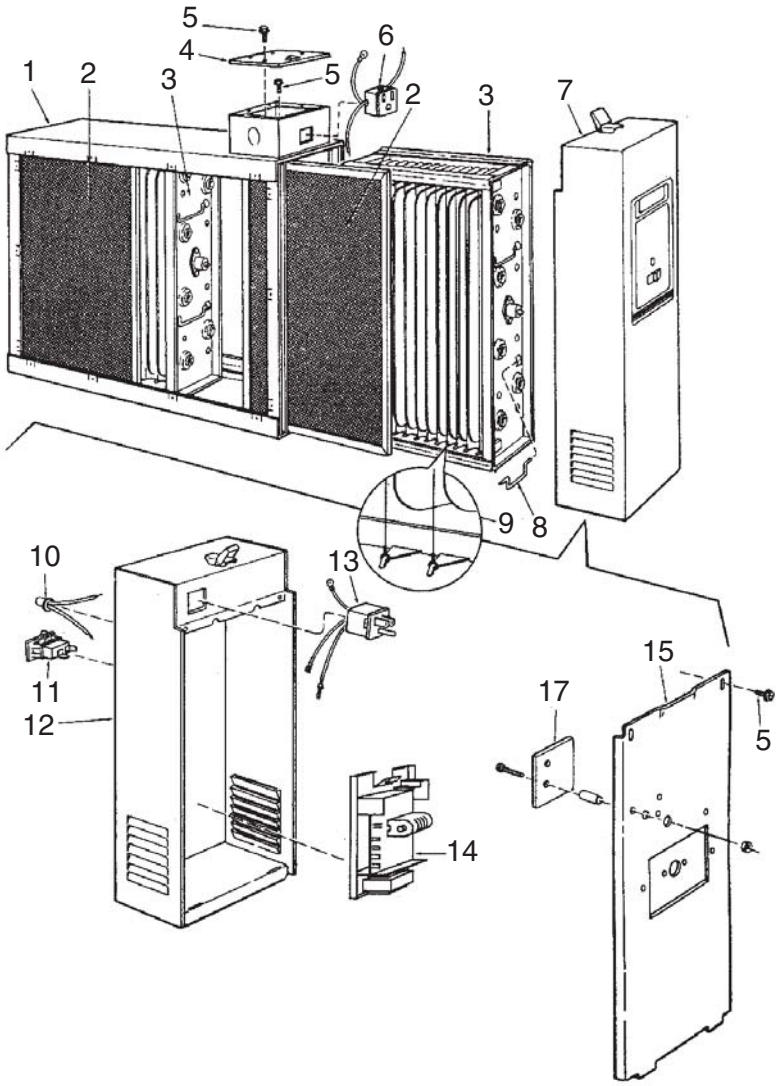
Electronic air cleaners are by far the most efficient cleaners of indoor air. Unlike standard or media air filters that merely collect relatively large particles, electronic air cleaners attract and retain pollutants like a powerful magnet. Using electrostatic precipitation principles, they are even effective on particles so small an electron microscope would be required to see them.

All electronic air cleaners from White-Rodgers clean the air using the following steps. As particles enter the air cleaner, the larger particles are trapped by the ① **Prefilter Screen** (most models), while smaller particles pass through to the ② **Charging Section**, where they're given a positive electrical charge by a series of tungsten wires. The charged particles are then drawn into the ③ **Collection Section**. Here a series of positive plates repel the positive particles, and drive them forcefully onto a series of negative plates, which hold the positive particles like a magnet. Contaminants are held in this section until washed away during cleaning. In some models the clean air is also circulated through an optional ④ **Charcoal Filter**, where odors are absorbed. The fresher, cleaner air is then discharged from the unit. Electronic air cleaners are 10 to 20 times more efficient than standard filters as they remove up to 98 percent of the dirt, dust and smoke that otherwise circulate through the air.

Why choose a White-Rodgers Electronic Air Cleaner?

VISIBLE WITH NAKED EYE		VISIBLE WITH MICROSCOPE			VISIBLE WITH ELECTRON MICROSCOPE	
PARTICLE SIZE IN MICRONS*						
100	10	1.0	0.5	0.1	0.01	0.001
ELECTRONIC AIR CLEANER (3" to 5" cell depth)						
Bacteria						
Pollen						
Plant Spores					Viruses	
			Cooking Smoke and Grease			
			Tobacco Smoke			
		Atmospheric & Household Dust				
Coal Dust						
		Animal Dander				
		Insecticide Dust				
MEDIA AIR FILTER (typical 3" to 8" depth media filter)						
Bacteria						
Pollen						
Plant Spores					Viruses	
			Cooking Smoke and Grease			
			Tobacco Smoke			
		Atmospheric & Household Dust				
Coal Dust						
		Animal Dander				
		Insecticide Dust				
STANDARD FILTER (typical 1" aluminum or media filter)						
Bacteria						
Pollen						
Plant Spores					Viruses	
			Cooking Smoke and Grease			
			Tobacco Smoke			
		Atmospheric & Household Dust				
Coal Dust						
		Animal Dander				
		Insecticide Dust				

*One micron equals 1/25,000 of an inch.



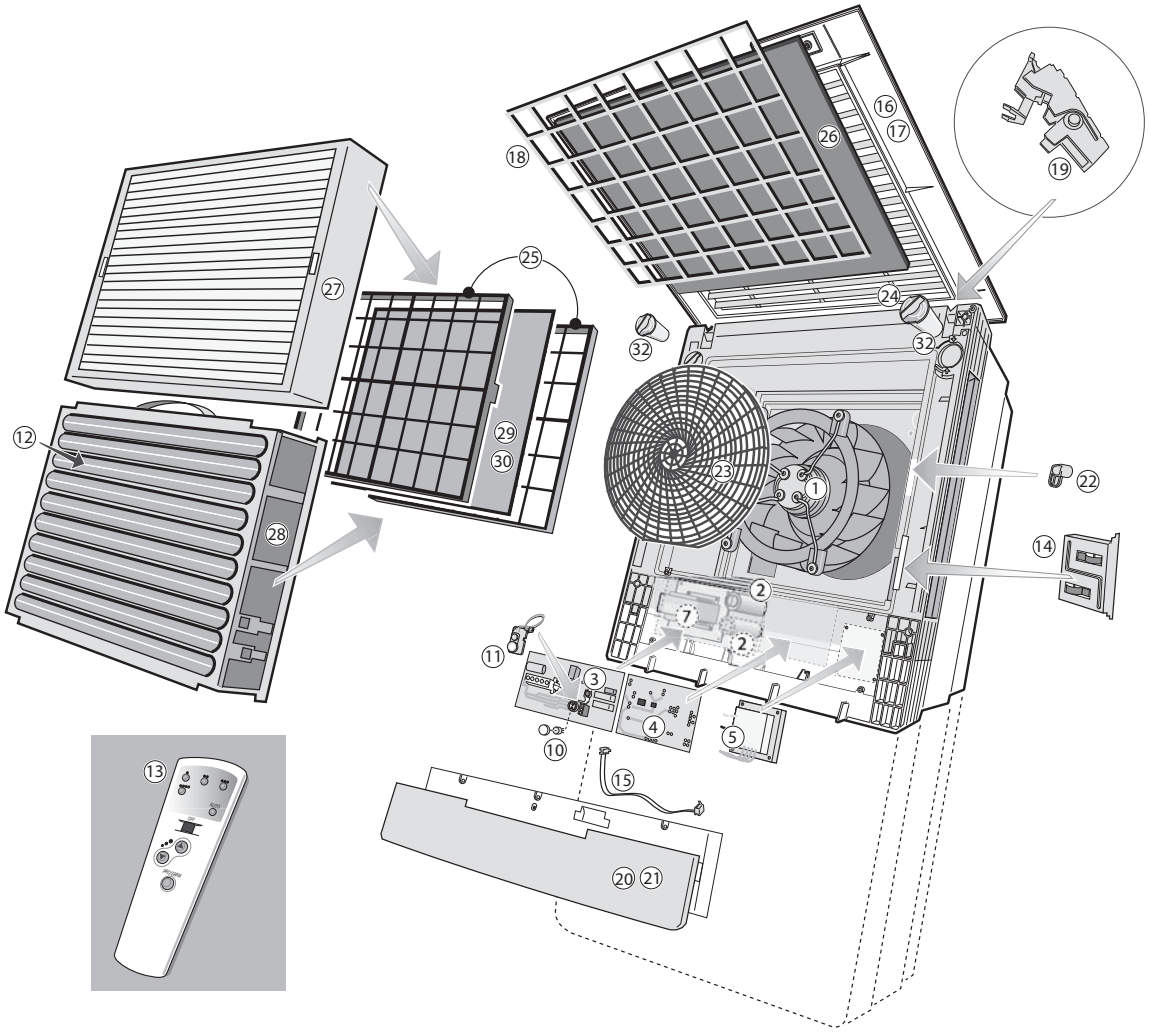
ITEM NO.	DESCRIPTION	SST1000-101 / 151	SST1400-101 / 151	SST1600-101 / 151	SST2000-101 / 151
1	Cabinet	N/A	N/A	N/A	N/A
2	Pre-Filter	• F825-0431	• F825-0432	• F825-0337	• F825-0338
3	Collecting Cell	• F811-0398	• F811-0397	None	• F811-0319
4	Junction Box Cover	None	None	None	None
5	Screw #6 X 3/8 *	–	–	–	–
6	Connector, Female	F818-0053	F818-0053	F818-0053	F818-0053
7	Power Pack Assembly without Air Flow	None	None	None	None
	Power Pack Assembly with Air Flow	None	None	None	None
8	Cell Handle	None	None	None	None
9	Ionizing Wire	F843-0484	F843-0484	F843-0500	F843-0500
10	Light	F844-0130	F844-0130	F844-0130	F844-0130
11	Switch	F876-0202	F876-0202	F876-0202	F876-0202
12	Power Pack, Cabinet Only	N/A	N/A	N/A	N/A
13	Connector, Male	F827-0026	F827-0026	F827-0026	F827-0026
14	Power Supply	F858-1002	F858-1002	F858-1002	F858-1002
15	Cover, Power Pack	None	None	None	None
16	Manual †	37-6373E	37-6373E	37-6373E	37-6373E
17	Charcoal Filter (with mounting clips) †	F825-0466	• F825-0467	• F825-0468	• F825-0469
18	Air Flow Switch (monitor kit) ††	F859-0381	F859-0381	F859-0381	F859-0381
	Power Cord, 6 ft., 120 V †	None	None	None	None

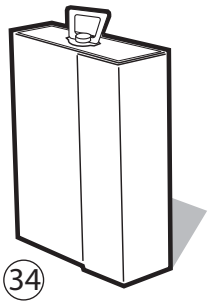
* Standard Hardware Item

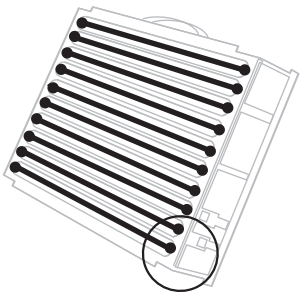
• Two Required

† Not Shown

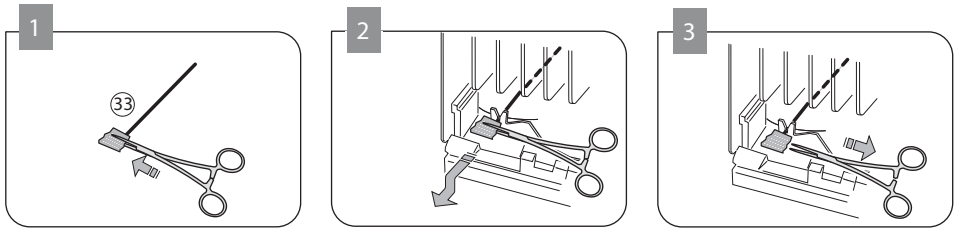
†† Kit converts -100 models to Air Flow Switch. -150 models include Air Switch







Replacement ionizing wires electronic cell



Pos.	White-Rodgers Model Number	Description	UL	Units where used							
				MCS600W	MCS600B	MCD1200W	MCD1200B	ECS750W	ECS750B	ECD1500W	ECD1500B
Electrical components											
1	F849-0064	Motor + fan (120V / 1ph / 60Hz)	x	x	x	x	x	x	x	x	x
2	F809-0095	Capacitor 5,0 µF (120V / 1ph / 60Hz)	x	x	x	x	x	x	x	x	x
3	F859-0386	PC board control	x	x	x	x	x	x	x	x	x
4	F859-0387	PC board HT	x					x	x	x	x
5	F881-0241	HT transformer (120V / 1ph / 60Hz)	x					x	x	x	x
7	F881-0242	Transformer motor (120V / 1ph / 60Hz)	x	x	x	x	x	x	x	x	x
8	F881-0244	Choke 120V / 60Hz Kit UV Light	x	x	x	x	x	x	x	x	x
10	F829-0014	Fuse 4,0 A-T (120V / 60Hz)	x	x	x	x	x	x	x	x	x
11	F848-0389	Sensor module Air Quality Analyzer	x	x	x	x	x	x	x	x	x
12	F843-1398	Ionizing wires collecting cell (set of 10)	x					x	x	x	x
13	F848-0390	Remote control	x	x	x	x	x	x	x	x	x
14	F819-0160	Contact board	x					x	x	x	x
15	F843-1399	Flatcable	x					x	x	x	x
Mechanical components											
16	F831-0131	Inlet grid white	x	x	x	x	x	x	x	x	x
17	F831-0132	Inlet grid bronze	x	x	x	x	x	x	x	x	x
18	F828-0212	Frame prefilter	x	x	x	x	x	x	x	x	x
19	F833-0023	Hinge inlet grid	x	x	x	x	x	x	x	x	x
20	F820-0355	Base cover white	x	x				x			
21	F820-0356	Base cover bronze	x		x				x		
22	F839-0020	Turning knob electronic cell	x					x	x	x	x
23	F828-0213	Fan protection frame	x	x	x	x	x	x	x	x	x
24	F820-0357	Cover fragrance gel	x	x	x	x	x	x	x	x	x
25	F828-0214	Frame activated carbon filter	x	x	x	x	x	x	x	x	x
Spare filters											
26a	F825-0630	Prefilter (2 pcs)	x	x	x	x	x	x	x	x	x
27b	F825-0633	Media filter (2 pcs)	x	x	x	x	x				
28	F825-0634	Electronic cell	x					x	x	x	x
29a	F825-0635	Activated carbon filter (2 pcs)	x	x	x	x	x	x	x	x	x
30a	F825-0628	Activated carbon filter Odor Free (2 pcs)	x	x	x	x	x	x	x	x	x
30b	F825-0629	Activated carbon filter Odor Free (2 pcs)	x	x	x	x	x	x	x	x	x
32	F848-0391	Fragrance gel (2 pcs)		x	x	x	x	x	x	x	x
	F801-0198	ComfortPro Level 1 service kit includes: 6 prefilters, 1 media filter, 6 activated carbon filters		x	x	x	x	x	x	x	x
	F801-0199	ComfortPro Level 2 service kit includes: 12 prefilters, 2 media filters, 12 activated carbon filters		x	x	x	x	x	x	x	x
	F801-0202	ComfortPro service kit includes: 12 prefilters, 12 activated carbon filters		x	x	x	x	x	x	x	x
General components											
33	F848-0386	Service tool for ionizing wires electronic cell						x	x	x	x
34	F810-0360	Service transport box electronic cell						x	x	x	x
	F801-0193	Wall mounting kit for single air cleaner (option)		x	x			x	x		
	F801-0194	Corner Wall Mount Hardware Kit		x	x			x	x		
	F801-0195	Ceiling mount kit		x	x	x	x	x	x	x	x
	F801-0196	Recessed ceiling mount kit for single air cleaner		x	x			x	x		
	F801-0197	Recessed ceiling mount kit for double air cleaner									x
	F848-0384	Pedestal mount for single air cleaner (option)		x	x			x	x		
	F848-0388	2 UV replacement bulbs only		x	x	x	x	x	x	x	x

ComfortPro Air Cleaner Programming Options

Program Setting 1: Service Indicator
Program Setting 2: Resetting the Service Indicator
Program Setting 3: Maximum fan speed for Air Quality Analyzer (AUTO mode)
Program Setting 4: Manual lock
Program Setting 5: Voltage output for maximum
Program Setting 6: Maximum fan speed IR control / panel button
Program Setting 7: Sensitivity adjustment Air Quality Analyzer
Program Setting 8: Time without high voltage after service (Electronic Air Cleaners only)
Reset to factory default

Program Setting 1: Service Indicator

The Service Indicator is used to predict when the filter will need cleaning (electronic air cleaners) or replacement (media air cleaners).

The Service Indicator automatically calculates the service interval based on the pollution level selected and the fan speed. If the filter becomes clogged the led • and •••• will flash each time the air cleaner is turned on.

Pollution level guidelines for establishing setting:
• LOW DUTY: general pollution without tobacco smoke
•• MEDIUM DUTY: moderate tobacco smoke concentrations
••• HEAVY DUTY: high tobacco smoke concentrations
•••• EXTREME DUTY: extremely high tobacco smoke concentrations

To select the pollution level:
- Press PROGRAM; you are in the program mode 1 and STANDBY led will flash once every two seconds.
- Default: OFF (all leds off).
- Press ▲: led • (LOW) will light up, meaning you've set the pollution level to LOW DUTY.
- Press ▲: led •• (MEDIUM) will light up, meaning you have set the pollution level to MEDIUM DUTY.
- Press ▲: led ••• (HIGH) will light up, meaning you have set the pollution level to HEAVY DUTY.
- Press ▲: led •••• (TURBO) will light up, meaning you have set the pollution level to EXTREME DUTY.
- If you want to go back to one of the previous pollution levels, press ▼.
- Press PROGRAM to confirm setting 1 and to go to setting 2.

Program Setting 2: Resetting the Service Indicator

The indicator needs to be reset when the media filter is changed out. If led • and led •••• are flashing, it is time to change the filter(s) and to reset the indicator.

To Reset:

- Press PROGRAM: you are in the program mode 2 and the STANDBY led will flash twice every two seconds.
- Default: OFF (all leds are off).
- If the indicator is programmed (setting 1), you will see all the leds switched on in setting 2, provided the Service Indicator is in use for a while.
- Reset Service Indicator: press OFF (all leds are off).
- Press PROGRAM: all user settings are saved and the air cleaner is back in normal control.

Program Setting 3: Maximum fan speed for Air Quality Analyzer (AUTO mode)

It is not possible to go directly to setting 3.
If the panel button (>>) and then the PROGRAM key are pressed simultaneously before confirming setting 2, you're in setting 3 and STANDBY led will flash three times every two seconds.

Adjusting the maximum fan speed for the optional Air Quality Analyzer is very convenient for meeting rooms and open plan offices.
- Default: •••• (TURBO).
- Press ▼ and so on to go to the desired maximum fan speed.
- Press PROGRAM: confirm setting 3 and go to setting 4.

Program Setting 4: Manual lock

In setting 4 STANDBY led will flash four times every two seconds. Blocking the panel button (>>), to ensure that non-authorised people cannot control the air cleaner.
- Default: unlock; no leds are burning.
- Press ▼ or ▲: lock; led • (LOW) is burning.
- Press ▼ or ▲: unlock; led • (LOW) is off.
- Press PROGRAM: confirm setting 4 and go to setting 5.

Program Setting 5: Voltage output for maximum efficiency (Electronic Air Cleaners only)

In setting 5 STANDBY led will flash five times every two seconds. This setting can be used to lower the efficiency (up to 10% at low HV). This will increase the time between cleaning intervals.
- Default: high HV level (7600 V); leds •, •• and ••• are burning.
- Press ▼: medium HV level (7300 V); leds £ and ££ are burning.
- Press ▼: low HV level (7100 V); led • is burning.
- Press ▲: to increase efficiency again up to maximum HV level (7900 V); leds •, ••, ••• and •••• are burning.
- Press PROGRAM: confirm setting 5 and go to setting 6.

Program Setting 6: Maximum fan speed IR control / panel button

In setting 6 STANDBY led will flash six times every two seconds. Adjusting the maximum fan speed for IR-control / panel button is very convenient for air cleaners installed in meeting rooms and open plan offices.
- Default: •••• (TURBO).
- Press ▼ and so on to go to the desired maximum fan speed.
- Press PROGRAM: confirm setting 6 and go to setting 7.

Program Setting 7: Sensitivity adjustment Air Quality Analyzer

In setting 7 STANDBY led will flash seven times every two seconds.
Setting the sensitivity of the Air Quality Analyzer. The more sensitive, the quicker the reaction to changes in pollution level.
- Default: OFF (all leds are off), meaning the lowest sensitivity
- Press ▲: led • (LOW) will light up, meaning you've set the pollution sensitivity to low.
- Press ▲: led •• (MEDIUM) will light up, meaning you have set the pollution sensitivity to medium.
- Press ▲: led ••• (HIGH) will light up, meaning you have set the pollution sensitivity to heavy.
- Press ▲: led •••• (TURBO) will light up, meaning you have set the pollution sensitivity to extreme.
- If you want to go back to one of the previous pollution sensitivity, press ▼.
- Press PROGRAM to confirm setting 7 and go to setting 8.

Program Setting 8: Time without high voltage after Service (Electronic Air Cleaners only)

In setting 8 STANDBY led will flash eight times every two seconds.
Setting a specific time for no high voltage after servicing is useful when the filter cells are damp or condensed in winter time. This setting will go back to default value if power is interrupted to the air cleaner.

- Default: OFF (all leds are off), when the air cleaner is switched on, there's always high voltage on the cell(s).
- Press ▲: led • (LOW) will light up, meaning you've set the time of no high voltage to 30 minutes.
- Press ▲: led •• (MEDIUM) will light up, meaning you've set the time of no high voltage to 60 minutes.
- Press ▲: led ••• (HIGH) will light up, meaning you've set the time of no high voltage to 120 minutes.
- Press ▲: led •••• (TURBO) will light up, meaning you've set the time of no high voltage to 240 minutes.
- If you want to go back to one of the previous time setting levels, press ▼.
- Press PROGRAM to confirm setting 8. The air cleaner will return to the normal running mode.

Reset to factory default

To reset the factory default settings:
Open the inlet grid, press the panel button (>>). While pressing the panel button (>>) close the inlet grid. Release the panel button (>>) when you hear two beeps.
Everything is now back into the default setting, except the Service Indicator (hours in use).

9 FILTER REPLACEMENT / CLEANING

In order to open the inlet grid (i.e. access the filter components), a narrow round screwdriver type tool will be needed (such as a torx type). The inlet grid is secured by two mechanical clips. To release these clips there are two access holes parallel to the control board faceplate on the inlet grid (approx. 3½" from the sides).
Insert the tool into the access holes and gently push further through some light resistance. This will allow the clips to be "unlocked" and thus the inlet grid will open easily.

DO NOT PULL THE DOOR OPEN WITHOUT RELEASING THE CLIPS.

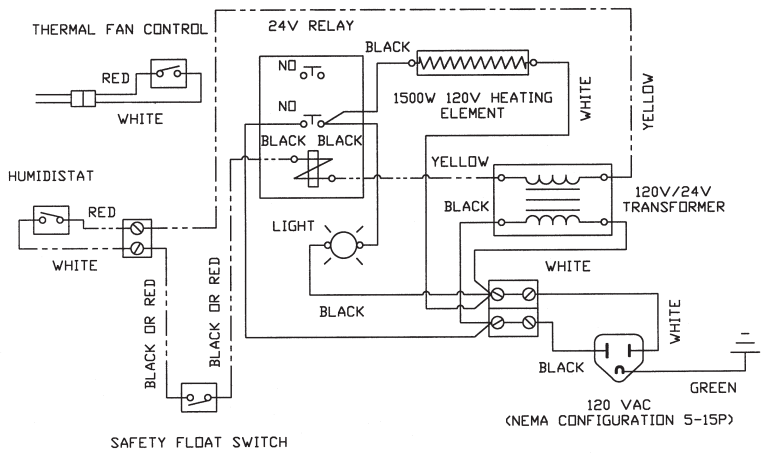
9.1 Prefilter replacement

The disposable prefilter can only be used once and cannot be cleaned. Do not turn the prefilter around since it can only be used in one flow direction.

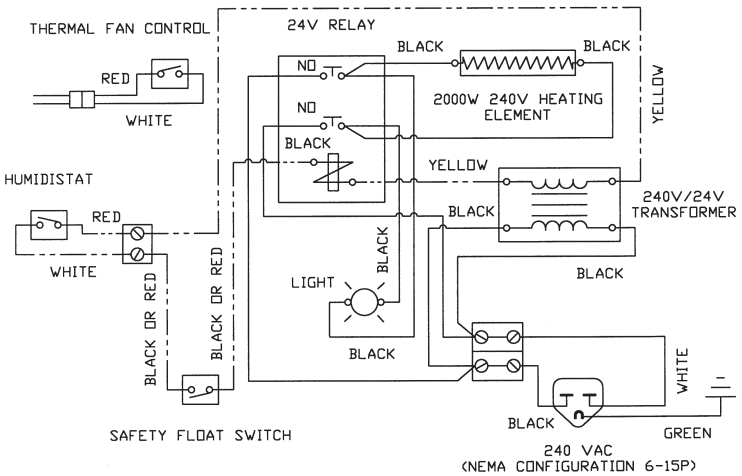
9.2 Electronic filter cleaning

A crackling or snapping sound will be heard occasionally during use of the air cleaner. This is normal and is caused by high voltage arcing in the filter. Cleaning the electronic filter is necessary when the crackling is heard frequently.
For maximum efficiency your air cleaner cell(s) should be cleaned regularly.

120 VOLT MODEL HSP2000



240 VOLT MODEL HSP2600



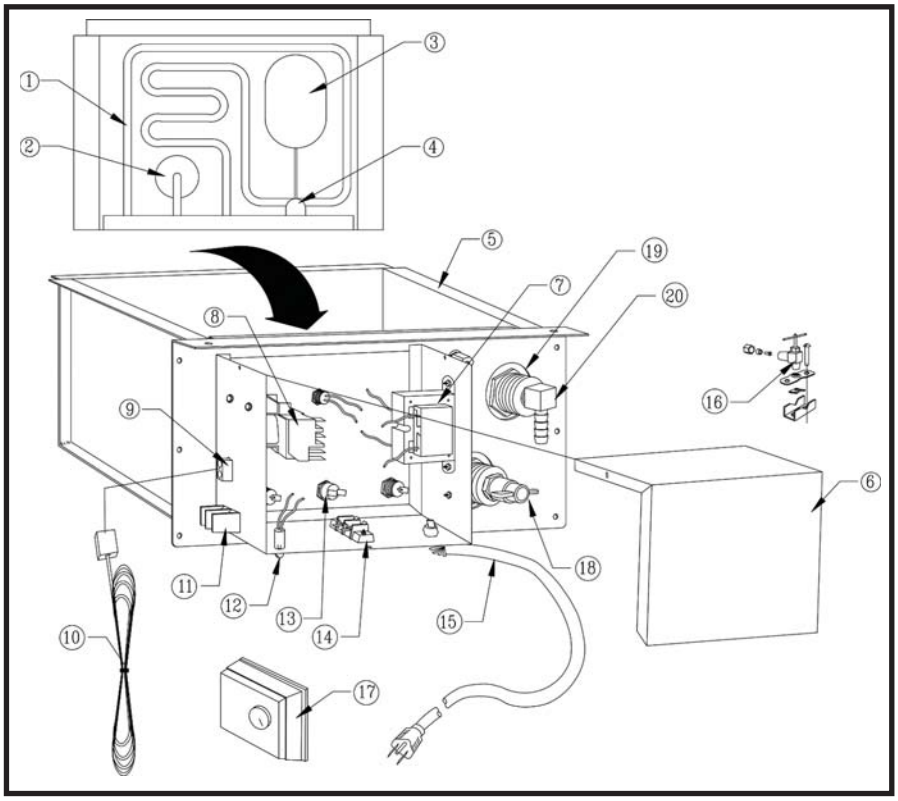
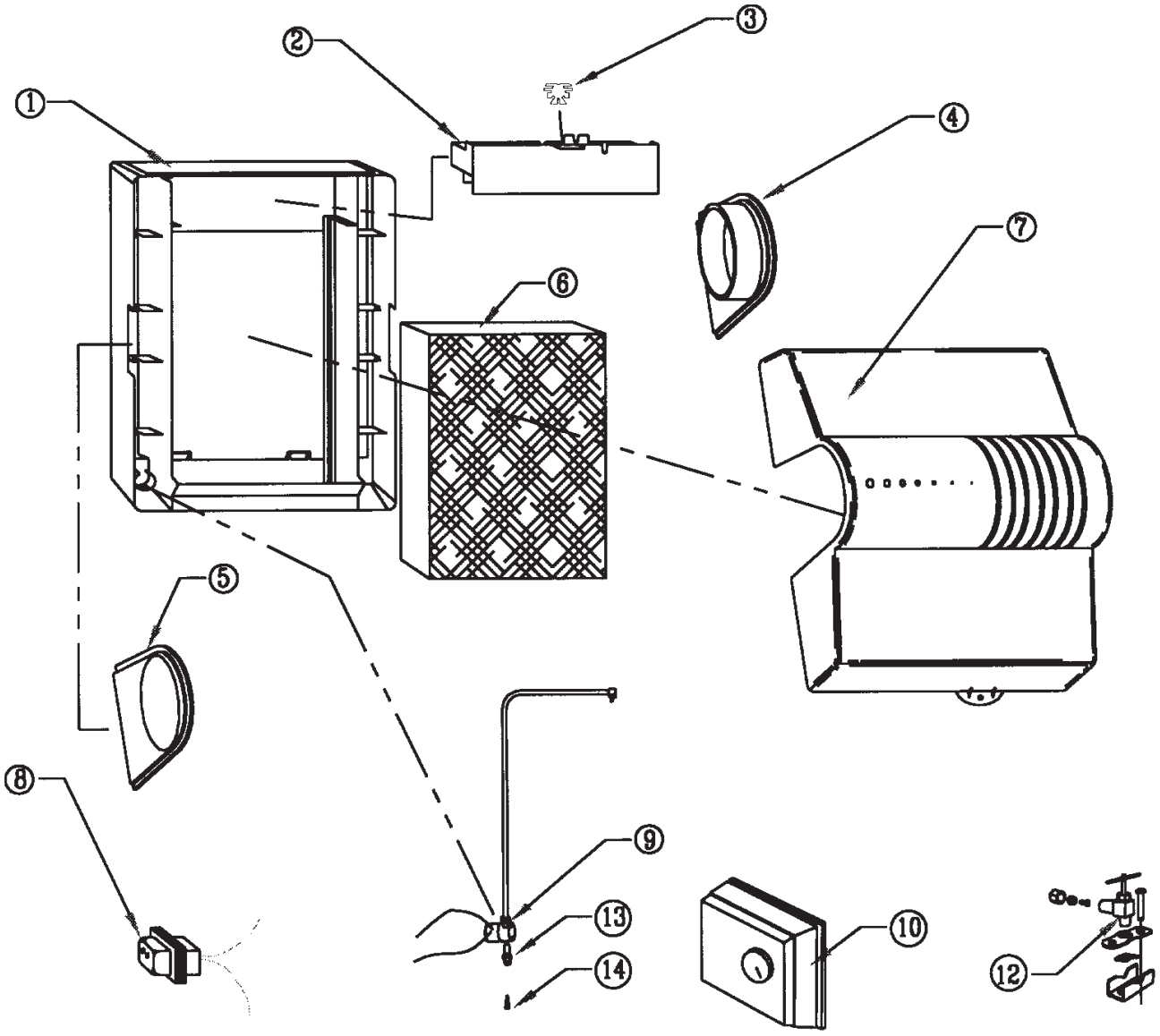


Figure 10—Parts Diagram of Models HSP2000 and HSP2600

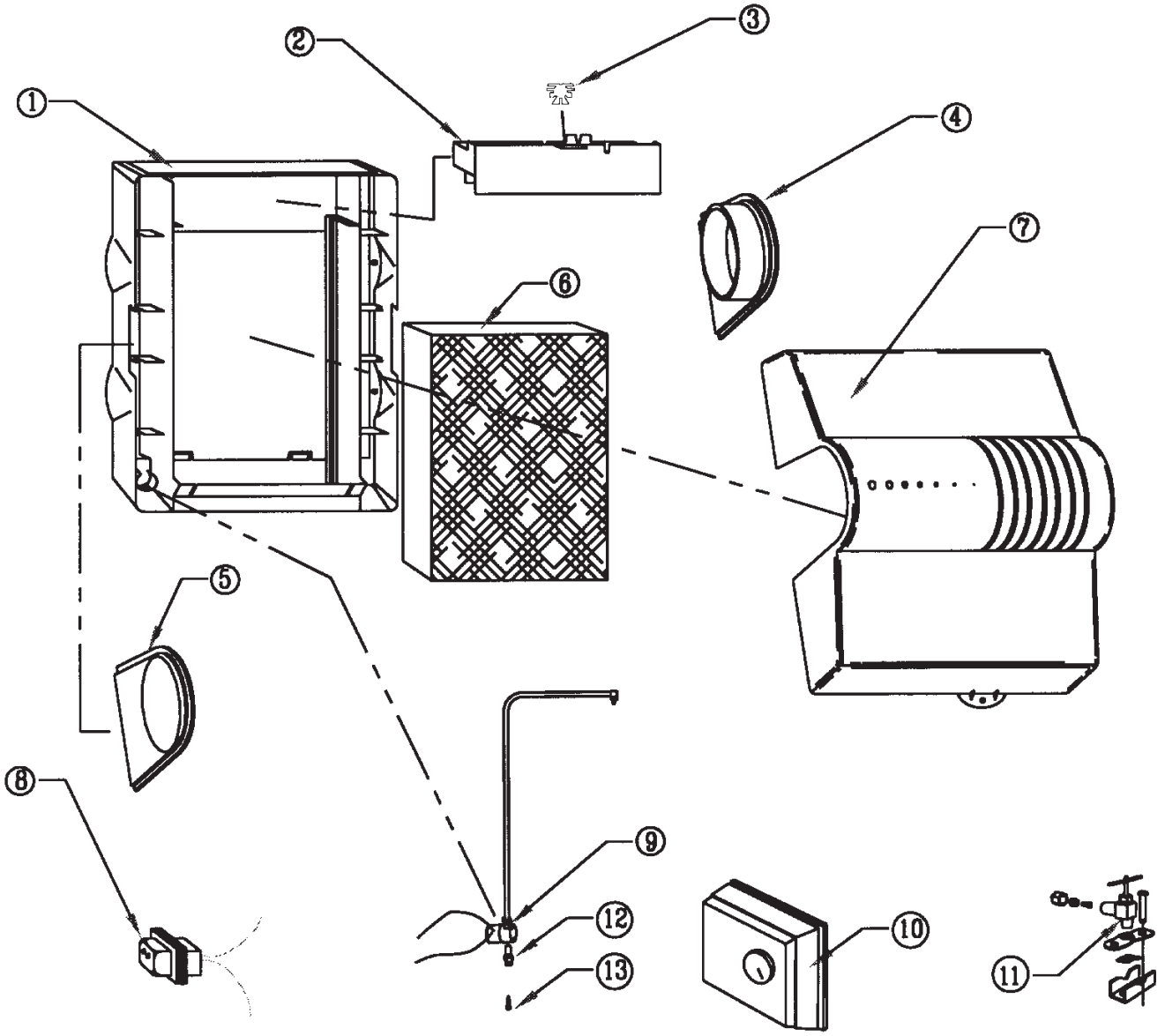
Parts for Models HSP2000 and HSP2600		
Item	**Part Name**	**Part No.**
1*	120 Volt Heater	000-0430-055
1**	240 Volt Heater	000-0430-056
2	Safety Float Switch	000-0814-132
3	Float for Water Fill Valve	A00-1309-012
4	Water Fill Valve	000-1731-012
5	Water Pan Assembly	A01-1730-078
6	Cover	N/A
7*	Transformer 120 Volt Primary, 24 Volt Secondary	000-0814-133
7**	Transformer 240 Volt Primary, 24 Volt Secondary	000-0814-140
8	Control Relay DPST 24 Volt	000-0431-031
9 & 10	Fan Wiring Assembly	N/A
11	Humidistat Control Terminal Block	000-0814-135
12	Indicator Light	000-0814-139
13	Thermal Fan Control "Thermostat"	000-0431-030
14	Power Distribution Terminal Block	N/A
15*	120 Volt Power Supply Cord	000-0811-107
15**	240 Volt Power Supply Cord	N/A
16	Saddle Valve	A00-1128-005
17	Compustat Assembly	N/A
18	Drain Cock Valve	000-1349-065
19	Drain & Overflow Bushing (w/ Overflow Bushing, Washer & Lock Nut)	A00-1319-067
20	90° Barbed Elbow	N/A
Not Shown	9 pc. Gasket Set (w/ Drain, Overflow, Thermostat, Safety Float & Heater Washers)	A00-0693-020

*Model HSP2000 **Model HSP2600



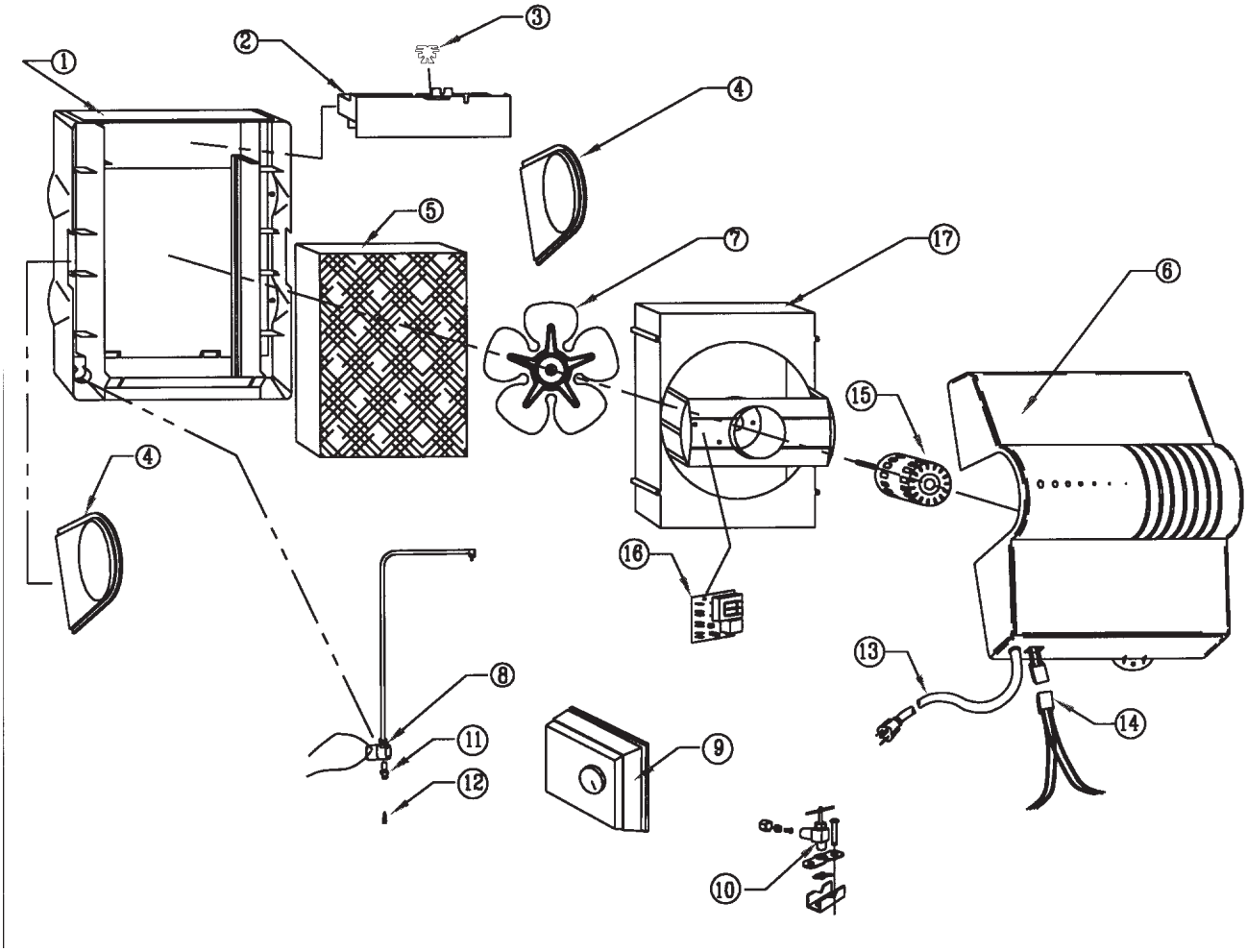
ITEM NO.	DESCRIPTION	MODEL NUMBER
1	MOUNTING BASE	–
2	DRIP TRAY	000-0602-055
3	WICK	000-1317-091
4	SIDE PIECE WITH COLLAR	–
5	SIDE PIECE W/O COLLAR	–
6	EVAPORATOR PAD INCLUDES KEY #3	PAD-A04-1725-052
7	COVER	–
8	TRANSFORMER 24V, 10 VA, 120V PRIMARY	000-0814-008
9	24V SOLENOID VALVE (UNIVERSAL KIT	WRA01-0814-148
10	HUMIDISTAT ASSEMBLY	2271-100
12	SADDLE VALVE ASSEMBLY	A00-1128-005
13	ORIFICE .020DIA.	000-1106-030
14	IN-LINE FILTER	000-1319-051
†	CURRENT SENSING RELAY	A50

† Not Shown



ITEM NO.	DESCRIPTION	MODEL NUMBER
1	MOUNTING BASE	000-1730-091
2	DRIP TRAY	000-0602-055
3	WICK	N/A
4	SIDE PIECE WITH COLLAR	NLA
5	SIDE PIECE W/O COLLAR	N/A
6	EVAPORATOR PAD INCLUDES KEY	PAD-A04-1725-051
7	COVER	N/A
8	TRANSFORMER 24V, 10 VA, 120V PRIMARY	000-0814-008
9	24V SOLENOID VALVE (UNIVERSAL KIT)	WRA01-0814-148
10	HUMIDISTAT ASSEMBLY	2271-100
11	SADDLE VALVE ASSEMBLY	A00-1128-005
12	ORIFICE .020DIA.	000-1106-030
13	IN-LINE FILTER	000-1319-051
†	22.5″ TUBING	NLA
†	CURRENT SENSING RELAY	A50

† Not Shown



ITEM NO.	DESCRIPTION	MODEL NUMBER
1	MOUNTING BASE	000-1730-091
2	DRIP TRAY	000-0602-055
3	WICK	N/A
4	SIDE PIECE W/O COLLAR	N/A
5	EVAPORATOR PAD INCLUDES KEY #3	PAD-A04-1725-051
6	COVER W/VENTS	A05-0641-169
7	10- DIA. FAN BLADE	NLA
8	24V SOLENOID VALVE (UNIVERSAL KIT)	WRA01-0814-148
9	HUMIDISTAT ASSEMBLY	2271-100
10	SADDLE VALVE ASSEMBLY	A00-1128-005
11	ORIFICE .020DIA.	000-1106-030
12	IN-LINE FILTER	000-1319-051
13	POWER SUPPLY CORD	N/A
14	2 PC. CONNECTOR ASSEMBLY	N/A
15	FAN MOTOR	000-1721-048
16	ISOLATION RELAY	000-0431-034
17	FAN SHROUD	N/A
†	SIDE PIECE WITH COLLAR	NLA
†	CURRENT SENSING RELAY	A50
†	22.5″ TUBING	NLA
†	120/24 VOLT TIMER 10VA	000-0814-008
†	COVER ATTACH KNOB	NLA

† Not Shown




ZONING SYSTEM DESIGN

Zoning any forced air system is easy once you know a few of the basic rules. The main consideration is to maintain a constant amount of air flow (CFM) through the HVAC Unit. This needs to occur when only one zone is open and if the zones are of varying size when the smallest zone is open. The other consideration is not to oversize a duct system too much in order to maintain adequate velocity and airflow when all zones are open and may be calling for conditioning on those design temperature days.

The design of the duct system for today's zoning is an important factor to a comfortable and efficient zoning system. The number of zones, along with their size, often determine the best type of design.

There are scenarios for zoning. The first, which is typically on new installations where the duct work can be designed for zoning would be to oversize the ducts for each zone in order to get more air to the zone when it may be the only one calling. The scenario for all others would be to use a by-pass damper to relieve the excess air pressure in the duct system when a minority number of zones are calling.

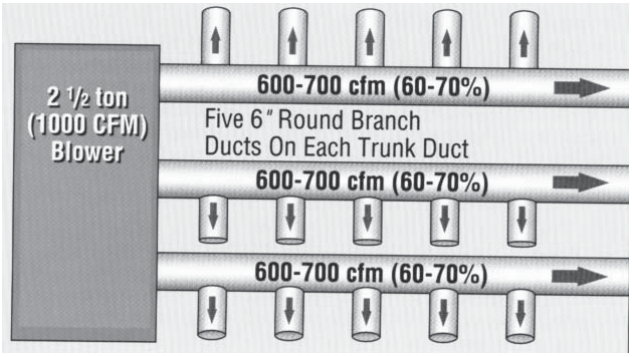
The reason for each zone duct being the same size is that any zone could be the only zone calling and therefore that zone must handle the CFM of the HVAC Unit. When the duct is sized for 2/3 of the total CFM the smaller size does restrict the airflow and forces the air at a higher pressure and velocity, however it does not increase the air typically over that static pressure rating of the blower motor, usually 0.5"W.C. This also keeps the air velocity from being noticeably noisy. Below is a quick guide to determine the minimum equivalent size of a zone duct for each size HVAC Unit.

System CFM	Zone Trunk Duct Size	Branch Ducts
800 CFM	12 × 8 or 12" Round	5 - 6" Rounds
1,000 CFM	14 × 8 or 12" Round	5 - 6" Rounds
1,200 CFM	16 × 8 or 12" Round	6 - 6" Rounds
1,400 CFM	18 × 8 or 14" Round	5 - 7" Rounds
1,600 CFM	20 × 8 or 14" Round	5 - 7" Rounds
2,000 CFM	22 × 8 or 16" Round	5 - 8" Rounds

Systems over 5 Tons typically are commercial and would use a by-pass damper to relieve the excess air pressure when the majority of zones shut down.

In retrofit and systems with 4 zones or more, over sizing the ducts is not practical. In these instances a by-pass damper is used to relieve the excess air back into the return air duct or dump the air into a central area of the building, such as a hallway, where often there is a common return. In this instance try to locate the by-pass air as far away from the return air intake as possible.

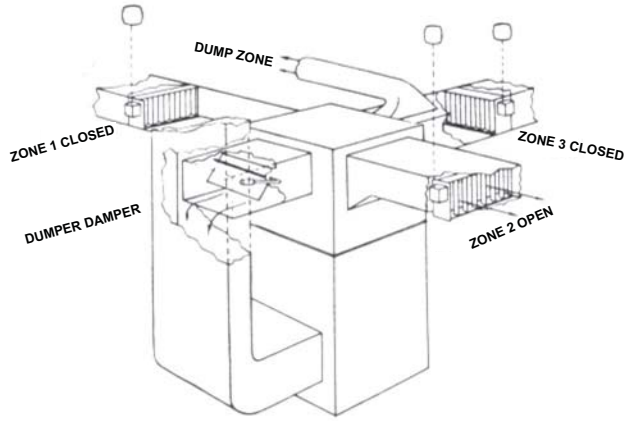
In new installations where ducts are being added it is recommended to size each zone duct the same and to size the duct for approximately 2/3 of the total HVAC System CFM. This is practical on systems with 2 or 3 zones and when all zones are approximately equal in size. This is NOT practical in an installation where 80% of conditioned area is one zone and 20% is the other zone.



The key to a good zoning system is to deliver the conditioned air to the calling zone as fast and quietly as possible in order to satisfy the demand. Whatever air cannot be directed into the zone must then by by-passed. This develops the formula for calculating the size of the by-pass damper.

Total CFM - **S**mallest Zone CFM = **B**y-Pass CFM

Once the amount of by-pass air is known it is just common sense to size a duct adequately to handle the amount of air. White-Rodgers has both round and rectangular / square by-pass damper sizes.

The diagram above shows a typical three zone damper system with a barometric by-pass, Model CSPRD, between the supply air and return air duct. A round take-off is also shown as an uncontrolled dump zone delivering air continuously to a non-critical temperature area, such as a basement or hallway as another method of relieving excess air. Either a by-pass or a dump zone is used but rarely ever is there a need for both.

MINIMUM POSITION DAMPER

Another form of by-pass is using minimum position dampers, such as the CZD and CRDS dampers. Setting the larger zone dampers to a minimum position can also be a method of relieving excess air pressure. This should be used when only small amounts of air need to be by-passed as the minimum position air in some cases can cause a zone to overshoot its comfort zone. Caution must be exercised when using minimum position dampers for by-pass.

ZONING HEAT PUMPS

Heat Pumps are a very popular form of heating and cooling in the milder climates of the country. These efficient units use the compressor for both heating and cooling and have a reversing valve that reverse the flow of refrigerant in order to switch between heating and cooling modes.

Heat pumps, while very efficient, are also most efficient in milder climates where often there is more of a cooling demand than a heating demand, such as the southern United States. A heat pump is also rated based upon its cooling capacity and not the heating capacity and rely typically on electric resistance heating to supplement the heat pump in colder weather, often less than 35°F to 40°F. When this back-up form of heat is used to supplement the heat pump compressor, the cost to heat the home rises dramatically. It is this reason that zoning should be installed with every heat pump.

Heat pumps with their limited capacity for heating cannot afford to be run on the colder climates heating the entire home or building. However if the heat pump is zoned, most likely less than the total building requires heat at any one time. The zone calling typically requires less than the total BTU capacity of the heat pump, more evenly matching the heat pumps capacity to the load of the calling zone. By doing so this lessens the need for the supplemental heat to come on, therefore providing substantial energy savings.

For example, a typical home may have a 3 Ton (36,000 BTU) heat pump. The total heating load for the home at heating design temperature maybe 60,000 BTUs or even more. Obviously with only 36,000 BTUs the heat pump can never keep up at design temperatures. However during milder temperature days, those above 45°F, the heat pump will often be more than adequate.

Heat pumps most efficient outdoor temperature, typically 45°F to 50°F and the amount of BTUs produced by the heat pump decreases as the temperature moves further below this temperature. This is when the supplemental electric resistance heat is often needed. As the heat pump compressor heats the air, the electric resistance heaters, located downstream of the heat pump coil, can come on to supplement the heat pump air. However if the system is zoned and heating is required for typically only one room or zone, the capacity of the heat maybe equal to or greater than the heating load of that zone and even as the output of the heat pump diminishes as the outdoor temperature falls, the capacity of the heat pump, (BTU output) is adequate for the zone(s) calling therefore not requiring the use of the supplemental heating.

The combined use of zoning and heat pumps allows more equally matched capacity to match the load of those zones calling allowing the most efficient form of heating to be used. Even during the colder times when the supplemental electric heat is needed, it is important to remember that a smaller amount of heating is always required for one room or zone vs. the whole house. Zoning allows the heating to be directed only to those areas needing it.

FOSSIL FUEL FURNACES AND ADD-ON HEAT PUMPS

When a heat pump is added on to a fossil fuel (gas or oil) furnace, the sequence of operation is somewhat different than using electric resistance heating as supplemental heating. The heat pump coil is often on the supply side of the furnace and both the heat pump and furnace cannot be run together as the high temperature from the furnace will cause the heat pump compressor safeties to engage.

All heat pump manufacturers use a fossil fuel kit in order to make the most effective use of the heat pump and furnace. Simply this fossil fuel kit uses an outdoor thermostat to switch between the heat pump and furnace based upon the outdoor temperature or balance point. The balance point is calculated to determine the most effective temperature to operate the heat pump vs. the furnace. See the heat pump manufacturer's information to calculate the balance point.

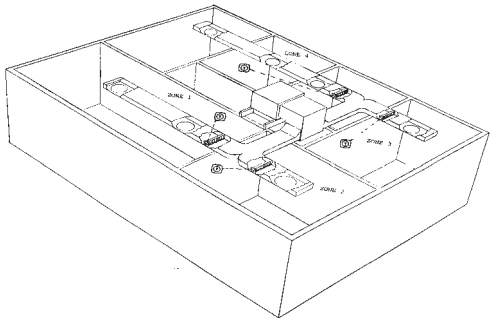
When using a White-Rodgers System with an add-on heat pump it is recommended to use the manufacturer's fossil fuel kit in order maintain the manufacturer's warranty. The zone control panel equipment terminal block will be wired to the thermostat connections on the fossil fuel kit.

When using any heat pump it is important to remember that with a limited amount of heating capacity, ZONING is imperative in order to make maximum use of the heat pump and where the individual zone load is more closely matched to the capacity of the heat pump.

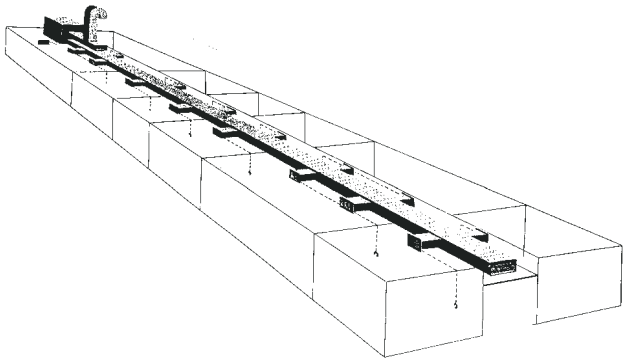
ZONING COMMERCIAL SYSTEMS

Zoning for commercial and light commercial office buildings makes even more sense as every person has their own idea of their own comfort level. The number 1 and 2 complaints in any office is its either TOO HOT or its TOO COLD. Being able to provide each office with its own thermostat to control the temperature is a simple and cost effective way to solve this problem.

Here is a small professional office with 4 zones. One zone would be the waiting room, reception area, another be the receptionist's office, another be the boss's / doctor's office, or conference room and the other smaller rooms be offices or examining rooms all on the same zone.



In commercial buildings the need for zoning is increased by the building exposure when offices facing south and north are controlled by the same thermostats. Those south facing offices on a bright sunny day may be needing cooling while offices on the northern side with no solar gain still need heating. In the morning the entire building may need heating for a morning warm up and soon after only the perimeter offices need heating while the interior core needs cooling. Conference rooms that go for hours unused can be shut off and then when there is a meeting and the offices are not being used, the conference room can be controlled comfortably by having its own thermostat.



White-Rodgers Systems can automatically direct the flow of the conditioned air to those zones needing it and automatically switch over and provide the opposite mode to the other zones eliminating the need for on site techs to constant balance and adjust outlets based upon the ever changing conditions.

Light Commercial and Commercial systems are basically just bigger residential systems with more capacity. Duct design for these will almost always include a by-pass system, especially those over two to three zones. The commercial systems are easier to retrofit as the false ceiling space if often used as a common return and a great place to by-pass the air. Wiring is a snap as well as damper installation all taking place in the false ceiling.

Zoning also helps the landlord in tenant improvement costs by eliminating the need to ad separate air conditioning units in order to satisfy multiple tenants on one HVAC system. While one tenant in a professional suite maybe an attorney and have more normal working hours, the doctor and dentist with after hours patients on evenings and Saturdays can still get conditioning by having there own temperature control.

Commercially, zoning is a very economical alternative to the more sophisticated VAV and computer controlled HVAC systems. Zone Control in commercial buildings can range from installing a single motorized damper and thermostat to control an over-conditioned or seldom used room or office; such as a conference / training room to zoning every room on the HVAC System.

There is really little difference in zoning a residential 5 Ton Split HVAC System and a commercial 5, 7-1/2, 10, 15 or 20 Ton Package Rooftop HVAC Unit. The system components of the dampers, thermostats and control panel can be the same in many instances. The only difference is the commercial rooftop maybe 2 stage heating and/or cooling and there may be more zones and the duct sizes may be larger, however the basic operation remains the same.

The Number 1 and 2 complaints in office buildings are people are either Too HOT…..or Too COLD. Zoning is the less expensive alternative to the more commercially used VAV Systems and provides just as good temperature control as those expensive system for a fraction of the cost.

The design of a commercial zoning is also the same as a residential system where a by-pass is most typically used. Small commercial systems that may be just two zones might be able to get away without a by-pass provided they are only two zones and the ducts for each zone are large enough to handle 60% to 70% of the total airflow.

Commercial zoning systems of three zones or more will need a by-pass. The by-pass for commercial is often easier as many times the false ceiling space is used as a common return. Here again it is always important for the by-pass damper to be located as far away from the blower as possible. Barometric by-pass dampers can be used up to 7.5 Tons (3,000CFM). Over 10 Tons (4,000 CFM) should use a motorized by-pass and a static pressure control.

ZONING versus MULTIPLE UNITS

For years many HVAC Installers and Home Builders have used multiple HVAC units in order to accomplish zoning. Installing a unit for the upstairs and another for the downstairs is typically most common. While effective to achieve zoning, using multiple units is often an unnecessary and substantially higher added cost.

There are good reasons for using multiple units. They would be that the load of the home is so big that multiple units are needed. Homes continue to grow in size and on average homes over 3,000 square feet will typically require more than 5 Tons of cooling. In these larger homes, multiple units are necessary. Typically trying to use one central unit also creates long duct runs that may not properly get the airflow to all areas. Using multiple smaller units can be more effective however in these instances a zoning system should still be looked at as each smaller unit could still be subdivided into small zones.

The case for multiple units is also used in existing homes where add-on air conditioning may be installed and duct work cannot be run throughout the house. Example a older home without ductwork, that may utilize steam or hot water heating and air conditioning is being added. In order to add central air conditioning for both levels ductwork cannot be run from the basement to the second floor or from the attic down to the first floor.

However when two units are installed side by side in the same area and both units add up to less than 6 Tons, this is the case for using one unit and zoning.

Anytime a contractor can install one unit versus two, or more, the homeowner wins. Maintenance costs are cut with every unit saved. Remember the maintenance of air filters, electronic air cleaners, humidifiers, electrical requirements and the life expectancy of these HVAC units as well, are unnecessary added costs that can be saved by using one unit and zoning.

Another reason for using one larger unit with zoning is to economically obtain zoning and the highest efficiency HVAC equipment. Often when multiple HVAC units are installed these units are typically on the lower scale of efficiency. For heating this is an 80% efficient furnace. For cooling this is a 10 SEER air conditioning unit.

ZONING EFFICIENCY AND DOWNSIZING

The standard way of not living in your whole house all of the time and mostly occupying one zone of the home at a time proves the need for zoning. Zoning makes the use of the heating and cooling more effective by only conditioning those zones being occupied or that may need it. Therefore typically the majority of the time, even on a two zone system only one zone is typically calling.

When this occurs the furnace and air conditioner is oversized in BTU capacity when supplying only a single zone. Due to this many HVAC Installers will downsize the heating and/or cooling units based upon the use of zoning. On a two zone system this many not be recommended, however when using 3 or more zones it is practical to downsize to the next lower capacity unit.

An HVAC Unit should be sized to heat and cool the home at design temperatures (the hottest days in summer and the coldest days in winter). Realistically how often do design conditions occur. Of course this depends upon where you live. In the milder climates downsizing is much more of a possibility than in the severe heating climates of Northern states or the southern cooling climates.

HVAC installers have been quite successful in going to the next smaller size unit when using zoning. In many cases heating and cooling units are often oversized, especially on older homes. Doing a heat loss and heat gain calculation is very important in determining the size of the heating and cooling unit. Once the loads are determined for the overall structure, the affect that zoning will have on the overall load can be determined. Seldom used zones such as basements or extra bedroom loads can be looked at as not always needing conditioning at the same time as more often used zones. In instances where 3 or more zones are used may be advantageous to downsize to the next smaller size of heating and cooling unit.

NOTE: There are times during extended periods at design temperatures where it will take longer for the zones to satisfy as the heating or cooling. It is important to note that some zones would have to be adjusted in order to direct more BTUs to the more important zones.

Down sizing while also increasing efficiency is often the best way to go. When considering the alternative of using 2 separate lower efficiency units in order to zone vs. one high efficiency unit with zone damper system, the cost difference is negligible if not sometimes less. Take for example the following scenario and price out the costs comparison of the following example.

A 100,000BTU Home with 2 Zones.

Two Units @ 80% Efficiency 2Units	vs.	One Zoned 90% Efficiency 1 Unit
x 50,000 BTU Each (100,000 Total)		x 90,000 BTU (Downsized)
x .8 (80% Efficiency)		x .9 (90% Efficiency)
= 80,000BTU	vs.	= 81,000BTU

When you look at the two options you can still get more output, with higher efficiency and still provide zoning. Combine this with the potential utility rebates for the higher efficiency and that often offsets the added cost of the zoning system. Even going to one 80,000BTU, 90% efficiency unit will only decrease the total output by 10% . In milder climates this can be an approach to lower HVAC installed costs when quoting against the competition with 2 lower efficiency units.

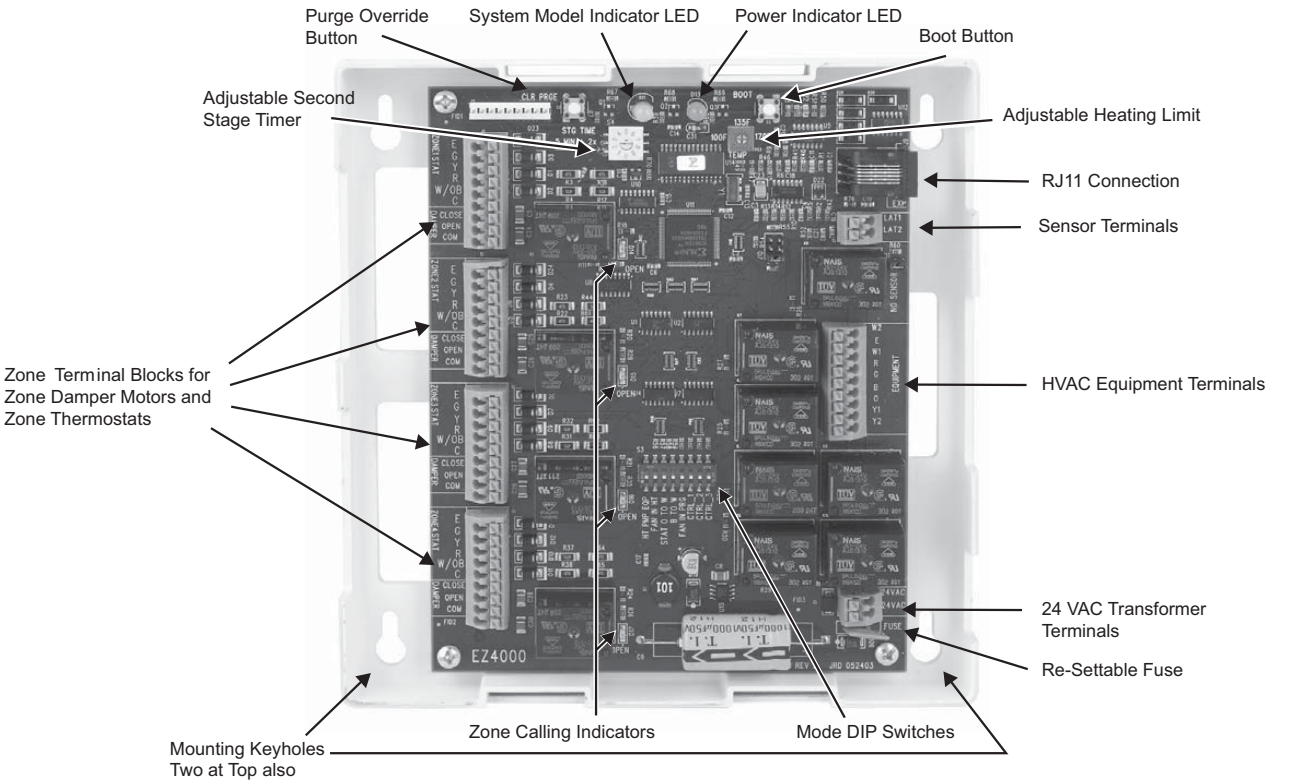
Applying higher efficiency and zoning to cooling can also increase the effectiveness of the cooling. Here again if utility rebates are offered for the higher efficiency this can further offset the added cost of zoning and possibly add other comfort options.

Typically the more zones you have the wider the diversity in the use of the zones. This factor can help in downsizing the unit. Take for example an exercise room that may only be used a hour or two a day. The family recreation room that is only used for a few hours in the evening and not when all are sleeping in the bedrooms or eating in the kitchen dining room zones.

Zoning and high efficiency equipment can increase the overall energy performance of your home and keep rising energy costs down to manageable level.

CZ-4
MASTER CONTROL PANEL

White Rodgers



The CZ-4 basic function is zone control. On a call for heating or cooling, the panel will accept the first call from any zone. Upon accepting this call, the CZ-4 will open the damper(s) to the zone calling, close the damper(s) to those areas not calling, activate the needed HVAC controls for heating or cooling, whichever is being called and not accept any calls for the opposite mode.

Any calls for the opposite mode will be locked out until the initial mode is either satisfied or a period of time has elapsed that is sufficient for the first mode to satisfy, a maximum of 20 minutes. A Patent Pending sequence determines the time the unit has been running or needs to continue to run in order to adequately provide conditioning for each mode. If a particular mode has already been calling for 20 minutes or longer and an opposite call comes in the CZ-4 will immediately drop the mode, enter the purge mode in order to dissipate the conditioned air into the zones calling before switching over to provide the new conditioning call to its zones.

When using the CZ-4 to control two stage heating and/or cooling, the second stage is controlled based upon time after the first stage call from the thermostat. When any zone calls the panel's built-in timer begins and after the set period of time elapses, the CZ-4 will also activate the W3 for Heating or Y2 for Cooling. The Second Stage Timer is adjustable from 5 to 23 minutes after the first stage calls. Once the second stage is on, it will continue to run until the first stage is satisfied or the limit setting is reached.

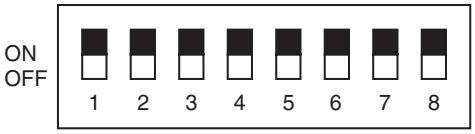
Once all zone thermostats are satisfied for heating and cooling, the CZ-4 can now accept Fan calls allowing Continuous Air Circulation (CAC) in those zones where the thermostat's Fan Switch is set to ON. These zone dampers will be Open while the dampers to the zones where the Fan Switch is set to AUTO will be CLOSED.

When all zone thermostats are satisfied for both Heating and Cooling and all Fan switches are set to AUTO position, the HVAC unit will be off and all zone dampers will return to a normally open position. Once a zone calls for heating, cooling or fan, the dampers to the calling zones remain open and dampers to the zones not calling will close.

SET-UP FOR VARIOUS HVAC EQUIPMENT

The CZ-4 is factory set for conventional fossil fuel (oil or gas) single or two stage heating and cooling. The panel only needs to be configured when using with a conventional electric furnace or hydro-air system in order to bring the fan on with a call for heat, or when using with a heat pump.

Most all of the panel configuration is done by setting the DIP switches in the lower center of the panel. Below is shown their setting and functions.



1. **HT PMP EQP** – Heat Pump Equipment – This switch changes the output of the HVAC Equipment terminals from conventional Heating and Cooling to a traditional Heat Pump Output. When OFF, a heat call activates the W1 output. When ON, a Heat call activates the Y1 output to bring on the compressor.
2. **FAN IN HEAT** – Activates the O output to turn the Fan on with a call for Heat. This is used for Heat Pumps, Electric Heat furnaces and Hydro-Air Systems. In the OFF position the CZ-4 will not activate the Fan in heating unless there is a fan call from one of the zone thermostats.
3. **STAT O TO W** – Switch is placed to ON when using Heat Pump thermostats that use an O terminal to activate the reversing valve in COOLING. The O on the thermostat is wired to W on the zone terminal in order to determine if the call is for heating or cooling. All zone thermostats must operate and be wired the same way.
4. **STAT B TO W** – Switch is used when using Heat Pump thermostats that use a B terminal to activate the reversing valve in HEATING. The B terminal on the thermostat is wired to W on the zone terminal in order to determine if the call is for heating or cooling. All zone thermostats must operate and be wired the same way.

4. **STAT B TO W** (cont.)
   NOTE: Some OEMs use the B terminal as a transformer Common and not as the heating reversing valve. These thermostats will use the O terminal for the reversing valve and should be wired accordingly using DIP Switch #3. The B terminal will then be wired to the C terminal on the thermostat terminal block.
5. **FAN IN PRG** – This switch keeps the fan running during the purge time in order to dissipate the conditioned air into the last zone(s) calling. Placing this switch to ON prevents the fan from turning off from the fan control in the HVAC Unit during the purge mode and coming back on moments later if another call is waiting. In OFF the fan will be controlled by HVAC Fan controls. This is desirable in residential applications to prevent cold drafts after heating by having the switch OFF.
6. **CNTL 1** – EMERGENCY HEAT – This switch can be used to place all zones into the Emergency Heat mode. This switch would be used when single stage thermostats are used. **NOTE: There is no indication on the panel to show this switch is ON.**
7. **CNTL 2** – Future Use.
8. **CNTL 3** – Future Use.

One of the many features of the DIP switches is if at anytime the equipment is changed from single stage to heat pump or vice versa the thermostats do not need to be changed with the equipment change. Changing the DIP switch settings is all that is needed.

WIRING

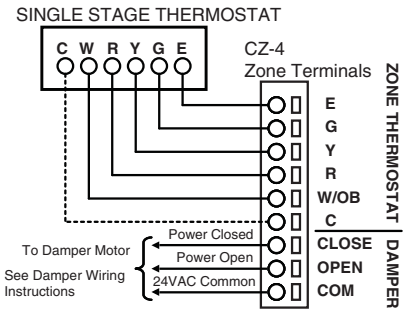
The CZ-4 is very simple to wire and requires only a minimum number of connections. The CZ-4 terminal blocks are screwless and all wires can easily be pushed into their respective terminal by depressing the button for each point and releasing once the wire is seated. To remove the wire, just press its button again and remove the wire.

Zone Dampers – The CZ-4 can power any 24VAC damper, either 2 wire or 3 wire. See specific wiring instructions with the damper or inside panel cover.

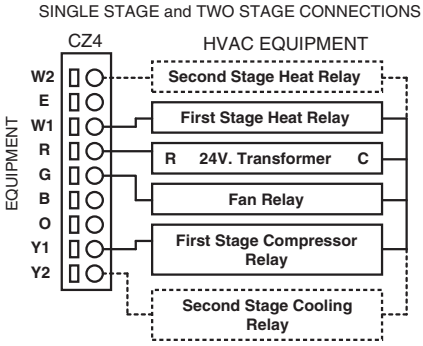
Zone Thermostats – The thermostats wiring will be for single stage (Y-G-R-W-C) or Heat Pump (Y-G-R-E-C and O or B). This wiring is shown on diagrams 1 for single stage and 3 for heat pumps.

Equipment – The HVAC equipment will follow wiring diagram 2 for single and two stage systems or 4 for heat pump systems.

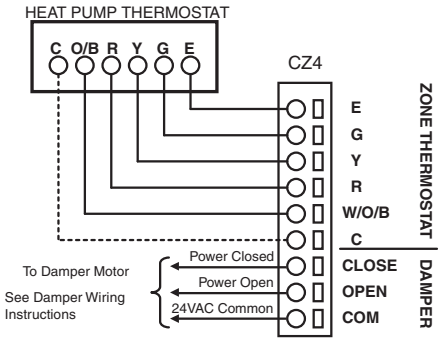
WIRING DIAGRAM 1 – Single Stage Thermostat



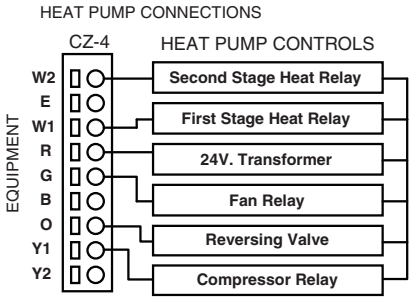
WIRING DIAGRAM 2 – Single Stage and Two Stage Equipment



WIRING Diagram 3 – Heat Pump Thermostat



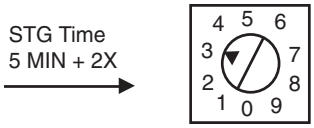
WIRING DIAGRAM 4 – Heat Pump Equipment



STAGE TIMER

The CZ-4 has a built-in stage timer that eliminates the need and added cost of using two stage thermostats. On a call for either heating or cooling the timer begins. A minimum of 5 minutes, adjustable to a maximum of 23 minutes, can be set in order to activate the W2 or Y2 outputs after the first stage call.

The Stage Timer is marked 0 through 9 and each increment is indented as the dial is rotated. A minimum 5 minutes is set when the dial is set to 0. To calculate the stage timing the dial setting is multiplied by 2 and added to the base of 5 minutes. Example: Dial setting is 3 x 2 = 6 + 5 = 11 Minutes for the Stage Timer.



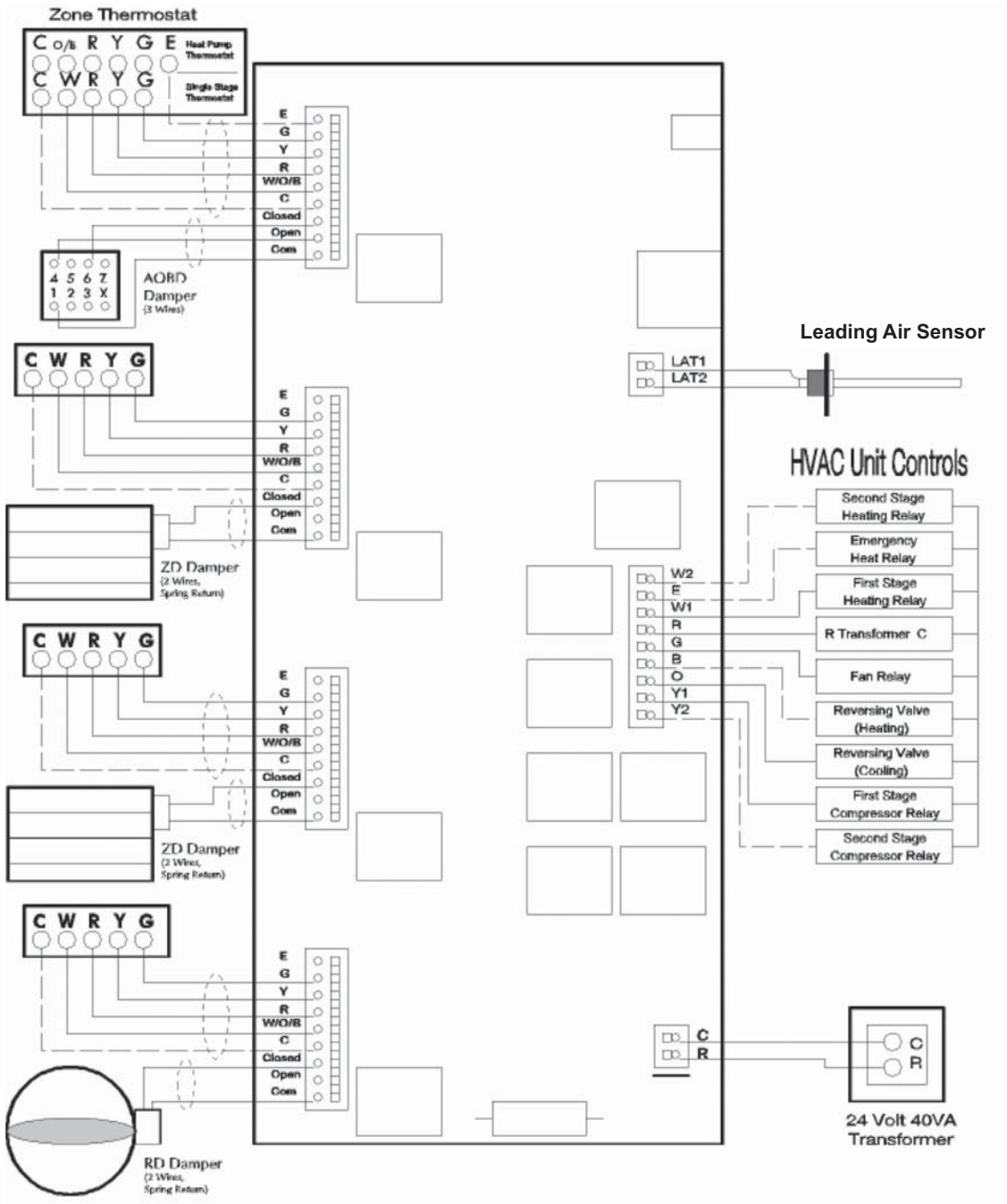
PURGE TIME

The CZ-4 has a built-in Purge Time after each call is satisfied and provides a minimum off time before another call is initiated. The Purge Time is set at 2.5 minutes after all calls for a particular mode are satisfied or when the Changeover Timer requires a changeover due to opposing calls.

After all calls are satisfied or the changeover timer activates, the Purge Timer begins and the heating or cooling, whichever was on, is deactivated. Typically the fan may be running during this time and the damper(s) to the last zone(s) calling will remain open to purge the conditioned air only into those zones that were calling for the conditioning.

DIP Switch 5 can be set ON to keep the Fan running during the Purge mode in order to prevent the fan cycling off and back on between modes. In the instance where the Fan staying ON may create a draft, and the frequency of opposite calls is minimal this switch can be kept to OFF.

The CLR PRGE button on the top left of the panel can be pushed to override the Purge mode and speed installation and checkout. This button is only active when the System LED is AMBER.



MINIMUM ON TIMER

The CZ-4 also has a minimum on time whenever the compressor operates in order to prevent frequent short cycling. Once there is a call for cooling or the compressor on a heat pump, the CZ-4 will hold that call for a period of 2 minutes.

CHANGEOVER TIMER

Whenever a call is made for either heating or cooling, the changeover timer is activated in order to track the amount of time heating or cooling is on. When an opposite call is made after a first call is existing the changeover timer calculates the amount of time the unit has already been supplying the first mode in order to determine how long it will hold off the opposite call. If an opposite call is made shortly after the first call, the opposite call may be held off for as much as 20 minutes. If the first call or subsequent calls for the first call mode has had that mode operating for up to 20 minutes already and an opposite call comes in after 20 minutes, the changeover timer will immediately recognize the opposite call, shutting off the current mode, enter the purge mode and automatically switch to the opposite mode.

The longer a call has been running, up to 20 minutes, the shorter the wait time will be for an opposite call. If a call is over 20 minutes and an opposite call is made the changeover will be immediate following the purge time. This intelligent changeover timing makes the CZ-4 unique to any other zoning system.

CAZ-2

The Zone Panel can be added onto with Model CAZ-2. The CAZ-2 is available as a 2 zone adder panel and expands any CZ-4 panel to an almost unlimited number of zones. The CAZ-2 panel is connected by a 6 conductor RJ11 telephone cable. This makes wiring between the CZ-4 and CAZ-2 literally a snap.

CHECKOUT

The CZ-4 has unique features that simplify the checkout of the system and has LED readouts that constantly indicate the system operation. Once 24 Volt Power is applied to the panel, the Green Power LED will illuminate. This will stay illuminated constantly when power is applied.

The System LED will provide several different indications based upon color and if it is flashing.

Heat ON – RED
Heat Limit – RED Flashing
Cool ON – GREEN
Cool Limit – GREEN Flashing
FAN ON – AMBER
PURGE – AMBER Flashing

Each zone has its own small Green indicator LED next to each zone relay. This light is lit when the specific zoning is calling for the mode shown on the System LED.

TROUBLESHOOTING

The CZ-4 is a very simple control to troubleshoot, especially with the LED indicators. The only other device needed is a simple Volt/Ohm meter. Almost all problems can be traced to an external component or wiring to the CZ-4. While the CZ-4 has been designed to operate under extreme voltage conditions and is fuse protected, like any computer the micro-processor can hang up and not operate properly. For those instances a BOOT button has been installed that re-boots the micro-processor just like your computer. Pressing this button for a few seconds and then releasing it will allow the micro-processor to reboot and in most all cases eliminate the problem. If not, the following procedure can help isolate the problem.

ZONE(S) NOT CALLING

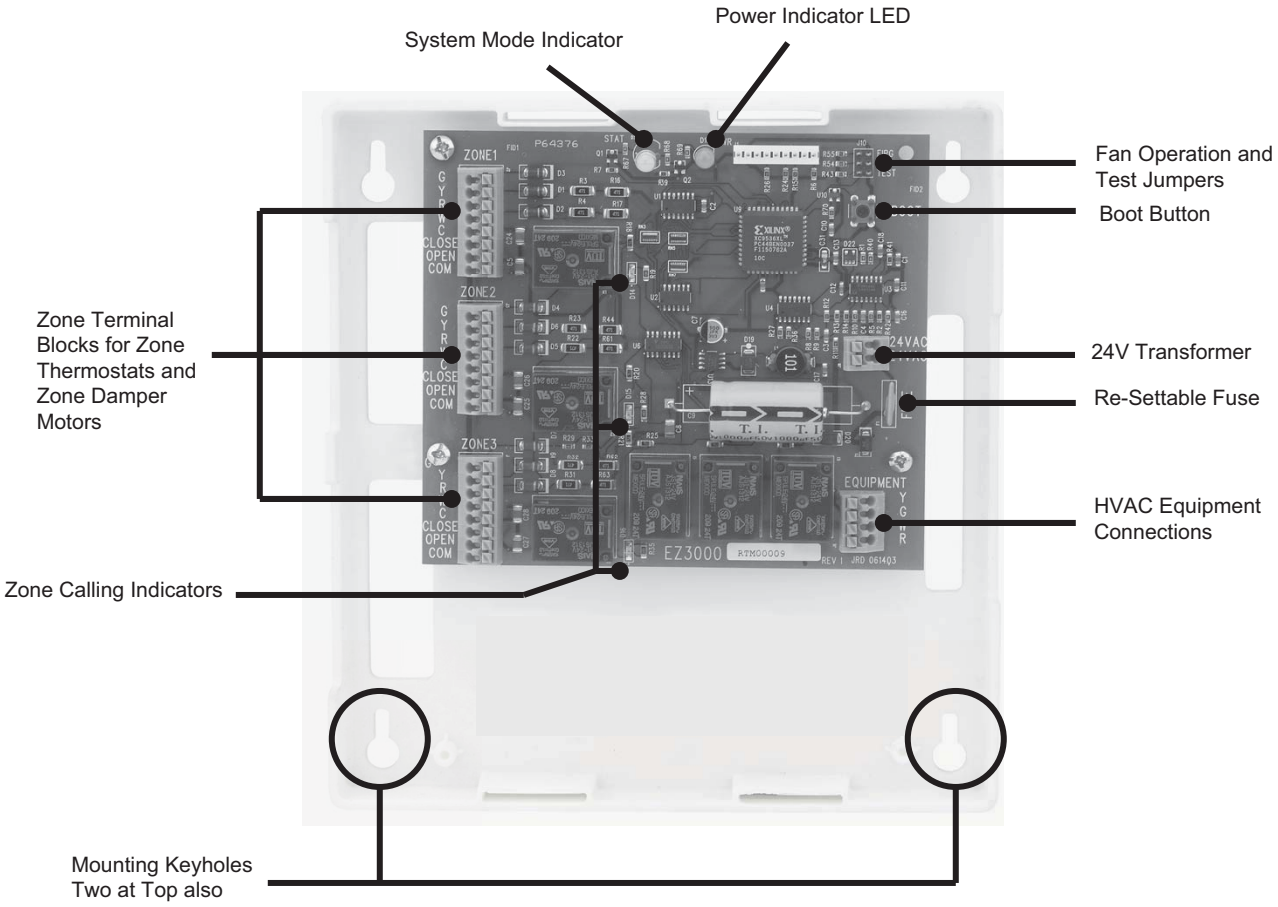
Each zone has a Green LED next to the zone relay when it is calling and that calling is being recognized by the CZ-4. If a zone is supposed to be calling and the Zone LED is not on, check for 24VAC across the thermostat terminal C and the Y, if a Cool call, W if a Heat call, or G if a Fan call. If there is no voltage here at the panel, the panel is not getting the signal from the thermostat. The problem is mis-wiring, a broken wire or a problem in the thermostat. To check the zone on the panel, place jumper from R to Y, R to W or R to G to see that the panel is operating properly.

ZONE(S) WILL NOT SHUT OFF

If a zone will not stop calling, the Zone LED should still be on. Depending on the call, disconnect the Y, W or G wire from the terminal strip. The zone will drop out. Check the thermostat wiring for a miswiring or short that keeps the zone calling.

DAMPER MOTOR CHECKOUT

To checkout the dampers, the panel provides 24VAC to the COM and OPEN when the damper is to be open and 24VAC to COM and CLOSE when the damper is to be CLOSED. When any zone is calling and its Green LED is ON, there is 24VAC across COM and OPEN. The only time a damper will close is when another zone is calling and its zone is not calling. In this instance there will be 24VAC across COM and CLOSE.



INSTALLATION

The Comfort Plus™ Zoning System-3 is a two (2) and three (3) zone control panel for single stage heating only, cooling only or heating and cooling. The CMM-3 can control any single stage gas-oil-electric furnace, hydro-air heating and air conditioning. The CMM-3 panel is the central control panel where all zone dampers, zone thermostats, HVAC Equipment and power transformer are wired. When installing the CMM-3 panel it is important to pick a central location where it is most convenient to bring all the wires. Most often this is at the furnace or air handler. It is often the most convenient location and closest to power, the HVAC unit controls and the zone dampers when typically located at or near the plenum.

The CMM-3 panel is made of sturdy ABS plastic and can be mounted to any flat surface. It is recommended that the panel be mounted to a wall or return plenum and NOT on the furnace or plenum where it will be in contact with the high temperatures. The panel can be located in an attic space or in an enclosed cabinet of a rooftop unit, provided the panel enclosed and not in direct exposure to the elements. The cover easily removes from the case by pulling firmly and separating the cover from the case exposing the circuit board. There are 4 key-hole mounting points in each corner of the case. The case has openings in the rear of the case as well as the side for all wiring. Wiring can come from the back as well as the side in order to make a neat installation.

OPERATION

The CMM-3 can controls single stage heating and cooling HVAC Equipment. The CMM-3 is compatible with any standard single stage thermostat and setback thermostats as well. The CMM-3 has various features that make installation and checkout very simple for all of the board's functionality. The CMM-3's basic function is zone control. On a call for heating or cooling, the panel will accept the first call from any zone. Upon accepting this call the CMM-3 will keep open the damper(s) to the zone calling; close the damper(s) to those zones not calling, activate the needed HVAC controls for heating or cooling, whichever is being called and not accept any calls for the opposite mode.

Any calls for the opposite mode will be locked out until the initial mode is either satisfied or a period of time has elapsed that is sufficient for the first mode to satisfy, a maximum of 20 minutes. A Patent Pending sequence determines the time the unit has been running or needs to continue to run in order to adequately provide conditioning for each mode. If a particular mode has already been calling for 20 minutes or longer and an opposite call comes in the CMM-3 will immediately drop the mode, enter the purge mode in order to dissipate the conditioned air into the zones calling before switching over to provide the new conditioning call to its zones.

PURGE TIME

Once a call is satisfied the CMM-3 drops the call for the heating or cooling unit controls, whichever was calling and hold the damper(s) to the zone(s) that were last calling during the Purge Mode. The Purge mode is nominally 2 minutes and allows the excess conditioned air in the plenum to be distributed only to the zone(s) that were last calling. This eliminates the problem of overshooting the temperature in the satisfied zones. During the Purge mode the panel can be set to keep the Fan running during Purge or to let the fan control in the HVAC unit to control the fan. By using the FIPG (Fan On-In Purge) jumper, on the top right corner of the control panel, this keeps the fan running until the Purge mode is over. This mode avoids the fan shutting off during the Purge mode and coming back on when another zone may be on constant fan after the Purge Mode is over. This may be more often used in commercial applications for continuous air circulation (CAC). In residential applications the fan remaining on, especially in heating, may be drafty and objectionable. Once all zone thermostats are satisfied for heating and cooling, the CMM-3 can now accept Fan calls allowing Continuous Air Circulation (CAC) in those zones where the thermostat's Fan Switch is set to ON. These zone dampers will be OPEN while the dampers to the zones where the Fan Switch is set to AUTO will be CLOSED. When all zone thermostats are satisfied for both Heating and Cooling, and all Fan switches are set to AUTO position, the HVAC unit will be off and all zone dampers will return to a normally open position. Once a zone calls for heating, cooling or fan, the dampers to the calling zones remain open and the dampers to the zones not calling will close.

HVAC EQUIPMENT SET UP

The CMM-3 is factory set for conventional fossil fuel (oil or gas) single stage heating and cooling. The panel only needs to be configured when using with a conventional electric furnace or hydro-air system in order to bring the fan on with a call for heat. By using the FIH (Fan On-In Heat) jumper, located on the upper right corner of the board, this allows the Fan to be activated with a call for heat. Once the heat call is satisfied the fan will shut off as well, as long as the FIPG jumper is off as well.

CHANGEOVER TIMER

Whenever a call is made for either heating or cooling, the changeover timer is activated in order to track the amount of time heating or cooling is on. When an opposite call is made after a first call is existing the changeover timer calculates the amount of time the unit has already been supplying the first mode in order to determine how long it will hold off the opposite call. If an opposite call is made shortly after the first call, the opposite call may be held off for as much as 20 minutes. If the first call or subsequent calls for the first call mode has had that mode operating for up to 20 minutes already and an opposite call comes in after 20 minutes, the changeover timer will immediately recognize the opposite call, shutting off the current mode, enter the purge mode and automatically switch to the opposite mode.

The longer a call has been running up to 20 minutes, the shorter the wait time will be for an opposite call. If a call is over 20 minutes and an opposite call is made the changeover will be immediate following the purge time. This intelligent changeover timing makes the CMM-3 unique to any other zoning system.

CHECKOUT

The CMM-3 has unique features that simplify the checkout of the system and has LED readouts that constantly indicate the system operation. Once 24 Volt Power is applied to the panel the Green Power LED will illuminate. This will stay illuminated constantly when power is applied.

The System LED will provide several different indications based upon color and if it is flashing.

Heat ON – RED
Heat Overlimit – RED Flashing
Cool ON – GREEN
Cool Overlimit – Green Flashing
FAN ON – AMBER
PURGE – AMBER Flashing

Each zone has its own small Green indicator LED next to each zone relay. This light is lit when the specific zoning is calling for the mode shown on the System LED.

WIRING

The CMM-3 is very simple to wire and requires only a minimum number of connections. The CMM-3 terminal blocks are screw-less and all wires can easily be pushed into their respective terminal by de-pressing the button for each point and releasing once the wire is seated. To remove the wire, just press its button again and remove the wire.

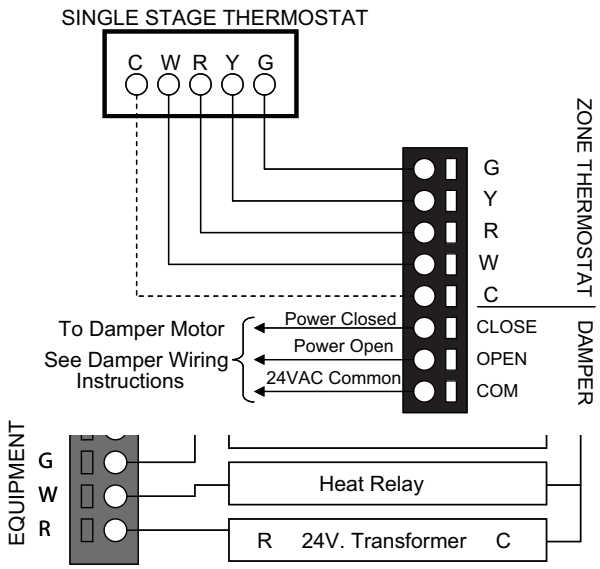
Zone Dampers – The CMM-3 can power any 24VAC damper, either 2 wire or 3 wire. See specific wiring instructions with the damper and inside panel cover.

Zone Thermostats – The thermostats wiring will for single stage can be four or five wire. The fifth wire being the C-Common terminal for 24 Volt powered thermostats. There are 5 terminals on the CMM-3 for each thermostat, marked Y-G-R-W-C. This wiring is shown on Wiring Diagram 1 for single stage thermostats.

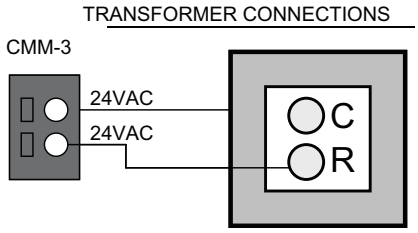
HVAC Equipment – The HVAC equipment will follow Wiring Diagram 2 for Single Stage Systems.

Transformer – A separate 24 Volt AC, 40VA Transformer is recommended to power the control panel and dampers. Often the transformer on the HVAC unit only has enough power for its own controls. Therefore it is recommended a separate transformer be used to power this panel and the dampers wired to it.

WIRING DIAGRAM 1 – Zone Thermostat and Damper



WIRING DIAGRAM 3 – 24 Volt AC, 40 VA Transformer

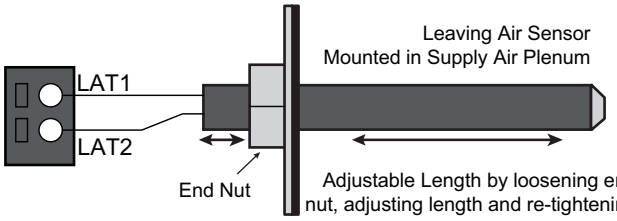


LEAVING AIR SENSOR (CLAS)

The Leaving Air Sensor, Model CLAS, is a remote sensor that is located in the supply air duct to sense the leaving air temperature of the HVAC Unit. The CLAS is a high limit protection for the heating and a low limit protection for the cooling. When zoning, the airflow through the HVAC Unit is critical. The CLAS protects the equipment in low air flow situations as well as when by-pass air is being directed back into the return air duct.

The heating limit is fixed at 180°F. The cooling limit is fixed at 40°F. When the CLAS senses heating above its set point, or cooling below its set point, the CMM3 will drop both stages of heating or cooling. The CLAS must sense a 10°F fall for heating or rise for cooling before re-activating the first stages of heating or cooling. If two stage heating or cooling is being used the second stage timer will start again once the first stage is re-activated.

The CLAS requires 2 wires from the sensor to the LAT terminals on the CMM3 panel. The CLAS probe can also be adjusted for length by loosening the end nut and sliding the probe thru the mounting plate in order for the probe to pass through any duct insulation.



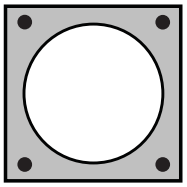
NOTE: If the CLAS is not used, the NO SENSOR jumper located just above the LAT terminals must be on the pins.

TROUBLESHOOTING

The CMM-3 is a very simple control to troubleshoot, especially with the LED indicators. The only other device needed is a simple Volt/Ohm meter.

The first check is for 24VAC Power to the panel. When there is power the Green Power LED will be lit. If not check the transformer and the power supply to it.

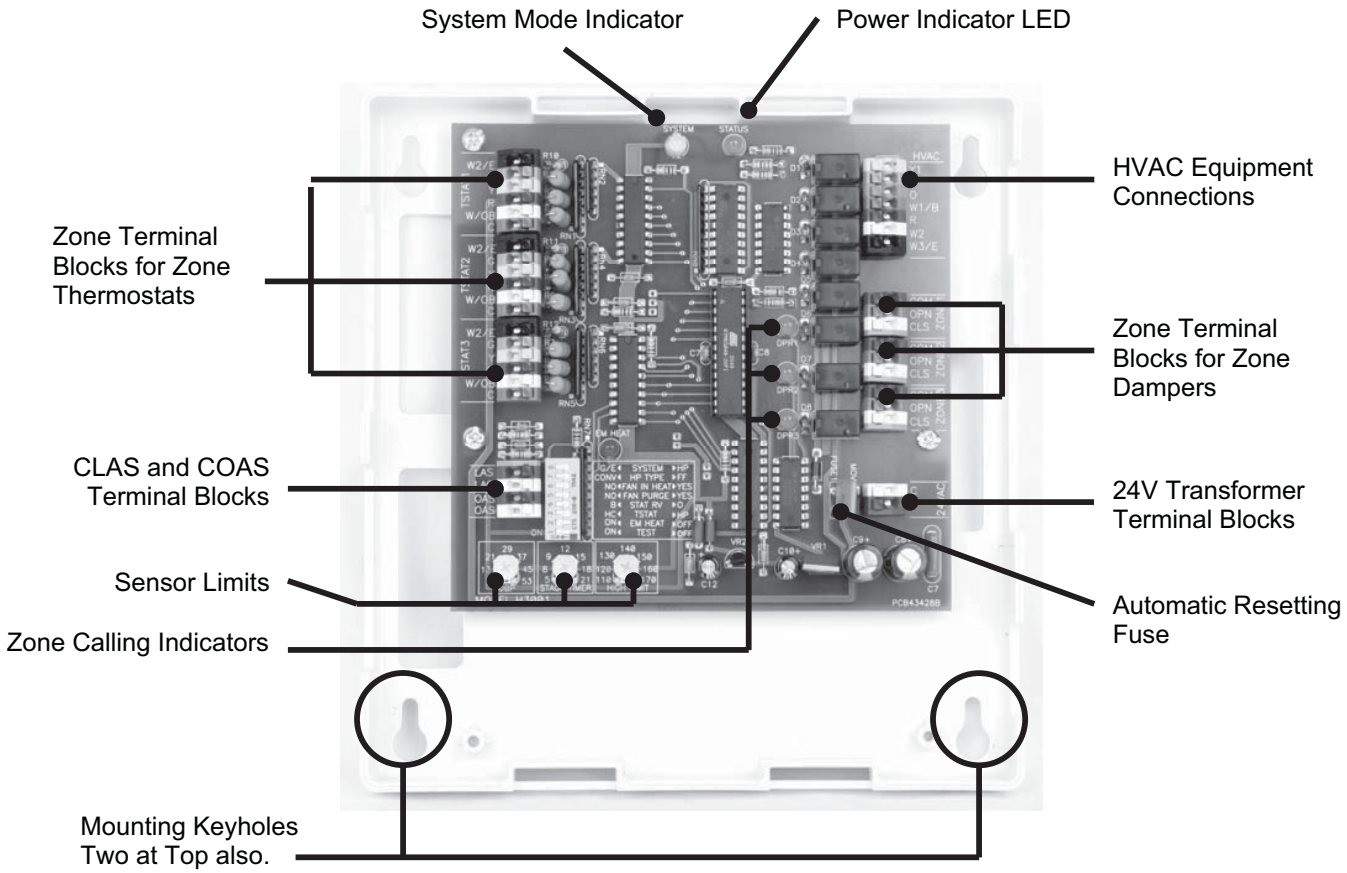
Almost all problems can be traded to an external component or wiring to the CMM-3. While the CMM-3 has been designed to operate under extreme voltage conditions and is fuse protected, like any computer the micro-processor can hang up and not operate properly. For these instances a BOOT button has been installed that re-boots the micro-processor just like your computer. Pressing this button for a few seconds and then release it will allow the micro-processor to re-boot and in most all cases eliminate the problem. If not the following procedure can help isolate the problem.



Zone(s) Not Calling
Each zone has a Green LED next to the zone relay when it is calling. The LED being lit shows that the call is being recognized by the CMM-3. If a zone is supposed to be calling and the Zone LED is not on, check for 24VAC across the thermostat terminal C and the Y, if a Cool call, W if a Heat Call, or G if a Fan call. If there is no voltage here at the panel the panel is not getting the signal from the thermostat. The problem is mis-wiring, a broken wire or a problem in the thermostat. To check the zone on the panel, place jumper from R to Y to simulate a Cool call, R to W to simulate a Heat call, or R to G to simulate a Fan call. By jumpering these terminals the zone call LED will activate.

Zone(s) Will Not Shut Off
If a zone will not stop calling, the Zone LED should still be on. Depending on the call disconnect the Y, W or G wire from the terminal strip. The zone will drop out. Check the thermostat wiring for a mis-wiring or short that keeps the zone calling.

Damper Motor Checkout
To checkout the dampers, the panel provides 24VAC to the COM and OPEN terminal when the damper is to be open and 24VAC to COM and CLOSE when the damper is to be CLOSED. When any zone is calling and its Green LED is ON, there is 24VAC across COM and OPEN. The only time a damper will close is when another zone is calling and its zone is not calling. In this instance there will be 24VAC across COM and CLOSE terminals. Refer to the instructions with each damper for their individual checkout.



INSTALLATION

The CMM-3U Control is a three (3) zone control panel that can be used with conventional single stage, two stage heating and cooling, heat pumps with or without dual fuel and up to three stages of heating. The CMM-3U panel is the central control panel that all zone dampers, zone thermostats, Heat Pump Controls, power transformer, Outdoor Air Sensor and Leaving Air Sensor are wired.

When installing the CMM-3U panel it is important to pick a central location where it is most convenient to bring all the wires. Most often this is at the furnace or air handler. It is often the most convenient location and closest to power, the HVAC unit controls and the zone dampers when typically located at or near the plenum.

The CMM-3U panel case is made of sturdy ABS plastic and can be mounted to any flat surface. It is recommended that the panel be mounted to a wall or return plenum and NOT on the furnace or plenum where it will be in contact with the excessive hot temperatures.. The panel can be located in an attic space or in an enclosed cabinet of a rooftop unit. Insure the panel is not in direct exposure to the elements.

The cover easily removes from the case by pulling firmly and separating the cover from the case exposing the circuit board. There are 4 key-hole mounting points in each corner of the case. The case has openings in the rear of the case as well as the side for all wiring. Wiring can come from the back as well as the side in order to make a neat installation.

OPERATION

The CMM-3U can be controlled by conventional single stage or heat pump thermostats. Each thermostat can then call for heating, cooling or the fan. When a thermostat calls the panel will keep open the damper to the calling zone, if not already open, close the dampers to the zone(s) not calling and activate the appropriate HVAC equipment. When opposite calls exist for both heating and cooling the panel will allow the zones to automatically switch between the modes. When all zones are satisfied the panel then looks for individual fan calls from any zone and controls the dampers based on these calls as well. When all zone thermostats are not calling for heating, cooling or the fan all dampers will return to a normally open position.

Once a call for either heating or cooling is made the panel will open the damper(s) to the zone(s) calling, close the damper(s) to those zones not calling, activate the appropriate controls for heating or cooling, whichever is being called and not accept any calls for the opposite mode.

Any calls for the opposite mode will be locked out until the initial mode is either satisfied or a period of time has elapsed that is sufficient for the first mode to satisfy, a maximum of 20 minutes. A unique sequence determines the time the unit has been running or needs to

continue to run in order to adequately provide conditioning for each mode. If a particular mode has already been calling for 20 minutes or longer and an opposite call comes in the CMM-3U will immediately drop the mode, enter the purge mode in order to dissipate the conditioned air into the zones calling before switching over to provide the new conditioning call to its zones.

When using the CMM-3U to control two stage heating, the second stage is controlled based upon time after the first stage call from the thermostat. When any zone calls the panel's built-in timer begins and after the set period of time elapses the CMM-3U will also activate the W for second stage heating. The Second Stage Timer is adjustable between 2, 4, 8 or 16 minutes after the first stage calls. Once the second stage is on, it will continue to run until the first stage is satisfied.

Once all zone thermostats are satisfied for heating and cooling, the CMM-3U can now accept Fan calls allowing Continuous Air Circulation (CAC) in those zones where the thermostat's Fan Switch is set to ON. These zone dampers will be Open while the dampers to the zones where the Fan Switch is set to AUTO will be CLOSED.

When all zone thermostats are satisfied for both Heating and Cooling, and all Fan switches are set to AUTO position, the HVAC unit will be off and all zone dampers will return to a normally open position. Once a zone calls for heating, cooling or fan, the dampers to the calling zones remain open and the dampers to the zones not calling will close.

SET-UP FOR VARIOUS HVAC EQUIPMENT

The CMM-3U is factory set for conventional heating and cooling operation. The panel only needs to be configured when using with an electric furnace or heat pumps.

Most all of the panel configuration is done by setting the DIP switches in the top right of the panel. Other functions come by wiring for specific applications. Below is shown the most typical settings. Review each function for you application.

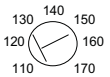
1. **SYSTEM – G/E OR HP** This switch sets the HVAC Output operation. In G/E the Y1 operates as first stage cooling only. In HP position Y1 makes as the compressor call for both heating and cooling.
2. **HP Type – CONV or FF** – This switch is used to determine the equipment output when the System switch is set to HP, this switch determines if the output will be for a conventional heat pump with electric back-up heat or fossil (dual) fuel mode.
3. **FAN IN HEAT – YES or NO** – This switch will activates the Fan on a call for Heat in the Yes position. In Off, the heating unit must activates the fan when the heat is called.
4. **FAN PURGE – YES or NO** – This switch determine if the Fan is kept on during the Purge Mode, after the end of each heat or cool call.
5. **STAT RV – O or B** – When using HP type thermostats this determines if the O or B terminal is wired to the W/OB terminal on each thermostat to determine if the call if for Heat (B) or Cool (O).
6. **TSTAT – HC-HP** Switch determines if conventional Heat/Cool thermostats or Heat Pump thermostats are being used for ALL zones. A conventional HC stat would have separate W and Y output for heating and cooling calls. A HP thermostat uses Y for both a heat and cool call and the O or B is used to determine whether the call is for Cooling (O) or Heating (B).
7. **EM HEAT** – This switch sets any heat call to call for the Emergency Heat. The Red EM HEAT LED on the panel will light only when this switch is ON. This is used when there is no EH switch on the thermostats.
8. **TEST** – This switch accelerates the panel timings in order to provide a quick checkout of all of the functions without having to wait the full time for each sequence.

One of the many features of the DIP switches is if at anytime the equipment is changed from single stage to heat pump or vice versa the thermostats do not need to be changed with the equipment change. Changing the DIP switch settings is all that is needed.

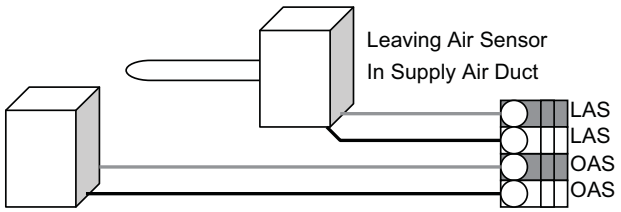
LEAVING AIR SENSOR (CLAS)

The Leaving Air Sensor, Model CLAS, is a remote sensor that is located in the supply air duct to sense the Leaving Air temperature of the HVAC Unit. The LAS is a high limit protection for the heating and a low limit protection for the cooling. When zoning, the airflow through the HVAC Unit is critical. The CLAS protects the equipment in low air flow situations as well as when by-pass air is being directed back into the return air duct.

The heating limit is adjustable from 110°F to 170°F. The cooling limit is fixed at 45°F. When the CLAS senses heating above its set point, or cooling below its set point, the CMM-3U will drop both all stages of heating or cooling. The CLAS must sense a 10°F fall for heating or rise for cooling before re-activating the first stages of heating or cooling. If two stage heating or cooling is being used the second stage timer will start again once the first stage is re-activated.



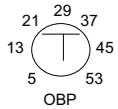
The CLAS requires 2 wires from the sensor to the LAS terminals on the CMM-3U panel.



Outdoor Air Sensor only used with Fossil/Dual Fuel Applications

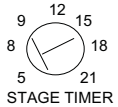
OUTDOOR AIR SENSOR (COAS)

The Outdoor Air Sensor is used only when using a Heat Pump with Dual/Fossil Fuel back-up furnaces. The COAS senses the outdoor air temperature and switches the heating control between the heat pump and the fossil fuel furnace. The temperature set point for this is adjustable on the Outdoor Balance Point (OBP) dial on the control panel. It is adjustable from 5°F to 53°F. It is suggested that this be set just above freezing to avoid the heat pump from potentially going into Defrost mode.



Stage Timer

The CMM-3U has a built-in stage timer that eliminates the need and added cost of using two stage thermostats. On a call for either heating the timer begins. Setting the Stage Timer dial provides a adjustable time delay of 5 to 21 minutes between the first and second stage calls and the same between a second stage and third stage call of heating, if used.



PURGE TIME

The CMM-3U has a built-in Purge Time after each call is satisfied and provides a minimum off time before another call is initiated. The Purge Time is set at 2minutes after all calls for a particular mode are satisfied or when the Changeover Timer requires a changeover due to opposing calls.

After all calls are satisfied or the changeover timer activates, the Purge Timer begins and the heating or cooling, whichever was on, is deactivated. Typically the fan may be running during this time and the damper(s) to the last zone(s) calling will remain open to purge the conditioned air only into those zones that were calling for the conditioning. DIP Switch 4 can be set ON to keep the Fan running during the Purge mode in order to prevent the fan cycling off and back on between modes. In the instance where the Fan staying on may create a draft, and the frequency of opposite calls is minimal this switch can be kept to OFF.

Minimum On Timer

The CMM-3U also has a minimum on time whenever the compressor operates in order to prevent frequent short cycling. Once there is a call for cooling or the compressor on a heat pump, the CMM-3U will hold that call for a period of 2 minutes.

CHANGEOVER TIMER

Whenever a call is made for either heating or cooling, the changeover timer is activated in order to track the amount of time heating or cooling is on. When an opposite call is made after a first call is existing the changeover timer calculates the amount of time the unit has already been supplying the first mode in order to determine how long it will hold off the opposite call. If an opposite call is made shortly after the first call, the opposite call may be held off for as much as 20 minutes. If the first call or subsequent calls for the first call mode has had that mode operating for up to 20 minutes already and an opposite call comes in after 20 minutes, the changeover timer will immediately recognize the opposite call, shutting off the current mode, enter the purge mode and automatically switch to the opposite mode.

The longer a call has been running up to 20 minutes, the shorter the wait time will be for an opposite call. If a call is over 20 minutes and an opposite call is made the changeover will be immediate following the purge time. This intelligent changeover timing makes the CMM-3U unique to any other zoning system.

CHECKOUT

The CMM-3U has unique features that simplify the checkout of the system and has LED readouts that constantly indicate the system operation. Once 24 Volt Power is applied to the panel the Green Power LED will illuminate.

This will stay illuminated constantly when power is applied. The System LED will provide several different indications based upon color and if it is flashing.

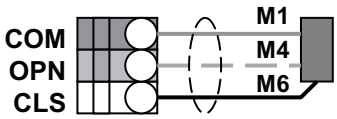
Heat ON – RED
Heat Limit – RED
Flashing Cool ON - GREEN
Cool Limit - GREEN Flashing
FAN ON - AMBER
PURGE - AMBER Flashing

Each zone has its own small Green indicator LED next to each zone relay. This light is lit when the specific zoning is calling for the mode shown on the System LED.

WIRING

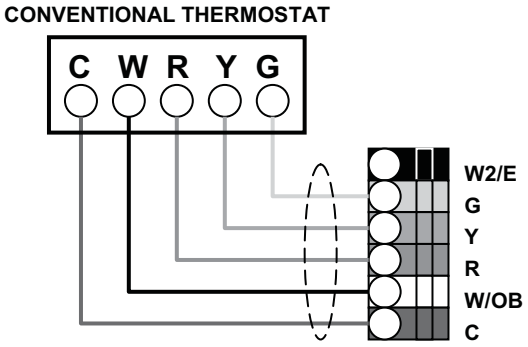
The CMM-3U is very simple to wire and requires only a minimum number of connections. The CMM-3U terminal blocks are color coded and screw-less for all wires to be easily pushed into their respective terminal by de-pressing the button for each point and releasing once the wire is seated. (Solid wire can often just be pushed into the terminal without de-pressing the button.) To remove the wire, just press its button again and remove the wire.

Zone Dampers – The CMM-3U can power any 24VAC damper, either 2 wire or 3 wire. See specific wiring instructions with the damper or inside panel cover. The three damper motor contacts are for 24VAC power are COM (Common), OPN (Open) and CLS (Closed). Two wire, spring return, normally open dampers use only COM and CLS terminals.

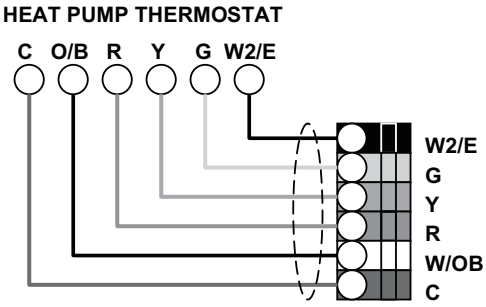


Zone Thermostats – The thermostats wiring will be for Conventional single stage (Y-G-R-W-C) or Heat Pump (Y-G-R-E-C and O or B). See Wiring Diagram 1and 2 each type of thermostat.

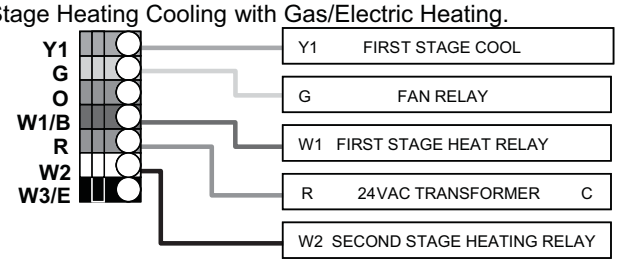
WIRING DIAGRAM 1 – Conventional Thermostats



WIRING DIAGRAM 2 – Heat Pump Thermostat

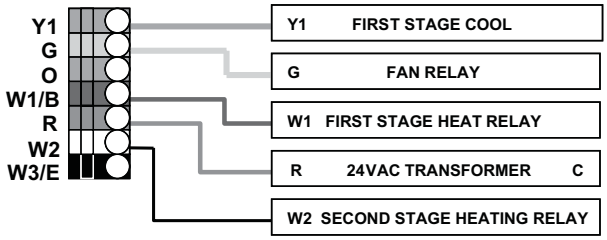


WIRING DIAGRAM 3 - HVAC Equipment – Single Stage Heating Cooling with Gas/Electric Heating.

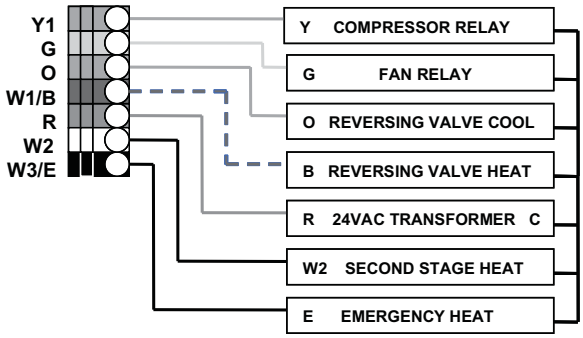


TECHNICAL HELP

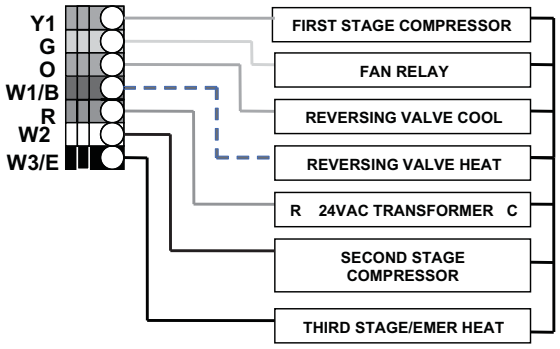
WIRING DIAGRAM 4 - HVAC Equipment – Conventional Two Stage Heating and Single Stage Cooling



WIRING DIAGRAM 5 - Single Speed Compressor Heat Pump



WIRING DIAGRAM 6 - Two Speed Compressor Heat Pump



TROUBLESHOOTING

The CMM-3U is a very simple control to troubleshoot, especially with the LED indicators. The only other device needed is a simple Volt/Ohm meter. Almost all problems can be traced to an external component or wiring to the CMM-3U. The following procedures can help isolate the problem.

Zone(s) Not Calling

Each zone has a Green LED next to the zone relay when it is calling and that calling is being recognized by the CMM-3U. If a zone is supposed to be calling and the Zone LED is not on, check for 24VAC across the thermostat terminal C and the Y, if a Cool call, W if a Heat Call, or G if a Fan call. If there is no voltage here at the panel the panel is not getting the signal from the thermostat. The problem is mis-wiring, a broken wire or a problem in the thermostat. To check the zone on the panel, place jumper from R to Y, R to W or R to G to see that the panel is operating properly.

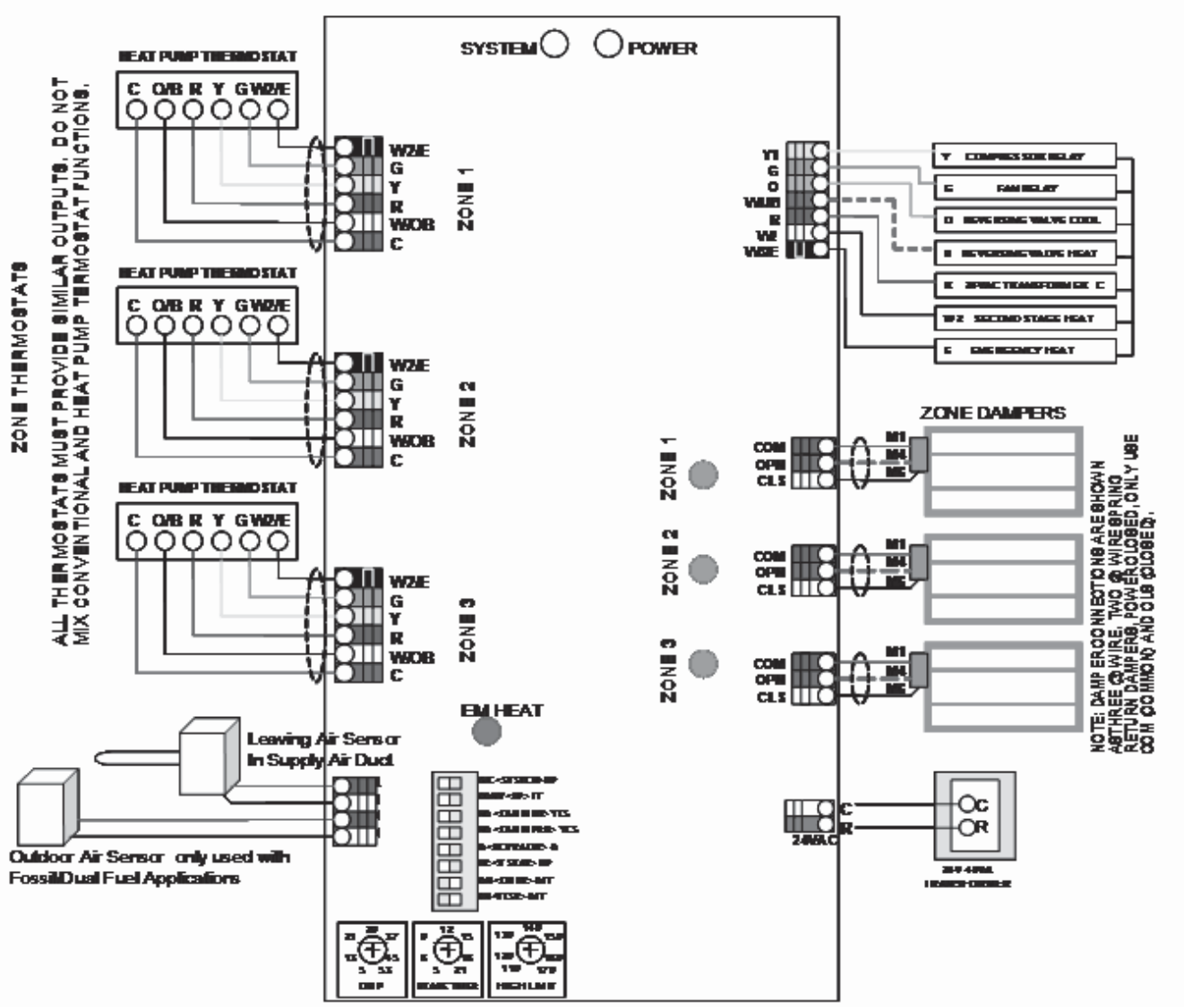
Zone(s) Will Not Shut Off

If a zone will not stop calling, the Zone LED should still be on. Depending on the call disconnect the Y, W or G wire from the terminal strip. The zone will drop out. Check the thermostat wiring for a mis-wiring or short that keeps the zone calling.

Damper Motor Checkout

To checkout the dampers, the panel provides 24VAC to the COM and OPEN when the damper is to be open and 24VAC to COM and CLOSE when the damper is to be CLOSED. When any zone is calling and its Green LED is ON, there is 24VAC across COM and OPEN. The only time a damper will close is when anther zone is calling and its zone is not calling. In this instance there will be 24VAC across COM and CLOSE.

CMM-3U WIRING DIAGRAM



CSPRD STATIC PRESSURE REGULATING DAMPER

White Rodgers

BAROMETRIC RELIEF DAMPERS

The Static Pressure Regulating Dampers, Model CSPRD, are barometric relief dampers used to by-pass excess air pressure on zoned systems. The CSPRDs automatically respond to the air pressure in duct as the various zone dampers open and close.

As zone dampers close off air to a number of zones, the supply air pressure in the duct system will increase. This increase in air pressure can increase the noise level and reduce the flow of conditioned air through the HVAC Unit. Using the CSPRD solves this by automatically compensating for the excess air pressure by opening on the increased pressure and relieving the excess air. The CSPRD helps maintain a constant air pressure in the duct system. This reduces noise that is caused by high air pressures and velocities, as well as maintains a constant volume of air (CFM) through the duct system. Maintaining a constant volume of air through the HVAC System keeps the efficiency of the system at its maximum.

CALCULATING BY-PASS AIR REQUIREMENTS

Determining the need for by-pass air and the size of the SPRD required is very simple. It can be very simply calculated by knowing the total CFM capacity of the HVAC unit (T_{CFM}) and subtracting the CFM capacity of the smallest zone (S_{CFM}) will equal the CFM of air required to be by-passed (B_{CFM}).

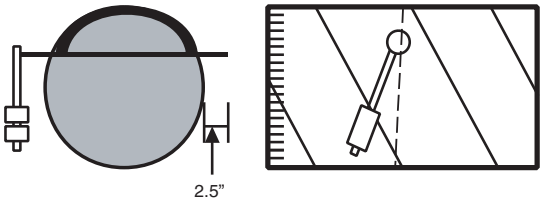
T_{CFM}	-	S_{CFM}	=	B_{CFM}
Total CFM		Smallest Zone CFM		By-Pass CFM

Once the by-pass amount of air is known, use the chart above to select an appropriately sized by-pass damper. It is always recommended to have a larger size by-pass than having one that is too small. It is much easier to reduce by-pass air through the damper or close it off than having to increase the size of the by-pass duct and/or damper.

LOCATION

Selecting a location to place the SPRD is very important for overall system operation. Ideally the best place for the SPRD is as far away from the air handler as possible and before any zone dampers. In an extended plenum application where zones come off the side of the main trunk, the end of the extended plenum is the ideal situation.

In most residential applications however the zone dampers are right at the plenum of the air handler. In this application the only location for the CSPRD is at the plenum. In this application, especially when the CSPRD is ducted to the return, it is recommended that a freeze protection, Model AFC, be used as well as the supply air sensors with the zoning panel to protect the equipment from overheating or cooling due to the return by-pass.

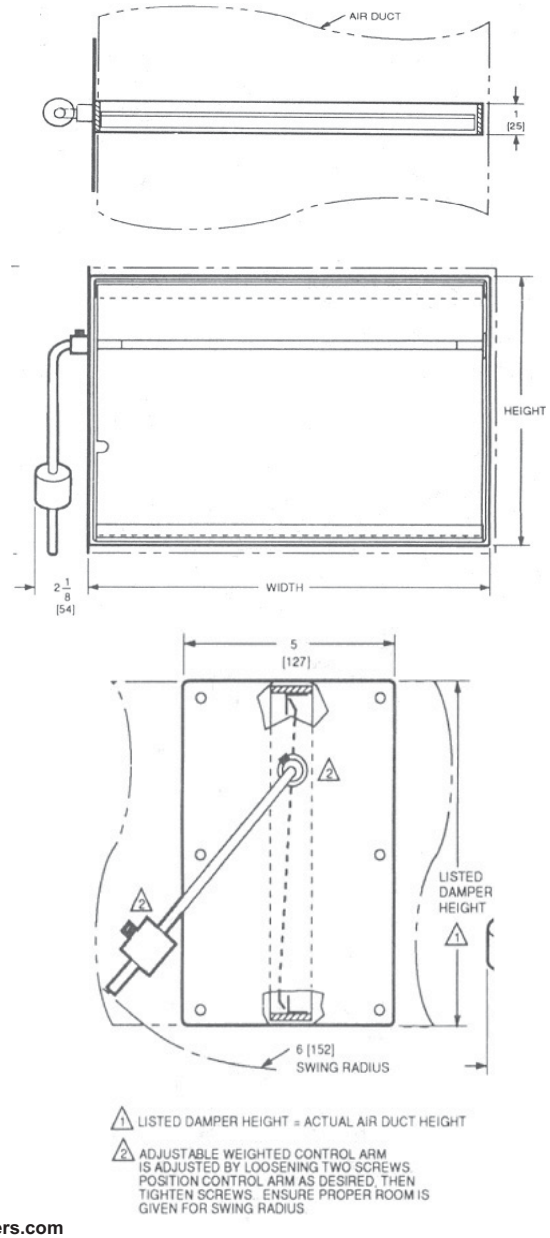


Most CSPRD installations are typically in horizontal ducts where the CSPRD control blade will close vertically. The CSPRD can also be installed in vertical ducts as well, however the counter balanced, weighted arm must be adjusted to offset the weight of the blade. See installation instructions for further information on this application.

The CSPRD has a weighted control arm that counter balances the weight of the damper blade. The weight adds pressure to the blade to control the amount of air by-passed. The weight can be adjusted up or down on the arm depending upon the amount of air to be by-passed.

In addition to the adjustment of the weight the arm can also be moved in order to add leverage for the weight to push against the blade to add more resistance.

To adjust the CSPRD, first all zones dampers must be open and the fan operating. When all dampers are open the CSPRD should be closed. In some instances the damper may be open slightly, especially when the CSPRD is installed as a true by-pass between the supply and return ducts. This occurs frequently when the damper is closest to the plenum.



SINGLE BLADE, ROUND, SPRING RETURN DAMPERS

The CRDS series are galvanized steel, single blade dampers compete with a 24 Volt, spring return motor actuator. These dampers are shipped complete and ready for installation. The CRDS can be installed in any position in any properly sized duct. All CRDS dampers are rated for duct systems less than 1.0" W.C.

All CRDS dampers are typically shipped as Normally Open dampers that are powered closed and spring returned opened. The CRDS is also unique in that it can be field converted from powered closed to powered open in less than a couple of minutes.

A 24 Volt AC, 50/60 Hz, spring return damper motor, powers the CRDS. The motor powers the damper closed and spring returns the damper open for fail-safe operation. Providing power to the damper drives the damper closed. Removing power from the motor allows the motor to spring back to the open position.

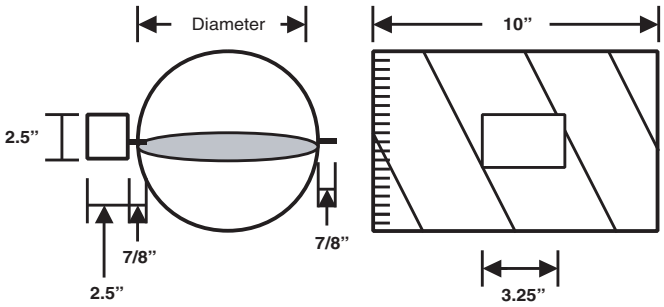
The 24 Volt, hysteresis, synchronous motor has been tested to over 250,000 cycles to provide long life. Even replacing the motor is a simple less than one (1) minute change by loosening the setscrew holding the motor onto the damper.

The CRDS motor also has a simple adjustment for setting the damper to a minimum position. A minimum position allows for excess by-pass air. To set a minimum position, loosen the setscrew, align the setscrew to the minimum position label and re-tighten.

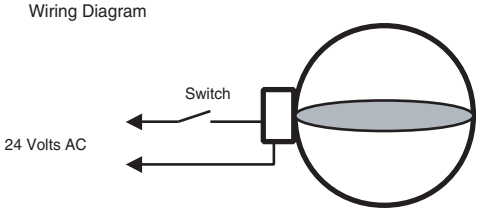
Minimum Position Adjustment

The minimum position screw can also be used to determine the damper position. The setscrew is aligned with the position of the damper blades. When the setscrew is in line with the duct, pointed at the Closed on the minimum position label, the damper is actually open. When it is hidden behind the motor and stopped against the anti-rotation post on the motor, it is Closed or at the minimum position.

Dimensional Drawing



Wiring Diagram



Damper Dimensions and Weights

Diameter		Length		Weight	
Inches	MM	Inches	MM	Lbs.	Kg
5"	127	10"	254	4lbs.	1.82
6"	152	10"	254	4lbs.	1.82
7"	179	10"	254	5lbs.	2.26
8"	203	10"	254	5lbs	2.26
9"	238	10"	254	7lbs.	3.18
10"	254	10"	292	7lbs.	3.18
12"	305	10"	336	9lbs.	4.08
14"	356	10"	394	12lbs.	5.44
16"	406	10"	451	15lbs.	6.80
18"	457	10"	482	19lbs.	9.09

Damper Specifications

Linkage – Direct Drive
Motor Voltage – 24 Volts AC, 50 / 60 Hz, 6.5 Watts, 7VA
Torque – 35in-oz to 55in-oz
Duct Pressure – Maximum 1.0" W.C.