CE Mid-Atlantic

"Dedicated to Earning Your Business"

LIGHT COMMERCIAL ROOFTOPS & SPLIT SYSTEMS FALL 2021

CE comfort | excellence

Class Agenda Part 1

- Light commercial equipment review
- Understanding Carrier Nomenclature
- Board Troubleshooting Central Terminal Board, Defrost Board, Ignition Gas Control Board

comfort | excellence

Carrier Model Numbers

- 48 Series GAS RTU
- 50 Series Electric Electric, or Heat Pump
  - 48/50 KC Up to 14.1 seer 3 to 5 Tons
  - 48/50 TC Up to 13 seer 3 to 27.5 Tons
  - 48/50 FC Up to 14 seer 3 to 6 ton
  - 48/50 GC Up to 16 seer 3 to 5 ton
  - 48/50 HC Up to 15.6 seer 3 to 25 Tons
  - 48/50 LC Ultra High Efficiency Up to 17.5 seer 3 to 23 Tons
  - 48/50 JC Variable speed high efficiency Up to 20.0 seer
  - Heat Pumps have the Q designation (50 TCQ, KCQ)

comfort | excellence

48/50 KC

- Single-stage cooling capacity control
- Up to 14.1 SEER and 12.0 EER
- Gas efficiencies up to 82%
- Cooling operating range up to 115 °F (46°C) and down to 25°F (-4°C) using winter start kit
- Innovative non-corrosive composite condensate pan in accordance with ASHRAE 62 Standard, sloping design side or center drain
- Exclusive IGC solid-state control for on-board diagnostics with LED error code designation, burner control logic and energy saving indoor fan motor delay
- Pre-painted exterior panels and primer-coated interior panels tested to 500 hours salt spray protection

comfort | excellence

48/50 KC

- Scroll compressors with internal line-break overload protection
- 24-volt control circuit protected with resettable circuit breaker
- Permanently lubricated evaporator-fan motor
- Totally enclosed condenser motors with permanently lubricated bearings
- Low pressure and high-pressure switch protection
- Exclusive IGC anti-cycle protection for gas heat operation
- Solid-state electronic direct spark ignition system and flame roll-out safety protector

48/50 TC

- Up to 13.0 SEER, 11.8 IEER, and 11.1 EER
- Gas efficiencies up to 82%
- Cooling operating range up to 115 °F (46°C) and down to 25°F (-4°C) using winter start kit
- Innovative non-corrosive composite condensate pan in accordance with ASHRAE 62 Standard, sloping design; side or center drain
- Exclusive IGC solid-state control for on-board diagnostics with LED error code designation, burner control logic and energy saving indoor fan motor delay
- Pre-painted exterior panels and primer-coated interior panels tested to 500 hours salt spray protection

48/50 FC GC JC

ecoblue™ technology

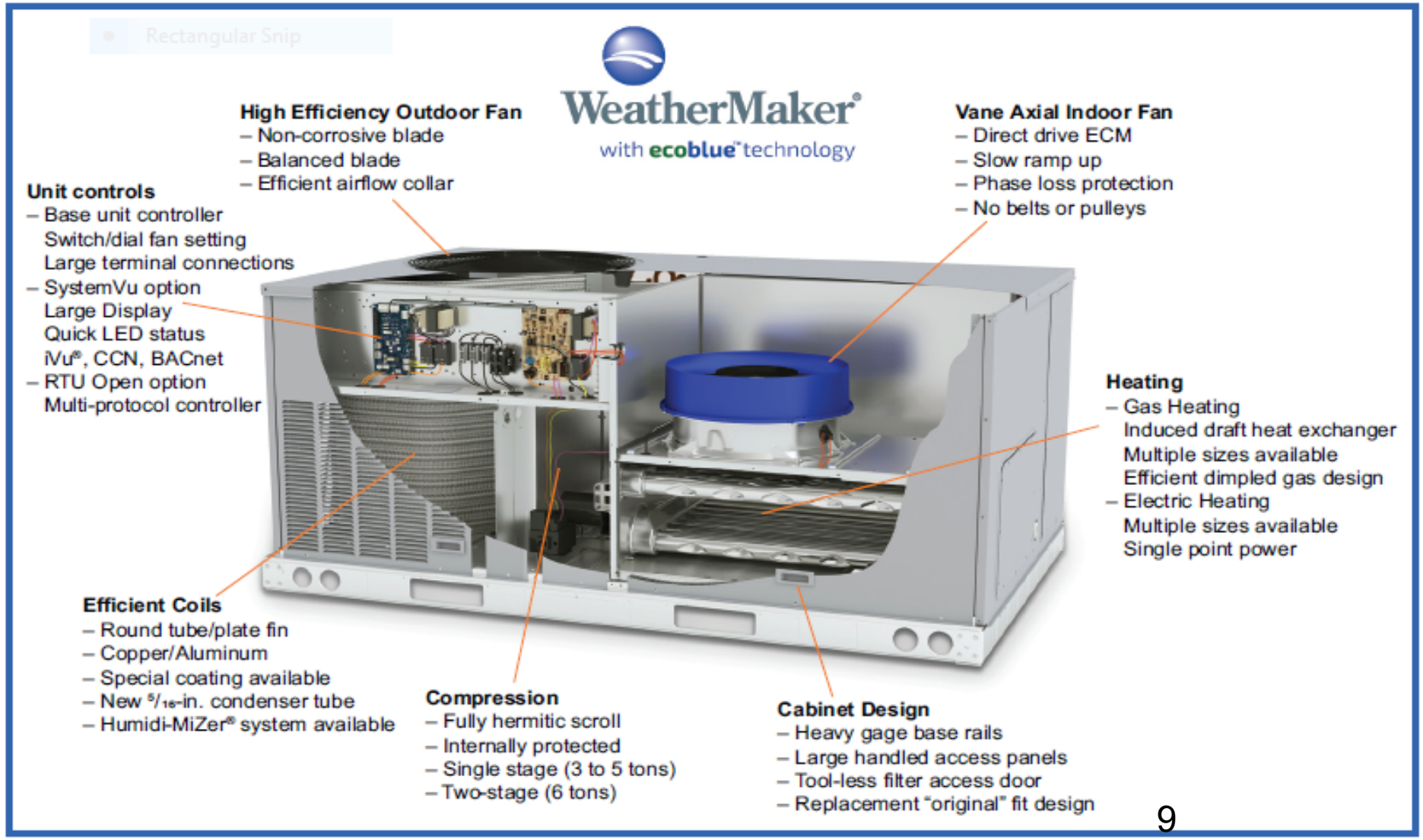
comfort | excellence

48/50 FC

- New unit control board with intuitive quick fan speed adjustment
- New direct drive - EcoBlue™ Technology indoor fan system uses Vane Axial fan design & electronically commutated motor
- Single-stage cooling capacity 04-06 models, two-stage on 07 models
- SEERs up to 14.0, IEER of 15.0
- Gas efficiencies up to 82%
- Cooling operating range up to 115 °F (46°C) and down to 40°F (4°C) using winter start kit
- Innovative corrosive-resistant composite condensate pan in accordance with ASHRAE 62 Standard, sloping design; side or center drain
- Exclusive IGC solid-state control for on-board diagnostics with LED error code designation and burner control logic
- Pre-painted exterior panels and primer-coated interior panels tested to 500 hours salt spray protection

comfort | excellence

48/50 FC



comfort | excellence

48/50 GC

•New unit control board with intuitive, quick fan speed adjustment
•NEW Direct Drive – EcoBlue™ Technology Indoor fan system uses Vane Axial fan design and electronically commutated motor with beltless design
•Two-stage cooling capacity control on all models
•SEER to 16.0
•Gas efficiencies up to 82%
•Cooling operating range up to 125 °F (52°C) and down to 35°F (2°C)
•Innovative corrosive-resistant composite condensate pan in accordance with ASHRAE 62 Standard, sloping design; side or center drain
•Exclusive IGC solid-state control for on-board diagnostics with LED error code designation, burner control logic and energy saving indoor fan motor delay
•Pre-painted exterior panels and primer-coated interior panels tested to 500 hours salt spray protection

comfort | excellence

48/50 JC

- New unit control board with intuitive, quick fan speed adjustment
- NEW Direct Drive – EcoBlue™ Technology Indoor fan system uses Vane Axial fan design and electronically commutated motor with beltless design
- Two-stage cooling capacity control on all models
- SEER to 20.0
- Gas efficiencies up to 82%
- Cooling operating range up to 125 °F (52°C) and down to 35°F (2°C)
- Innovative corrosive-resistant composite condensate pan in accordance with ASHRAE 62 Standard, sloping design; side or center drain
- Exclusive IGC solid-state control for on-board diagnostics with LED error code designation, burner control logic and energy saving indoor fan motor delay
- Pre-painted exterior panels and primer-coated interior panels tested to 500 hours salt spray protection

48/50 JC

- Variable speed scroll compressors with internal line-break overload protection
- 24-volt control circuit protected with resettable circuit breaker
- Permanently lubricated variable speed direct-drive ECM evaporator-fan motor
- Totally enclosed variable speed condenser motor with permanently lubricated bearings
- Low pressure and high-pressure switch protection
- Exclusive IGC anti-cycle protection for gas heat operation
- Solid-state electronic direct spark ignition system and flame roll-out safety protector

48/50 JC

Standard SystemVu™ Controls

- Large full text display – multi line display
- USB flash port for data transfer
- Built in i-Vu®, CCN and BACnet®
- Refrigerant pressure from display
- Quick LED Status – Run, Alert, Fault
- Conventional stat or sensor capabilities
- Historical component runtime and starts
- Supply air tempering
- Equipment / System Touch compatibility
- Demand limiting and ZS sensor compatibility
- Supports linkage on zoning systems using CNN, VVT and i-Vu® Open VVT controls

comfort | excellence

48/50 JC

Model Numbers

MODEL NUMBER NOMENCLATURE

Position:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Example:	5	0	H	C	-	D	0	8	A	3	A	5	-	0	A	0	A	0

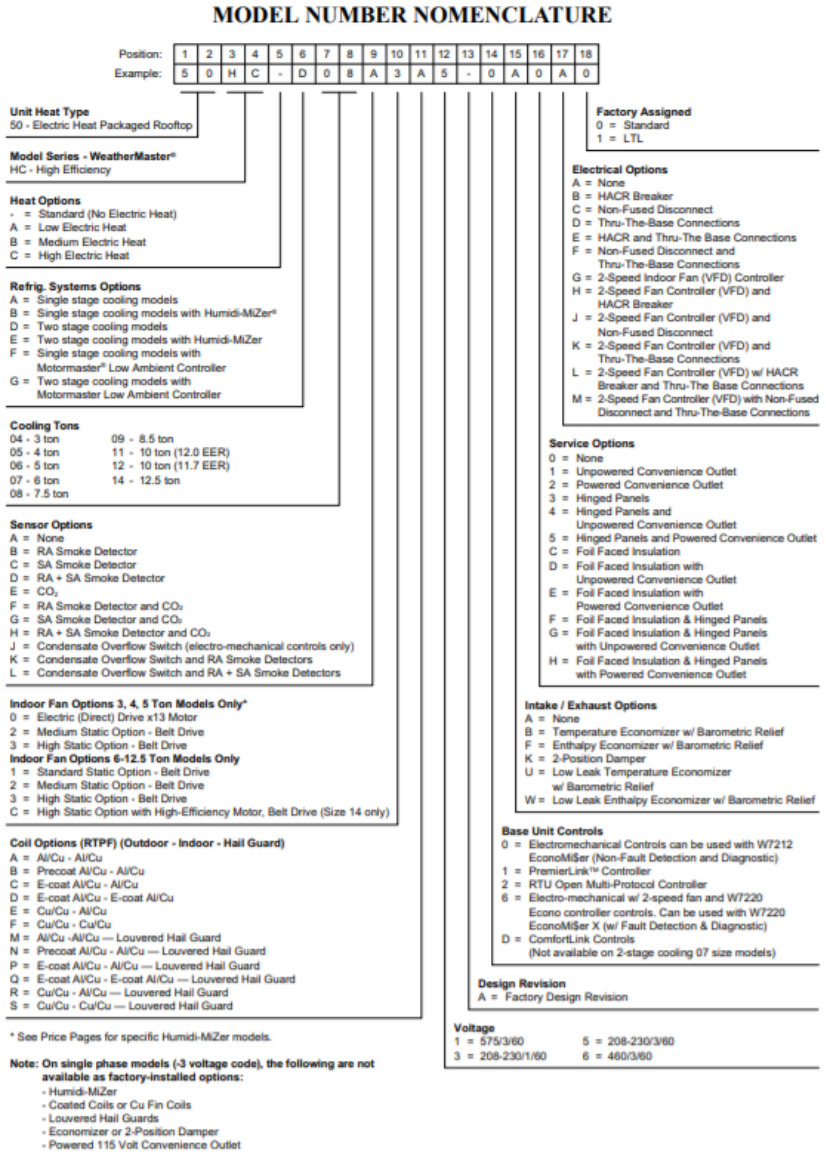
comfort | excellence

COOLING CAPACITY DESIGNATION

04	3 ton
05	4 ton
06	5 ton
07	6 ton
08	7 1/2 ton
09	8 1/2 ton
12	10 ton
14	12 1/2 ton
15	12 1/2 ton
16	15 ton
17	15 ton
20	18 ton
24	20 ton
25	20 ton
28	25 ton

comfort | excellence

Why Tech Support Requires Model Number



MODEL NUMBER NOMENCLATURE

Position:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Example:	5	0	H	C	-	D	0	8	A	3	A	5	-	0	A	0	A	0

Unit Heat Type
50 - Electric Heat Packaged Rooftop

Model Series - WeatherMaster®
HC - High Efficiency

Heat Options
- = Standard (No Electric Heat)
A = Low Electric Heat
B = Medium Electric Heat
C = High Electric Heat

Refrig. Systems Options
A = Single stage cooling models
B = Single stage cooling models with Humidi-MiZer®
D = Two stage cooling models
E = Two stage cooling models with Humidi-MiZer
F = Single stage cooling models with Motormaster® Low Ambient Controller
G = Two stage cooling models with Motormaster Low Ambient Controller

Cooling Tons
04 - 3 ton
05 - 4 ton
06 - 5 ton
07 - 6 ton
08 - 7.5 ton
09 - 8.5 ton
11 - 10 ton (12.0 EER)
12 - 10 ton (11.7 EER)
14 - 12.5 ton

Sensor Options
A = None
B = RA Smoke Detector
C = SA Smoke Detector
D = RA + SA Smoke Detector
E = CO_2
F = RA Smoke Detector and CO_2
G = SA Smoke Detector and CO_2
H = RA + SA Smoke Detector and CO_2
J = Condensate Overflow Switch (electro-mechanical controls only)
K = Condensate Overflow Switch and RA Smoke Detectors
L = Condensate Overflow Switch and RA + SA Smoke Detectors

Indoor Fan Options 3, 4, 5 Ton Models Only*
0 = Electric (Direct) Drive x13 Motor
2 = Medium Static Option - Belt Drive
3 = High Static Option - Belt Drive
Indoor Fan Options 6-12.5 Ton Models Only
1 = Standard Static Option - Belt Drive
2 = Medium Static Option - Belt Drive
3 = High Static Option - Belt Drive
C = High Static Option with High-Efficiency Motor, Belt Drive (Size 14 only)

Coil Options (RTPF) (Outdoor - Indoor - Hail Guard)
A = Al/Cu - Al/Cu
B = Precoat Al/Cu - Al/Cu
C = E-coat Al/Cu - Al/Cu
D = E-coat Al/Cu - E-coat Al/Cu
E = Cu/Cu - Al/Cu
F = Cu/Cu - Cu/Cu
M = Al/Cu -Al/Cu — Louvered Hail Guard
N = Precoat Al/Cu - Al/Cu — Louvered Hail Guard
P = E-coat Al/Cu - Al/Cu — Louvered Hail Guard
Q = E-coat Al/Cu - E-coat Al/Cu — Louvered Hail Guard
R = Cu/Cu - Al/Cu — Louvered Hail Guard
S = Cu/Cu - Cu/Cu — Louvered Hail Guard

* See Price Pages for specific Humidi-MiZer models.

Note: On single phase models (-3 voltage code), the following are not available as factory-installed options:
- Humidi-MiZer
- Coated Coils or Cu Fin Coils
- Louvered Hail Guards
- Economizer or 2-Position Damper
- Powered 115 Volt Convenience Outlet

Voltage
1 = 575/3/60
3 = 208-230/1/60
5 = 208-230/3/60
6 = 460/3/60

Design Revision
A = Factory Design Revision

Base Unit Controls
0 = Electromechanical Controls can be used with W7212 EconoMiSer (Non-Fault Detection and Diagnostic)
1 = PremierLink™ Controller
2 = RTU Open Multi-Protocol Controller
6 = Electro-mechanical w/ 2-speed fan and W7220 Econo controller controls. Can be used with W7220 EconoMiSer X (w/ Fault Detection & Diagnostic)
D = ComfortLink Controls (Not available on 2-stage cooling 07 size models)

Intake / Exhaust Options
A = None
B = Temperature Economizer w/ Barometric Relief
F = Enthalpy Economizer w/ Barometric Relief
K = 2-Position Damper
U = Low Leak Temperature Economizer w/ Barometric Relief
W = Low Leak Enthalpy Economizer w/ Barometric Relief

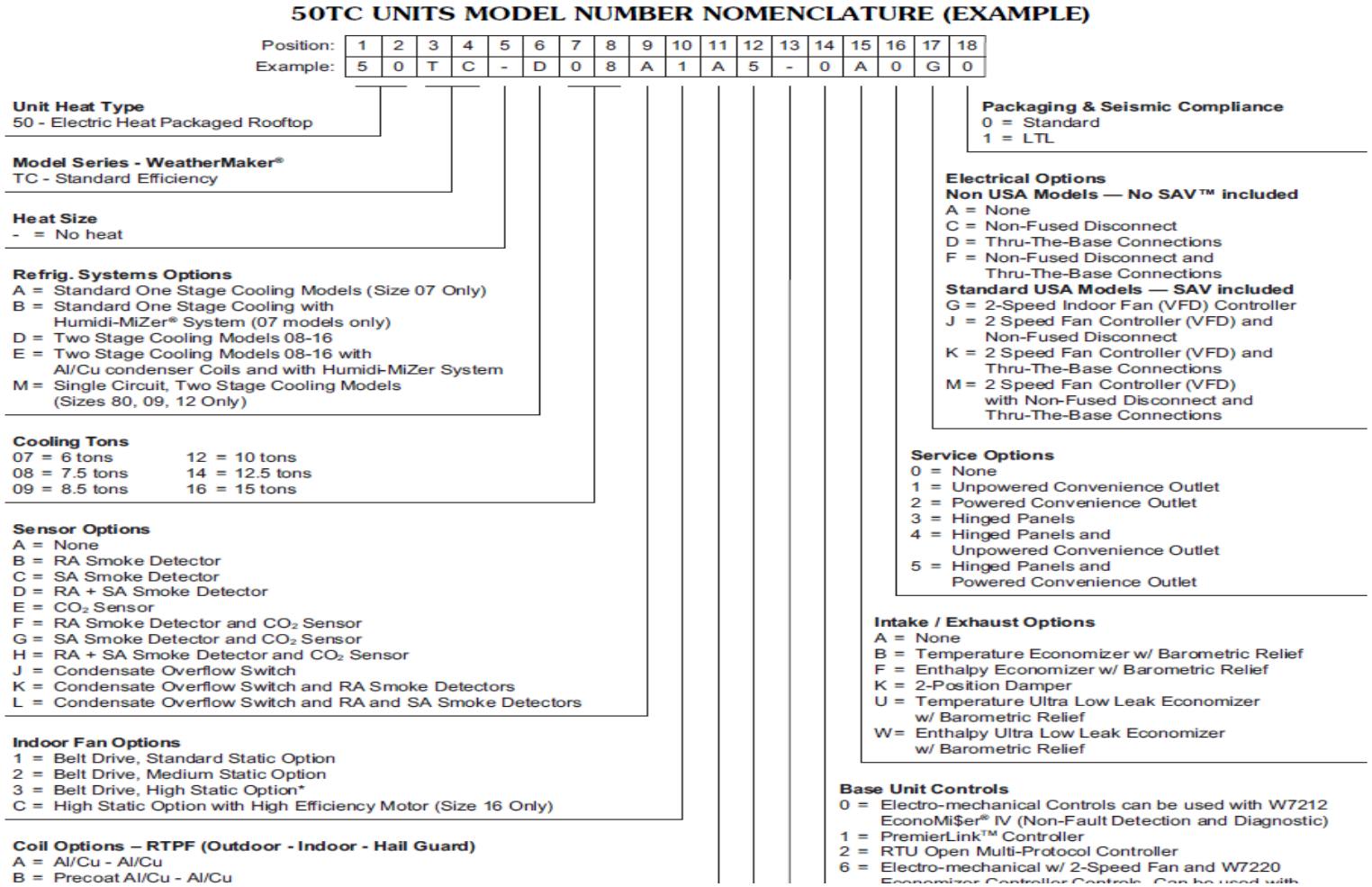
Service Options
0 = None
1 = Unpowered Convenience Outlet
2 = Powered Convenience Outlet
3 = Hinged Panels
4 = Hinged Panels and Unpowered Convenience Outlet
5 = Hinged Panels and Powered Convenience Outlet
C = Foil Faced Insulation
D = Foil Faced Insulation with Unpowered Convenience Outlet
E = Foil Faced Insulation with Powered Convenience Outlet
F = Foil Faced Insulation & Hinged Panels
G = Foil Faced Insulation & Hinged Panels with Unpowered Convenience Outlet
H = Foil Faced Insulation & Hinged Panels with Powered Convenience Outlet

Electrical Options
A = None
B = HACR Breaker
C = Non-Fused Disconnect
D = Thru-The-Base Connections
E = HACR and Thru-The Base Connections
F = Non-Fused Disconnect and Thru-The-Base Connections
G = 2-Speed Indoor Fan (VFD) Controller
H = 2-Speed Fan Controller (VFD) and HACR Breaker
J = 2-Speed Fan Controller (VFD) and Non-Fused Disconnect
K = 2-Speed Fan Controller (VFD) and Thru-The-Base Connections
L = 2-Speed Fan Controller (VFD) w/ HACR Breaker and Thru-The Base Connections
M = 2-Speed Fan Controller (VFD) with Non-Fused Disconnect and Thru-The-Base Connections

Factory Assigned
0 = Standard
1 = LTL

comfort | excellence

Model Number Nomenclature



Model Number Nomenclature

Position:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Example:	5	0	T	C	-	A	0	8	A	1	A	5	-	0	A	0	A	0

1 & 2 Unit Heat Type

3 & 4 Model Series

5 Heat Size/Type

6 Refrigeration Systems Options

7 & 8 Cooling Tons

9 Sensor Options

10 Indoor Fan Options

11 Coil Options w/ RTPF (Outdoor – Indoor – Hail Guard)

14 Coil Options – Novation (Outdoor – Indoor – Hail Guard)

G – Al/Al – Al/Cu
H – Al/Al –Cu/Cu
J – Al/Al – E-coat Al/Cu
K – E-coat Al/Al –Al/Cu
L – E-coat Al/Al –E-coat Al/Cu
T – Al/Al – Al/Cu – Louvered Hail Guard
U – Al/Al –Cu/Cu – Louvered Hail Guard
V – Al/Al – E-coat Al/Cu – Louvered Hail Guard
W – E-coat Al/Al –Al/Cu – Louvered Hail Guard
X – E-coat Al/Al –E-coat Al/Cu – Louvered Hail Guard

15 Intake / Exhaust Options

14 Base Unit Controls

13 Design Revision

12 Voltage

Break Down of 18 Digit Model

MODEL NUMBER NOMENCLATURE

Position:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Example:	5	0	H	C	-	D	0	8	A	3	A	5	-	0	A	0	A	0

Unit Heat Type
50 - Electric Heat Packaged Rooftop

Model Series - WeatherMaster®
HC - High Efficiency

Heat Options
- = Standard (No Electric Heat)
A = Low Electric Heat
B = Medium Electric Heat
C = High Electric Heat

Refrig. Systems Options
A = Single stage cooling models
B = Single stage cooling models with Humidi-MiZer®
D = Two stage cooling models
E = Two stage cooling models with Humidi-MiZer
F = Single stage cooling models with Motormaster® Low Ambient Controller
G = Two stage cooling models with Motormaster Low Ambient Controller

Cooling Tons

04 - 3 ton	09 - 8.5 ton
05 - 4 ton	11 - 10 ton (12.0 EER)
06 - 5 ton	12 - 10 ton (11.7 EER)
07 - 6 ton	14 - 12.5 ton
08 - 7.5 ton	

Sensor Options
A = None
B = RA Smoke Detector
C = SA Smoke Detector
D = RA + SA Smoke Detector
E = CO_2
F = RA Smoke Detector and CO_2
G = SA Smoke Detector and CO_2
H = RA + SA Smoke Detector and CO_2
J = Condensate Overflow Switch (electro-mechanical controls only)
K = Condensate Overflow Switch and RA Smoke Detectors
L = Condensate Overflow Switch and RA + SA Smoke Detectors

Factory Assigned
0 = Standard
1 = LTL

Electrical Options
A = None
B = HACR Breaker
C = Non-Fused Disconnect
D = Thru-The-Base Connections
E = HACR and Thru-The Base Connections
F = Non-Fused Disconnect and Thru-The-Base Connections
G = 2-Speed Indoor Fan (VFD) Controller
H = 2-Speed Fan Controller (VFD) and HACR Breaker
J = 2-Speed Fan Controller (VFD) and Non-Fused Disconnect
K = 2-Speed Fan Controller (VFD) and Thru-The-Base Connections
L = 2-Speed Fan Controller (VFD) w/ HACR Breaker and Thru-The Base Connections
M = 2-Speed Fan Controller (VFD) with Non-Fused Disconnect and Thru-The-Base Connections

Service Options
0 = None
1 = Unpowered Convenience Outlet
2 = Powered Convenience Outlet
3 = Hinged Panels
4 = Hinged Panels and Unpowered Convenience Outlet
5 = Hinged Panels and Powered Convenience Outlet
C = Foil Faced Insulation
D = Foil Faced Insulation with Unpowered Convenience Outlet
E = Foil Faced Insulation with Powered Convenience Outlet
F = Foil Faced Insulation & Hinged Panels
G = Foil Faced Insulation & Hinged Panels with Unpowered Convenience Outlet
H = Foil Faced Insulation & Hinged Panels with Powered Convenience Outlet

Serial Number Breakdown

1418PXXXXX

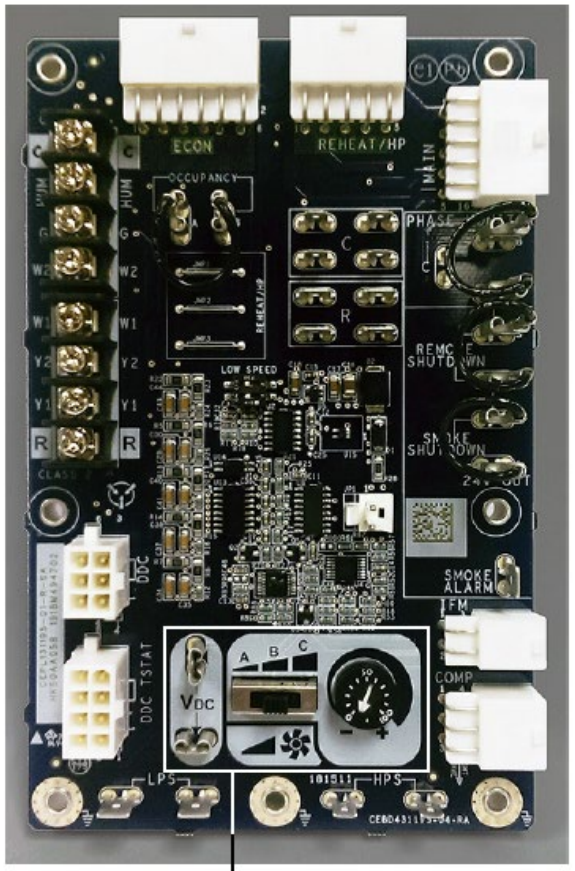
The first 4 numbers indicate the week and year the unit was built

comfort | excellence

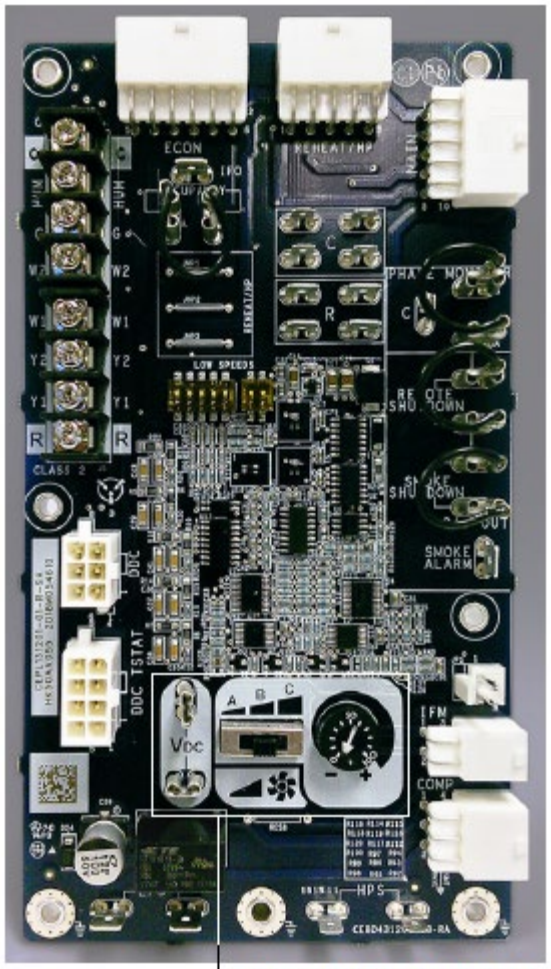
Common Parts

- CTB Central Terminal Board
- UCB Board
- Defrost Board
- IGC Ignition Board
- Hall Effect Sensors
- Axial Fan

UCB Board 48/50 FC GC



UCB Fan Speed Controls - 3-Phase Units

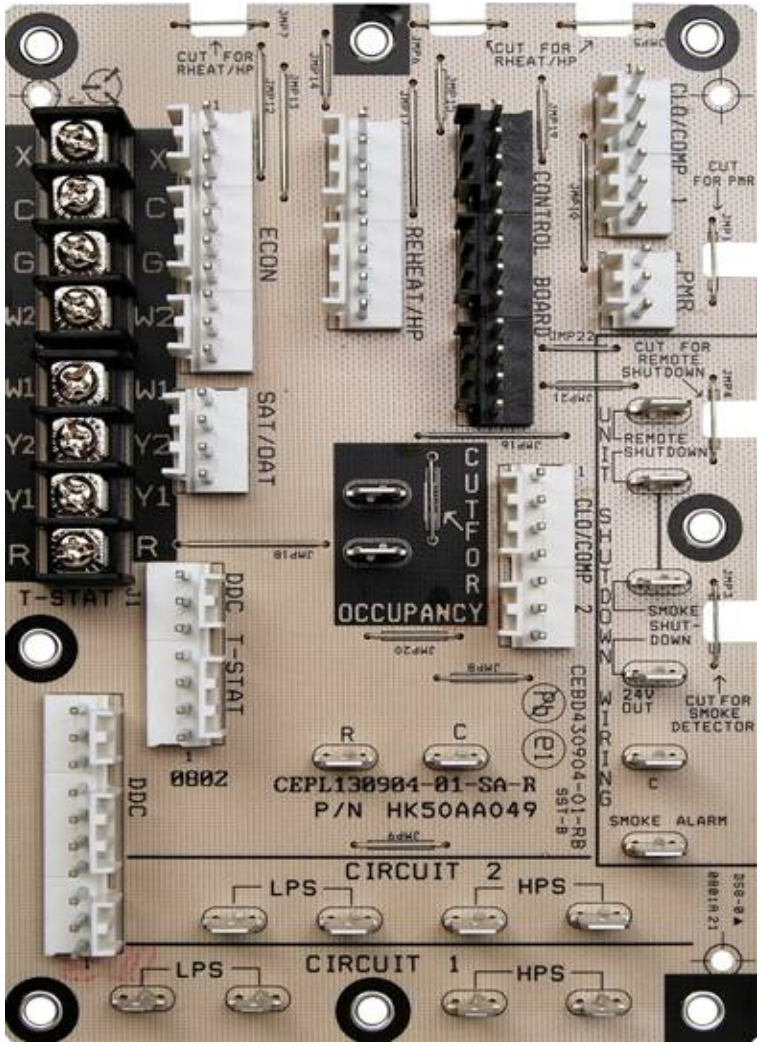


UCB Fan Speed Controls - Single Phase Units

comfort | excellence

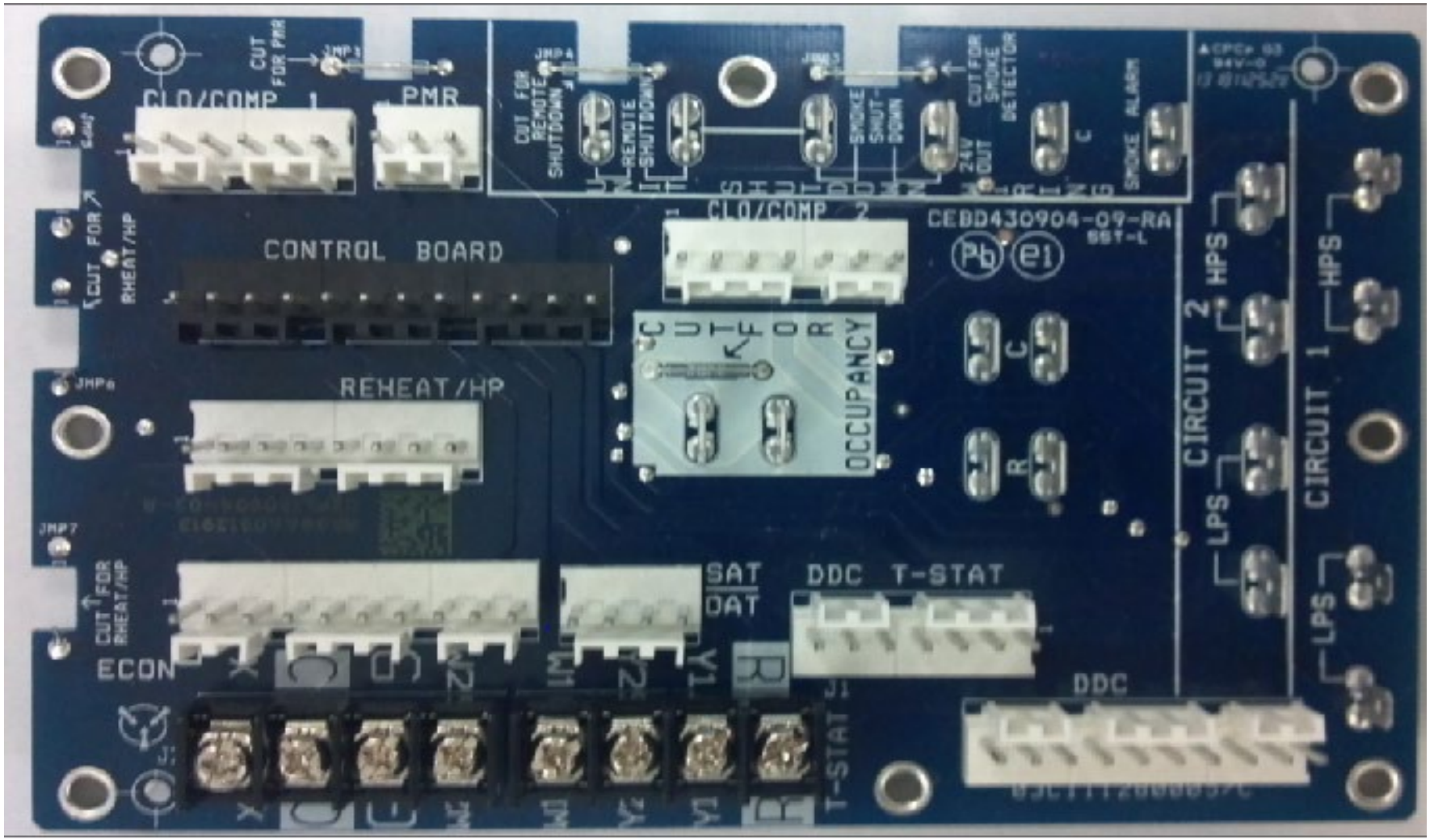
Central Terminal Board

- HK50AA049
  - Overview
  - Examining wiring paths

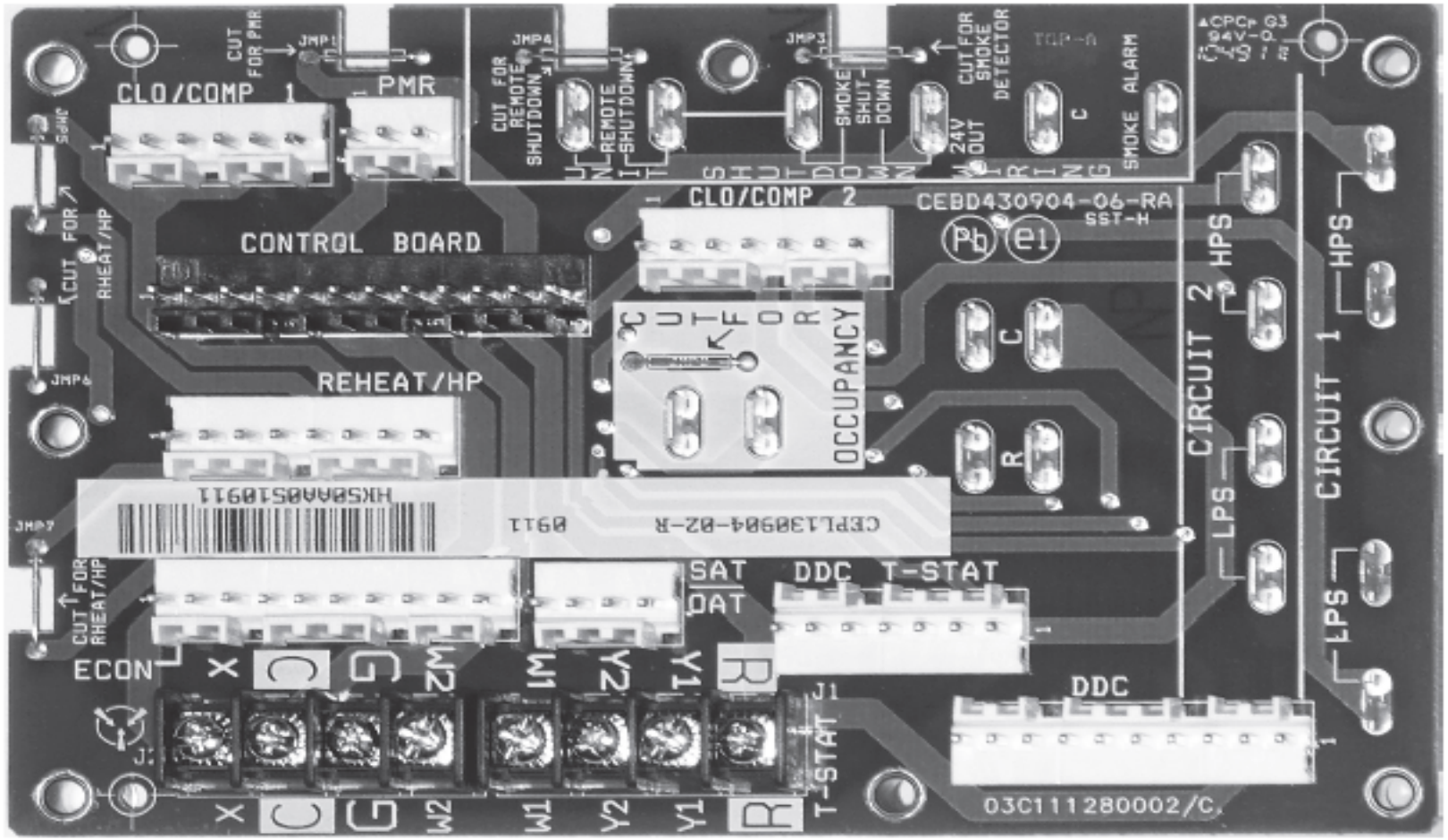


comfort | excellence

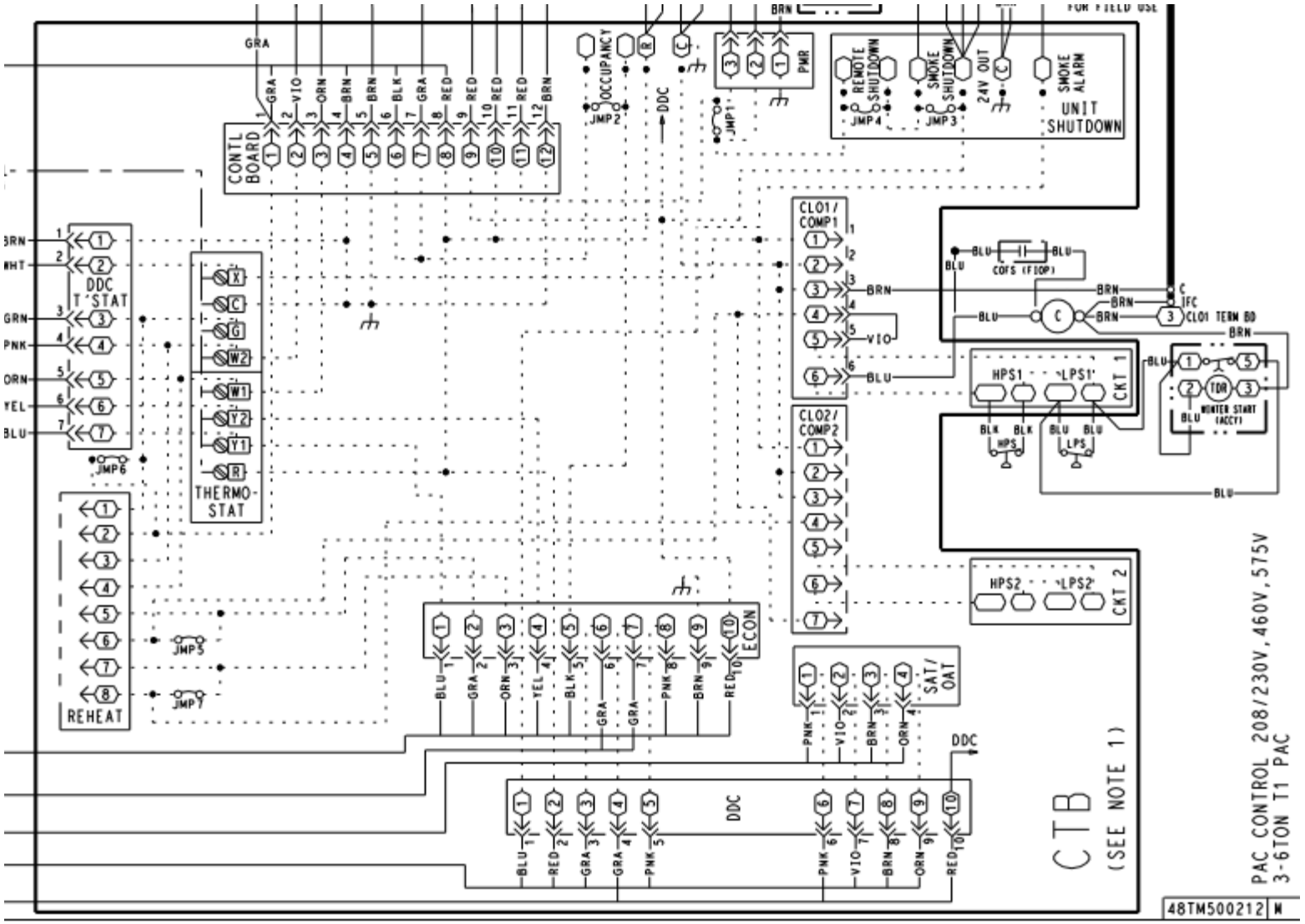
New Style Central Terminal Board



Central Terminal Board



Wire Diagram Found on Equipment of CTB

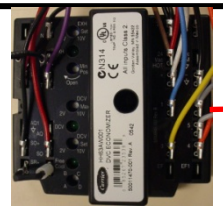


comfort | excellence

Control Terminal Board

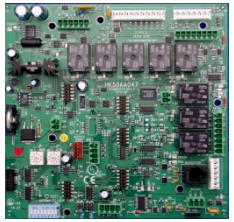
Provides:

- Clean connection points
- Insures positive connections
- Visual aid

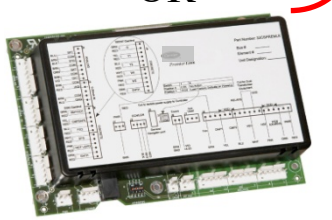


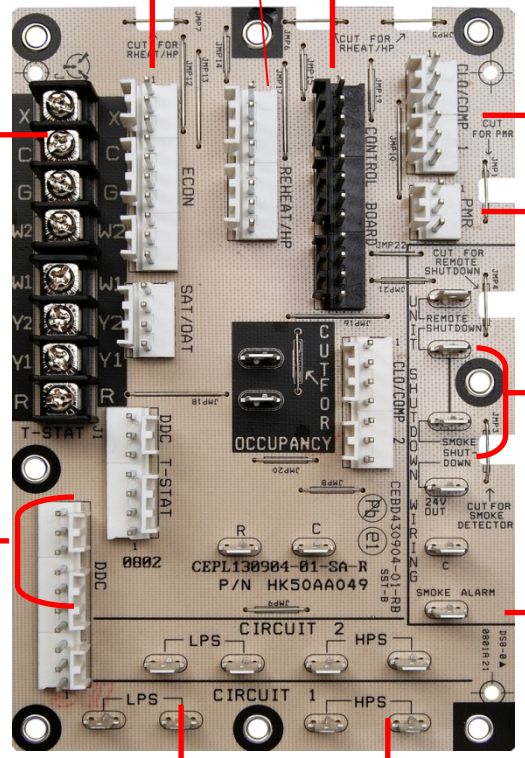
Reheat Board

OR



OR





Gas Controller

Phase Monitor

Fire / Remote Shutdown

Smoke Alarm

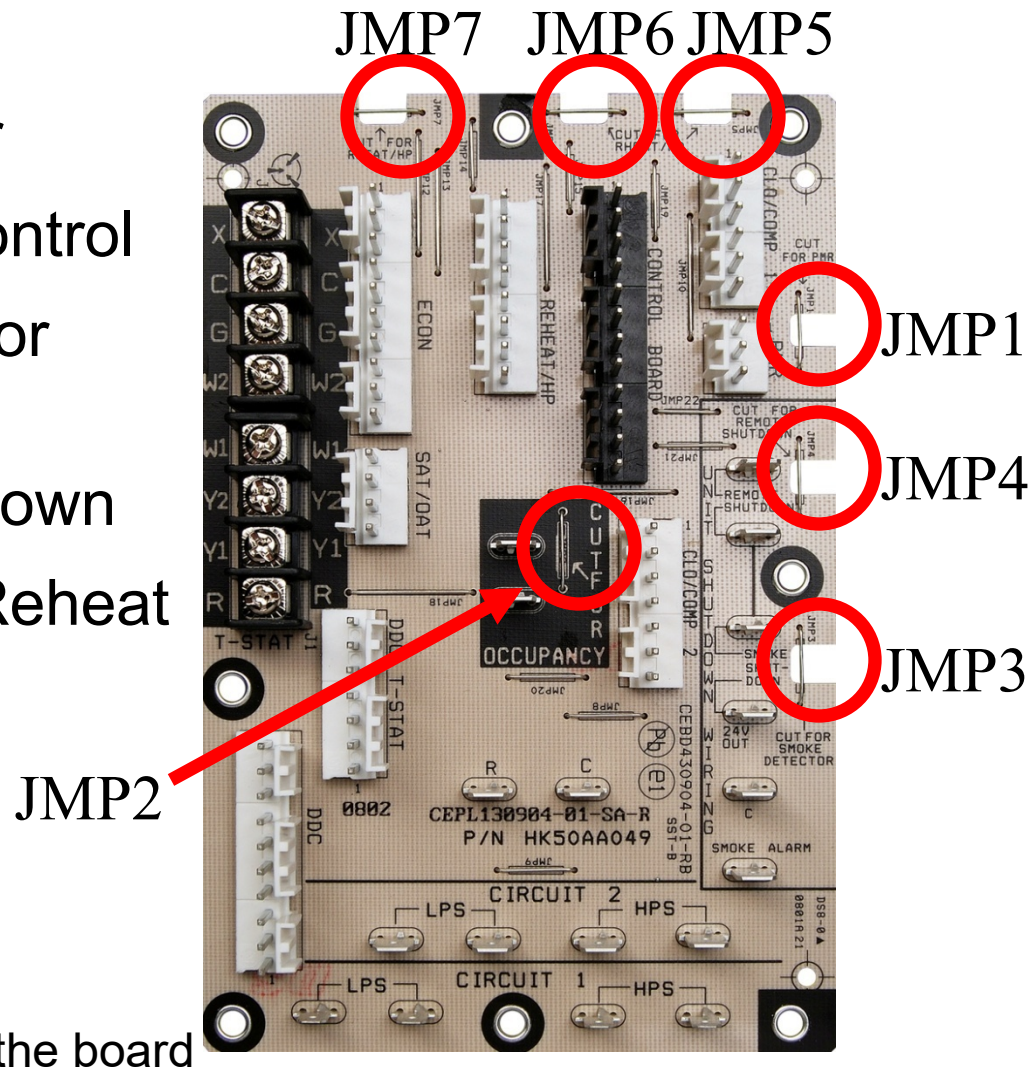
LPS

HPS

comfort | excellence

CTB: Jumpers

- JMP1 Phase Monitor
- JMP2 Occupancy Control
- JMP3 Smoke Detector Shutdown
- JMP4 Remote Shutdown
- JMP5, 6, 7 Heat Pump / Reheat



The CTB has no relays on the board

comfort | excellence

Terminal Board Connectors

Connector	Type	Pin Number	Description
PMR	3 Pin		
J1	4 Pin	1, 2, 3, 4	R-Y1-Y2-W1
J2	4 Pin	1, 2, 3, 4	W2-G-C-X
Econo	10 Pin	1	Y1 output **to** Economizer
		2	Y1 Return **from** Economizer
		3	Y2 Return **from** Economizer
		4	Y2 Output **to** Economizer
		5	Indoor Fan Output **to** Economizer
		6	Accusensor Connection
		7	Accusensor Connection
		8	Economizer Motor Output
		9	Economizer 24 vac Common
		10	Economizer 24 vac Power

comfort | excellence

CTB Jumpers

The CTB requires modifications when replaced
On heat pumps jumpers 5,6 and 7 must be cut

Jumpers 1 + 2

- Jumper 1

  Phase Monitor Accessory

  – Phase Monitor Relay power between 2 + 3

  – Opens Red-Pink of Phase Monitor Relay

    • Removes 24 vac from Remote Shutdown + Smoke Shutdown

  – Result

    • Immediate unit Shutdown

- Jumper 2

  Occupancy Jumper

  – Occupancy: Used to signal Building occupied and Min Economizer ventilation when IFC energized

  – Removes power to Economizer Control “N”

  – Result

    • Economizer dampers stay closed eliminating Fresh Air intake into unit

CE
comfort | excellence

Jumpers 3 + 4

- Jumper 3

  Smoke Detector

  - Allows Smoke Detector to control signal (Open contacts) to force unit “OFF”
  - Removes Transformer “R” from Terminal Board
  - Result: Immediate unit shutdown
  - Must be cut when installing smoke detectors

- Jumper 4

  Remote Shutdown

  - Allows remote contacts (NC) to control unit “ON” or “OFF”
  - Removes Transformer “R” from Terminal Board
  - Result: Immediate unit shutdown

comfort | excellence

Jumpers 5 + 6

- Jumper 5

  Used with R/H or Heat Pump

  – Opens “Y1” from Econo (pin 2), RH/HtPmp (pin 6), CLO/Comp1 (pin 4)

  – Allows RH control board to send signal CLO 1 controlling compressor 1 (pin 4)

- Jumper 6

  Used with R/H or Heat Pump

  – Opens “G” from RH/HtPmp (pin 1), IFM signal return (pin 2) and “G” from Control Board (pin 1)

  – Allows RH control board to control IFM

comfort | excellence

Jumper 7

- Jumper 7

  Used with R/H or Heat Pump

  – Opens “Y2” from Econ (pin 3), Rh/HtPmp (pin 8)

  – Allows RH/HtPmp board to send signal to CLO 2 (pin 4) controlling Compressor 2

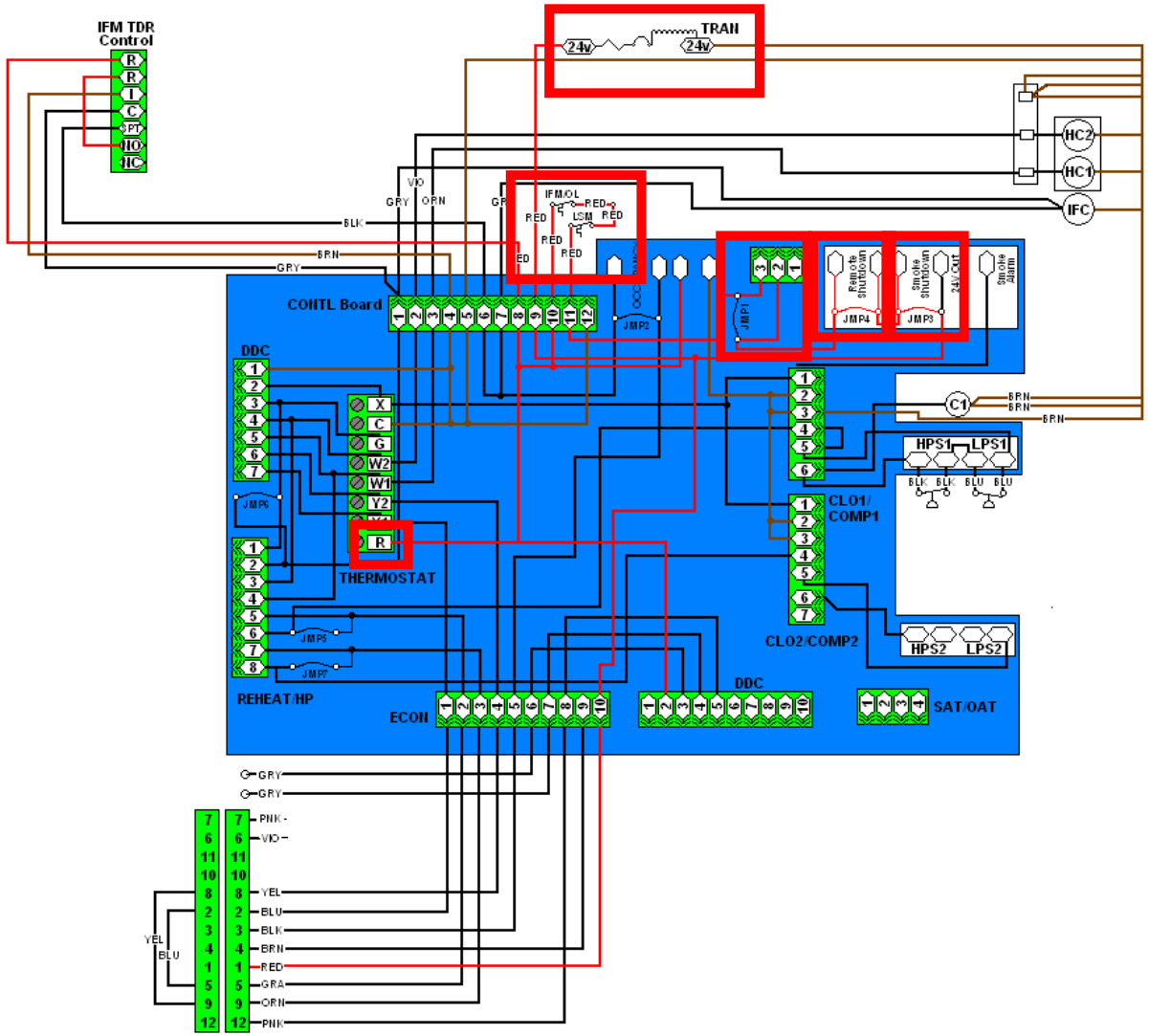
comfort | excellence

Path of Power

Low Voltage – Stand by

1. Transformer
2. Smoke Shutdown (JMP3)
3. Remote Shutdown (JMP4)
4. Phase Monitor (JMP1)
5. Indoor Fan Safeties
6. R Terminal/Accessories

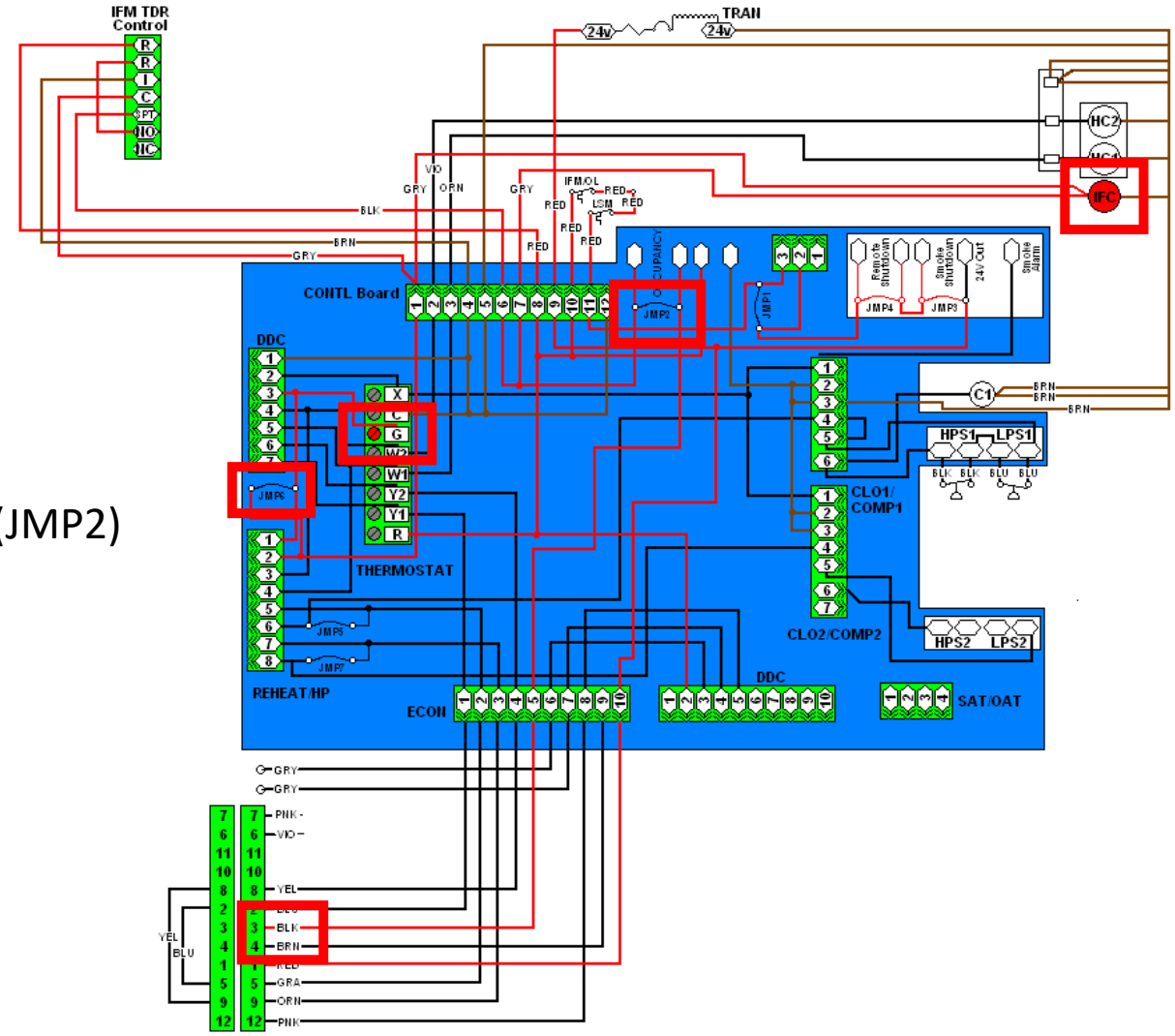
Powered Economizer
Always Remains Powered



Path of Power

Low Voltage – Fan

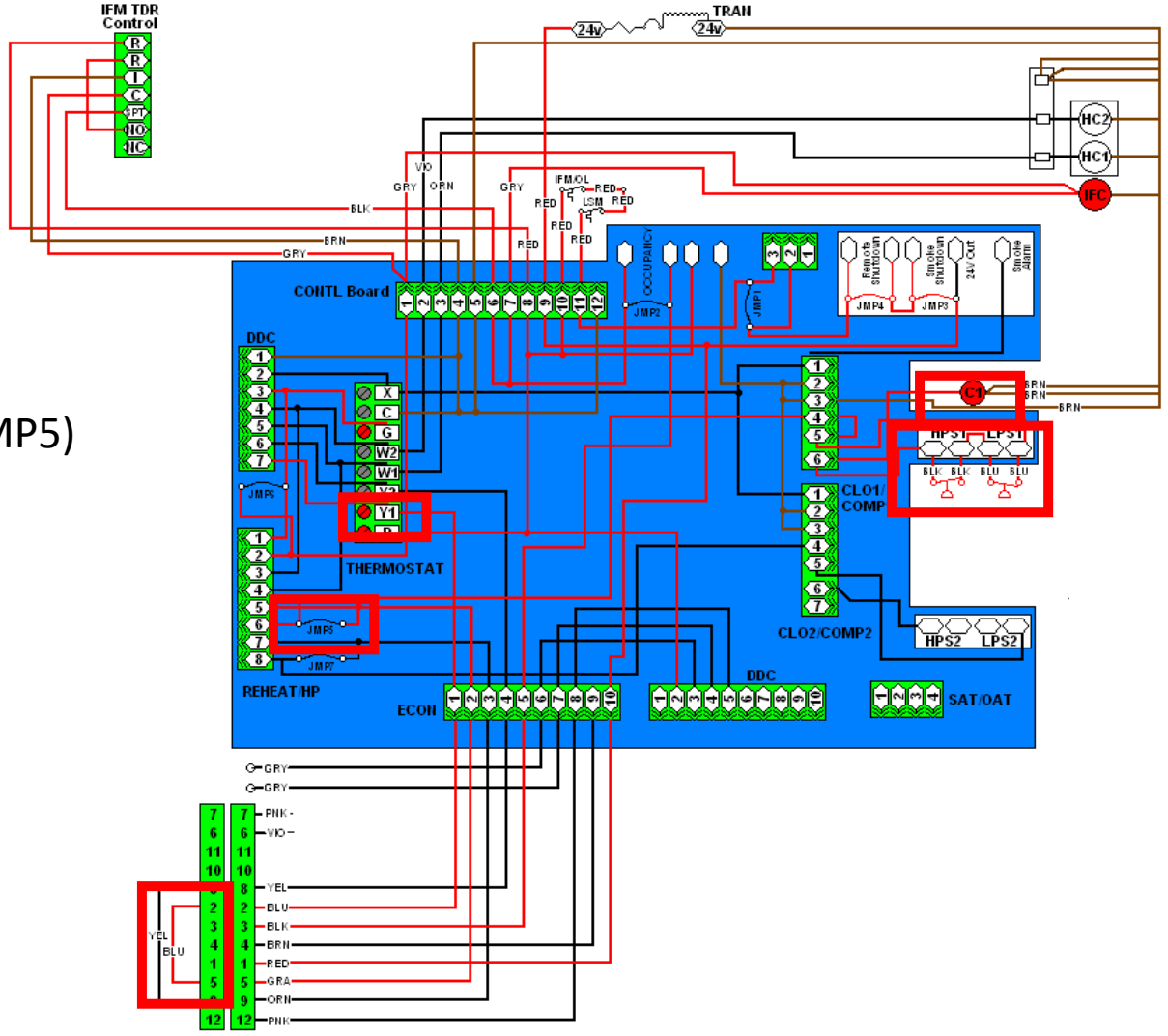
1. 24VAC to G
2. Through Fan Jumper (JMP6)
3. To Fan Contactor
4. Through Occupancy Jumper (JMP2)
5. To Economizer Min Position (BLK)



Path of Power

Low Voltage – 1st Stage Cooling

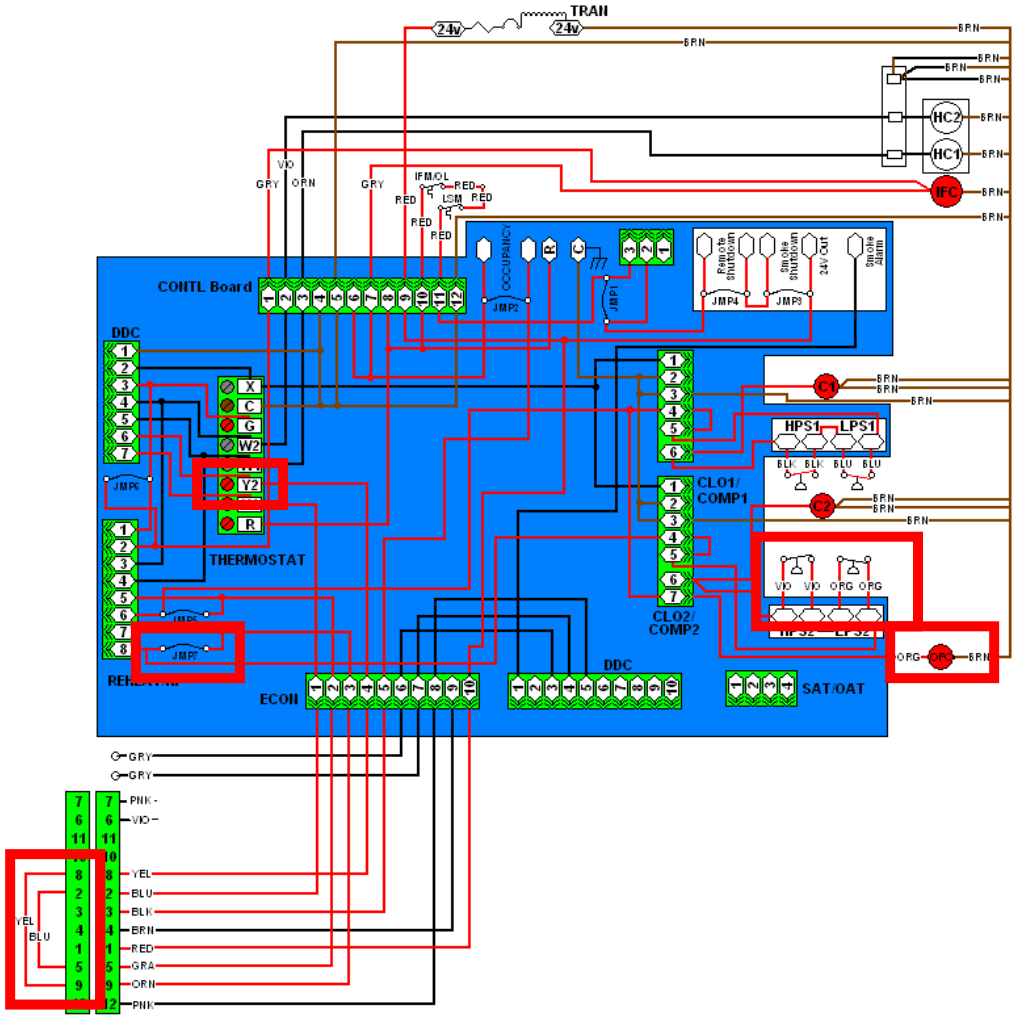
1. 24VAC to Y1
2. To Economizer
3. To 1st Stage Cooling Jumper (JMP5)
4. To Unit Safeties (HPS1/LPS1)
5. To 1st Stage Contactor (C1)



Path of Power

Low Voltage – 2nd Stage Cooling

1. 24VAC to Y2
2. To Economizer
3. To 2nd Stage Cooling Jumper (JMP7)
4. To Unit Safeties (HPS2/LPS2)
5. To 2nd Stage Contactor (C2)

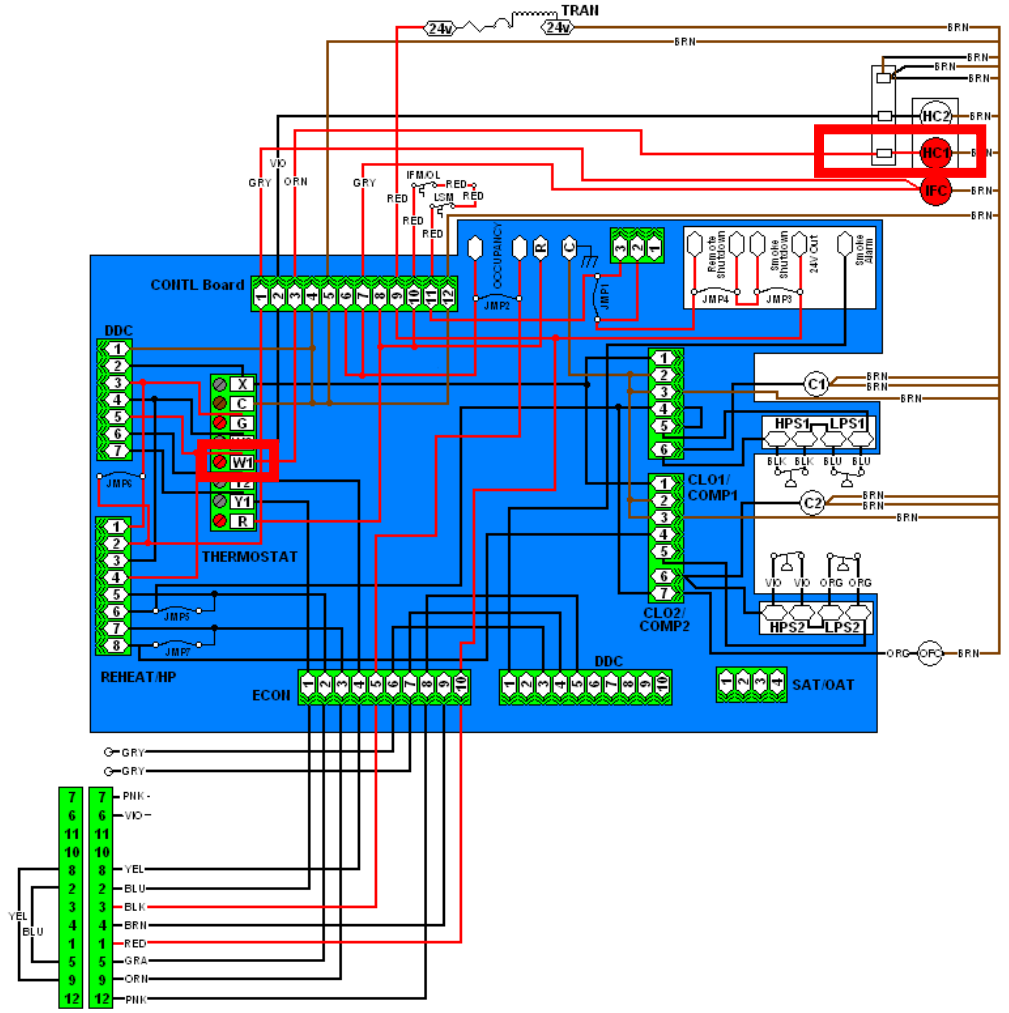


Path of Power

Low Voltage – 1st Stage Heating

2nd Stage is the same

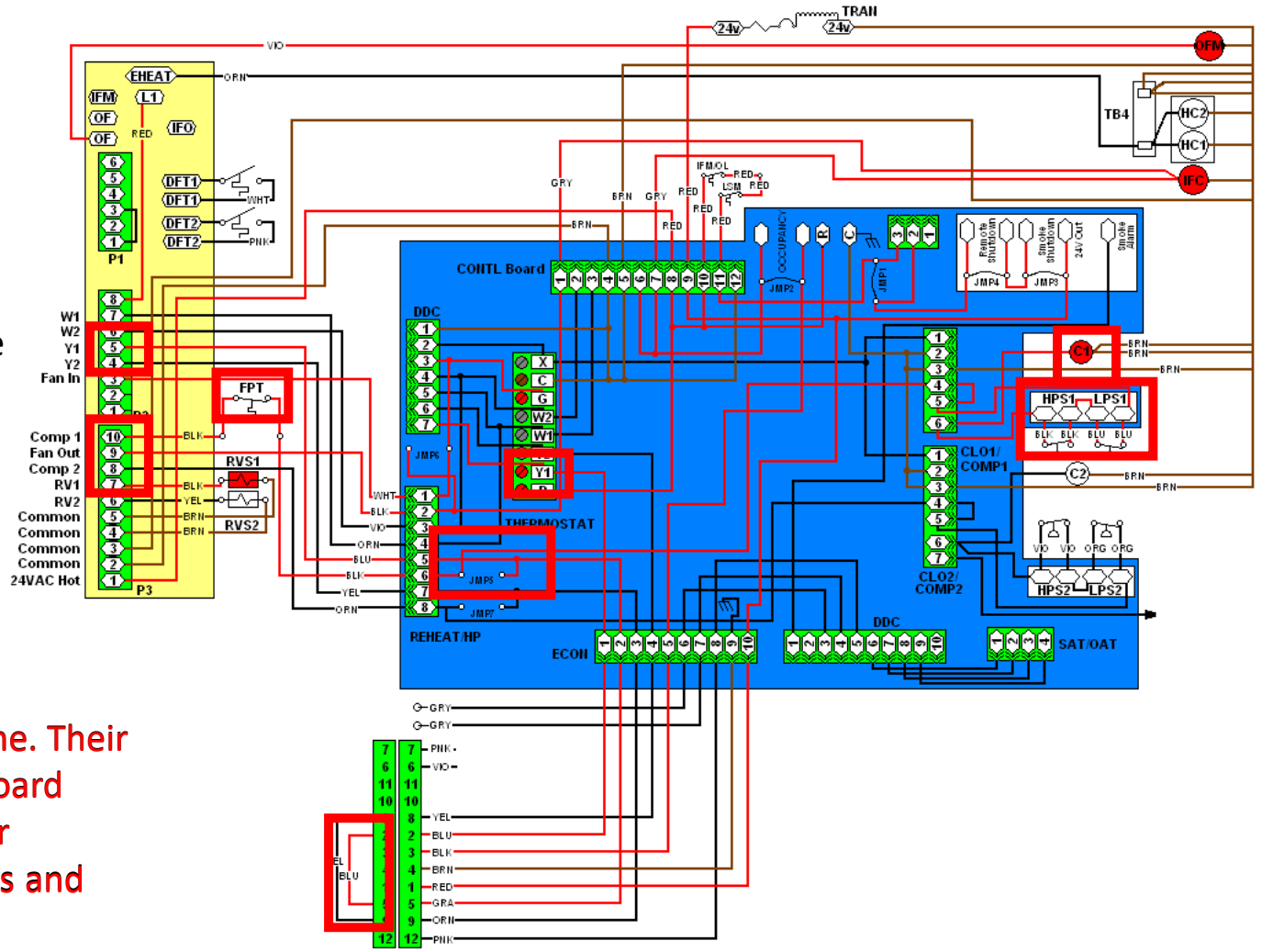
1. 24VAC to W1
2. To Electric Heat Contactor



Path of Power

Low Voltage – Heat Pump Cooling

1. 24VAC to Y1
2. To Economizer
3. Back to 1st Stage Cooling Jumper (cut)
4. To Defrost Board Y1 Input
5. Comp 1/RV1 Outputs made
6. Through Freeze Protection Stat
7. To Unit Safeties (HPS1/LPS1)
8. To 1st Stage Contactor (C1)

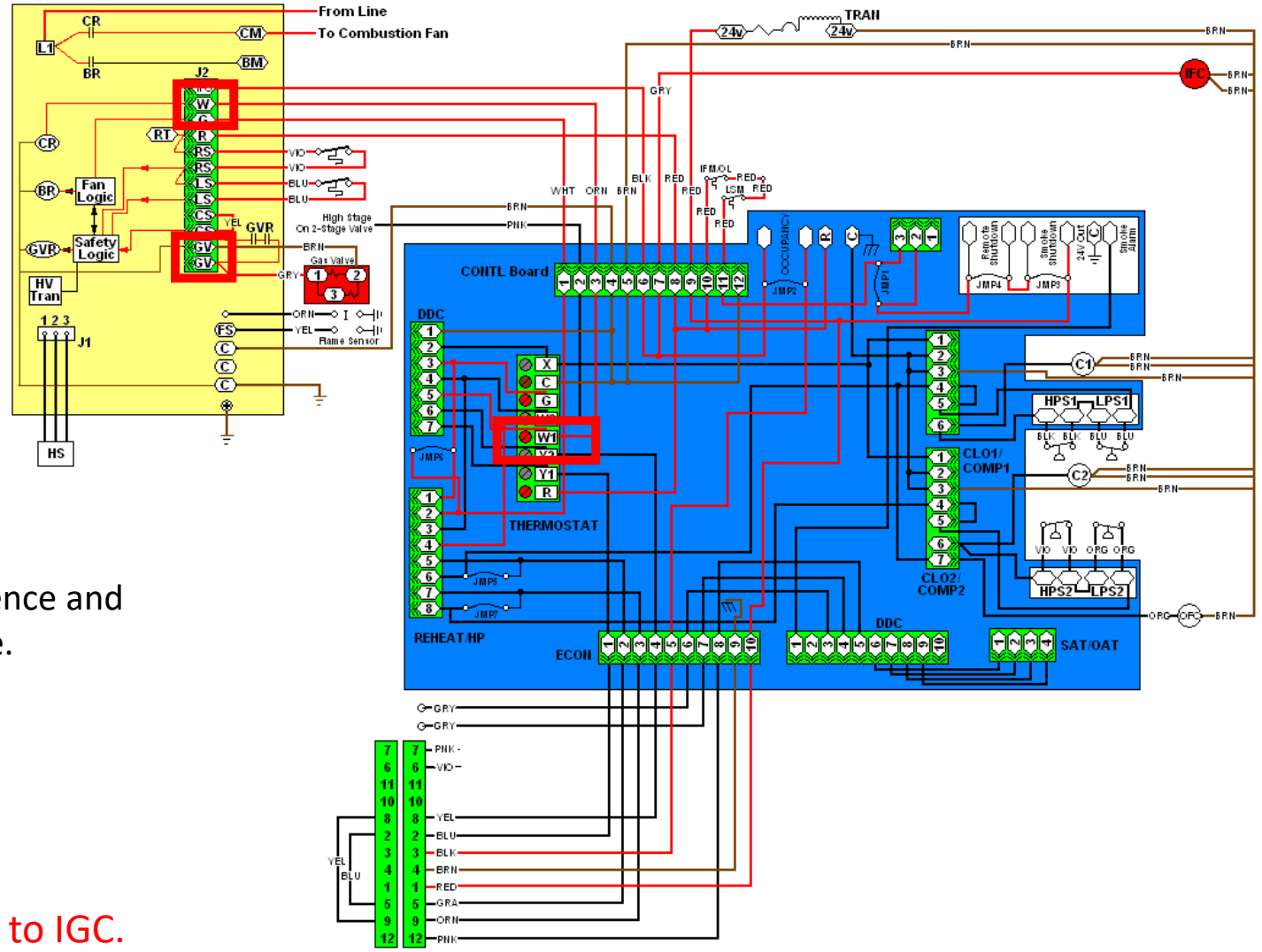


Y2, W1, and W2 work the same. Their signal is sent to the Defrost Board which controls the outputs for Reversing Valves, Compressors and Electric Heat.

Notice also that the fan Jumper (JMP6) is cut. The Defrost Board also controls the fan operation.

Path of Power

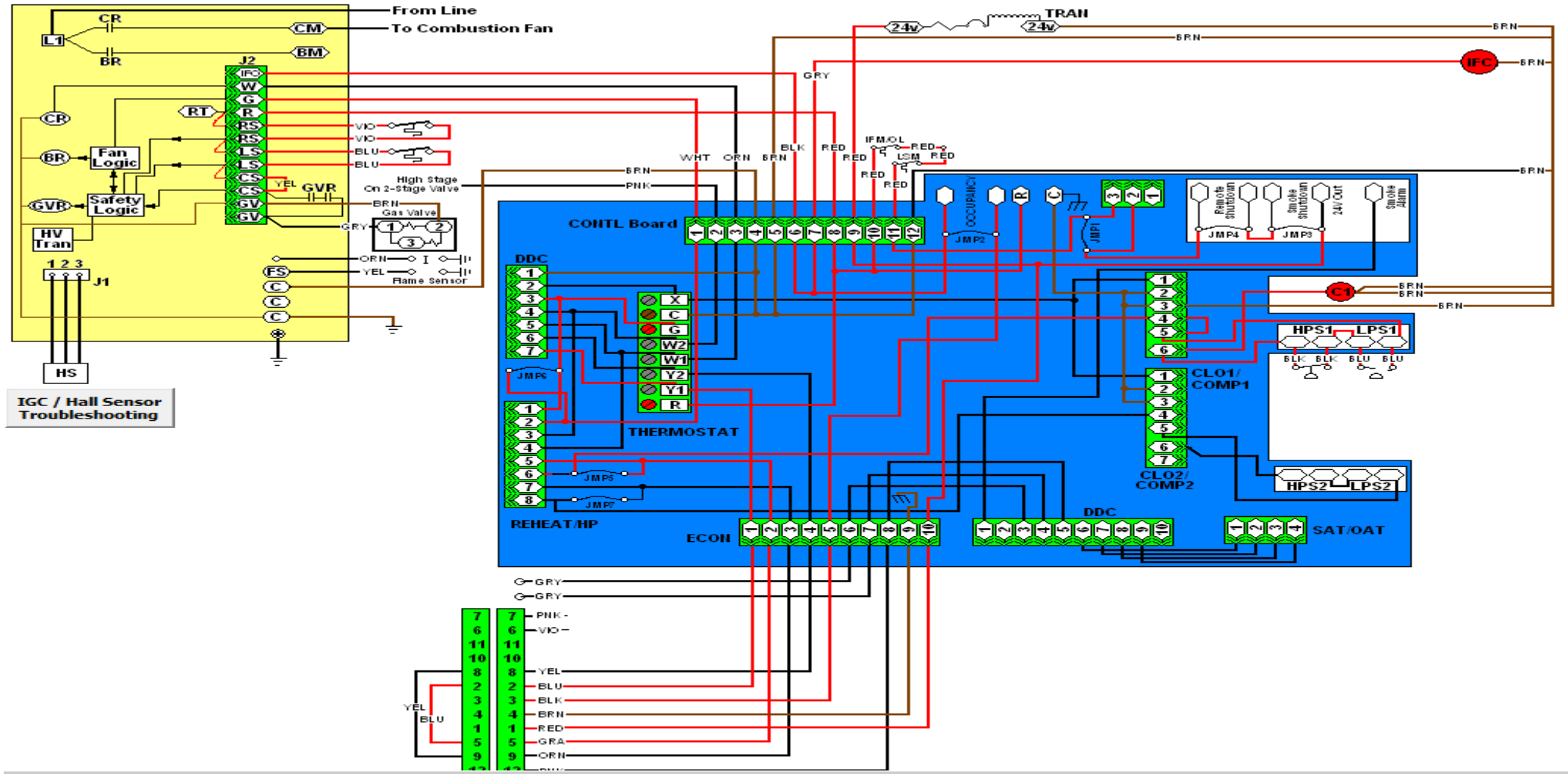
Low Voltage – Gas Heating



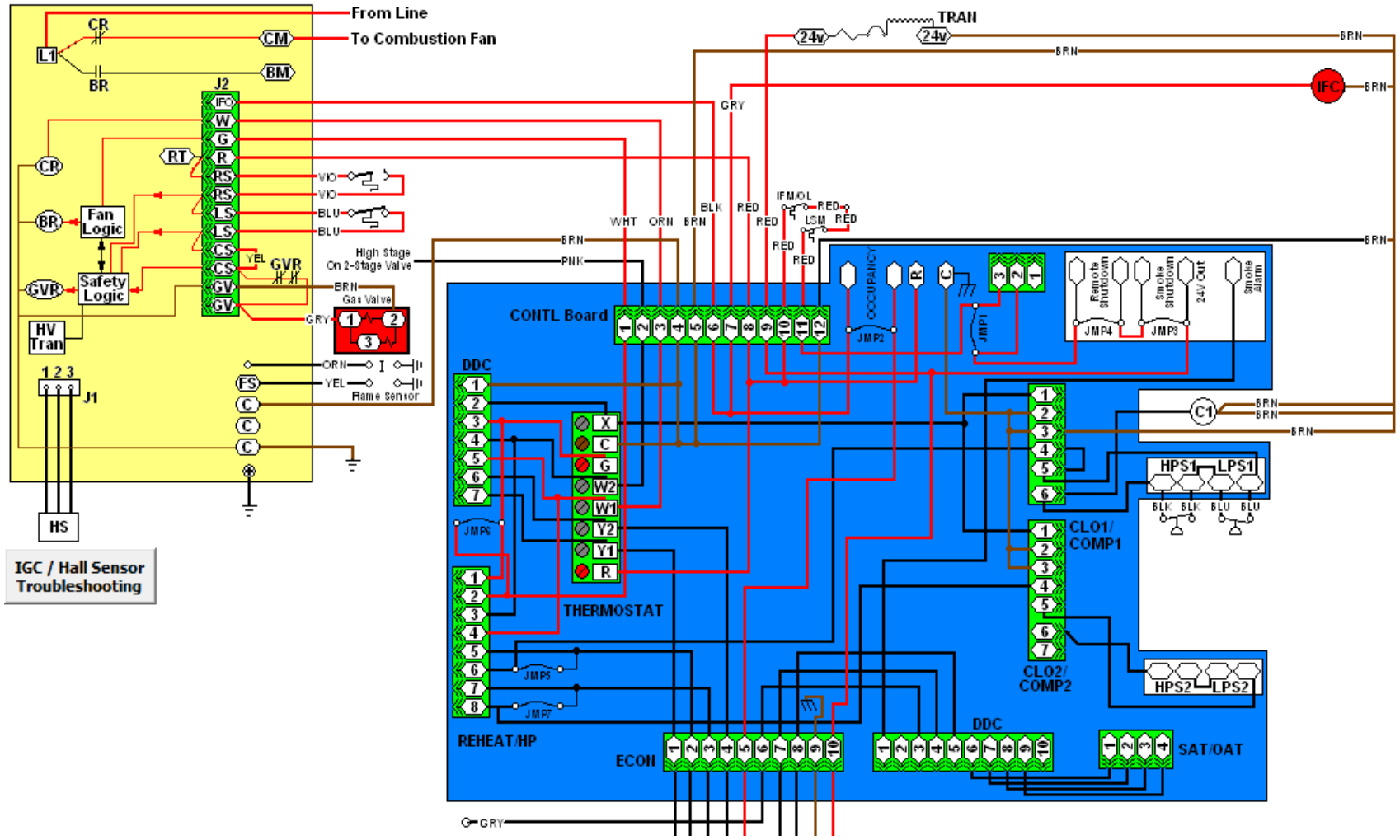
1. 24VAC to W1
2. Signal sent to W on IGC
3. IGC goes through Sequence and eventually opens gas valve.

Note that G signal goes to IGC.
IGC takes control of Indoor Fan.

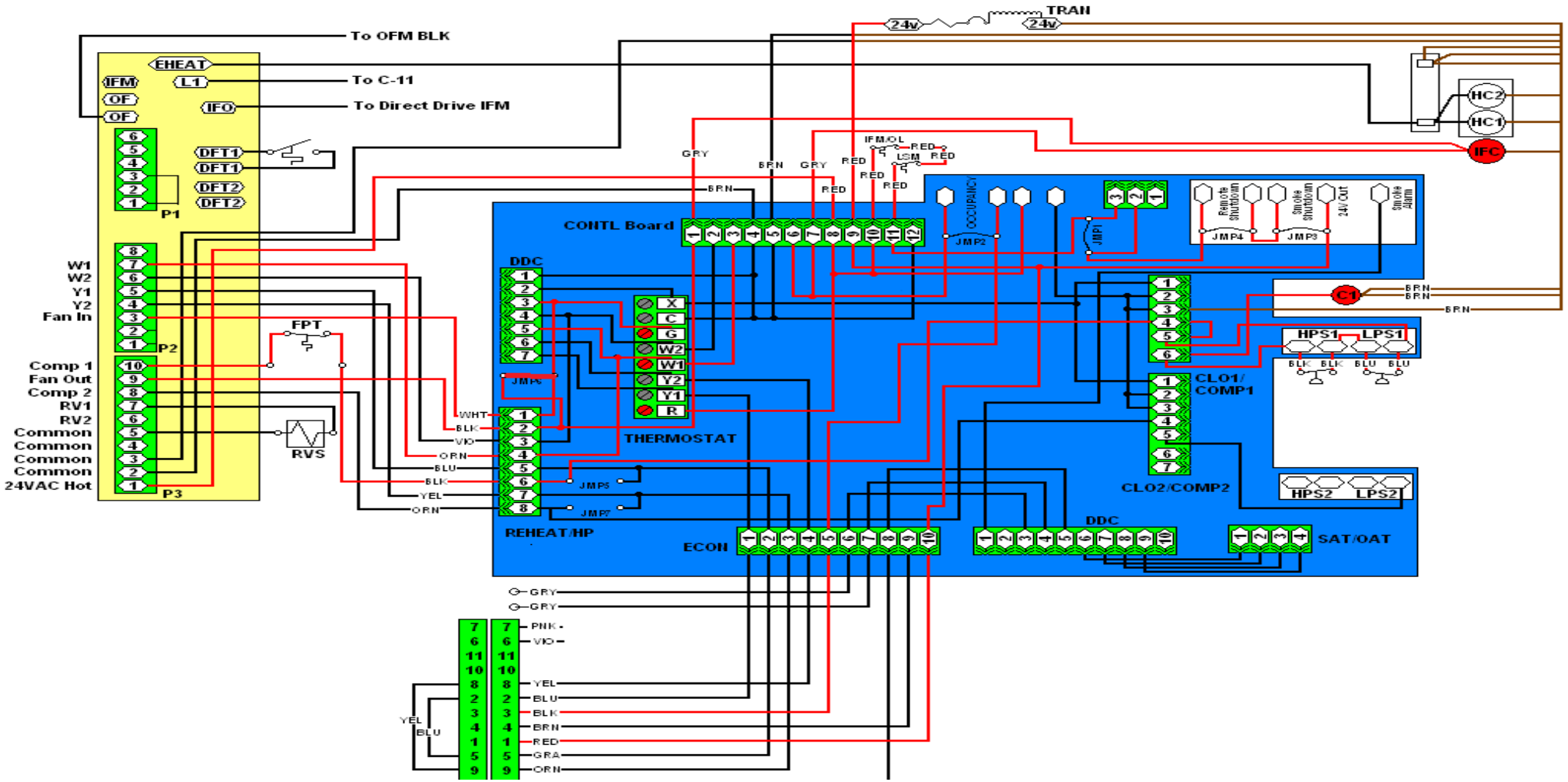
Class Exercise No cooling call what is wrong ?



Class Exercise No heating on a call for gas heat ?



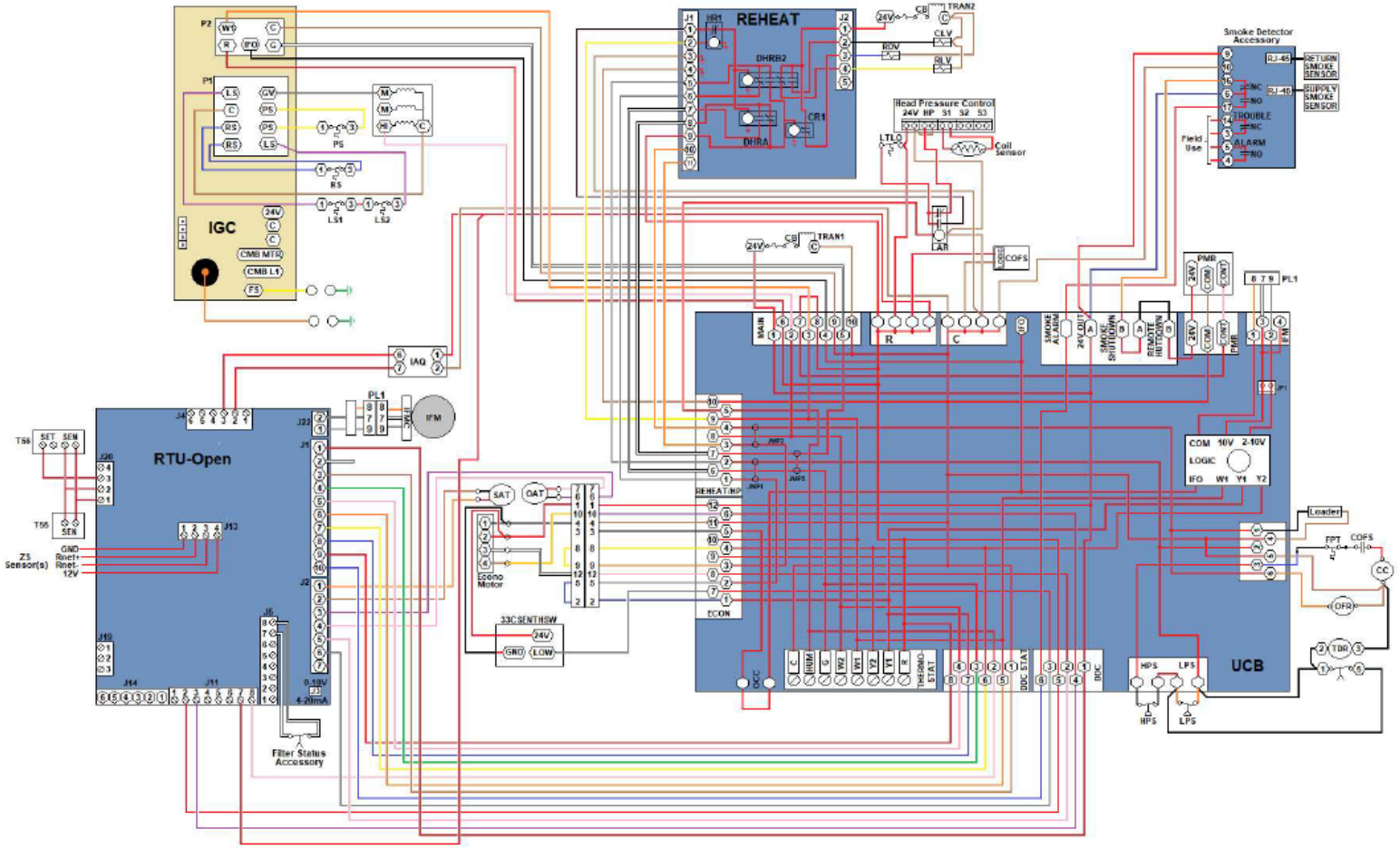
Class Exercise The fan will not shut off on this HP and the CTB was replaced ?



Safeties that can break 24vac to R-Connection

- The IFMOL Indoor fan motor overload limit
- Limit switches
- Roll Out switches
- Smoke detectors if installed
- Phase monitor if installed

48/50 FC GC with RTU Open



Carrier Commercial Heat Pump Control

- All Carrier Commercial Heat Pumps are wired conventional do not use heat pump thermostats O is not used.
- The reversing valve is controlled internally through the boards logic
- W1 brings on the compressors on a call for first stage heat
- W2 is for electric back up heat

Heat Pump Defrost Board

New PN: HK32EA005

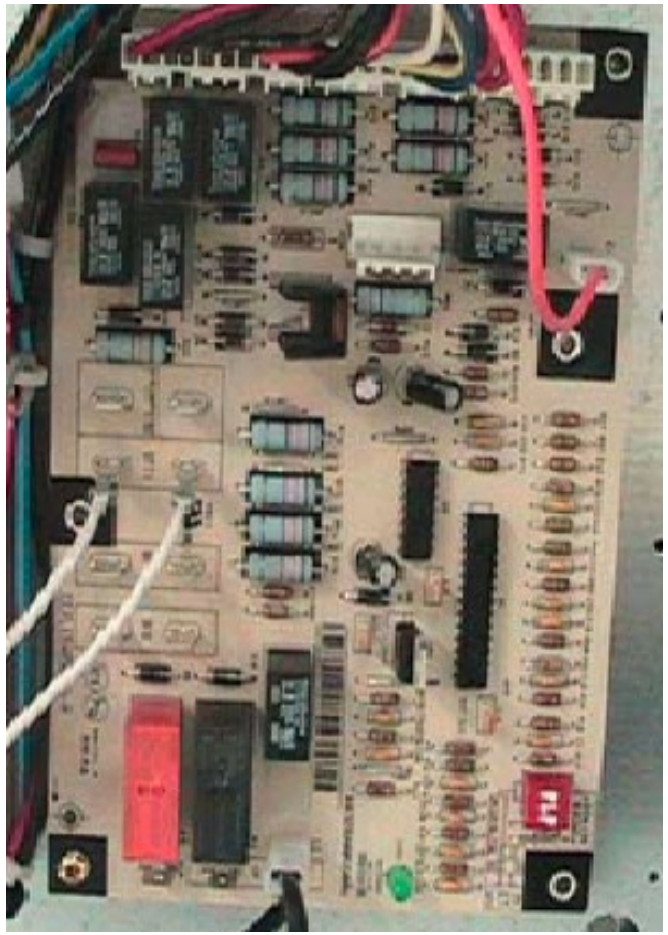
Thermostat demands for

1 or 2 stage Cooling

2 stage Heating

Emergency Heating

Defrost Control in Heating Mode

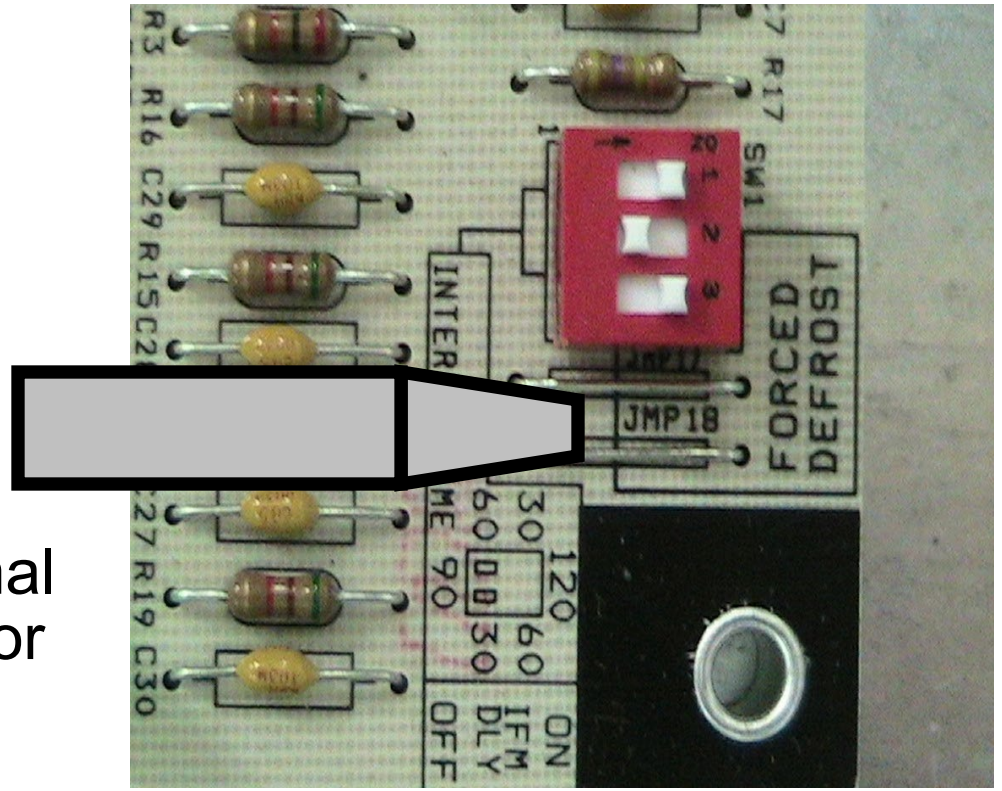


comfort | excellence

Defrost Speed-Up

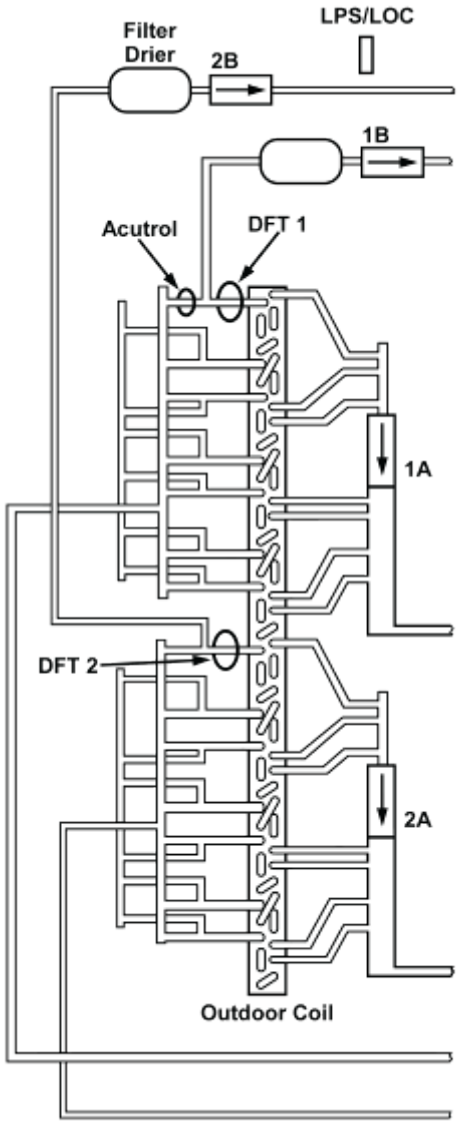
- JMP17-JMP18 (flat/slot screwdriver)
- 1-5 secs: Speed-Up (0.1 sec/min)
- 5-20 secs: Forced Defrost

Run to normal termination or 30 secs



comfort | excellence

Defrost Thermostat (DFT)



To Indoor Coil / Circuit #2

To Indoor Coil / Circuit #1

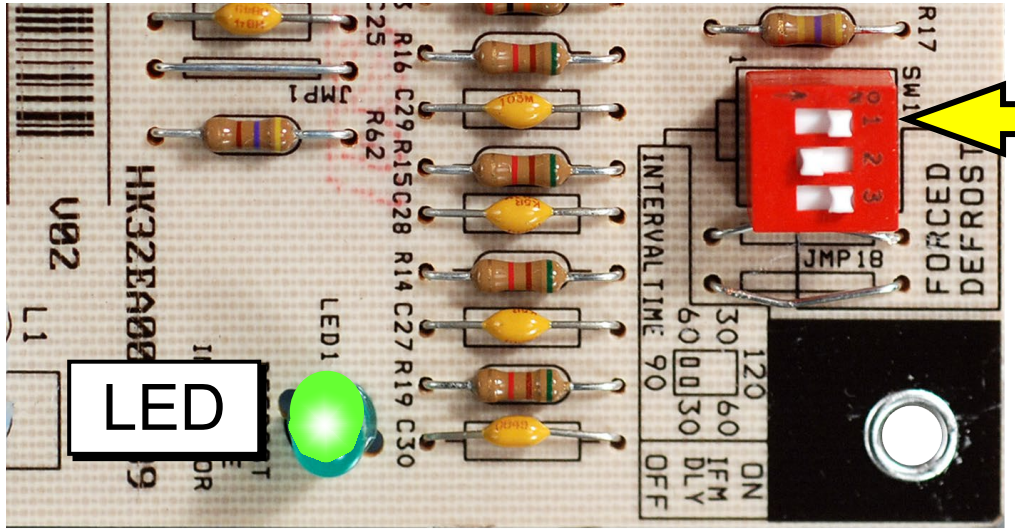
DFT 2 initiates defrost

From Reversing Valve #1 / Circuit #1

From Reversing Valve #2 / Circuit #2

comfort | excellence

DIP-Switches



SWITCH 1	SWITCH 2	TIME
ON	OFF	30 MINUTES
OFF	ON	60 MINUTES
OFF	OFF	90 MINUTES
ON	ON	120 MINUTES

comfort | excellence

Heat Pump Defrost

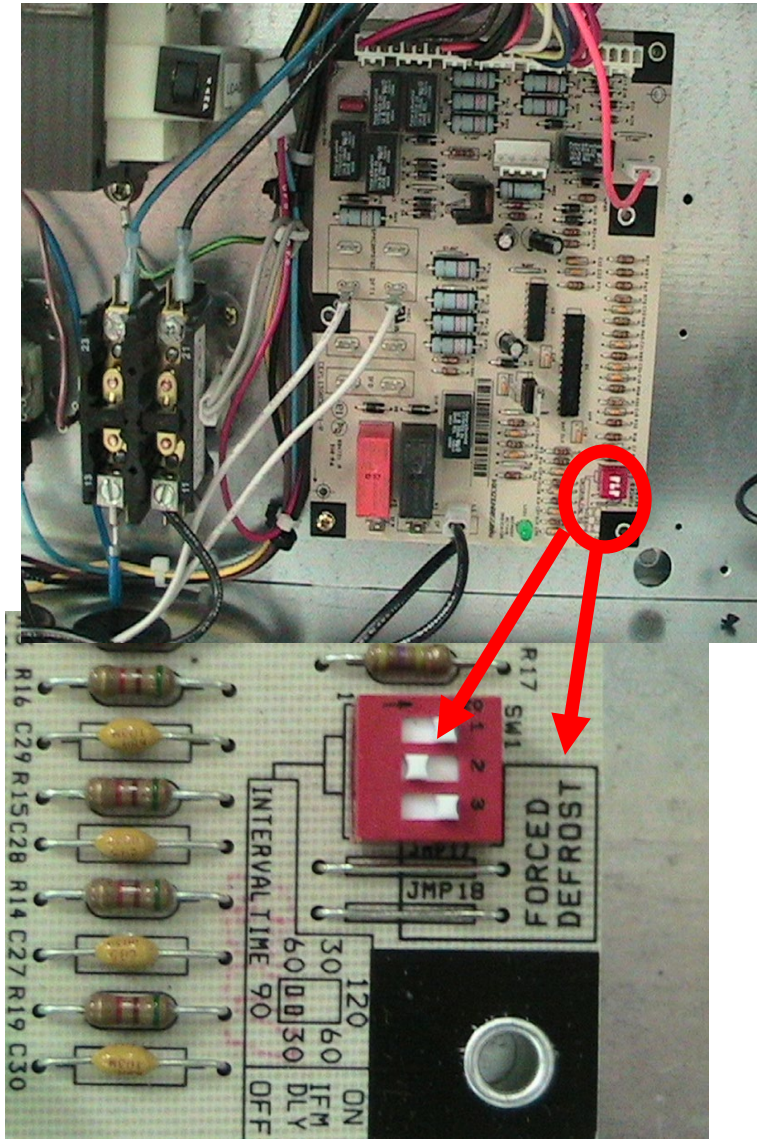
Time-Temperature Sequence

1. Heat Run Time (30,60,90 or 120 mins) Factory 60 mins
2. Initiate if tube temperature (DFT) low
3. Terminate when tube temperature (DFT) rises or defrost run period reaches 10 min

HH18SA261DFT Settings:

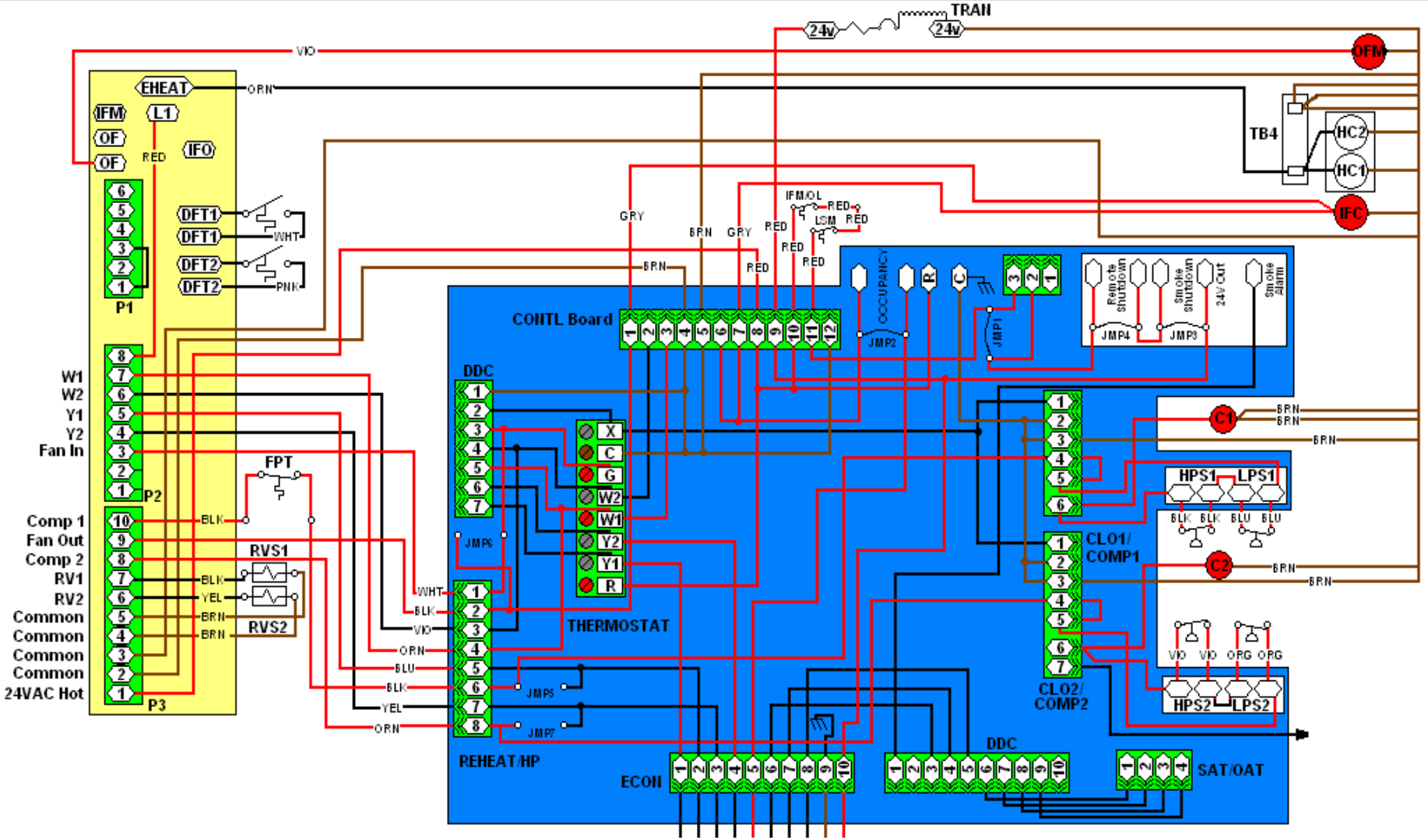
Close: 30F

Open : 80F



comfort | excellence

Defrost Overview



Heat Pump Defrost

Inputs

Point Name	Type of I/O	Connection Pin Number	Unit Connection	Note
G Fan	DI, 24Vac	P2–3	LCTB–G	
Y1 Cool 1	DI, 24Vac	P2–5	LCTB–Y1	
Y2 Cool 2	DI, 24Vac	P2–4	LCTB–Y2	
W1 Heat 1	DI, 24Vac	P2–7	LCTB–W1	
W2 Heat 2	DI, 24Vac	P2–6	LCTB–W2	
R Power	24Vac	P3–1	CONTL BRD–8	
C Common	24Vac	P3–2	CONTL BRD–4	
DFT1	DI, 24Vac	DFT–1 to DFT–1		
DFT 2	DI, 24Vac	DFT–2 to DFT–2		

Heat Pump Defrost

Outputs

Point Name	Type of I/O	Connection Pin Number	Unit Connection	Note
IFO Fan On	DO, 24Vac	P3–9	REHEAT–2	
OF OD Fan On	DO, 24Vac	OF	OFR	
RVS1	DO, 24Vac	P3–7 to P3–5		Energize in COOL
RVS2	DO, 24Vac	P3–6 to P3–4		Energize in COOL
COMP 1	DO, 24Vac	P3–10	FPT – REHEAT–6	
COMP 2	DO, 24Vac	P3–8	REHEAT–8	
HEAT 2	DO, 24Vac	E–HEAT	HC–1 (TB4–1)	
COM	24Vac	P3–3	HC–1 (TB4–3)	

Heat Pump Defrost

Configuration

Point Name	Type of I/O	Connection Pin Number	Unit Connection	Note
Select Jumper	24Vac	P1–1		
2 Compressor	24Vac	P1–3		Use for 50TCQD

Speed–Up Configuration

Point Name	Type of I/O	Connection Pin Number	Unit Connection	Note
Speed–Up Jumper		JMP17		
Speed–Up Jumper		JMP18		

Jumper for 1–3 seconds: Factory Test, defrost runs for 9 seconds
Jumper for 5–20 seconds: Forced Defrost, defrost runs for 30 seconds if DFT2 is open

New Gas Control Board

Gas Control Board

- LH33EP001
- All Voltages

comfort | excellence

IGC Fault Codes

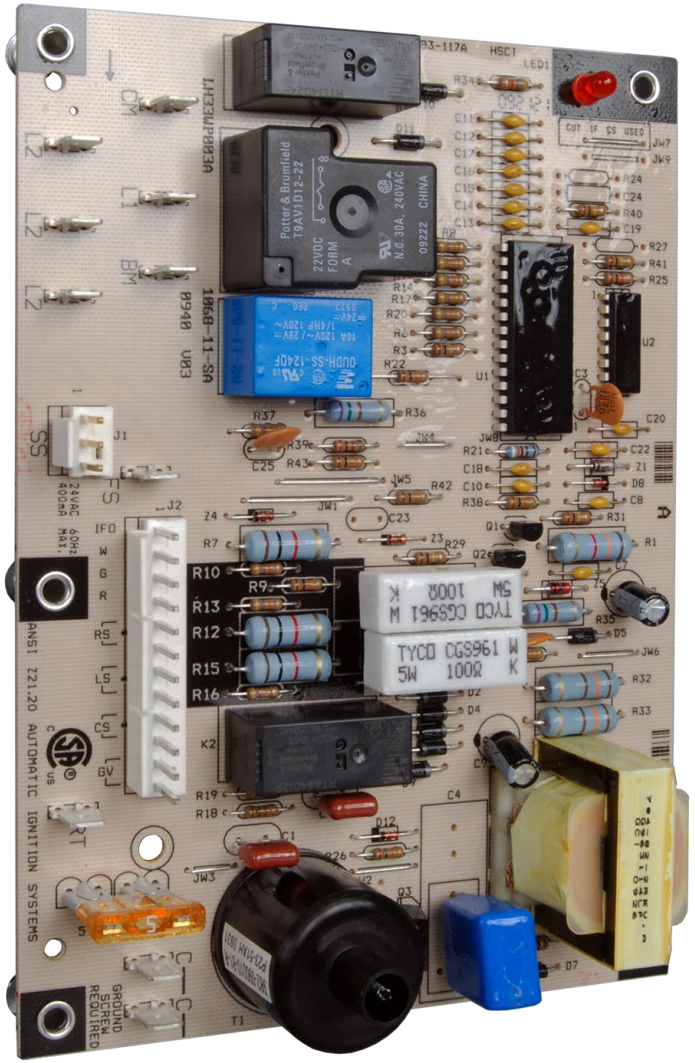
LED INDICATION	ERROR MODE
ON	NORMAL OPERATION
OFF	HARDWARE FAILURE
2 FLASHES	LIMIT SWITCH FAULT
3 FLASHES	FLAME SENSE FAULT
4 FLASHES	4 CONSECUTIVE LIMIT SWITCH FAULTS
5 FLASHES	IGNITION LOCKOUT FAULT
6 FLASHES	INDUCED DRAFT MOTOR FAULT
7 FLASHES	ROLLOUT SWITCH FAULT
8 FLASHES	INTERNAL CONTROL FAULT
9 FLASHES	TEMPORARY SOFTWARE LOCKOUT
NOTE: - WHEN W1 IS ENERGIZED THE BURNERS WILL REMAIN ON FOR A MINIMUM OF 60 SECONDS - IF MORE THAN ONE ERROR MODE EXISTS THEY WILL BE DISPLAYED ON THE LED IN SEQUENCE	

CE
comfort | excellence

Resetting Fault Codes

CODE	ACTION	LOCKOUT	RESET MODE
1	Blower On/Off Delay Modified	No	Code Retained Until Unit's 24 Volts is Cycled
2	Limit Trip	Temporary	Cleared After Limit Switch Resets
3	Flame Sensing Error – Senses Flame When it Shouldn't	Temporary	Cleared After Error Clears
4	Four Consecutive Limit Trips in One Call for Heat	Yes – Soft	Cleared by Cycling "W" Signal
5	Ignition Lockout – Attempted Ignitions for 15 Minutes Without Success	Yes – Soft	Cleared by Cycling "W" Signal
6	Inducer Fault – Signal Between Board and Motor Do Not Match	Yes – Soft	Cleared by Cycling "W" Signal
7	Rollout Switch Opens	Yes – Hard	Lockout is Retained Until Unit's 24 Volts is Cycled
8	Control Fault – Detects Hardware or Software Failure	Yes – Hard	Lockout is Retained Until Unit's 24 Volts is Cycled
9	Safety Critical Code Fault – Detects Hardware or Software Failure	Temporary	Cleared After 1 Hour

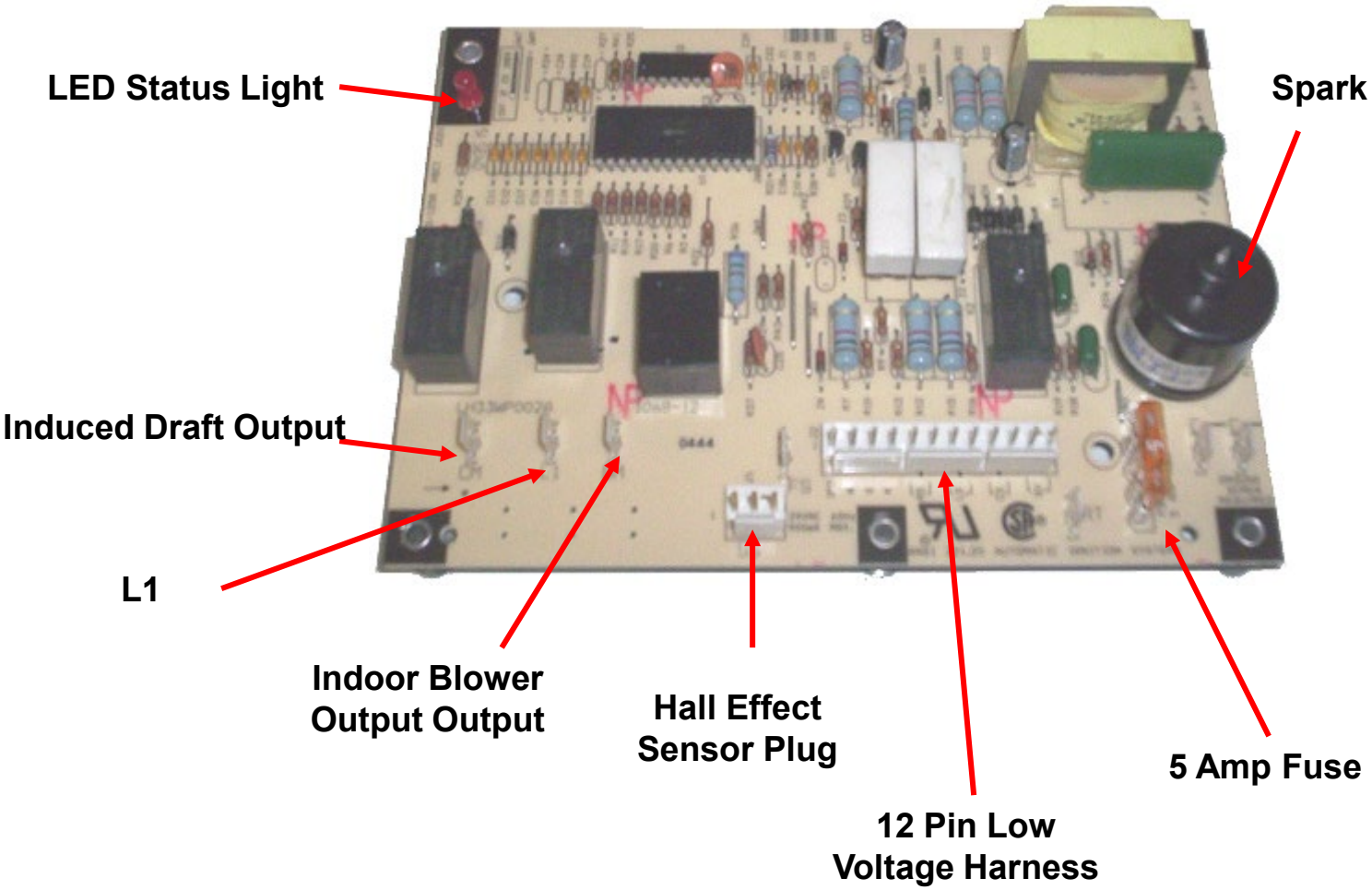
Gas Heat Controls and Hardware



IGC Board:

- Timed on/off control of the indoor fan
- Burner ignition and flame sensing
- Continuous monitoring of safety devices
- LED display of system status and error codes

IGC Overview



comfort | excellence

LH33EP001

Product Improvement	Current Design	New Design
Proof of combustion air	Hall effect sensor (sensor at end of the inducer motor)	Pressure Switch
Integrated Gas Controller (IGC)	Designed for Hall Effect sensor	Designed for pressure switch plus meets new UL standard
Ignition wire connection to the IGC board	Stick pin design	¼" spade connection
IGC Part Number (not interchangeable)	LH33WP002 (460/575) LH33WP003 (208/230)	LH33EP001 (All voltages)

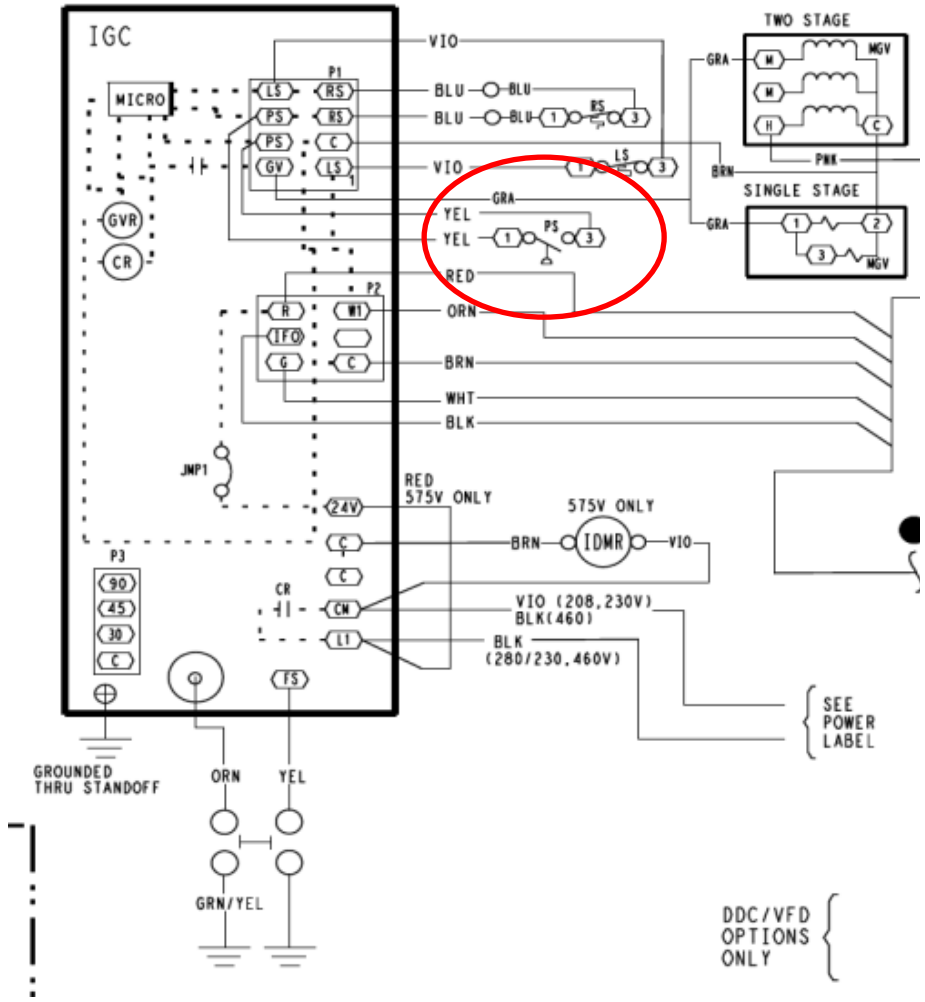
Some boards are voltage specific

Pressure Switch HK06WC061

- Mounting Limitation: Switch diaphragm must be mounted vertically.
- Function: Normally Open to close on negative pressure rise of .18 +- .07 inches W. C. Minimum open/close pressure differential at .015 inches W.C.
- Maximum System Pressure 3.0 inches W. C.

comfort | excellence

Pressure Switch Wiring



IGC Board

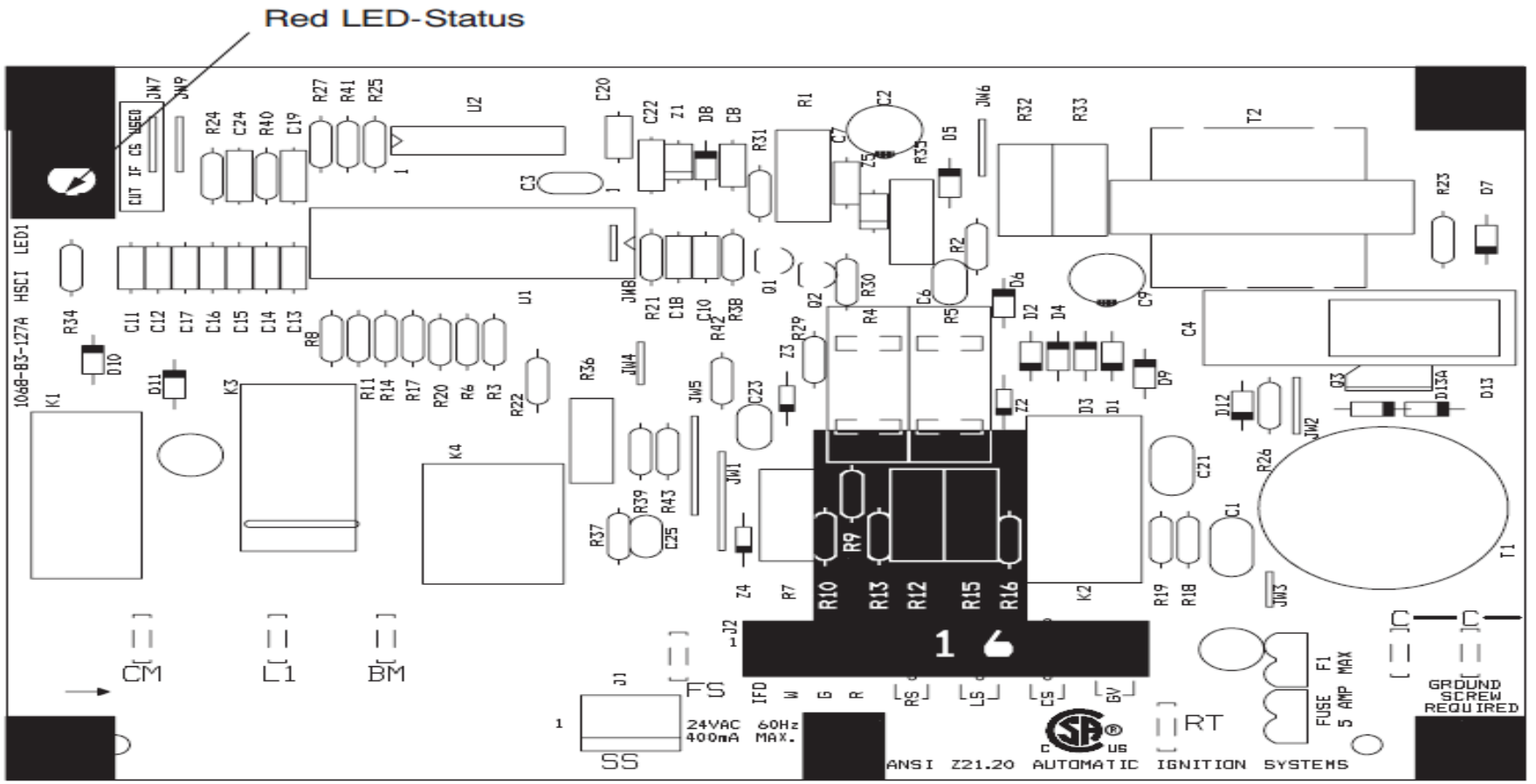


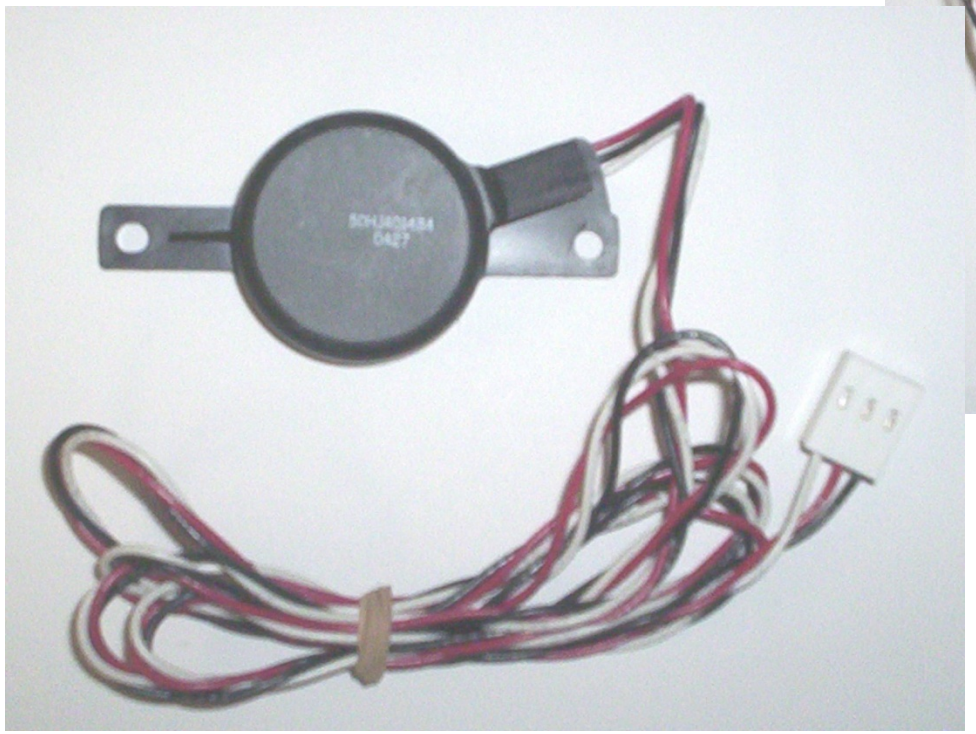
Fig. 69 - Integrated Gas Control (IGC) Board

IGC Board

- IGC Inputs and Outputs

TERMINAL LABEL	POINT DESCRIPTION	SENSOR LOCATION	TYPE OF I/O	CONNECTION PIN NUMBER
INPUTS				
RT, C	Input power from TRAN 1	control box	24 VAC	—
SS	Speed sensor	gas section	analog input	J1, 1-3
FS, T1	Flame sensor	gas section	switch input	—
W	Heat stage 1	LCTB	24 VAC	J2, 2
RS	Rollout switch	gas section	switch input	J2, 5-6
LS	Limit switch	fan section	switch input	J2, 7-8
CS	Centrifugal switch (not used)	—	switch input	J2, 9-10
OUTPUTS				
L1, CM	Induced draft combustion motor	gas section	line VAC	
IFO	Indoor fan	control box	relay	J2, 1
GV	Gas valve (heat stage 1)	gas section	relay	J2, 11-12

Hall Effect Sensor Overview



Test IGC Board and Hall Effect Sensor

Unplugged – reading circuit board

- Pin #3 black lead and pin #1 red lead
- Read 7.5-10 vdc
- Pin #3 black lead and pin #2 red lead
- Read 21-24 vdc

If outside these readings – Replace IGC

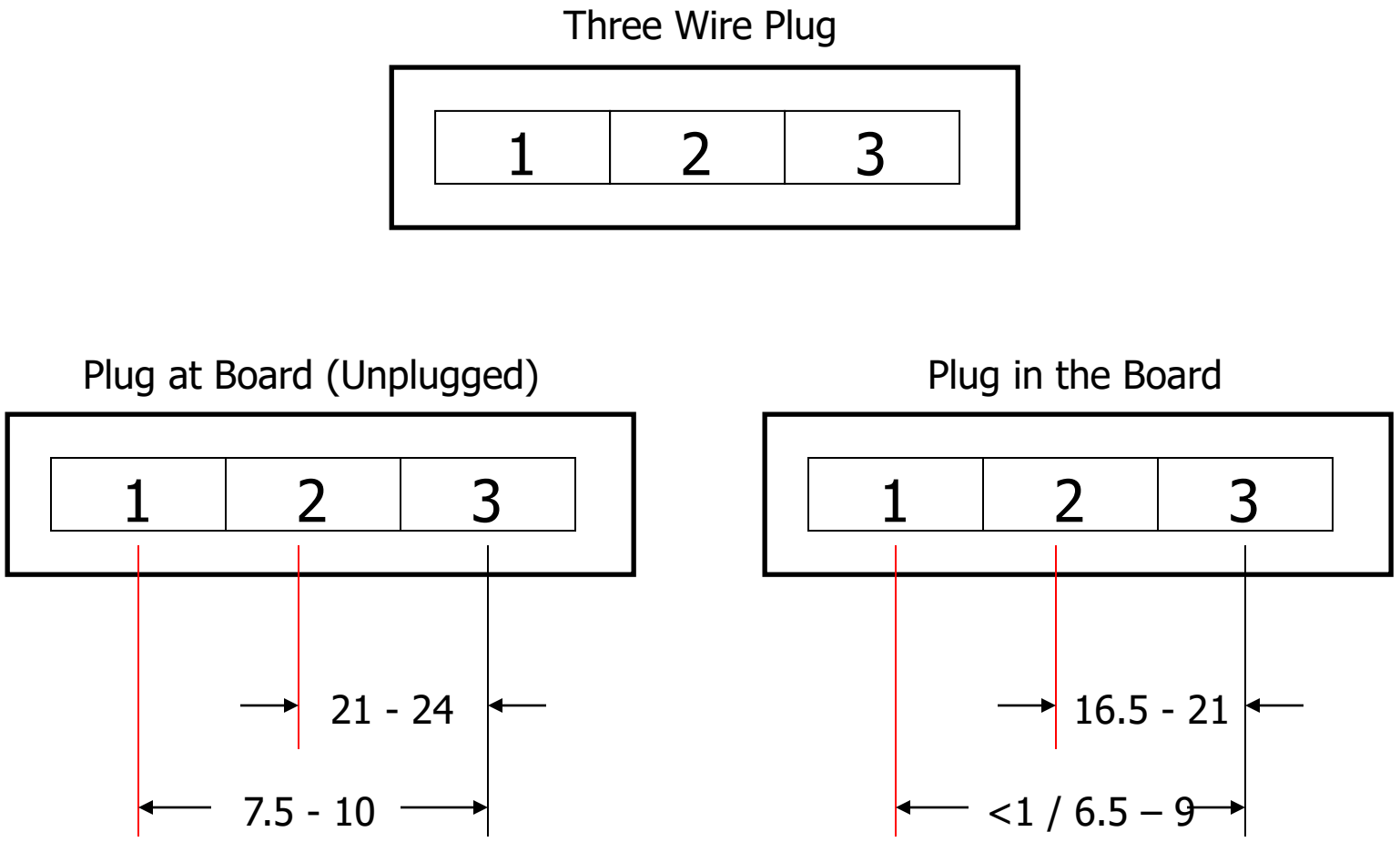
Plugged into circuit board

- Same pin test point (1-3), rotate motor
- Half turn reads <1 vdc, other half turn reads 6.5-9 vdc
- Same pin test point (2-3), rotate motor
- Will read 16-21 vdc

Anything outside of readings – Replace Hall Effect Sensor

comfort | excellence

Hall Effect Sensor Troubleshooting



DC Meter Required

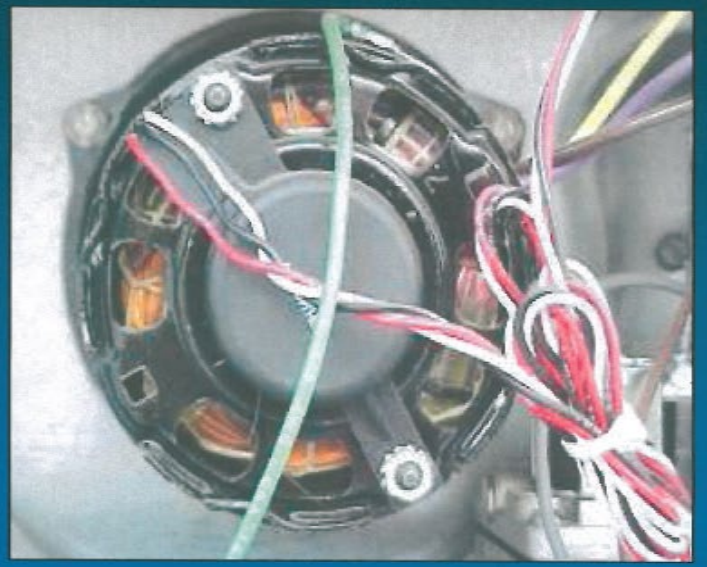
comfort | excellence

Hall Effect Sensor Troubleshooting

Hall Effect Sensor

The Hall Effect Sensor is a magnetic device mounted on the induced draft motor

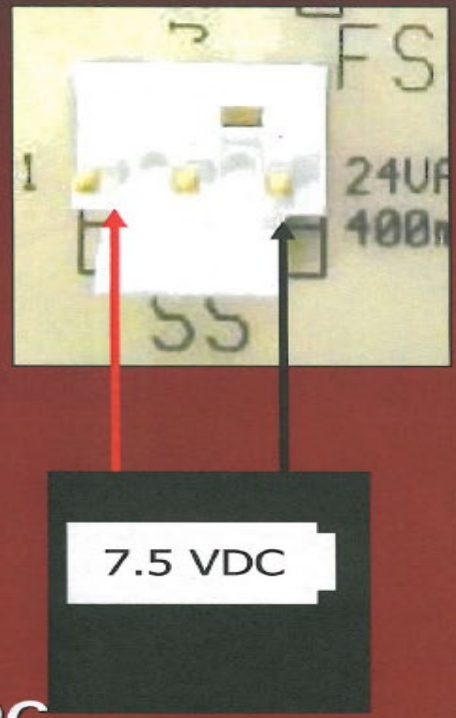
It sends a signal to the board to verify the motor is running at the correct speed



Hall Effect Sensor Troubleshooting

Testing the Hall Effect Sensor, #1

1. De-energize the IGC board.
2. Unplug Hall Effect Sensor
3. Energize the IGC Board
4. No Heat/Cool/Fan call from T-stat
5. Set meter to read maximum 30 VDC
6. Connect black lead to pin # 3
7. Connect red lead to pin # 1
8. The reading should be between 7.5 & 10 VDC

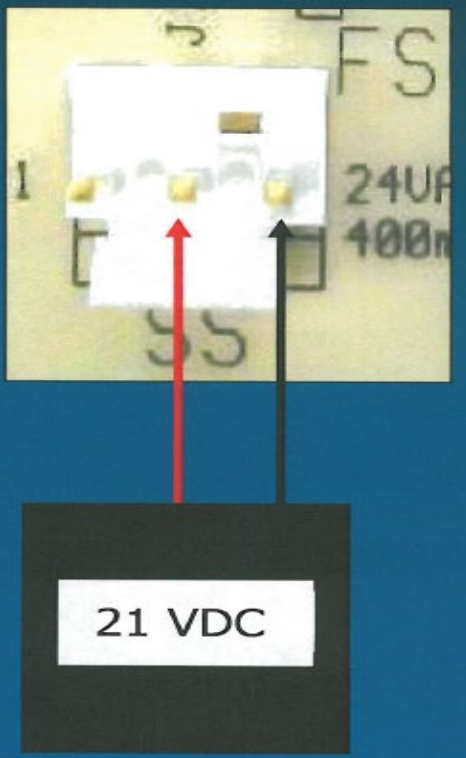


Hall Effect Sensor Troubleshooting

Testing the Hall Effect Sensor, #2

9. Move the red lead to pin # 2
10. The reading should be 21-24 VDC

If either of these two readings are out of range replace the board.

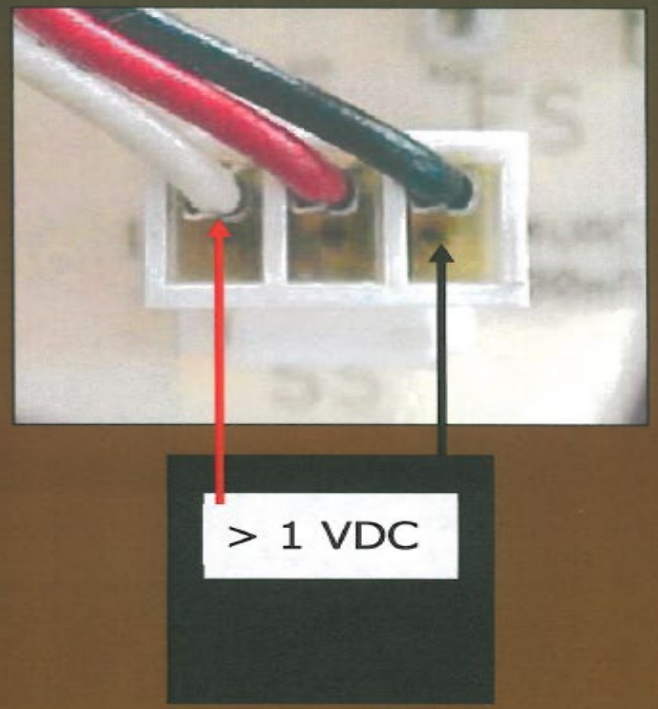


comfort | excellence

Hall Effect sensor troubleshooting

Testing the Hall Effect Sensor, #3

1. Re-plug sensor to board
2. With power on and t-stat off
3. Connect red lead to pin # 1
4. Connect black lead to pin # 3
5. Rotate motor by hand
6. You should read less than 1 VDC on on half turn



Hall Effect Sensor Troubleshooting

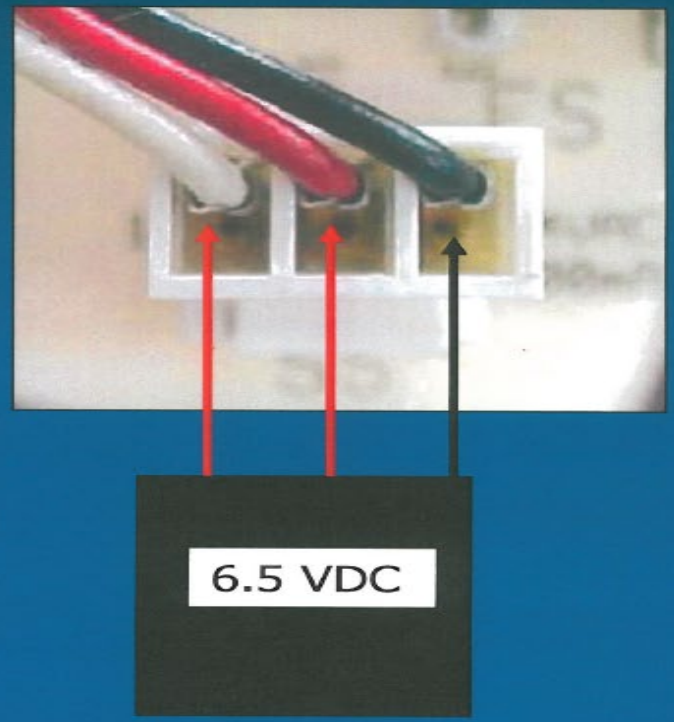
Testing the Hall Effect Sensor, #4

6. On the other half rotation you should read 6.5 – 9 VDC

8. Move the red lead to pin # 2

9. Reading should be between 16.5 & 21 VDC

If any of these three readings are out of range replace the sensor.



Humidi-MiZer Coil Example

Unit shown with end panel removed and in shipping condition.

Fan deck routes all the air through the Humidi-MiZer coil after it exits the evaporator.

HumidiMizer What's the Benefit?

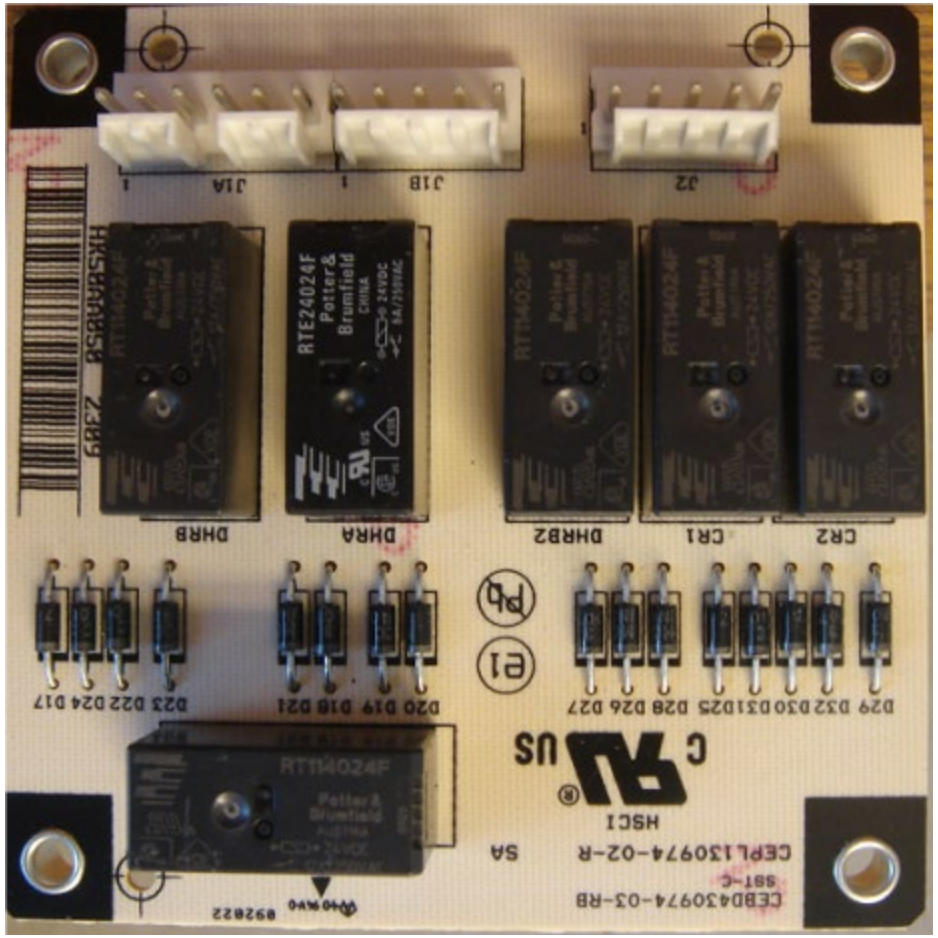
Each refrigerant circuit in a HumidiMiZer system can provide a total of 3 different modes of operation:

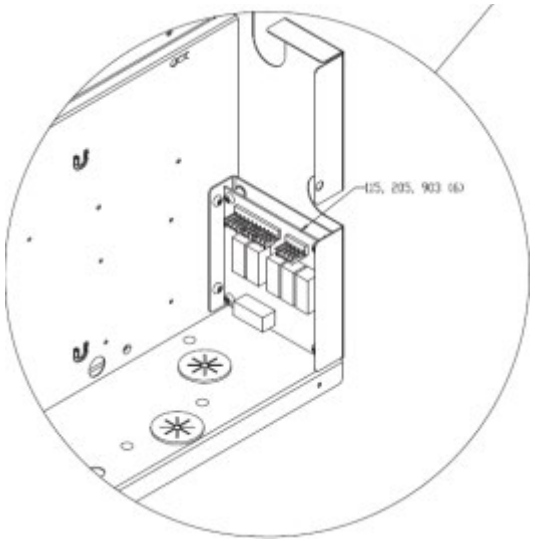
Normal, Sub-cooling, and Reheat modes

- Control of each mode determined by call for DEHUM, Y1, or Y2
- Compressor stays running (except when in complete free cooling mode w/ economizer)

comfort | excellence

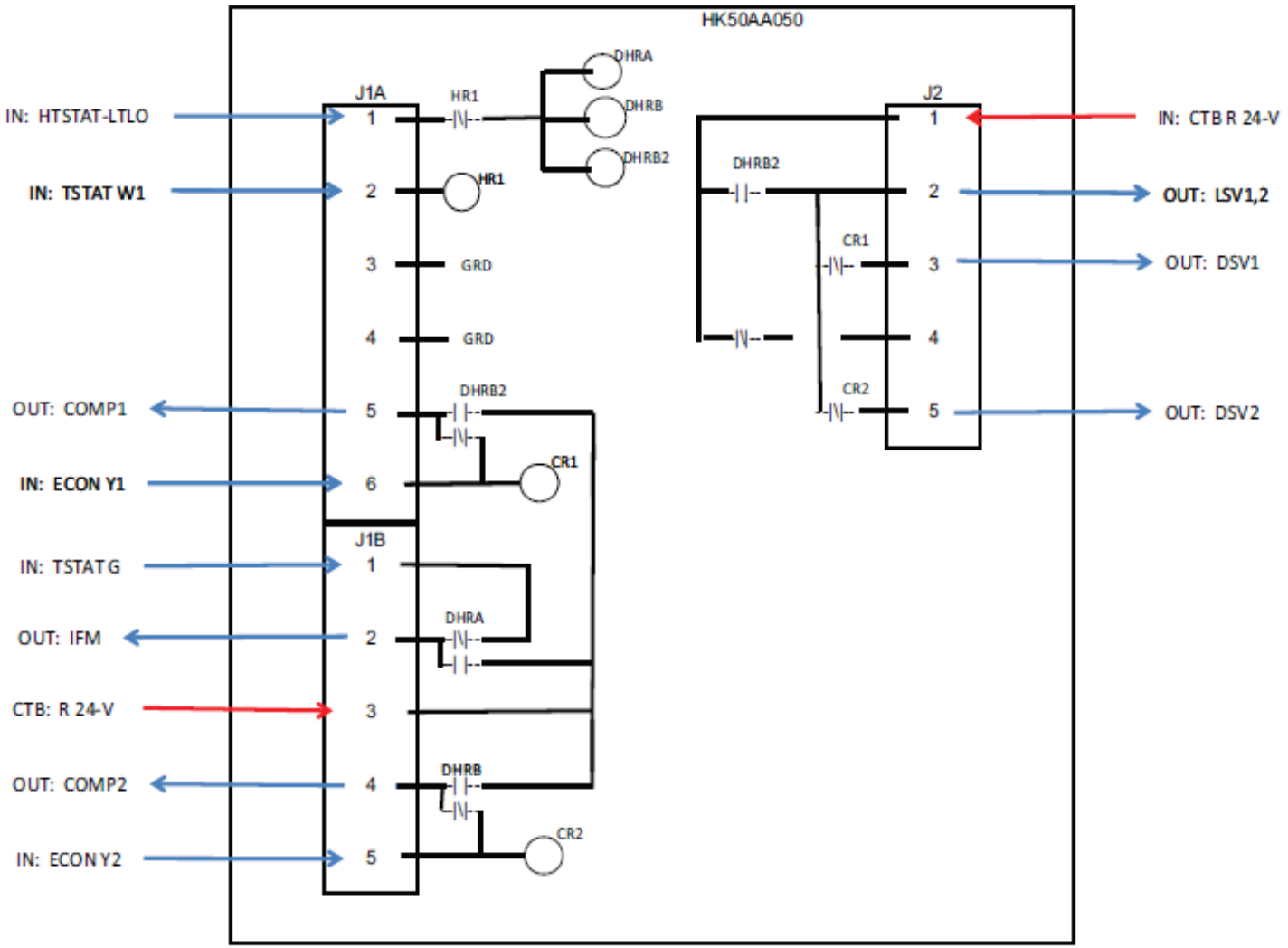
Reheat Board





comfort | excellence

Reheat Board



LEGEND

COMP -- COMPRESSOR
CR -- COOLING RELAY (24-VDC COIL, COM TO GROUND)
DHR -- DEHUMIDIFICATION RELAY (24-VDC COIL)
DSV -- DISCHARGE LINE SOLENOID VALVE
ECON -- ECONOMIZER
GRD -- GROUND
HR -- HEATING RELAY (24-VDC COIL)
HSTAT -- HUMIDISTAT
IFM -- INDOOR/SUPPLY FAN MOTOR
LSV -- LIQUID (3-WAY) SOLENOID VALVE
LTLO -- LOW TEMPERATURE LOCKOUT

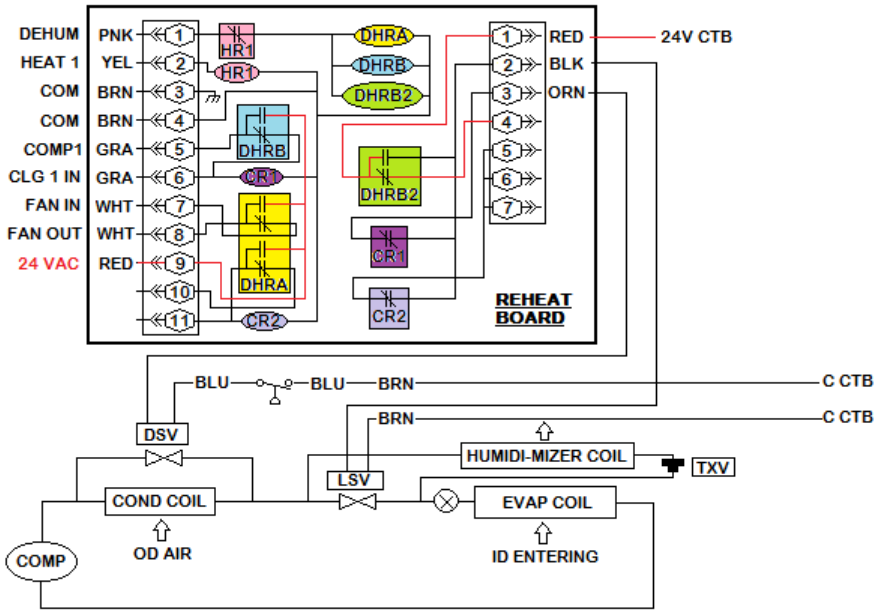
comfort | excellence

Reheat Operating Modes

- W1 Call: Heating ON, all compressors OFF
- Y Call only: Normal Cooling sequence (1 or 2 stages)
- Y plus Humidistat: Increased Latent Cooling Effect
- Humidistat only: Reheat (no/minimal Sensible Cooling)

comfort | excellence

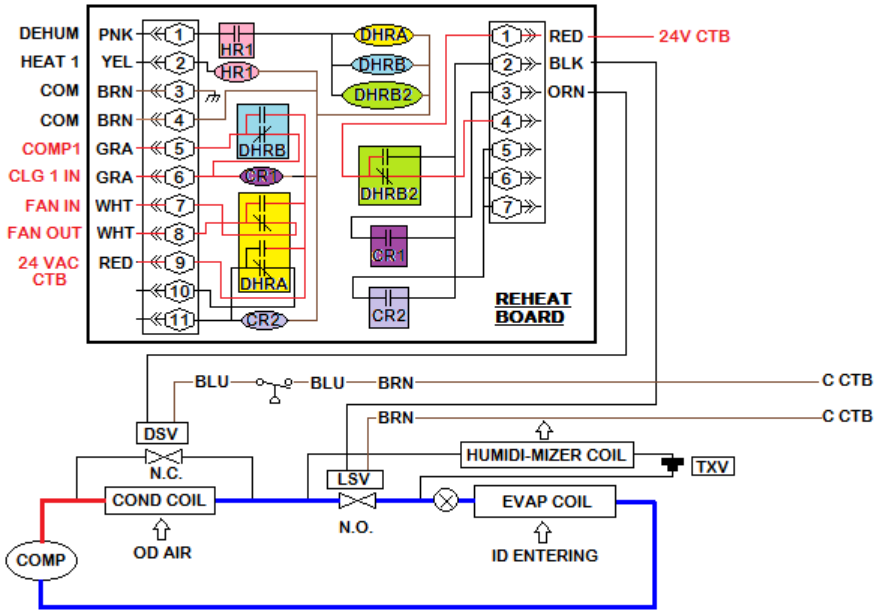
HumidiMizer – No Call



Reheat Board is powered, compressor is off, all valves in normal state position

comfort | excellence

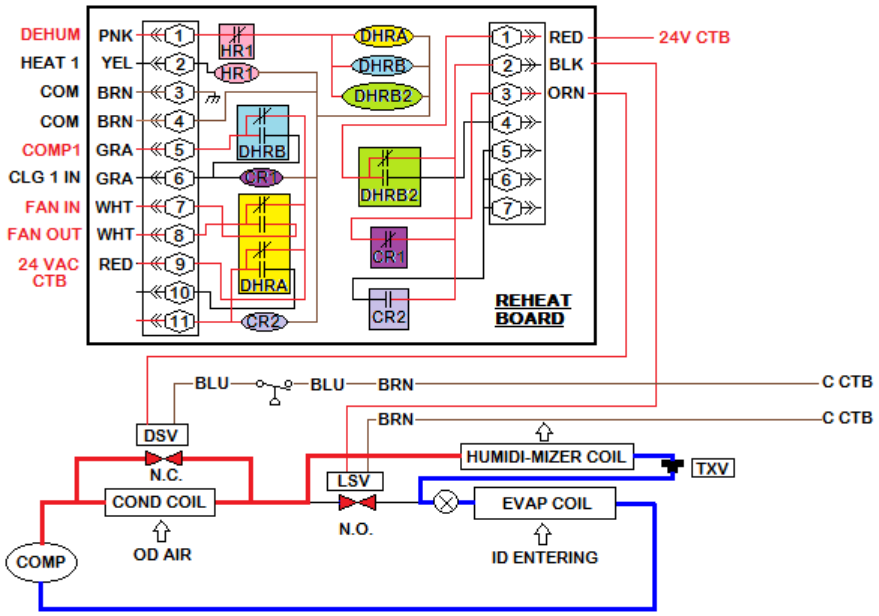
HumidiMizer – Cooling Only Call



- Signal for Fan and First Stage Cooling come into Reheat Board
- Signal is sent out to run fan and compressor
- Valves are left at normal state position
- Outdoor condenser coil is used, HumidiMizer coil bypassed.

comfort | excellence

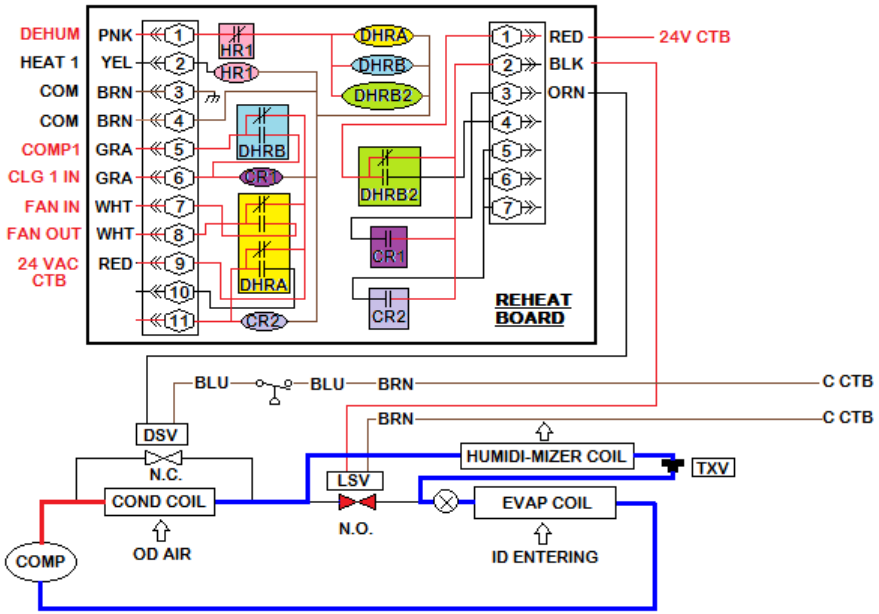
HumidiMizer – Dehumidification Only Call



- Signal for Fan and Dehumidification come into Reheat Board.
- Signal is sent out to run fan and compressor.
- Both valves are energized.
- Outdoor condenser coil is bypassed, HumidiMizer coil used for condensing refrigerant and reheating cold dry air from evaporator coil.

comfort | excellence

HumidiMizer – Cooling & Dehumidification Call

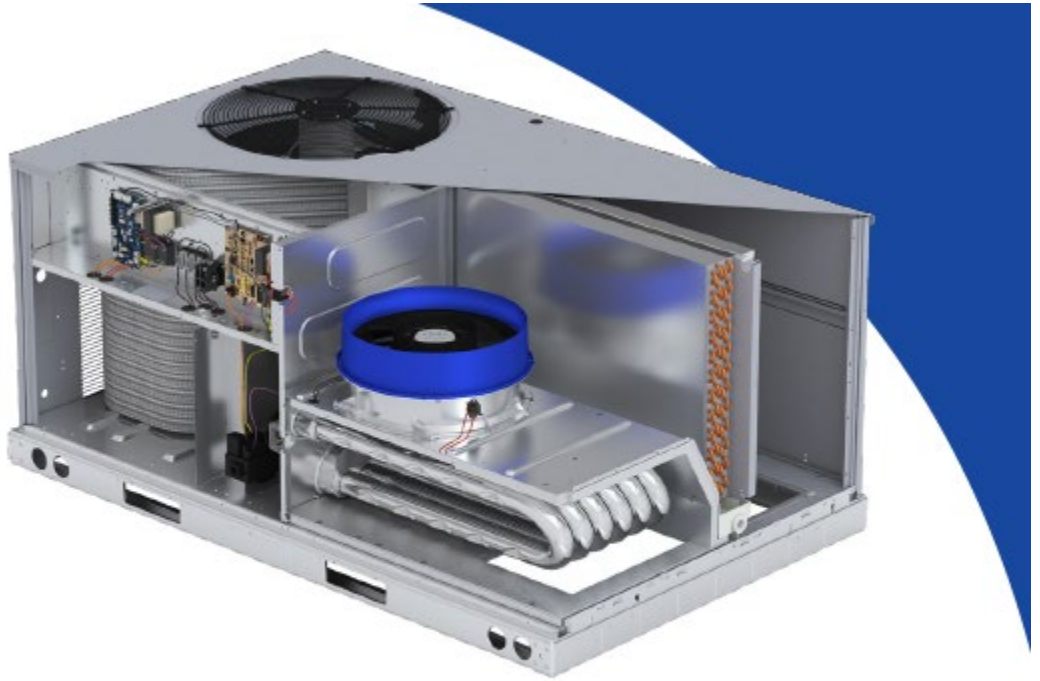


- Signal for Fan, Cooling and Dehumidification come into Reheat Board.
- Signal is sent out to run fan and compressor.
- LSV Valve is energized.
- Outdoor condenser coil is used, HumidiMizer coil is used for sub cooling refrigerant.

comfort | excellence

48 / 50 JC Variable Speed RTU

Carrier



NEW

PACKAGED
VARIABLE SPEED MODELS

CE
comfort | excellence

48/50JC Variable Speed RTU

Gas/Electric - 48JCV 3 To 5 Ton Models - Up To 20 SEER

Elect./Elect. - 50JCV 3 To 5 Ton Models - Up To 20 SEER

comfort | excellence

48/50JC Variable Speed RTU

Vane Axial Beltless Indoor Fan System

- Slow Speed Ramp Up
- Quiet Operation
- Direct Drive ECM Motor
- Easy Fan Set Up and Adjustment
- High Static Capability
- Up To 40% More Energy Efficient
- 75% Fewer Moving Parts

comfort | excellence

48/50JC Variable Speed RTU

Scroll Compression With Single Circuit Design

- Fully Active Coil Design
- Variable Speed Capacity Control All Models

  (Capacity Control Range 25% to 105%)

comfort | excellence

48/50JC Variable Speed RTU

Intelligent SystemVu™ Controls

– SystemVu™ Intelligent Integrated Controls With Key Pad and Display Standard On All Models

comfort | excellence

48/50JC Variable Speed RTU

SystemVu™

- Large Backlit Menu Driven Display With Four Line Text Capability
- Quick Unit Status LED's: RUN, ALERT, FAULT
- Read Refrigerant Pressures Through Display - No Gauges Required
- Auto or Manual Run Test Capabilities
- Record Component Run Hors and Starts
- Compressor Reverse Rotation Protection
- USB Data Port (Thumb Drive)

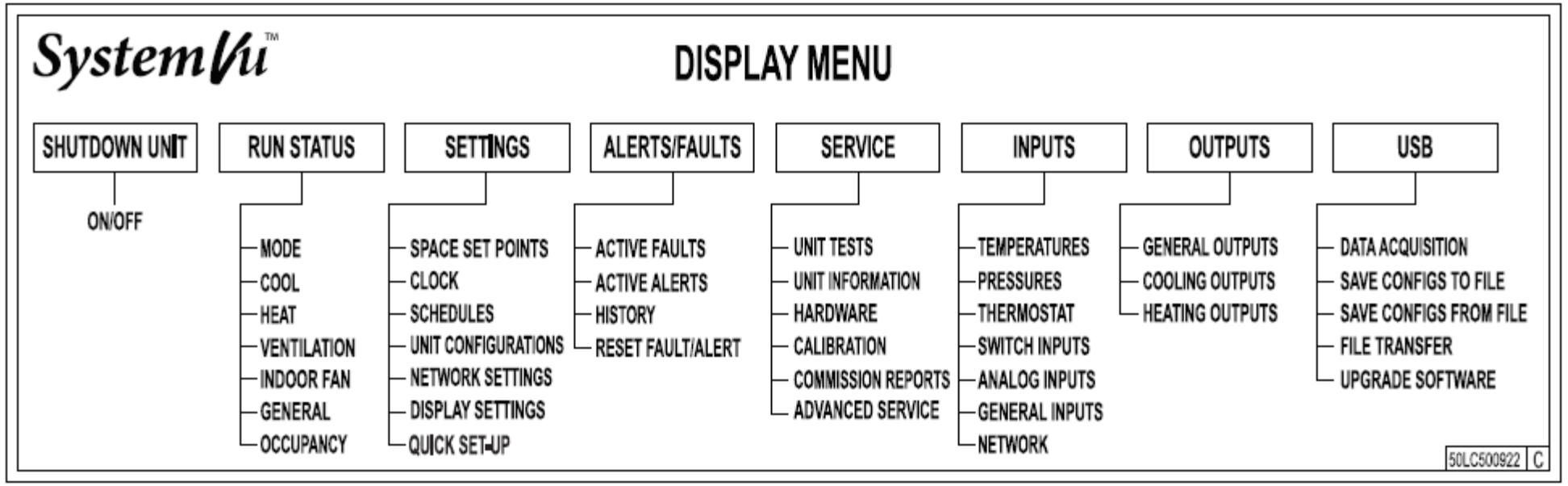
comfort | excellence

48/50JC Variable Speed RTU

48JCV 3 To 5 Ton Gas/Elect Models - Up To 20 SEER			
Nom. Cooling Tons	3	4	5
Model Number	48JC*V04	48JC*V05	48JC*V06
SEER	20	20	19
Cooling Capacity	Variable Speed	Variable Speed	Variable Speed
Blower Type - Speed	Vane Axial - Var. Speed	Vane Axial - Var. Speed	Vane Axial - Var. Speed
Gas Heat AFUE Rating %	81	81	81
Gas Heat Sizes (Output)	54,000 / 93,000	54,000 / 88,000 / 120,000	54,000 / 88,000 / 120,000
Clg. Metering Device	TXV	TXV	TXV
Cabinet Size (LxWxH) in	74 x 47 x 41	74 x 47 x 41	74 x 47 x 41
Std. Net Unit Weight	587	610	612

comfort | excellence

48/50JC Variable Speed RTU



CE
comfort | excellence

JC Warning Before Start-Up

IMPORTANT: Do not attempt to start unit, even momentarily, until all items on the Start-Up Checklist (see page CL-1) and the following steps have been read/completed.

IMPORTANT: Unit power must be ON for 24 hours prior to start-up to allow the crankcase heater to run. Otherwise, damage to the compressor may result.

comfort | excellence

48/50 JC Power Supply

Power Supply

All 208/230-v units are factory wired for 230-v power supply. If the 208/230-v unit is to be connected to a 208-v power supply, the transformers must be rewired by moving the wire from the 230-volt connection and moving to the 200-volt terminal on the primary side of the transformer. Refer to unit label diagram for additional information.

JC Variable Speed Compressor Rotation

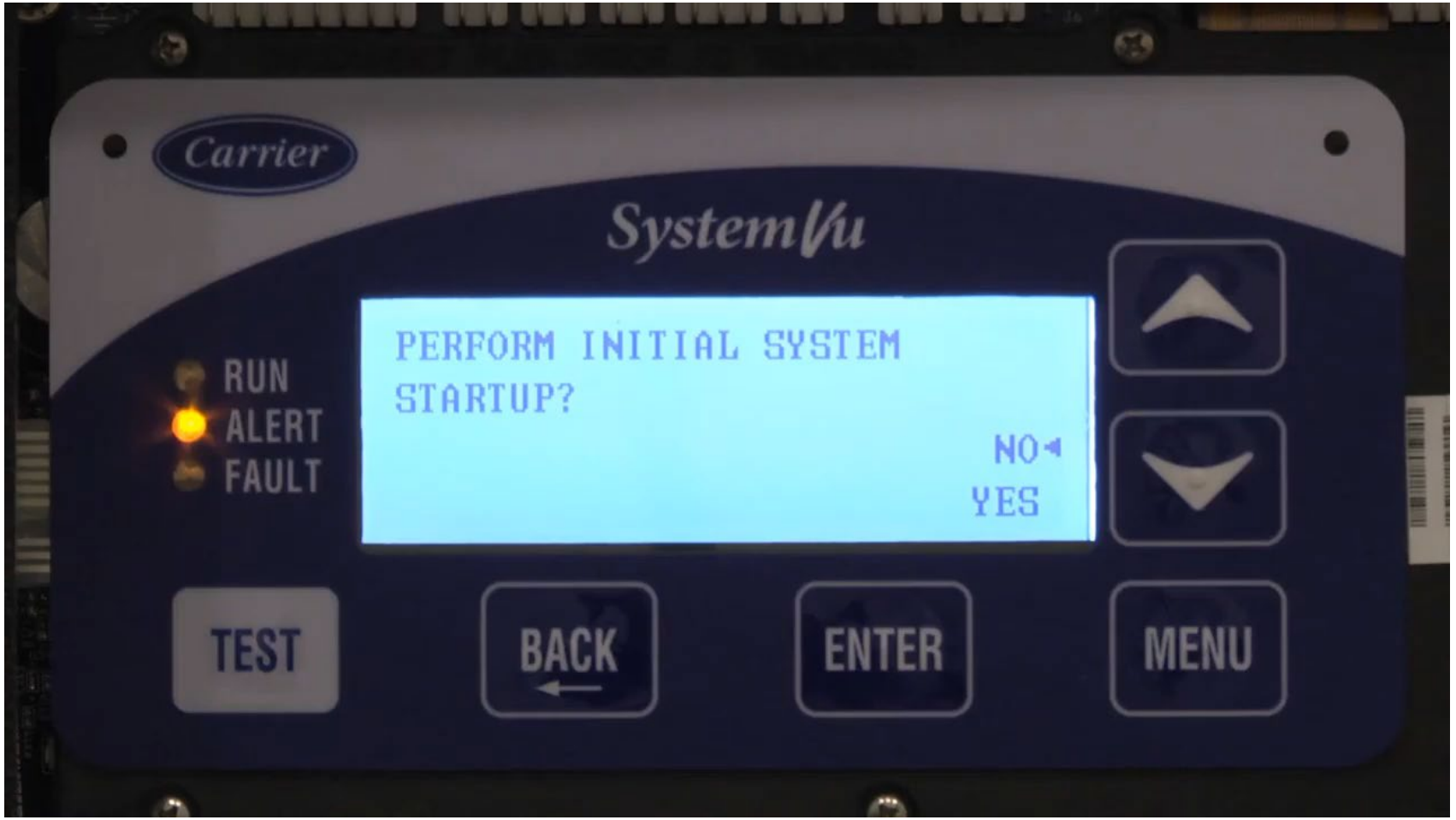
IMPORTANT: Swapping the unit supply power will not correct the compressor rotation. The Compressor VFD controls the phasing out to the compressor. Only a manufacturing error will cause a reverse rotation.

To correct the wrong compressor rotation direction, perform the following procedure:

1. Turn off power to the unit and lock out the power.
2. Switch any two of the Compressor VFD output power that run out to the compressor. .
3. Turn on power to the unit.
4. Verify corrected compressor rotation.

comfort | excellence

System Vu Quick Start



48/50JC Variable Speed RTU

FIELD CONTROL WIRING

The 48JC unit comes standard with SystemVu controls. An external space sensor or conventional thermostat is required (field-supplied).

48/50JC Variable Speed RTU

SPACE TEMPERATURE SENSOR (SPT)

There are 2 types of space temperature sensors available from Carrier, resistive input non-communicating (T-55, T-56 and T-59) and Rnet communicating (ZS) sensors. Each type has a variety of options consisting of: timed override button, set point adjustment, a LCD screen, combination of humidity or CO_2 sensing and communication tie in. Space temperature can be also be written to from a building network or zoning system.

48/50JC Variable Speed RTU

Fig. 38 shows the wiring connections from the accessory space temperature sensors to the SystemVu MBB.

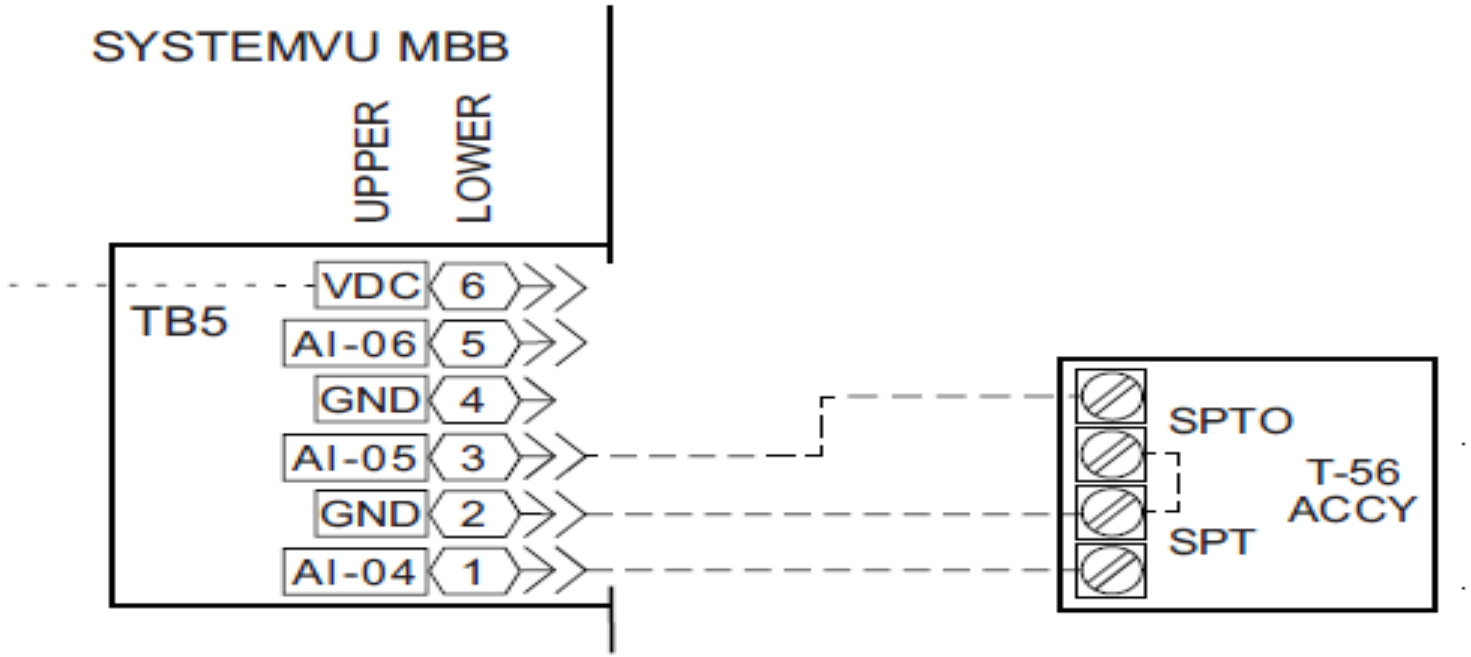


Fig. 38 — Typical Low Voltage SPT Connections

48/50JC Variable Speed RTU

Space Temperature Sensor (T-56)

The T-56 space temperature sensor (part no. 33ZCT56SPT) is a field-installed accessory. This sensor includes a sliding scale on the front cover that permits an occupant to adjust the space temperature set point remotely. The T-56 sensor also includes an override button on the front cover to allow occupants to override the unoccupied schedule (if programmed).

TB5-1 . . . . . Sensor Input

TB5-2 . . . . . Sensor Common

TB5-3 . . . . . Setpoint Offset Input

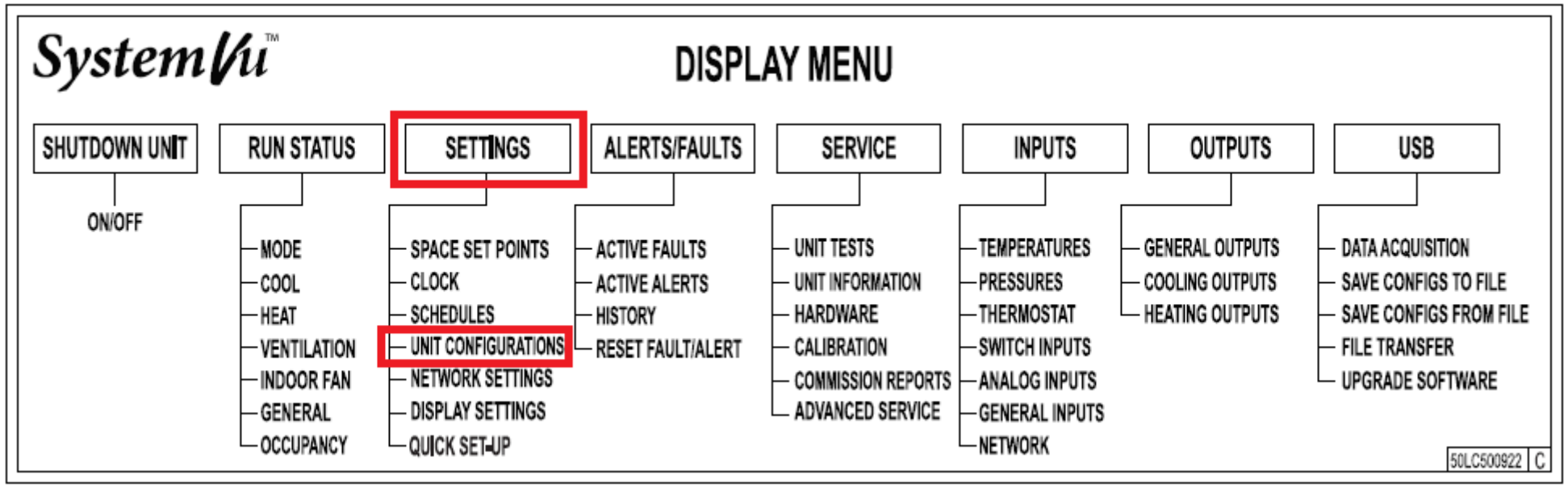
comfort | excellence

48/50 JC Variable Speed RTU

Space Temperature Sensor Control - Direct Wired (T-55 or T-56 or T-59)

Wire accessory space temperature sensor(s) to the T-55 terminals on the field connection terminal board located at the unit control box. Refer to Space Mounted Sensors section (page 58) for additional information.

The Unit Control Type configuration, (*UNIT CONTROL TYPE*) must be set to Space Sensor (1).



CE
comfort | excellence

48/50JC Variable speed RTU

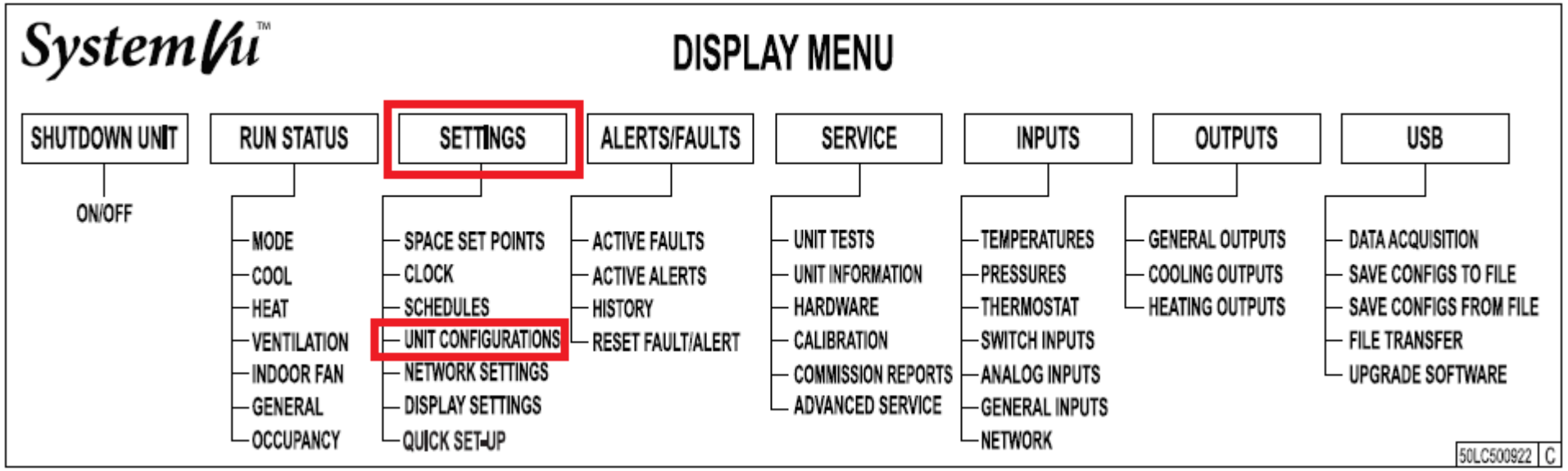
Thermostat Control

Wire accessory thermostat to the corresponding R, Y1, Y2, W1, W2, and G terminals on the Main Base board.

The Unit Control Type configuration, (***UNIT CONTROL TYPE***) default value is for thermostat (0) so there is no need to configure this item.

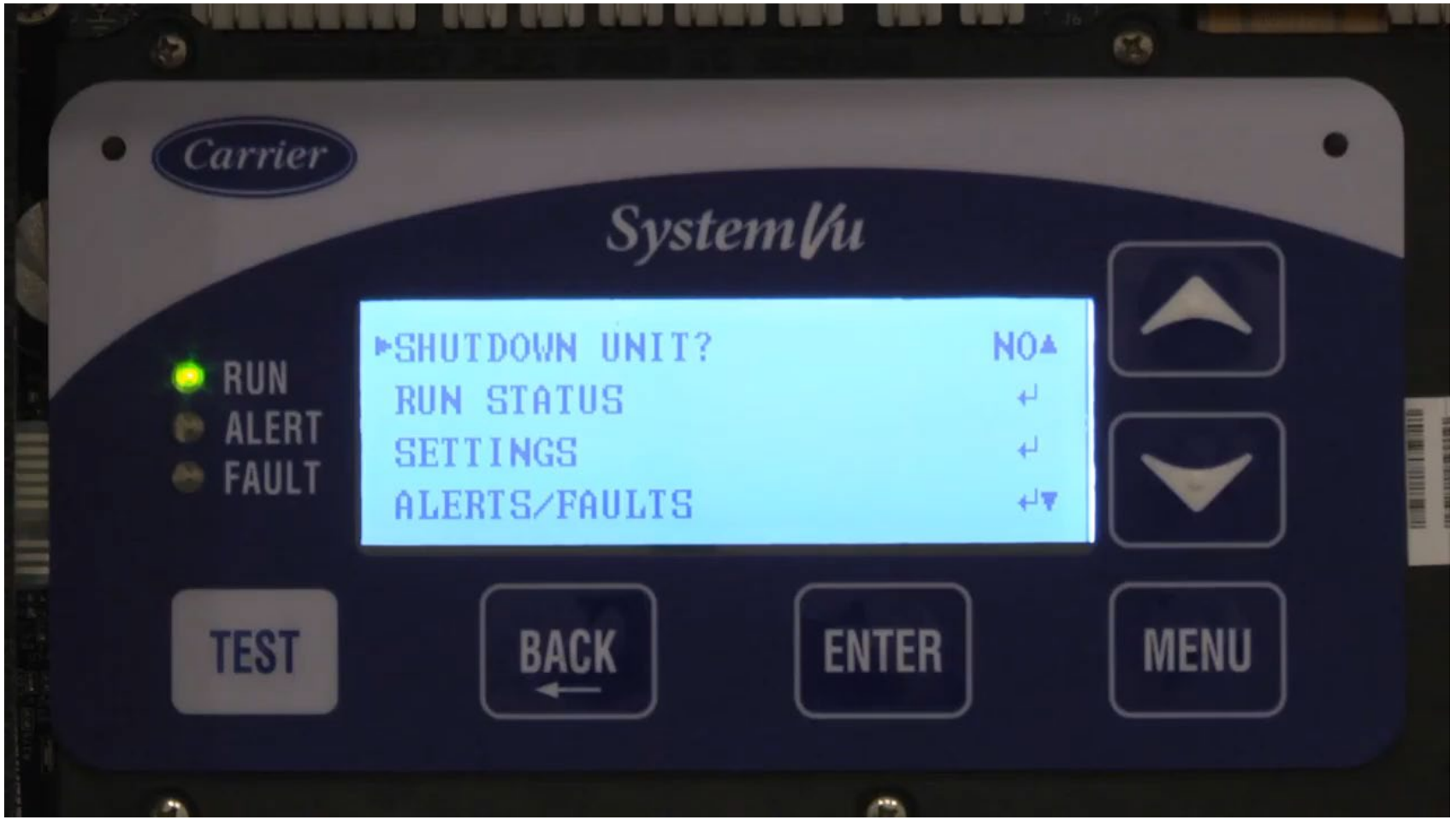
The Thermostat Hardware Type, (***THERMOSTAT TYPE***) selects the unit response to the thermostat inputs above.

NOTE: May not be compatible with heat anticipator thermostats.

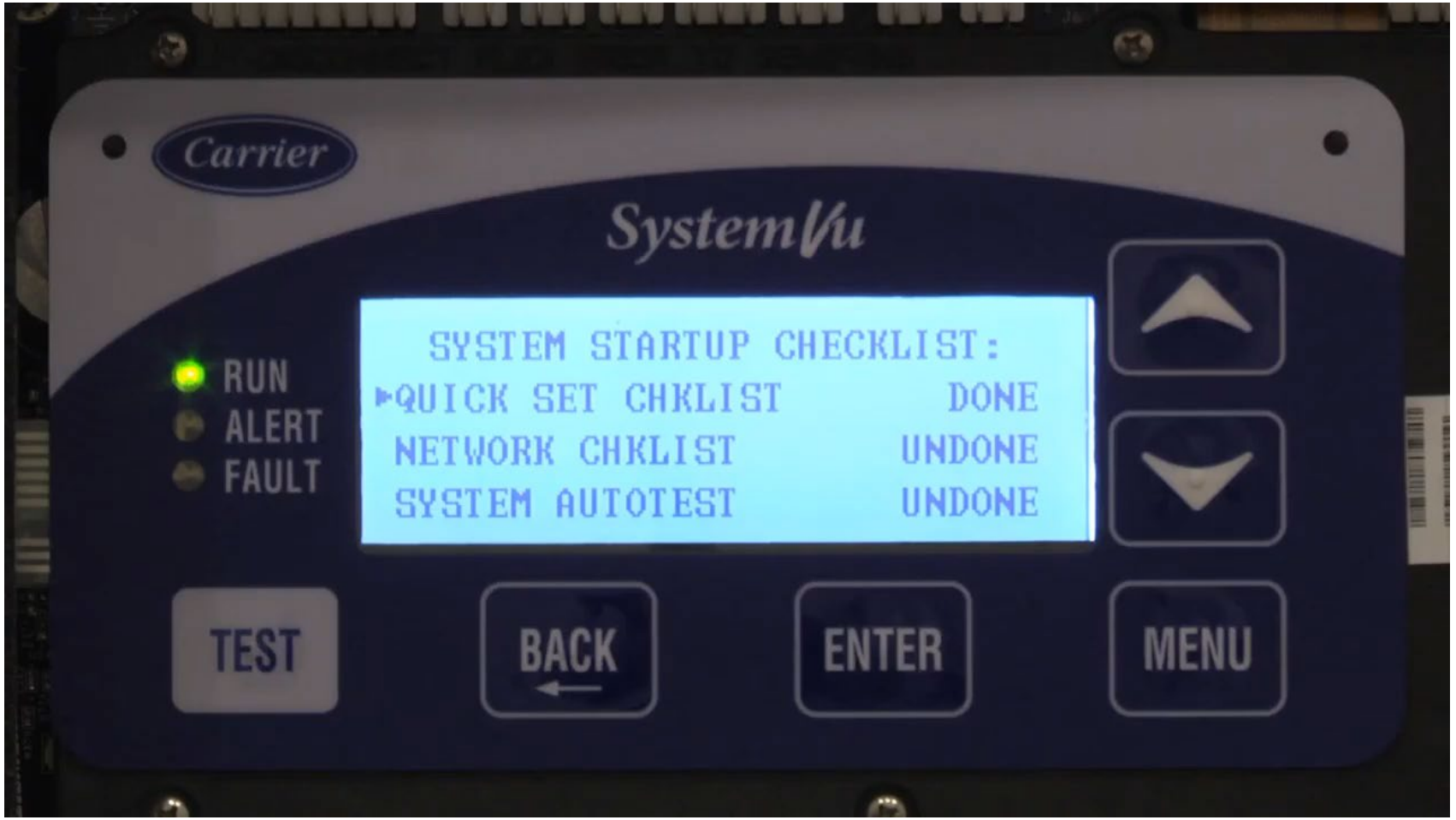


CE
comfort | excellence

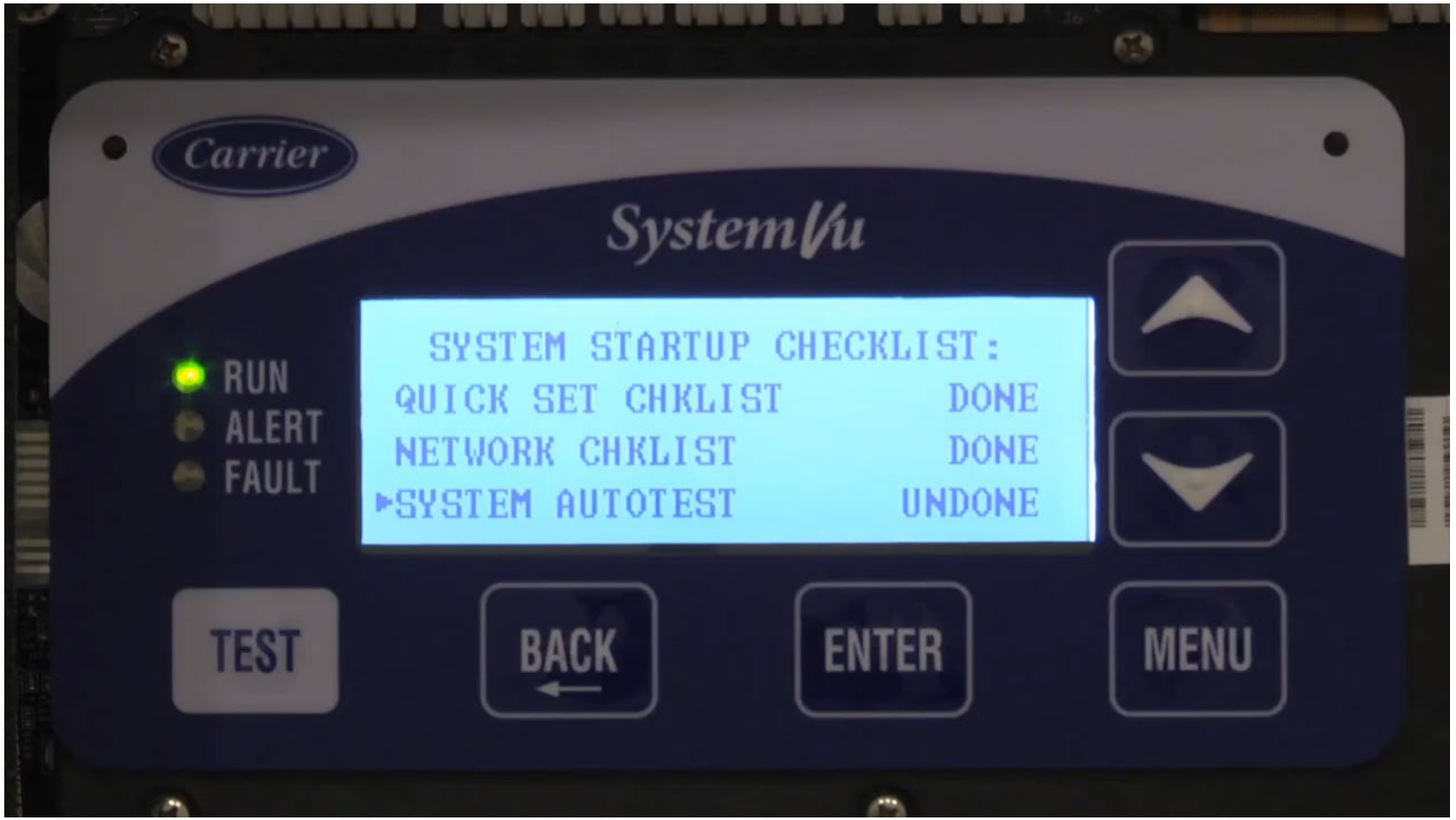
48/50JC System Vu Control Type



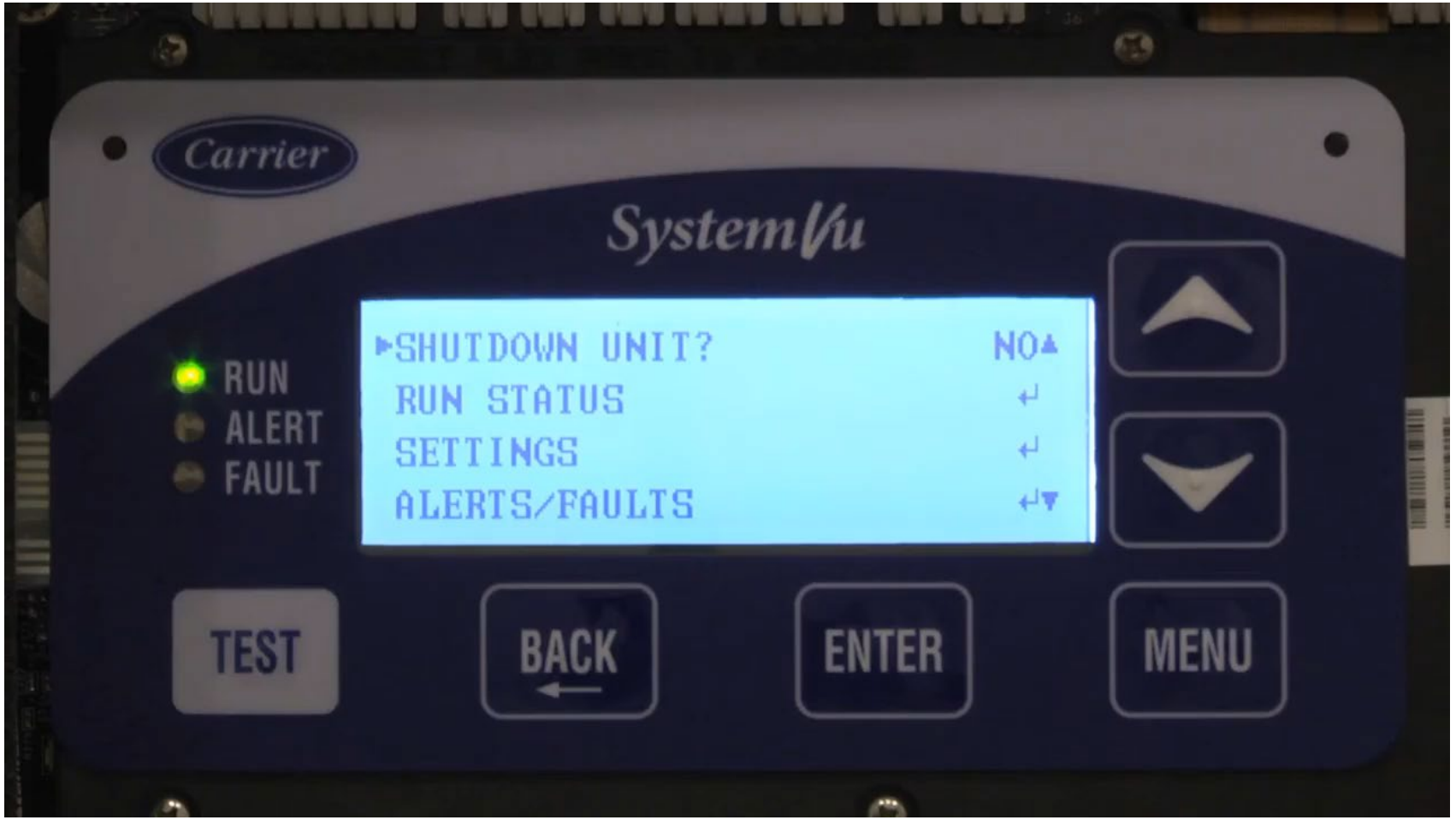
48/50JC System Vu Network Check List



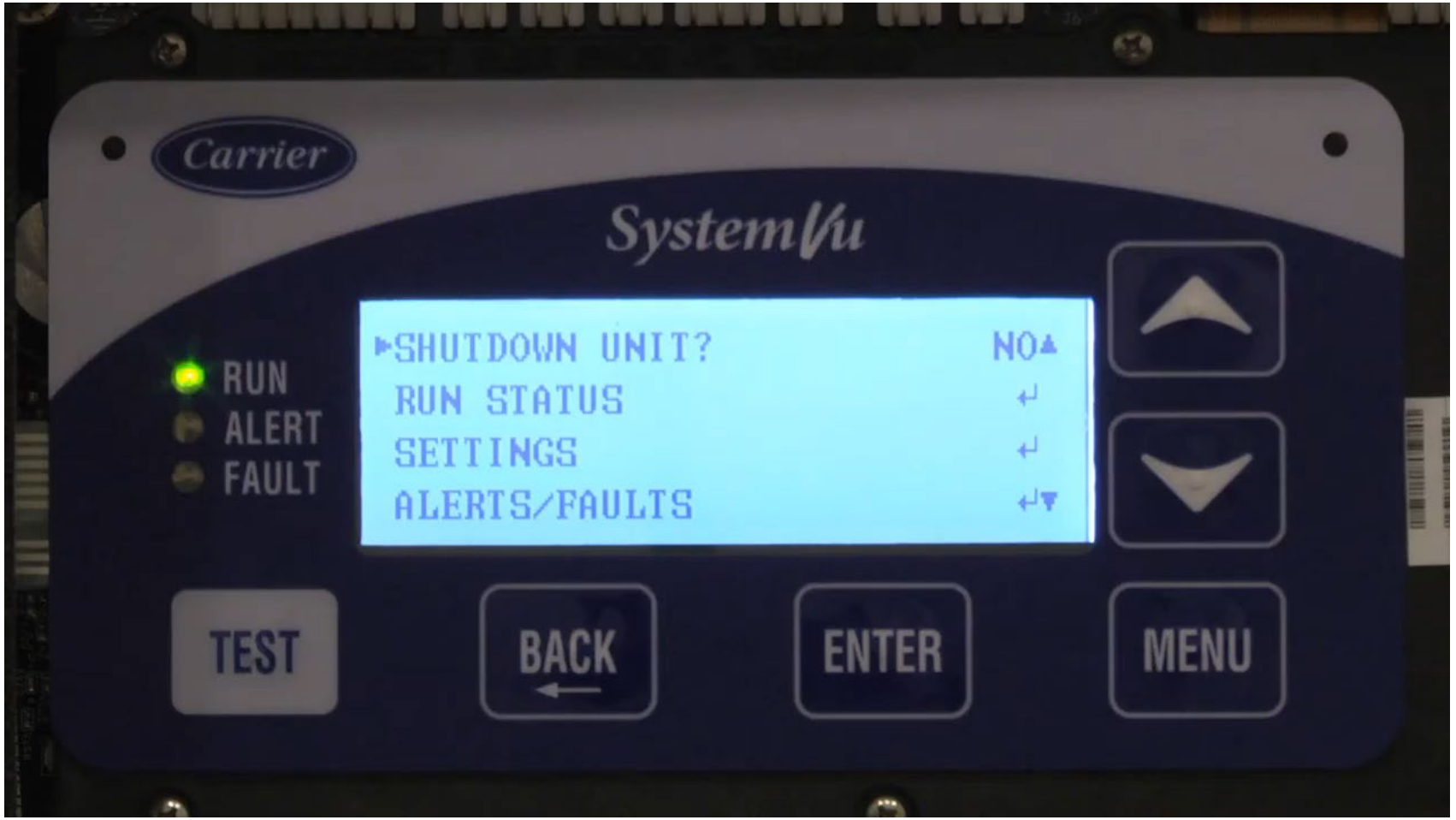
48/50JC System Vu Autotest



48/50JC System Vu Indoor Fan Set-Up



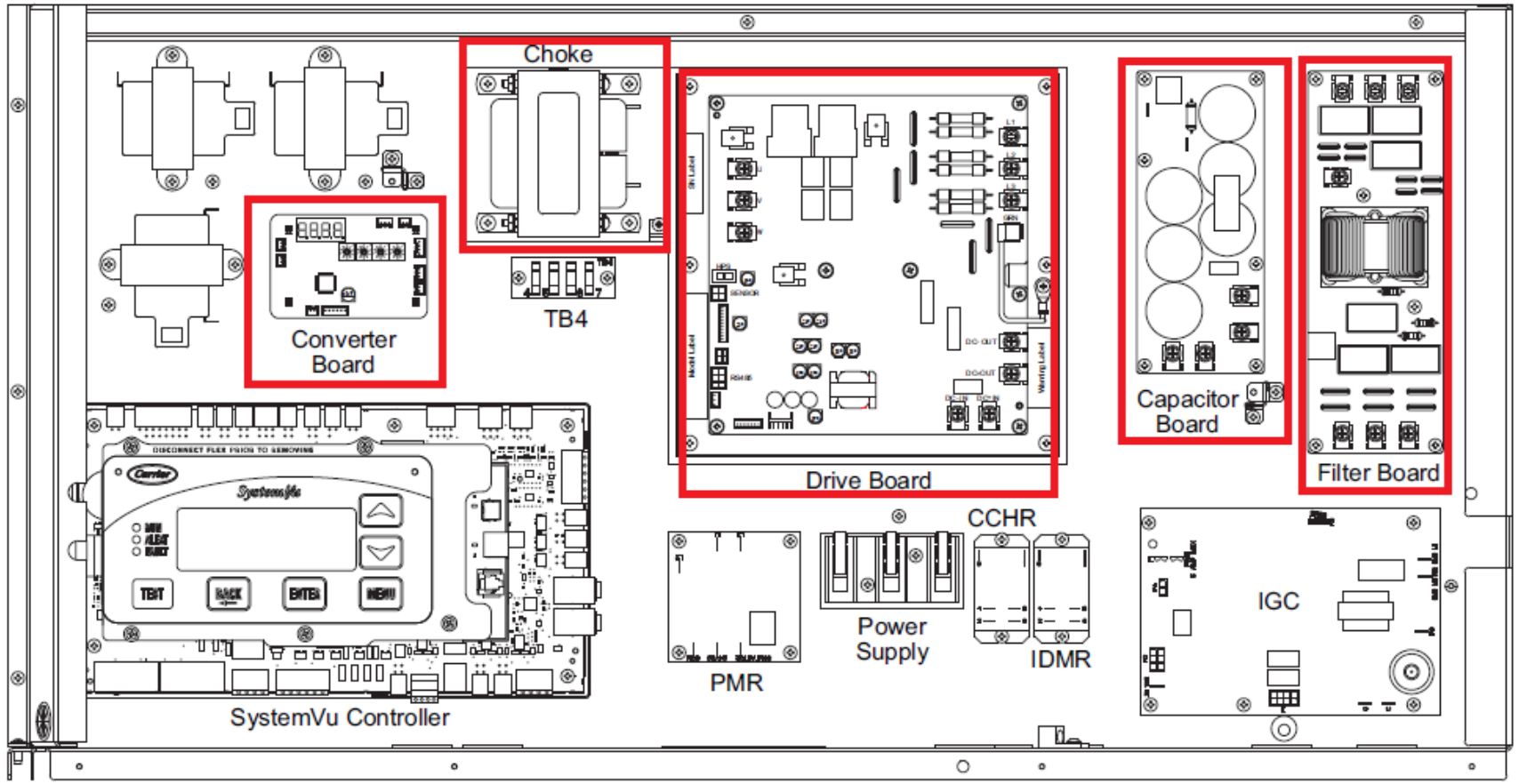
48/50JC System Vu Economiser Min. Pos.



Compressor VFD

- The compressor VFD looks differently than the industry standard. It is not packaged in its own housing to appear as a single component.
- The Compressor VFD consist of 5 components in the control section.
- The Driver board, Converter board, Filter board, Capacitor board and the Choke.

Compressor VFD



Control Box Layout

Compressor VFD Drive Board

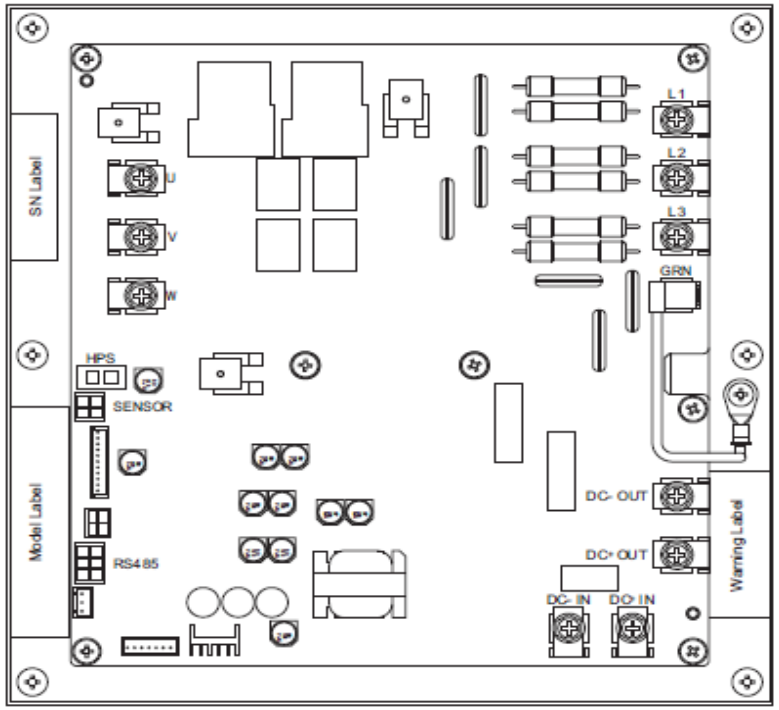


Fig. 30 — Drive Board

Table 27 — Drive Board Inputs/Outputs

TERMINAL LABEL	DESCRIPTION	TYPE	CONNECTOR
HPS	High Pressure switch input	3.3vdc	2 Pins
SENSOR	DLT sensor input	10k thermistor	Pins 1 and 2 (inner 2 pins)
RS485	Modbus communication with the converter board	RS485 Communication	Pins 1,4, and 5
L1, L2, L3	Supply Power from the filter board	AC high voltage	3x screw terminals
GRN	Supply Ground	Chassis Ground	2x 1/4-in. Quick Connect
DC+OUT, DC-OUT	DC bus out to capacitor board	DC high voltage	2x 1/4-in. Quick Connect
DC+IN, DC-IN	DC bus in from the capacitor board	DC high voltage	2x 1/4-in. Quick Connect
U, V, W	Output to the compressor	AC High voltage	3x screw terminals

Compressor VFD Converter Board

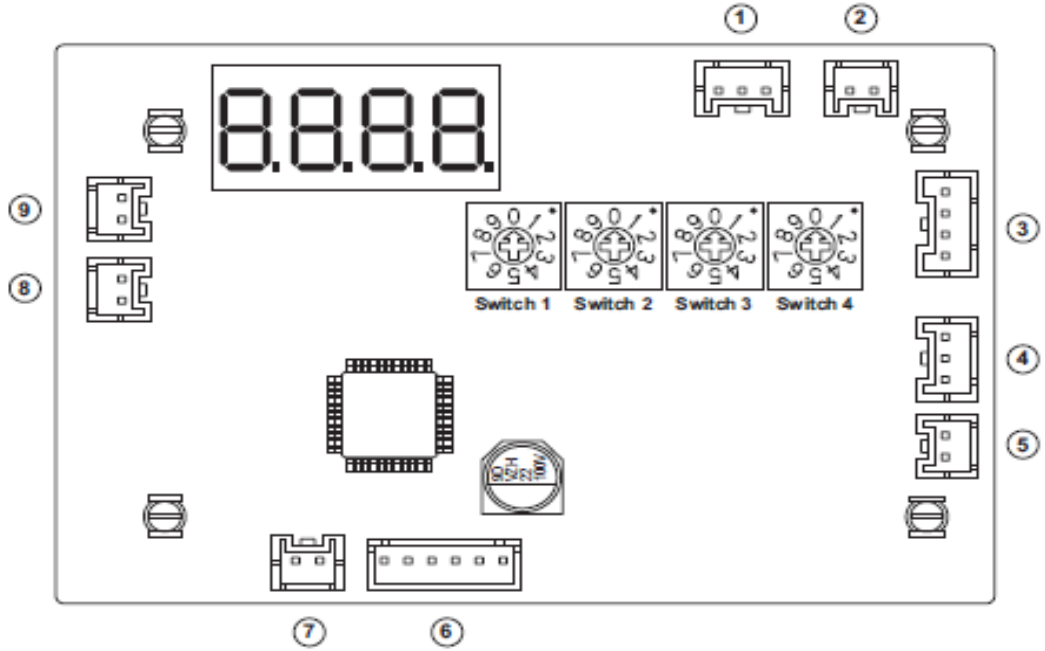
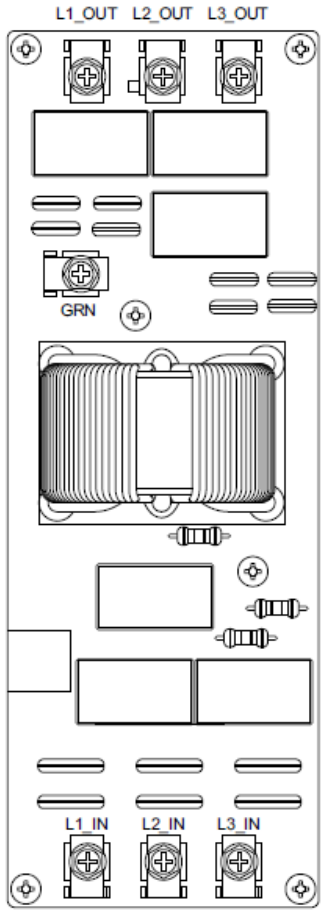


Fig. 31 — Converter Board

Table 28 — Converter Board Inputs/Outputs

REFERENCE NUMBER	DESCRIPTION	TYPE	CONNECTOR
1	Not used	—	—
2	Not used	—	—
3	Modbus communication with the drive board	RS485 Communication	Pins 1,2, and 3
4	Input control from SystemVu	PWM signal	Pins 1 and 3
5	Start/Stop input	24vac	Pins 1 and 2
6	Not used	—	—
7	Power supply	24vac	Pins 1 and 2
8	Not used	—	—
9	Not used	—	—

Compressor VFD Filter Board



Filter Board

Filter Board Inputs/Outputs

TERMINAL LABEL	DESCRIPTION	TYPE	CONNECTOR
L1_IN, L2_IN, L3_IN	Supply Power	AC High voltage	3x screw terminals
GRN	Supply Ground	Chassis Ground	1x screw terminal
L1_OUT, L2_OUT, L3_OUT	Supply Power to Drive board	AC High voltage	3x screw terminals

Compressor VFD Converter Board

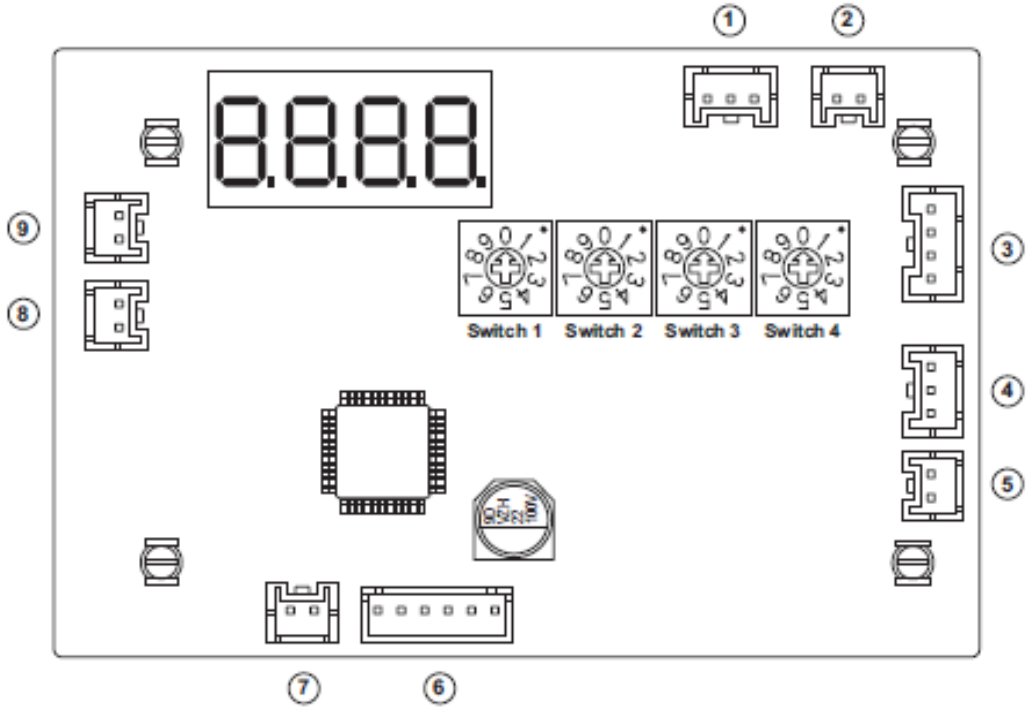


Fig. 31 — Converter Board

Table 29 — Converter Board Switch Settings

SIZE	SWITCH 1	SWITCH 2	SWITCH 3	SWITCH 4
04 (3Ton)	3	3	1	1
05 (4Ton)	3	4	1	1
06 (5Ton)	3	5	5	1

Table 30 — Converter Board Foldback Codes

FOLDBACK CODE	FOLDBACK DESCRIPTION
Sd01	Configuration Status (EEPROM/FLASH)
Sd02	Speed Foldback Flag (Output Voltage Limit)
Sd03	PFC Temperature Foldback Status
Sd04	AC Input Current Foldback Status
Sd05	Compressor Phase Current Foldback Status
Sd06	Compressor Power Module Temperature Foldback Status
Sd07	DLT Temperature Foldback Status
Sd08	Output Capacity Foldback Status
Sd09	Autosaved Data Status
Sd10	Speed Foldback Flag (Torque Limit)

Converter Board Error Codes

Converter Board Error Codes

ERROR CODE	FAULT DESCRIPTION	DRIVE MODBUS REGISTER	ACTION/CAUSE
E-01	Compressor Phase Over Current	Reg.78|80 Bit0	1. Check the U/V/W connections on the drive side 2. Check the compressor motor windings 3. Check the compressor is operating within specified limits. 4. Sensor on Drive not reading properly - Replace Drive.
E-02	AC Input Over Current (SW)	Reg.78|80 Bit1	1. Check that the line voltage is no more than 15% below the specified voltage for the drive. Check the line voltage for noise. 2. Check the compressor is operating within specified limits. 3. If the problem persists, then it is possibly a drive component issue. Replace the drive

comfort | excellence

Converter Board Error Codes

E-03	DC Bus Over Voltage (SW)	Reg.78|80 Bit2	1. Check that the line voltage is no more than 15% above the specified voltage for the drive. 2. Check the DC bus voltage if it is >385VDC. 3. Check the compressor is operating within the specified limits. 4. If the problem still persists, then it is possibly a drive component issue. Replace the drive.
E-04	DC Bus Under Voltage	Reg.78|80 Bit3	1. Check that the line voltage is no more than 15% below the specified voltage for the drive. 2. Check the DC bus voltage if it is <385VDC. 3. Check the compressor is operating within the specified limits. 4. If the problem still persists, then it is possibly a drive component issue. Replace the drive.

Converter Board Error Codes

E-05	AC Input Over Voltage	Reg.78|80 Bit4	1. Check that the line voltage is no more than 15% above the specified voltage for the drive. 2. Check the DC bus voltage if it is >385VDC. 3. Check the compressor is operating within the specified limits. 4. If the problem still persists, then it is possibly a drive component issue. Replace the drive.
E-06	AC Input Under Voltage	Reg.78|80 Bit5	1. Check that the line voltage is no more than 15% below the specified voltage for the drive. 2. Check the DC bus voltage if it is <385VDC. 3. Check the compressor is operating within the specified limits. 4. If the problem still persists, then it is possibly a drive component issue. Replace the drive.

Converter Board Error Codes

E-09	High Pressure Switch Fault	Reg.78|80 Bit8	1. Condensing Pressure beyond limit. system issue. 2. Check the high pressure switch.
E-12	Compressor Power Module Over Temp	Reg.78|80 Bit11	1. Verify proper airflow over the heat-sink of the drive. Remove any obstructions. 2. Check that the compressor is operating within specified limits. 3. Check the mounting screws on the drive, make sure they are tight. If the fault, persists replace the drive.
E-13	PFC-IGBT Over Temp	Reg.78|80 Bit12	1. Verify proper airflow over the heat-sink of the drive. Remove any obstructions. 2. Check that the compressor is operating within specified limits. 3. Check the mounting screws on the drive, make sure they are tight. If the fault, persists replace the drive.
E-14	Compressor Startup Fault	Reg.78|80 Bit13	1. Cycle power on the drive. 2. If the problem persists replace the drive.

comfort | excellence

Converter Board Error Codes

E-17	DC Voltage Low	Reg.79|81 Bit0	1. Check that the line voltage is no more than 15% below the specified voltage for the drive. 2. Check the DC bus voltage if it is <385VDC. 3. Check the compressor is operating within specified limits. 4. If the problem still persists, then it is possibly a drive component issue. Replace the drive.
E-18	Compressor Phase Over Current (Intermediate)	Reg.79|81 Bit1	1. Check the U/V/W connections on the drive side. 2. Check the compressor motor windings 3. Check the compressor is operating within specified limits. 4. Sensor on Drive not reading properly - Replace Drive.

Converter Board Error Codes

E-19	Compressor Phase Current Foldback Timeout	Reg.79|81 Bit2	Check if the compressor is operating outside the specified speed range.
E-20	Compress Power Module Temperature Foldback Timeout	Reg.79|81 Bit3	Compressor phase current ≥ foldback protection value (for 30 seconds). Check if the compressor is operating outside the specified speed range.
E-21	AC Input Current Foldback Timeout	Reg.79|81 Bit4	1. Check that the line voltage is no more than 15% below the specified voltage for the drive. 2. Check the compress is operating within specified limits. 3. If problem persists, replace the drive.
E-22	DLT Temperature Timout	Reg.79|81 Bit5	1. Check the DLT/Scroll Thermistor connection. 2. Check the compressor is operating within specified limits.
E-23	Auto Config Communication Timeout	Reg.79|81 Bit6	Baud rate or Parity of the system controller not matching with drive. Check whether system controller is working, the Power Cycle the drive.
E-24	Modbus Communication Lost	Reg.79|81 Bit7	1. Check Modbus communication cable connections. 2. Check the communications parameters are set right. 3. Power cycle the drive. 4. If problem persists. replace the drive.

Converter Board Error Codes

E-25	DLT High Temp	Reg.79|81 Bit8	1. Check the DLT/Scroll Thermistor connection. 2. Check the compressor is operating within specified limits.
E-27	Board Temperature High	Reg.79|81 Bit10	1. Verify proper airflow over the heatsink of the drive. Remove any obstructions. 2. Check that the compressor is operating within specified limits. 3. Check the mounting screws on the drive, make sure they are tight. 4. If the problem still persists replace the drive.
E-28	Compressor Power Module Temperature High	Reg.79|81 Bit11	1. Verify proper airflow over the heatsink of the drive. Remove any obstructions. 2. Check that the compressor is operating within specified limits. 3. Check the mounting screws on the drive, make sure they are tight. 4. If the problem still persists replace the drive.
E-31	Comms to DSP Communication Lost	Reg.79|81 Bit14	1. Check Modbus communication cable connections. 2. Check the communication parameters are set right. 3. Power cycle the drive. 4. If problem persists replace the drive.
E-33	Compressor Phase Current Imbalance	Reg.82|84 Bit0	1. Verify proper airflow over the heatsink of the drive. Remove any obstructions. 2. Check that the compressor is operating within specified limits. 3. Check the mounting screws on the drive, make sure that they are tight. 4. If the problem still persists replace the drive.

Converter Board Error Codes

E-35	Micro Electronic Fault	Reg.82|84 Bit2	1. DSP self-check error, restart the drive fault should go away. 2. If problem persists replace the drive.
E-39	Compressor Model Configuration Error	Reg.82|84 Bit6	1. Compressor model and configuration code do not match. 2. Check the setting on the Digital switches
E-40	High Pressure Sensor Type Configuration Error	Reg.82|84 Bit7	1. Pressure sensor and configuration code do not match. 2. Check the setting on the Digital switches
E-41	Compressor U-Phase OverCurrent/Sensor Fault	Reg.82|84 Bit8	1. Check the U/V/W connections on the drive side and compressor side. 2. Check the compressor motor windings.
E-42	Compressor V-Phase OverCurrent/Sensor Fault	Reg.82|84 Bit9	1. Check the U/V/W connections on the drive side and compressor side. 2. Check the compressor motor windings.
E-43	Compressor W-Phase OverCurrent/Sensor Fault	Reg.82|84 Bit10	1. Check the U/V/W connections on the drive side and compressor side. 2. Check the compressor motor windings.
E-51	DLT Temp Sensor Open or Short Fault	Reg.83|85 Bit2	1. Check the DLT/Scroll Thermistor connection. 2. Check the compressor is operating within specified limits.

Converter Board Error Codes

E-54	Power Module Temperature Sensor Open/Short Fault	Reg.83|85 Bit5	1. Verify proper airflow over the heatsink of the drive. Remove any obstructions. 2. Check that the compressor is operating within specified limits. 3. Check the mounting screws on the drive, make sure that they are tight. 4. If the problem still persists replace the drive.
E-55	PFC-IGBT Temperature Sensor Fault Open/Short Fault	Reg.83|85 Bit6	Temperature sensing device on the drive are possibly defective. If problem persists replace the drive.
E-62	Stator Heater Overcurrent	Reg.83|85 Bit13	Compress windings are drawing more current than expected in stator heater mode. If problem persist contact application engineer.
E-64	Fault Limit Lockout	Reg.83|85 Bit15	10 lockout errors in 10 hours. Troubleshoot the original errors.
E-66	Analog Communication Fault		Check the connection between the Converter board and the drive.
E-67	Configuration Setup Fault		1. Check the Digital switches settings. 2. Replace the Converter board.

Emerson Comfort Alert Troubleshooting

Controls

- Comfort Alert Diagnostic Module

Emerson Comfort Alert Troubleshooting

Comfort Alert Description

Capability To Send Signal To Thermostat

3Φ module detects missing and reverse phase

Green POWER LED Indicates Voltage Is Present At The Power Connection Of The Module

Spade Connectors Detect Tstat "Y" Demand and Pilot Voltage

Yellow ALERT LED Flashes To Indicate Fault Code

Diagnostics Key Directs Service Tech Quickly And Accurately To Root Cause Of The Problem

Red TRIP LED Indicates If Compressor Is Tripped Or Has No Power

comfort | excellence

Emerson Comfort Alert Troubleshooting

Comfort Alert – LED Fault Codes

- System Pressure Trip (Code 2)
- Short Cycling (Code 3)
- Locked Rotor (Code 4)
- Open Circuit (Code 5)
- Missing Phase (Code 6)
- Reverse Phase 3Φ (Code 7)
- Welded Contactor (Code 8)
- Low Voltage (Code 9)

comfort | excellence

Emerson Comfort Alert Troubleshooting

- **"Alert" Light Blinks When Any Of 8 Harmful System Conditions Is Detected**

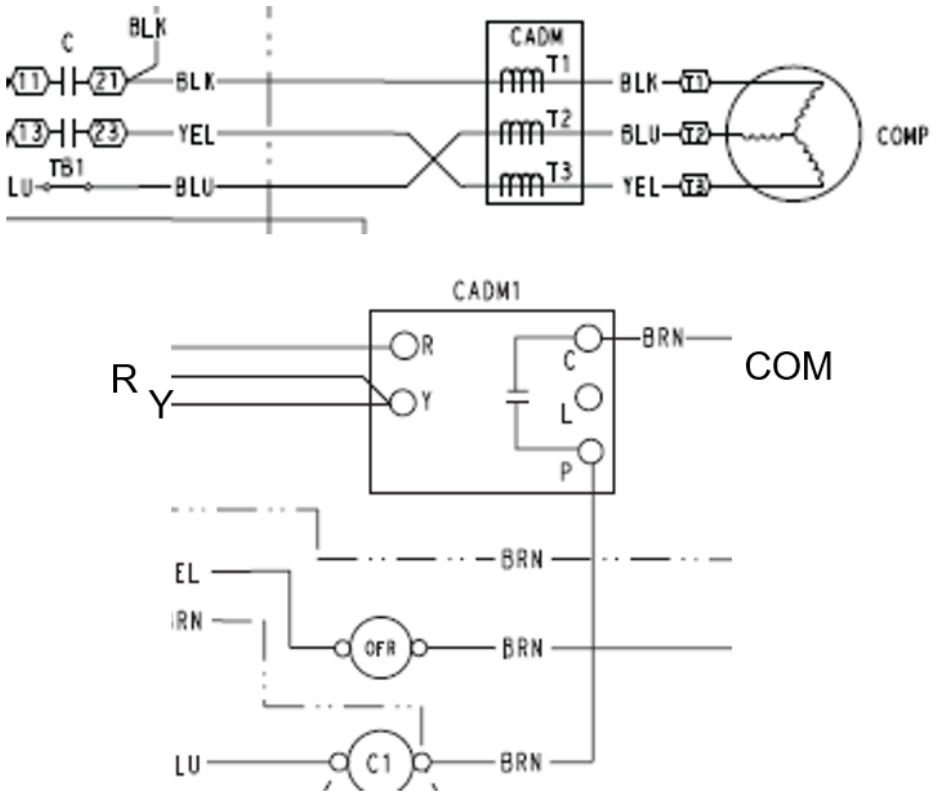
Alert Code	System Condition	Diagnostic Alert Light	Lockout?
Code 2	System Pressure Trip	Blinks 2 Times	YES
Code 3	Short Cycling	Blinks 3 Times	YES
Code 4	Locked Rotor	Blinks 4 Times	YES
Code 5	Open Circuit	Blinks 5 Times	NO
Code 6	Missing Phase	Blinks 6 Times	YES
Code 7	Reverse Phase	Blinks 7 Times	YES
Code 8	Welded Contactor	Blinks 8 Times	NO
Code 9	Low Voltage	Blinks 9 Times	NO

Protective Faults That Result In Compressor Lockout

comfort | excellence

Emerson Comfort Alert Troubleshooting

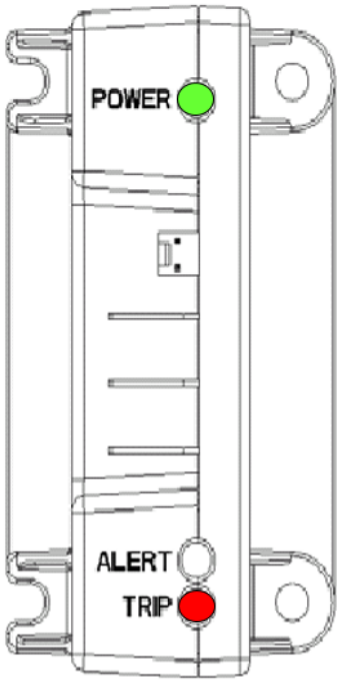
Comfort Alert Connections



Emerson Comfort Alert Troubleshooting

Sensing Motor Protector Trips

- **Comfort Alert Detects A Motor Trip When:**
  - Thermostat Demand “Y” Is On
  - No Current Is Measured To Compressor
- **Interpretation: Compressor Isn’t Operating When System Demand Is Present**
- **Root Causes**
  - **LPS, HPS Open**
  - **Motor Protector Open**
  - **Power Disconnected (Fuse, Switch, Etc.)**
  - **Comfort Alert Not Wired Properly**

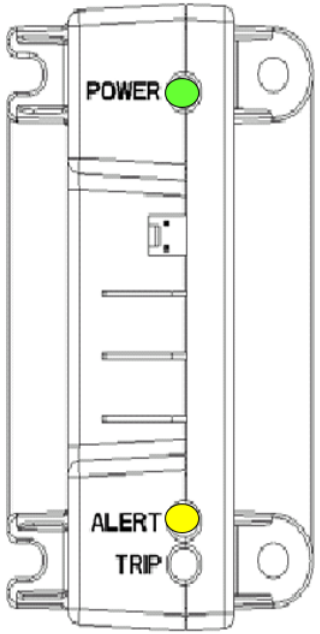


CE comfort | excellence

Emerson Comfort Alert Troubleshooting

Sensing System Pressure Trip
Code 2

- **Comfort Alert Detects System Pressure Code When:**
  - Four Consecutive Protector Trips Occur
  - The Average Run Until Trip Time Is Between 1 Minute And 15 Minutes
- **Interpretation: High Pressure Condition Causes Compressor To Run Briefly Before Tripping**
- **Root Causes**
  - **Blocked Condenser Coils**
  - **Condenser Fan Not Running**
  - **LPS**

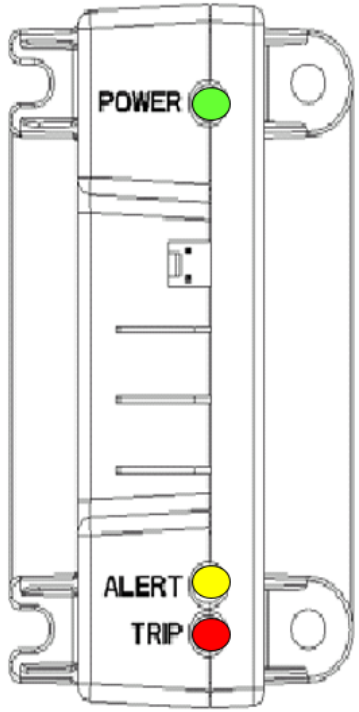


comfort | excellence

Emerson Comfort Alert Troubleshooting

Sensing Short Cycling
Code 3

- **Comfort Alert Detects Short Cycling Code When:**
  - A Pattern Of Short Cycles Emerges
  - Average Run Time For Past 4 Runs Is Less Than 3 Minutes
  - Normal End-of-Cycle (Y Input Removed)
- **Interpretation: Compressor Is Running Only Short Periods Of Time**
- **Root Causes**
  - Low Space Load
  - Faulty Thermostat

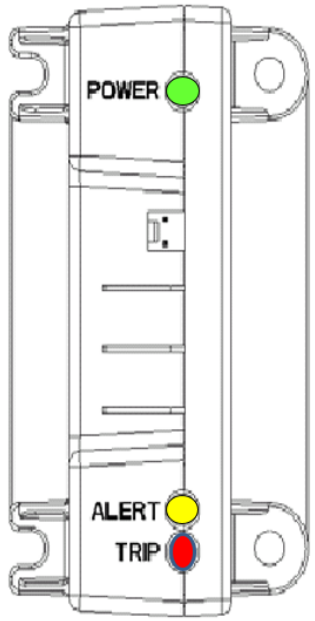


comfort | excellence

Emerson Comfort Alert Troubleshooting

Sensing Locked Rotor
Code 4

- **Comfort Alert Detects Locked Rotor Code When:**
  - Four Consecutive Protector Trips Occur
  - Y Demand Is Constant, Uninterrupted
  - The Average Run Until Trip Time Is Less Than 15 Seconds
- **Interpretation: Compressor Is Attempting To Start But Cannot**
- **Root Causes**
  - **Low Line Voltage**
  - **Mechanical Issue With Compressor**

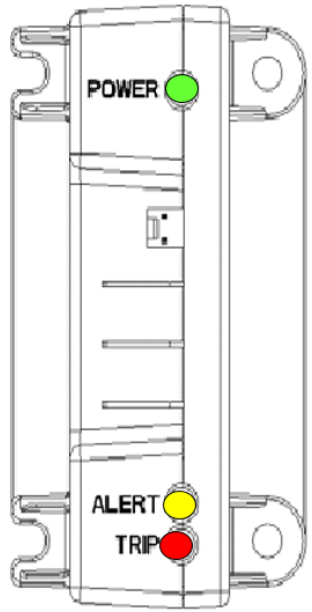


comfort | excellence

Emerson Comfort Alert Troubleshooting

Sensing Open Circuit
Code 5

- **Comfort Alert Detects A Open Circuit Code When:**
  - Y Present, No Compressor Current For More Than 4 Hours (Protector Trip)
- **Interpretation: Power Is Not Connected To Compressor**
- **Root Causes**
  - Power Disconnected (Fuse, Switch, Etc.)
  - Failed Compressor Protector
  - Comfort Alert Not Wired Properly
    - Motor Leads Not Routed Through Comfort Alert Current Sensors

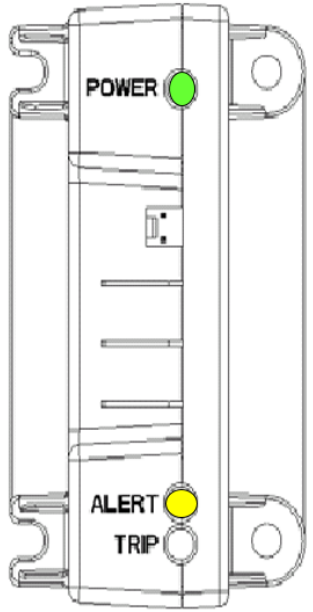


comfort | excellence

Emerson Comfort Alert Troubleshooting

Sensing Missing Phase
Code 6

- **Comfort Alert Detects A Code 6 When There is Power to Y or Y1 and:**
  - Time Frequency between T1 and T3 is within certain parameters depending on 50 or 60 Hz power supply when T2 is missing
  - Either T1 or T3 Does Not Detect Current
  - Both Events Have To Last One Second
- **Interpretation: One Winding Of Compressor Not Getting Power**
- **Root Causes**
  - Blown Fuse
  - Loose Or Broken Wires
  - Compressor Winding Damage

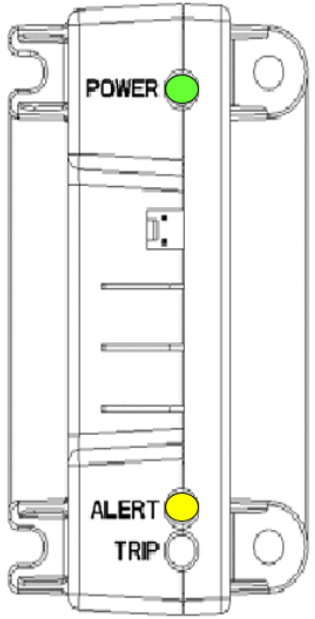


comfort | excellence

Emerson Comfort Alert Troubleshooting

Sensing Reverse Phase
Code 7

- **Comfort Alert Detects A Code 7 When There is Power to Y or Y1 and:**
  - Time Frequency between T1 and T3 is within certain parameters depending on 50 or 60 Hz power supply for 1 Second. This Time Parameter is Different from Code 6.
- **Interpretation: Two of the Phases are Reversed**
- **Root Causes**
  - Supply Power Leads Not Routed Correctly
    - From Power Source To Compressor

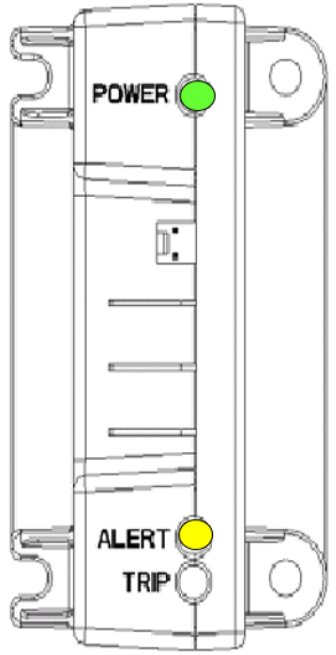


comfort | excellence

Emerson Comfort Alert Troubleshooting

Sensing Welded Contactor
Code 8

- **Comfort Alert Detects A Welded Contactor Code When:**
  - Current Is Detected Without “Y” Input
- **Interpretation: Compressor Contactor Will Not Disengage**
- **Root Causes**
  - Welded Contactor
  - Comfort Alert Not Wired Properly
    - Demand Wire Bypassing Comfort Alert Module



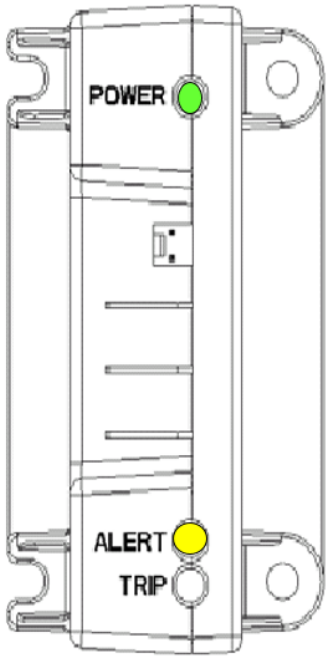
comfort | excellence

Emerson Comfort Alert Troubleshooting

Sensing Low Voltage
Code 9

- **Comfort Alert Detects Low Voltage Code When:**
  - Comfort Alert 24VAC Is Below 18VAC
- **Interpretation: Low Voltage Condition Exists**
- **Root Causes**
  - Control Transformer Overloaded
  - Line Voltage Low

Auto-reset at 19 VAC
3-Minute Recheck



comfort | excellence

Emerson Comfort Alert Troubleshooting

Multiple Alerts Condition

- **If Multiple Alerts Occur, Comfort Alert Displays The First Code That Is Detected**
  –Allows Technician To Determine The Root Cause
- **Example**
  - Low Line Voltage Leads To Locked Rotor Condition On Compressor
  - Comfort Alert Displays Low Voltage Code Even While Locked Rotor Events Are Happening
- **Protective codes (2,3,4,6,7,9) have Precedence over Non Protective Codes**
- **Over Current Sensed at Comfort Alert P-Terminal (1.5 +/-0.5 Amps) takes Precedence over Protective Code**

comfort | excellence

Emerson Comfort Alert Troubleshooting

CADM Resets

- **Automatic Reset**

  –Voltage Alert (Code 9) Resets When Voltage Rises Above 19VAC

- **Manual Reset**

  - All Alert Codes Can Be Reset By Cycling 24VAC Power

  - Previous Code Will Flash 60 Seconds

comfort | excellence

Emerson Comfort Alert Troubleshooting

CADM Memory

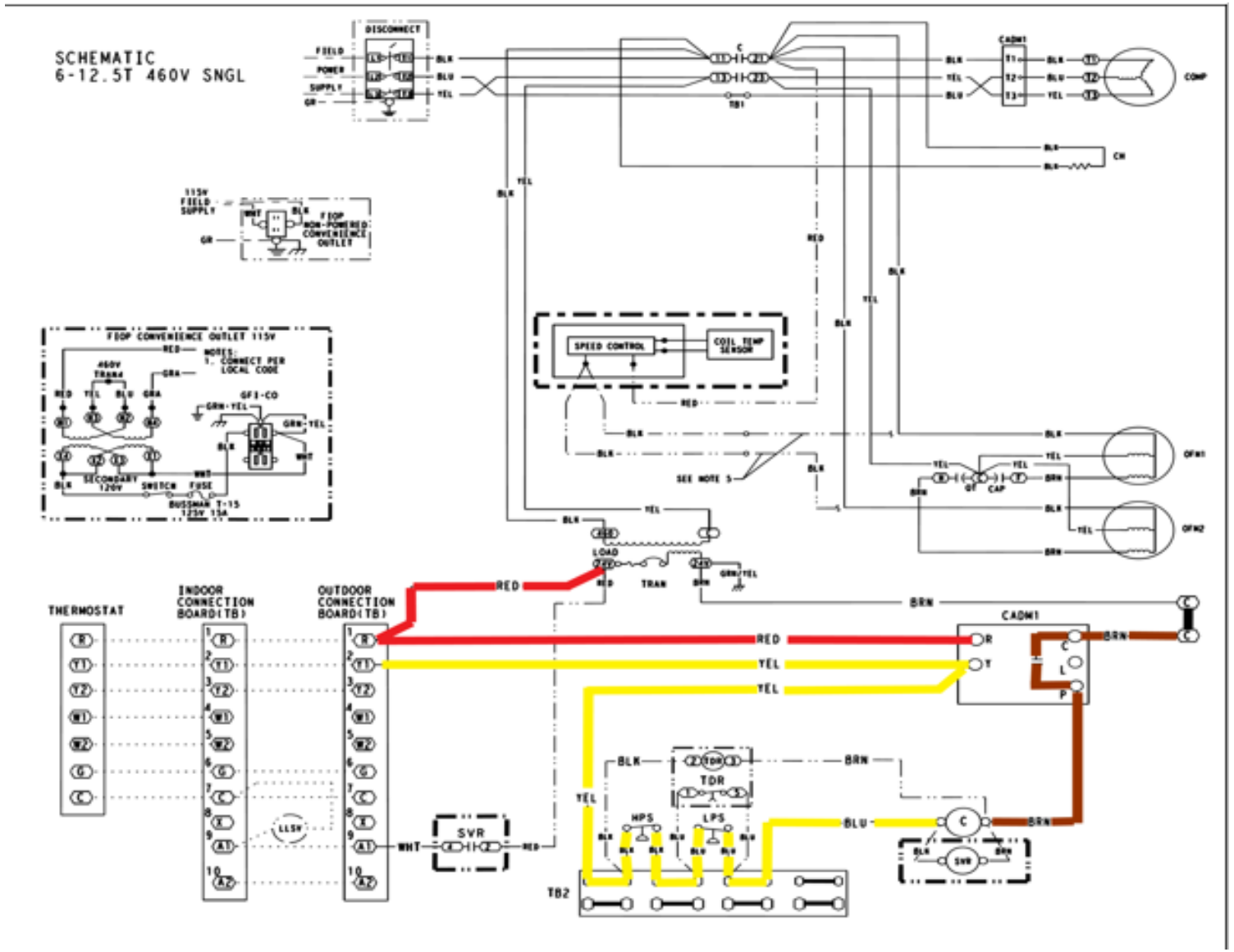
- **Comfort Alert Displays Last Alarm At Each Power Up**
  –Displays Code If Alarm Occurred During Last Power Cycle
  –Display Lasts For One Minute

- **Alarm History Is Kept In Memory**
  –Comfort Alert Analysis Software Required
  –Seven Day History Of Alarms
  –Overall Count Of Alarms In Permanent History

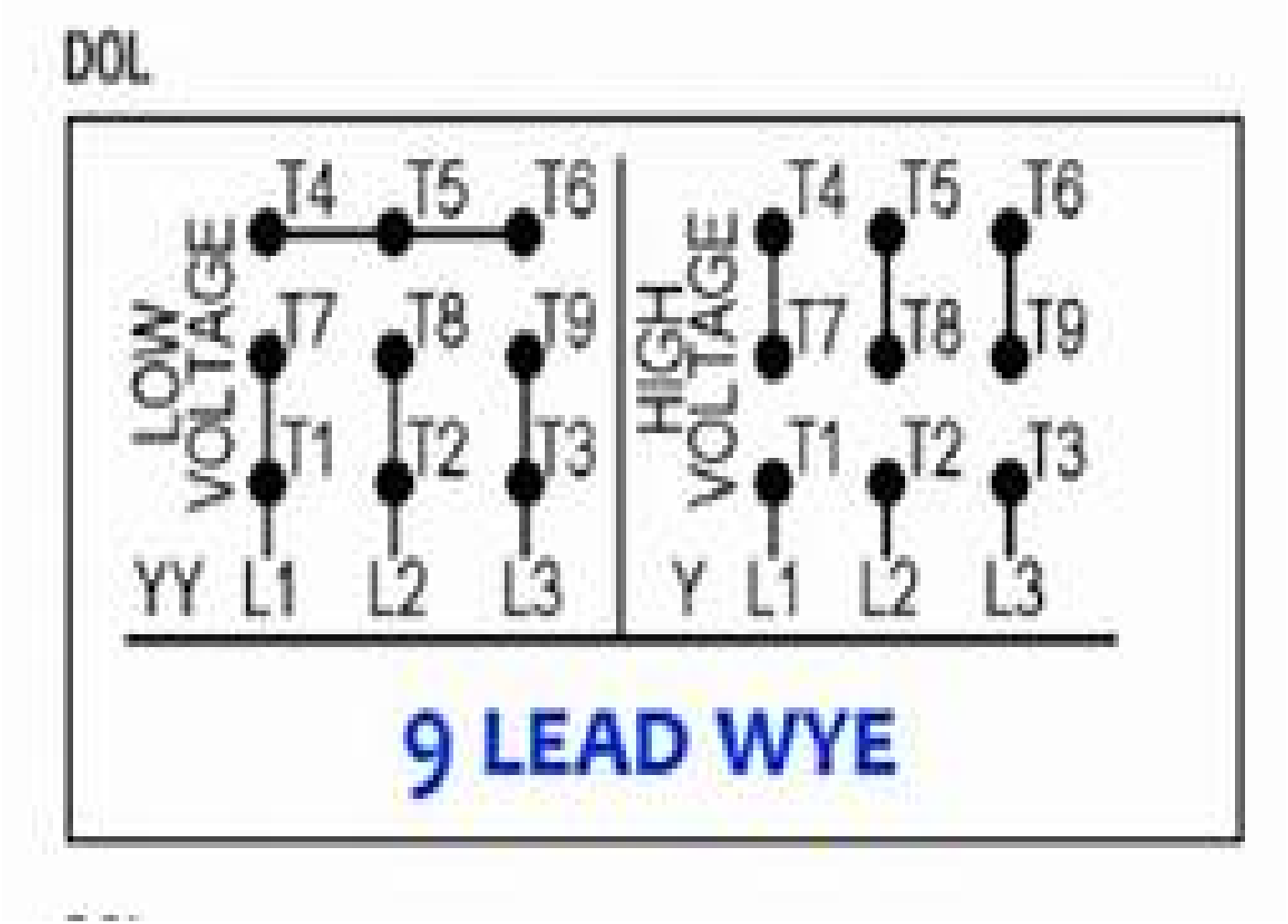
- **Anti Short Cycle Timer**
  –3 Minute Off Cycle after normal Shutdown
  –Time Delay not Active First 50 Starts
  – RED LED Flashes during OFF Period

comfort | excellence

Emerson Comfort Alert Troubleshooting

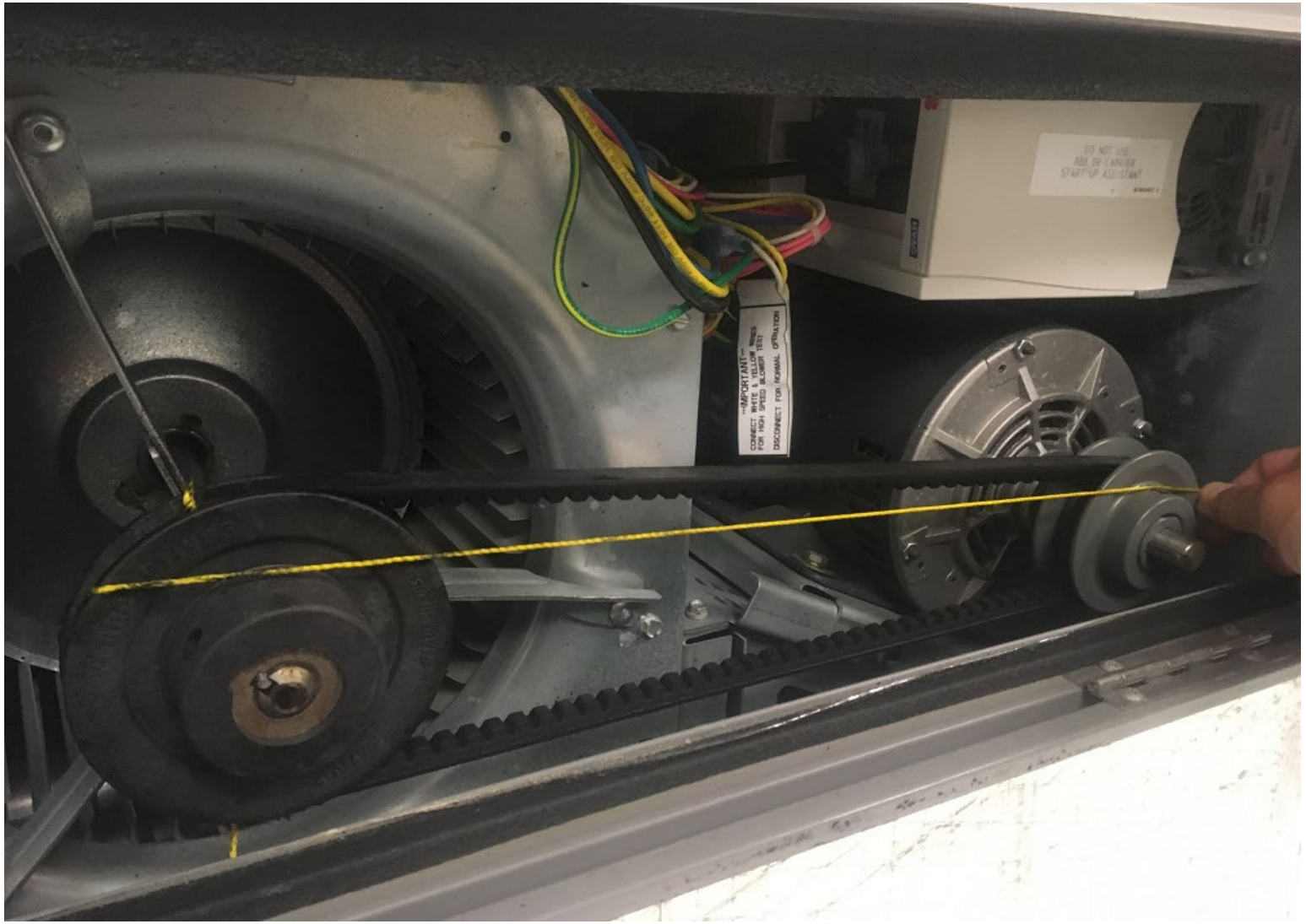


9 Lead Motor Wiring



Aligning Sheaves

Aligning Sheaves



Commercial Start up

- Check and tighten all bearing collars and sheaves before starting the unit
- The sheaves are not factory adjusted for airflow you may need to turn the sheave in or out a turn or so when adjusting the airflow.

Department of Energy - 2018

U.S. DEPARTMENT OF ENERGY

JANUARY 1, 2018

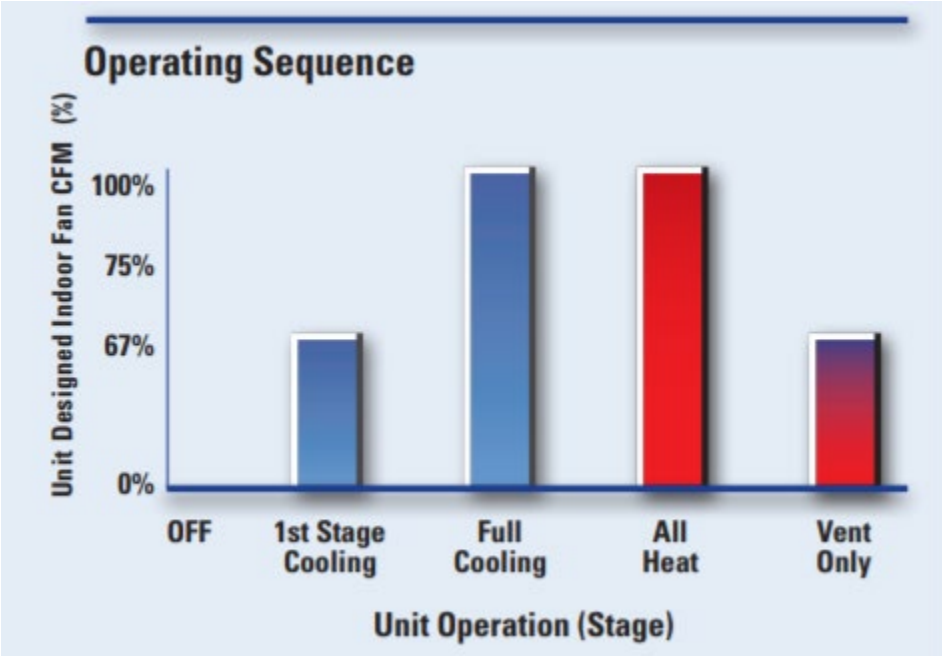
MANDATORY – Manufacturers

This new DOE ruling will be the only federal requirement for IEER NOT subject to state adoption.

CE comfort | excellence

Staged Air Volume

- Energy Savings Up to 25%
- Code Compliant ASHRAE 90.1.2010
- Comfort Control Humidity Control



comfort | excellence

Department of Energy - 2018

To Increase IEER levels and meet DOE - 2018:

- Integrate SAV™ standard into 48/50TC-Q (6-27.5 ton) models.
- Integrate SAV™ standard into:
  - *Horizontal Only 48HC 17.5 and 20 Ton Models*
  - *48/50HC 10 Ton Models (Both 11 & 12 sizes)*
- Integrate SAV™ standard into:
  - 40RU Split System Air Handlers

*

* Shown with field accessory display kit

comfort | excellence

Stage Air Volume - SAV ™ Indoor Fan Motor

SAV™ - Fan Automatically Adjusts To Unit Operation

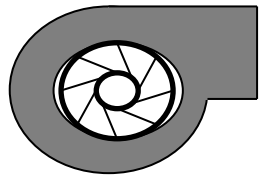
Saves Energy, Improves IEER – Great Payback)

Standard 2-stage Thermostat

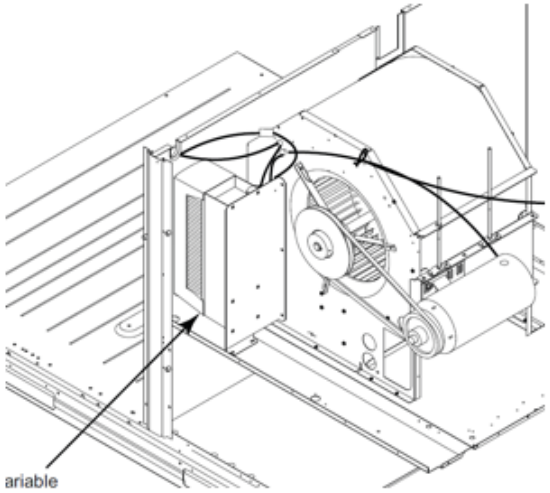
(VFD)
Speed Controller

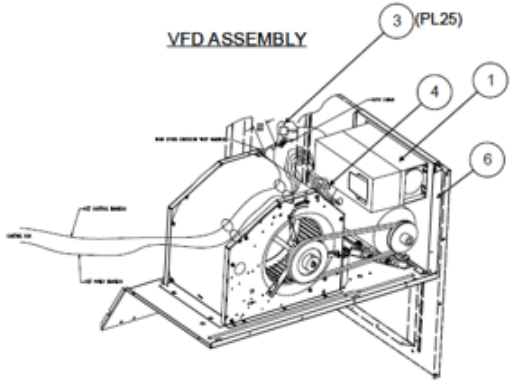
- 1st Stage Cooling = Fan at 66%
- 1st and 2nd Stage Cooling = Fan at 100%
- Any Heating = Fan at 100%
- Ventilation Only = Fan at 66%

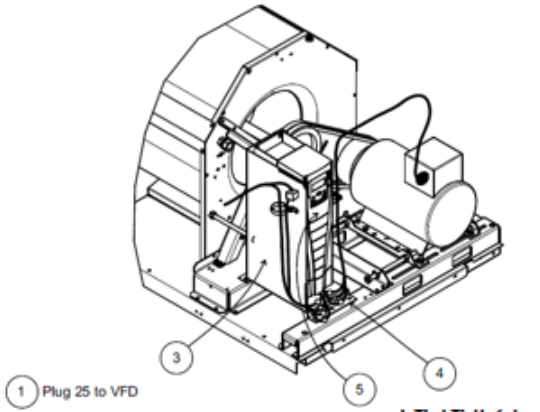
Indoor Fan Motor
Belt Drive

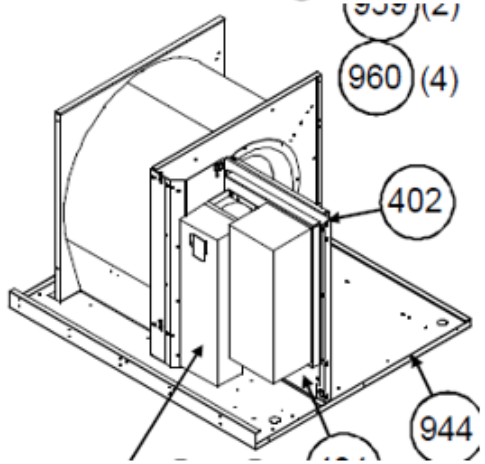


VFD Location

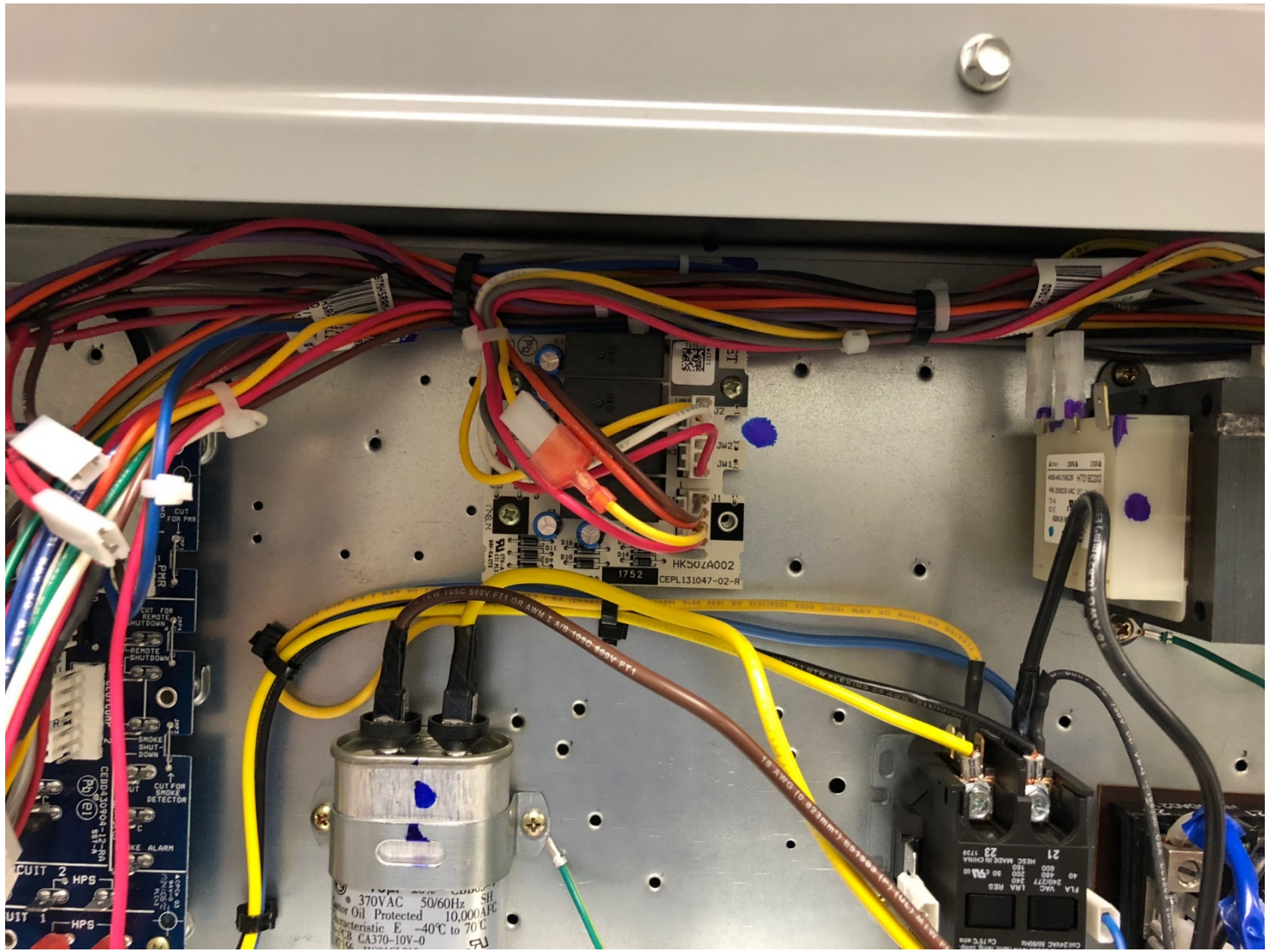








VFD Fan Board



VFD Fan Board

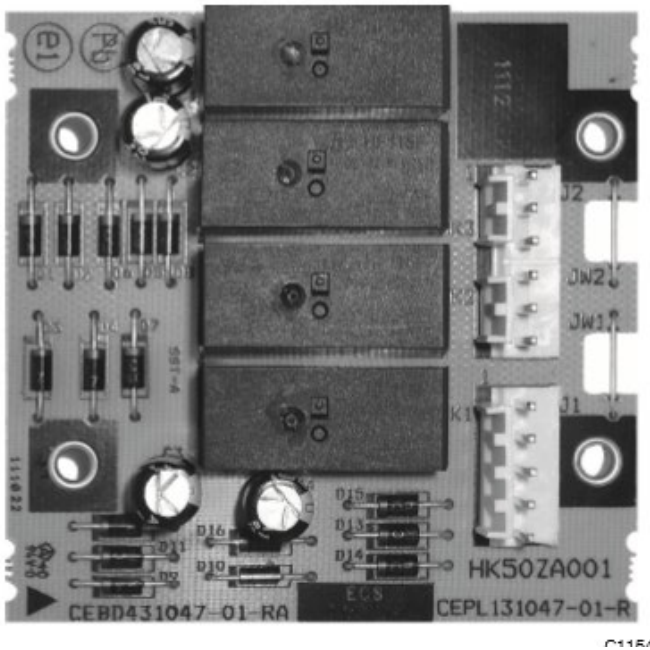


Table 10 – Two-Speed Configuration Logic (Thermostat Control)

INPUT	Relay Coil Status			Controlling Output	Fan Motor Speed
	K1	K2	K3		
G	Off	Off	On	K3	Low (40 Hz)
Y1	Off	Off	On	K3	Low (40 Hz)
Y2	Off	On	On	K2	High (60 Hz)
W1	On	On	On	K1	High (60 Hz)

VFD Fan Board

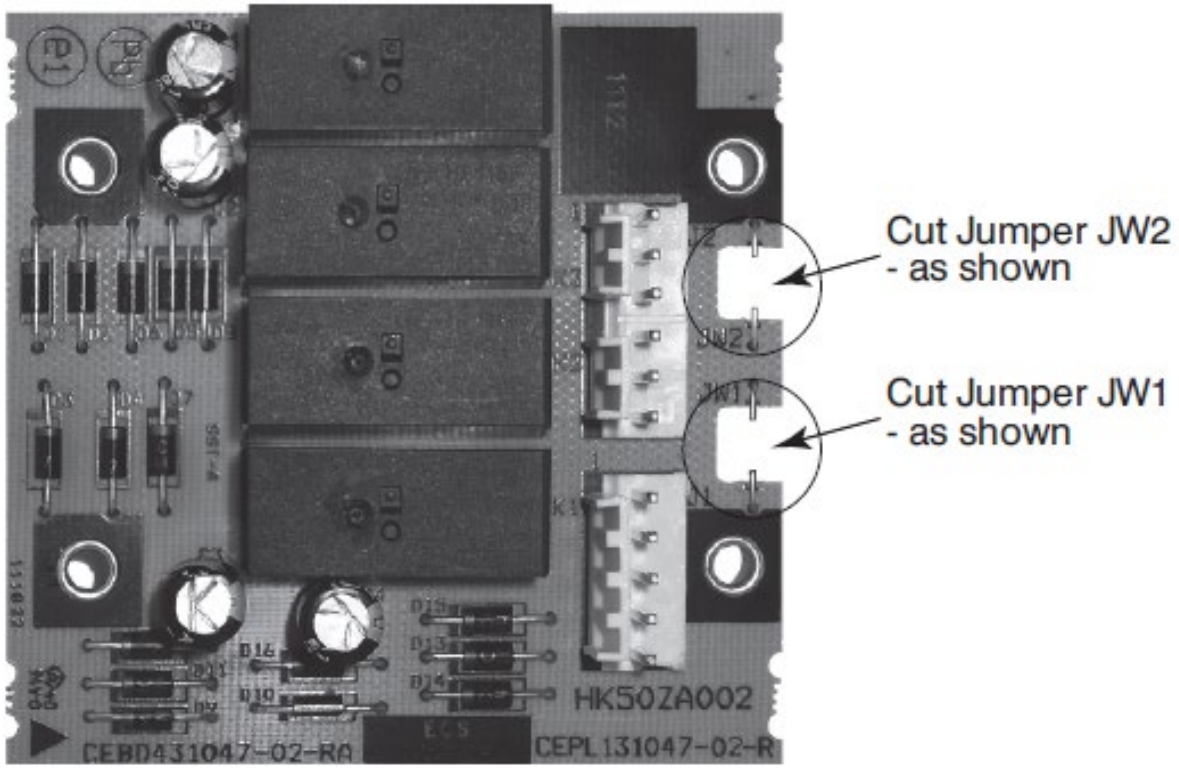
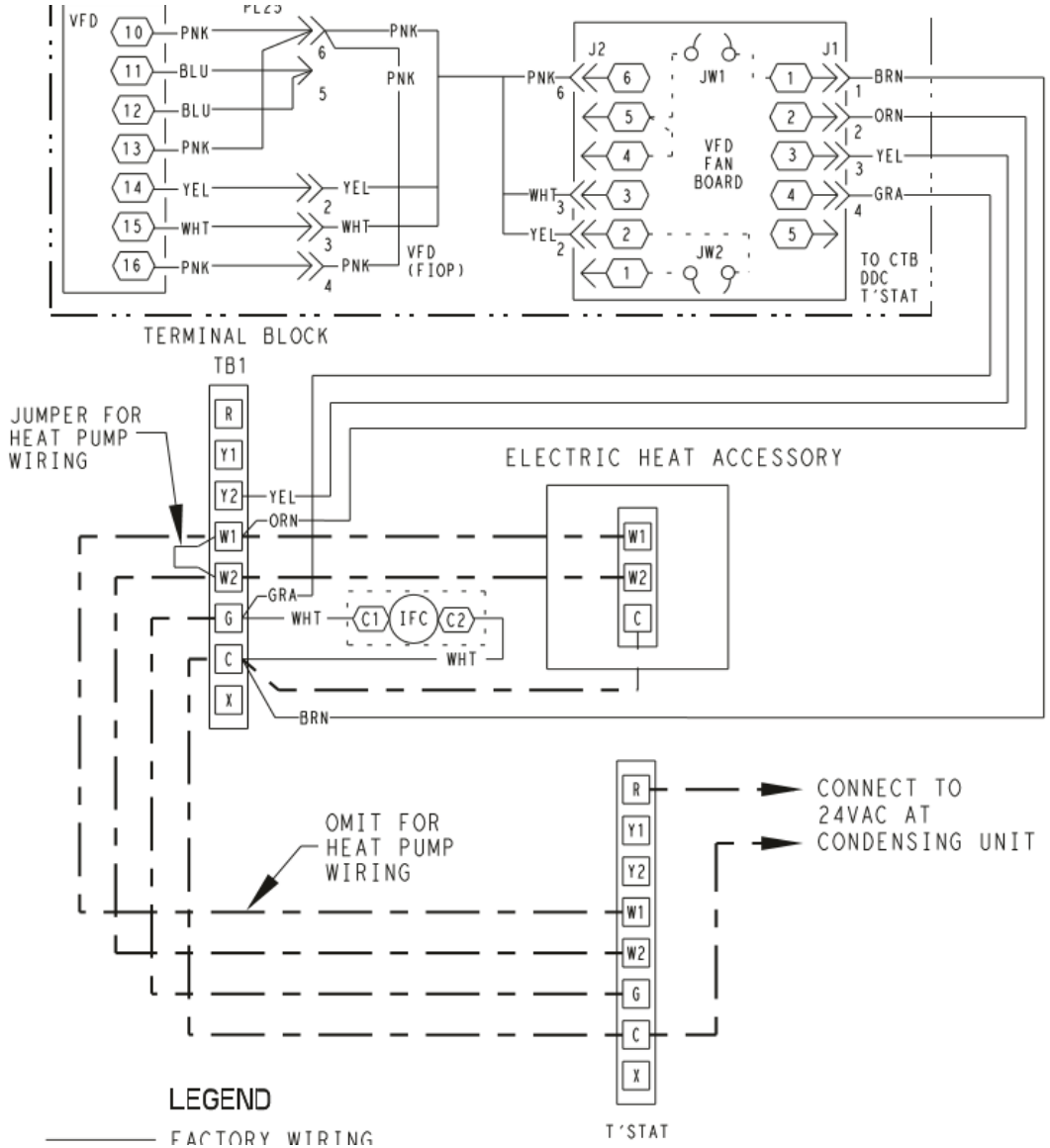
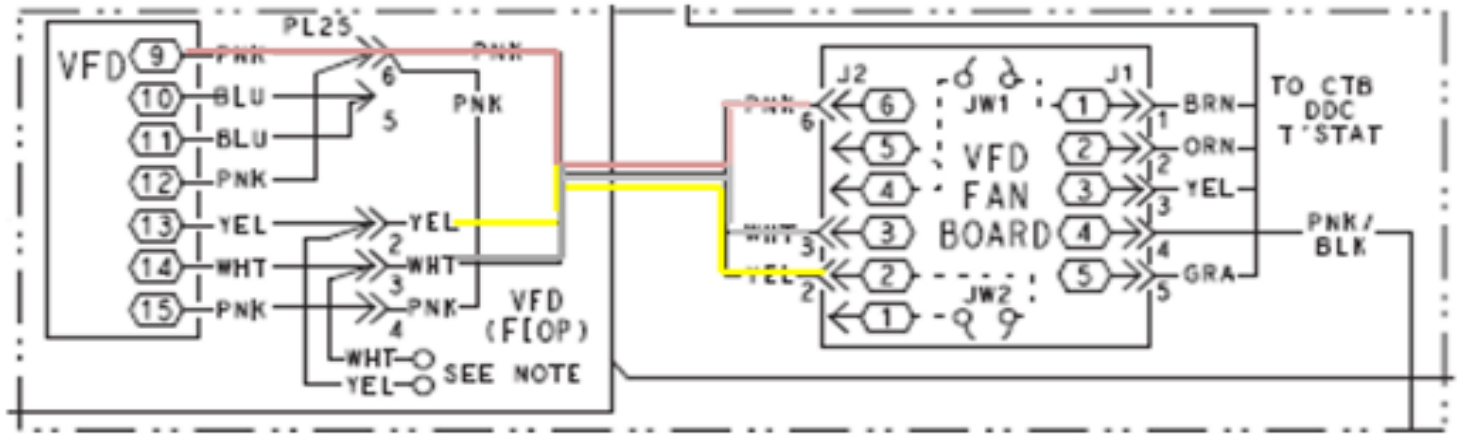


Fig. 22 — Jumpers JW1 and JW2 Cut for Two-Speed Fan Board Configuration

VFD Fan Board Wiring

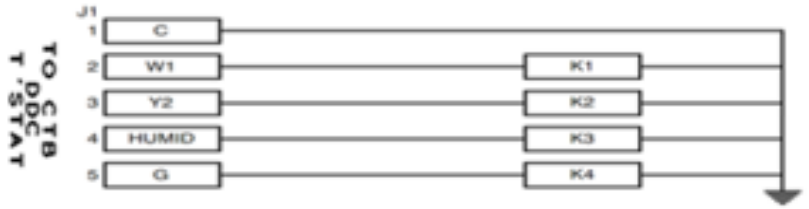


VFD Fan Board Wiring

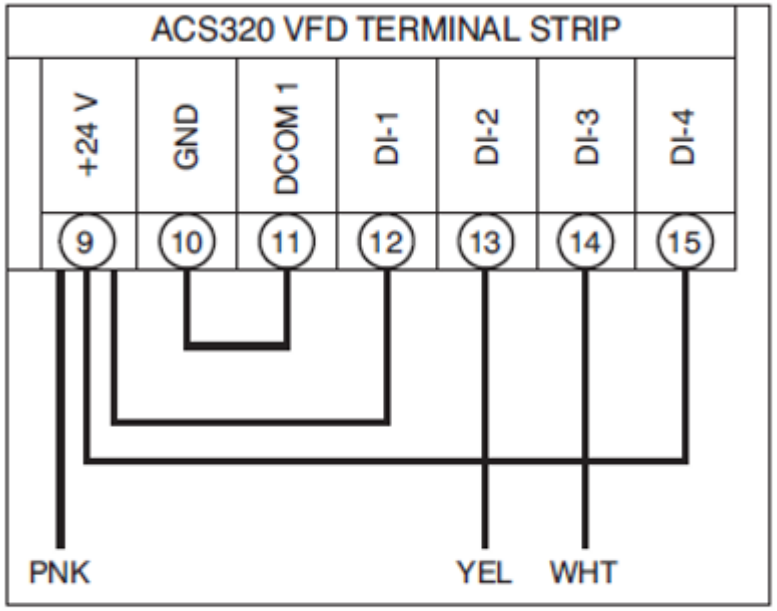


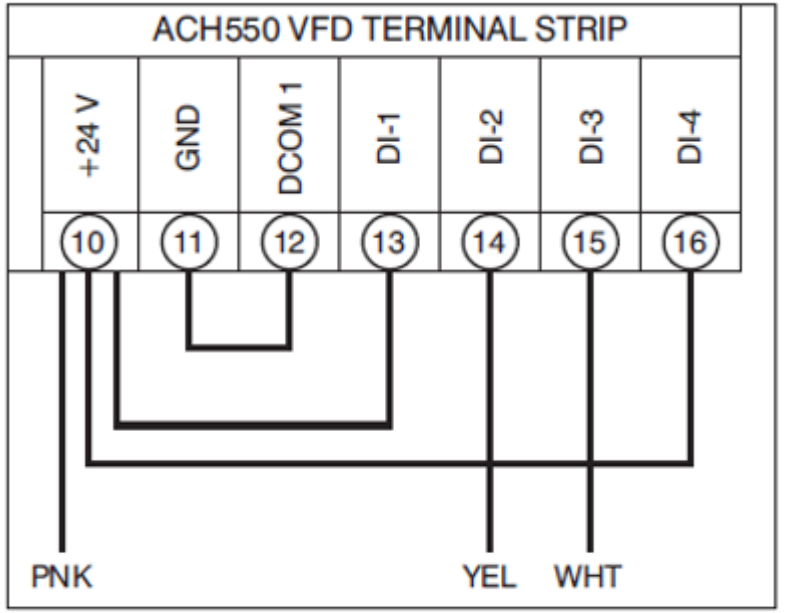
J2 Terminals From VFD Drive
J2-6 24VDC
J2-3 High Speed
J2-2 Low Speed

J1 Terminals From Input from Thermostat
J1-1 Common to Transformer
J1-2 W1 Makes K1
J1-3 Y2 Makes K2
J1-4 Humid Makes K3
J1-5 G/Y1 Makes K4



Small Medium Units VFD Wiring





comfort | excellence

VFD Fuse Protection

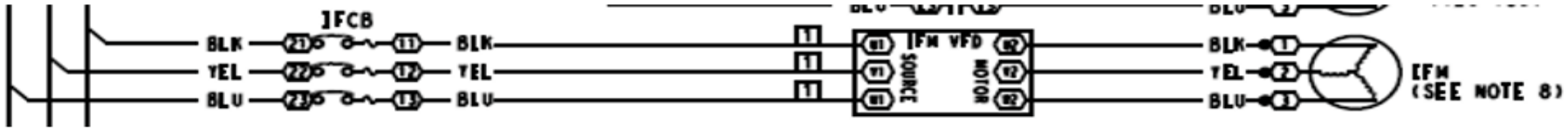
An input disconnect device must be installed between AC input power and the VFD

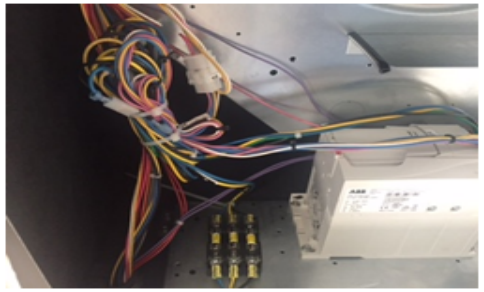
VFDs to be **installed with input fuse protection**

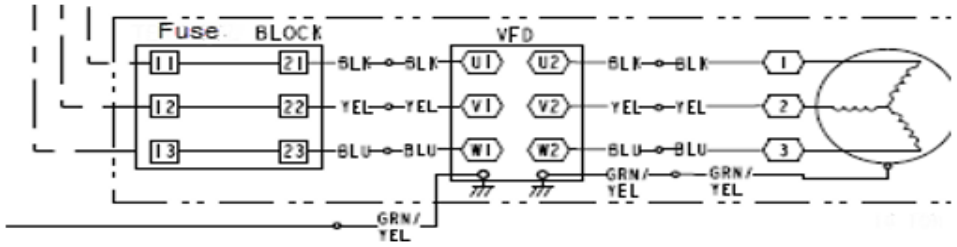
Fast-acting fuses provide rapid protection compared to circuit breakers (limits collateral damage due to a: ground fault, output short, or DC Bus short)

Input Power Specifications

Input Power Connection Specifications	
Prospective short-circuit current (IEC 629)	Maximum allowed prospective short-circuit current in the supply is 100 kA in a second providing that the drive's input power is protected with appropriate fuses. US: 100,000 AIC.







VFD Fuse Protection Update

VFD Fuses — Table 16 details the fuse requirement for the VFD installed in 48/50TC, 50TCQ. 48/50HC and 50HCQ units. All fuses are Class CC KTK except the 40A which is Class T. Check the control wiring diagram label on the specific unit in use for the fuse location.

Table 16 — VFD Fuse Requirements

UNIT SIZE	VOLTAGE	FUSE		
		STANDARD	MEDIUM	HIGH
07	208/230	20	20	20
	460	10	10	10
	575	10	10	10
08	208/230	20	20	20
	460	10	10	10
	575	10	10	10
09	208/230	20	20	20
	460	10	10	10
	575	10	10	10
12	208/230	20	20	20
	460	10	10	10
	575	10	10	10
14	208/230	20	20	20
	460	10	10	10
	575	10	10	10

VFD Fuse Protection Update

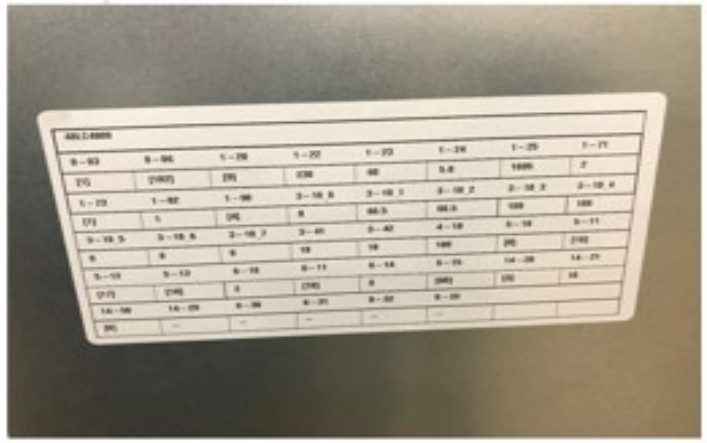
16	208/230	30	30	30
	460	10	10	10
	575	10	10	10
17	208/230	30	30	30
	460	10	10	10
	575	10	10	10
20	208/230	30	30	30
	460	10	10	10
	575	10	10	10
24	208/230	30	30	30
	460	10	10	10
	575	10	10	10
28	208/230	30	30	30
	460	10	10	10
	575	10	10	10
30	208/230	30	30	40
	460	10	10	10
	575	10	10	10

VFD Drives and AirFlow

Variable Frequency Drives General Information

The VFD should never be used to balance air flow. A jumper is provided that allows the drive to operate at 60Hz. This Jumper should be used to place the drive at its maximum hertz and all other air flow adjustments should be done with the blower sheaves and pulleys. Failure to do so may cause erratic operation of the blower system.

The factory is currently rolling out a sticker that will be placed on the drive to provide the proper settings for the drive.



VFD Drives

Fig. 1 — ACH550 Variable Frequency Drive (VFD)

ACH550

Fig. 2 — ACS320 Variable Frequency Drive (VFD)

ACS320

ABB Variable Frequency Drive

comfort | excellence

How to determine the VFD Setting on a replacement VFD

The replacement drive from RC comes with a key pad so a different part number is used to make sure the key pad is included.

WARNING VFD REPLACEMENT

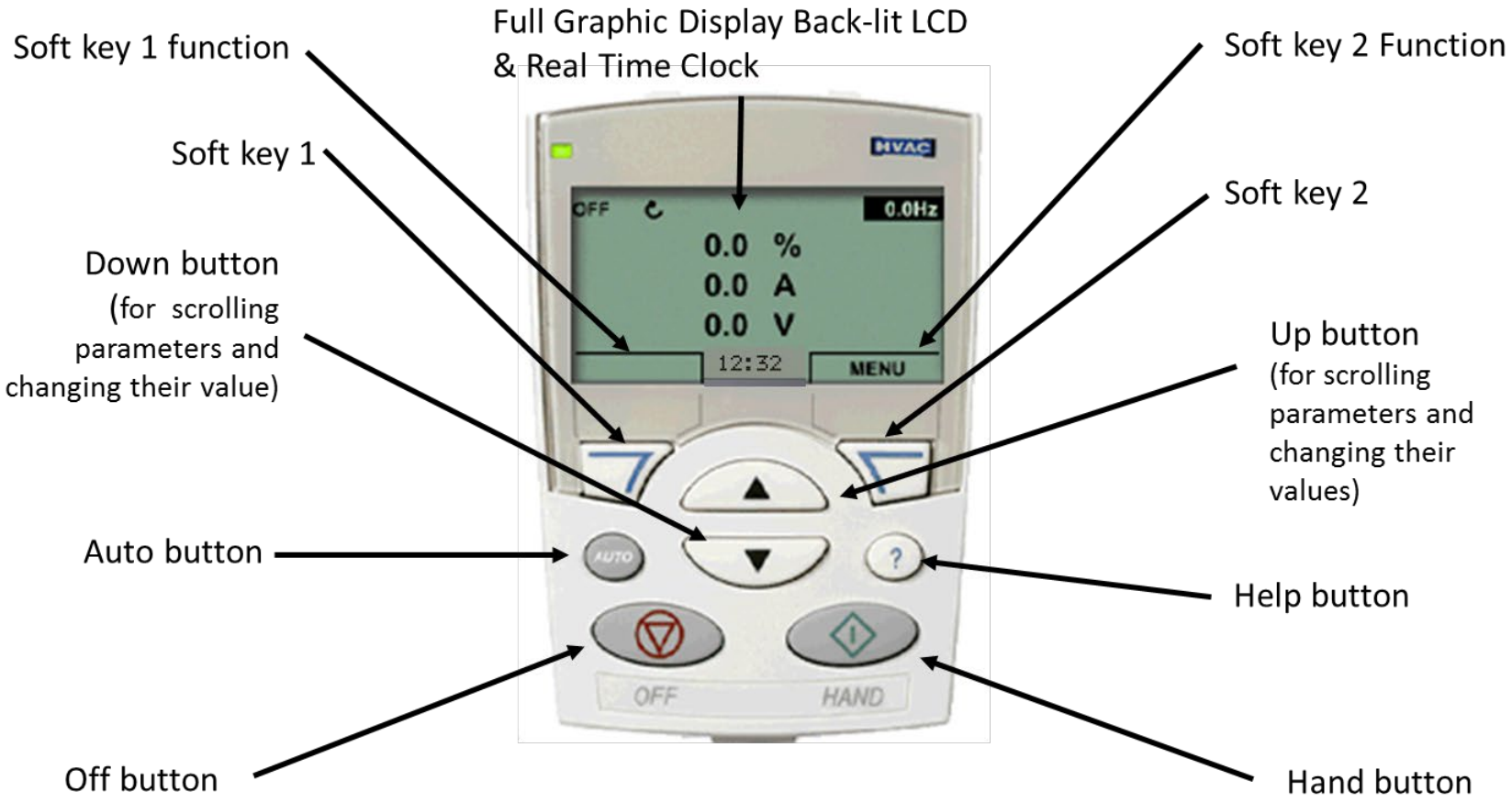
- ONLY USE START-UP ASSISTANT IF YOU WANT TO CREATE EXTRA WORK FOR YOURSELF!
- NEVER EVER USE START-UP ASSISTANT!

comfort | excellence

Control Panel Features ACH550 and ACS320

- **Alphanumeric control panel with backlit LCD display**
  - Easy monitoring - four-line display
    - Three selectable actual values displayed simultaneously
  - Supports
    - Start-up Assistant
    - Fault indications and history
    - Local / Remote control
  - Removable: Connection with CAT5 cable
  - Parameter upload/download (copy)
  - Display with 16 languages
  - Context sensitive Help key
  - Real Time clock

Control Panel – Button Functions ACH550 and ACS320



Control Panel – Assistants (Say no) Do not use

- **Assistants simplify functions of Drive Operation**
  . (Say no) Do not use

- **Maintenance Assistant**
  - Can be used to insert preventative maintenance functions using run time, motor revolutions or events
- **Diagnostic Assistant**
  - Activated with a fault and provides suggestions to correct fault based on the most common causes

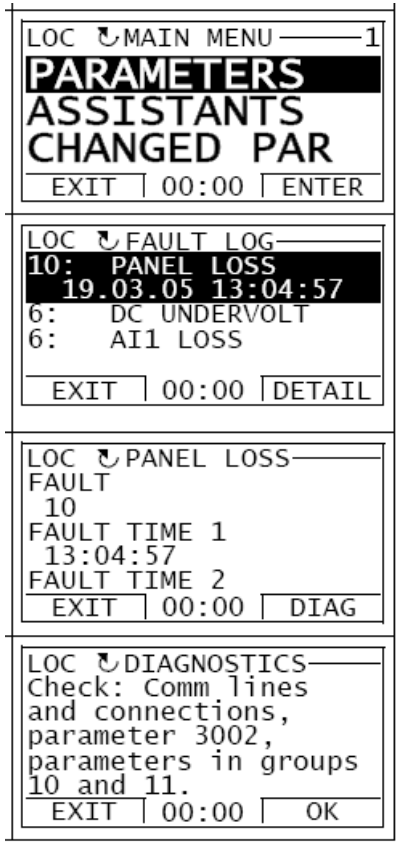
comfort | excellence

Control Panel – Parameters Mode

- **Parameters Mode**
  - Allows monitoring of signals in Groups 1,3 & 4 (Read-out Only)
  - Allows monitoring & editing of any parameters in groups 10-99
  - Provides the avenue to commission the drive
  - Start/stop, change direction and change control locations between Hand & Auto

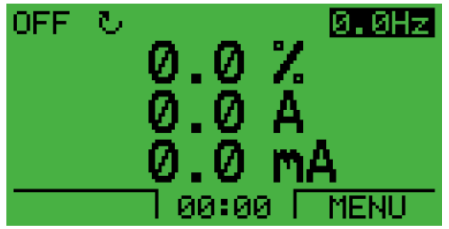
Control Panel – Fault Logger Mode

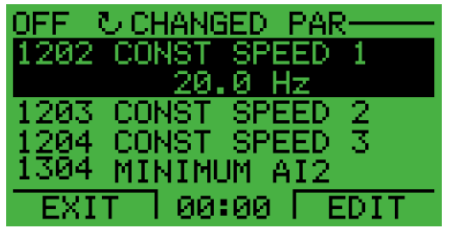
- **Fault Logger Mode**
  - View the drive fault history of a maximum of 10 faults (saves last 3 in memory after a power cycle)
  - View the last 3 faults (saves details on last fault in memory after a power cycle)
  - Provides help text for a given fault
  - Reduces troubleshooting time



Control Panel – Changed Parameters Mode

- **Changed Parameters Mode**
  - Provides the means to view parameters which have been changed with respect to default values for a given macro being utilized
  - Very useful troubleshooting tool
  - Allows user to edit changed parameters as well





comfort | excellence

VFD Set-up Tables

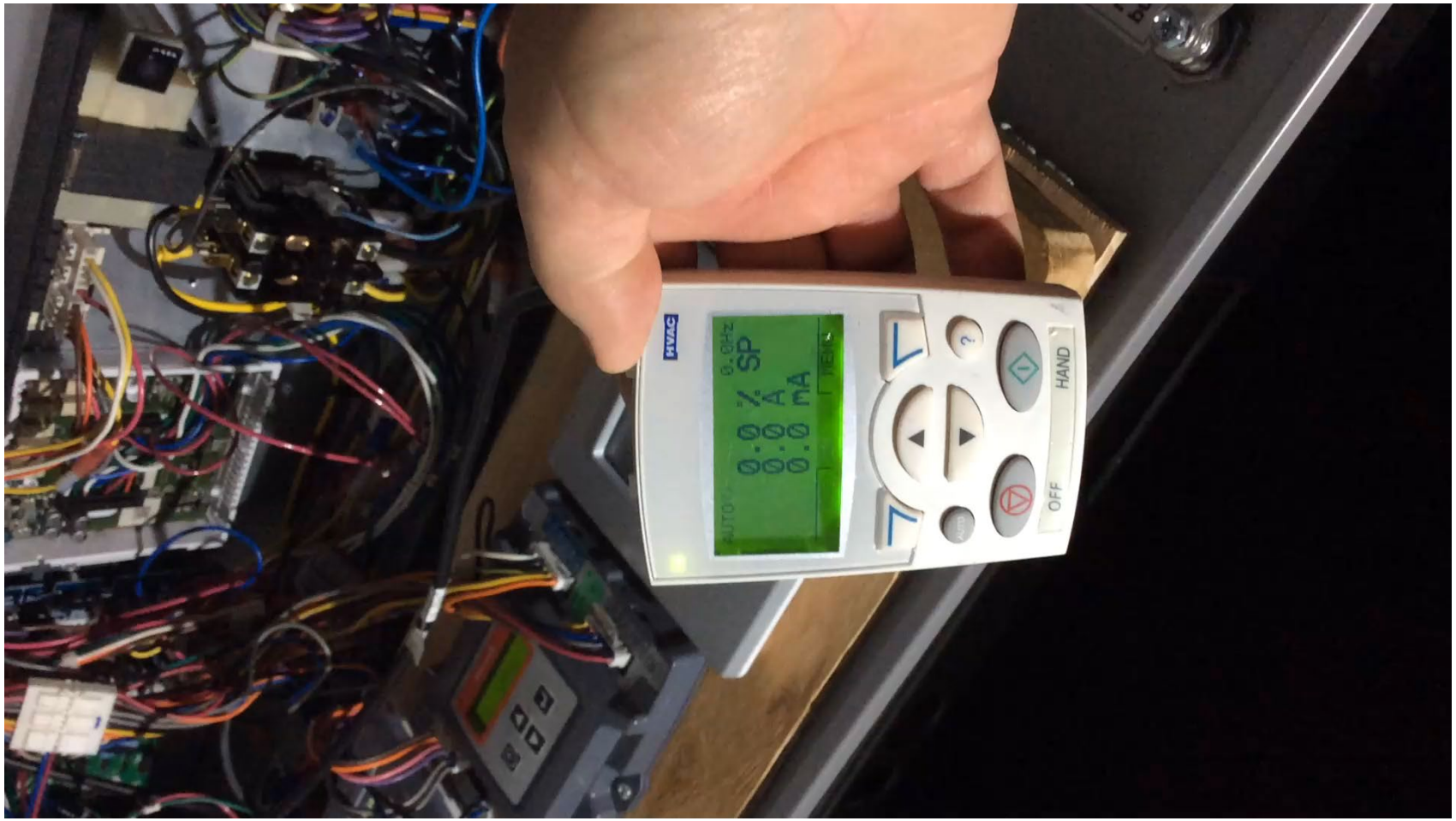
The VFD must be off when programming parameters
The VFD will not allow changes in the auto mode
All Carrier units do not come with VFD keypads

Table 16 – VFD Parameters —
48/50TC 08-14, 50TCQ 08-12, 48/50HC 08-12 and 50HCQ 08-09

VFD Part Number	ABB Part Number	Description	Motor Part Number	Voltage (9905)	Nom Amps (9906)	Motor Nom Freq (9907)	Nom RPM (9908)	Nom HP (9909)	Const Speed Sel (1201)	Const Speed 1 (1202)	Const Speed 2 (1203)	Const Speed 3 (1204)	Relay Out 3 (1403)	Max Amps (2003)	Min Freq (2007)	Max Freq (2008)	Switch Freq (2606)	Start Fcn (2101)	Stop Fcn (2102)	Accel/ Decel (2201)	Accel (2202)	Decel (2203)
HK30WA364	ACH550–U0–012A–2	1.7 HP 230V	HD56FR233	230	5.8	60Hz	1725	1.7	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	6.7	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA356	ACH550–U0–012A–2	1.7 HP 460V	HD56FR463	460	2.9	60Hz	1725	1.7	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	3.3	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA366	ACH550–U0–017A–2	1.7 HP 575V	HD56FR579	575	3.1	60Hz	1725	1.7	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	3.6	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA352	ACH550–U0–024A–2	2.4 HP 230V	HD56FE653	230	7.9	60Hz	1725	2.4	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	9.1	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA356	ACH550–U0–06A9–4	2.4 HP 460V	HD56FE653	460	4	60Hz	1725	2.4	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	4.6	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA360	ACH550–U0–06A9–4	2.4 HP 575V	HD56FE577	575	3.4	60Hz	1725	2.4	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	3.9	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA352	ACH550–U0–06A9–4	2.9 HP 230V	HD58FE654	230	9.2	60Hz	1725	2.9	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	10.6	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA356	ACH550–U0–08A8–4	2.9 HP 460V	HD58FE654	460	4.6	60Hz	1725	2.9	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	5.3	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA353	ACH550–U0–012A–4	3.7 HP 230V	HD60FE656	230	11.2	60Hz	1725	3.7	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	12.9	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA357	ACH550–U0–03A9–6	3.7 HP 460V	HD60FE656	460	5.6	60Hz	1725	3.7	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	6.4	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA361	ACH550–U0–06A1–6	3.7 HP 575V	HD58FE577	575	4.2	60Hz	1725	3.7	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	4.8	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA354	ACH550–U0–09A0–6	5.3 HP 230V	HD60FK658	230	13	60Hz	1740	5.3	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	150	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA358	ACH550–U0–07A5–2	5.3 HP 460V	HD60FK658	460	6.4	60Hz	1740	5.3	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	7.4	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA362	ACH550–U0–02A7–6	5.3 HP 575V	HD60FE576	575	5.4	60Hz	1725	5.3	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	6.2	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec

Never use the VFD to adjust airflow ! Adjust the sheaves

VFD Keypad Use



VFD Maintenance

Heat Sink Cleaning

The heat sink fins accumulate dust from the cooling air. In a normal environment check the heat sink annually, in a dusty environment check more often.

Use the following procedure to clean the heat sink on AHC550 VFDs:

1. Turn off and lock out unit power.
2. Remove the drive cover (see Fig. 38).
3. Press together the retaining clips on the top cover and lift (see Fig. 39).

VFD Maintenance

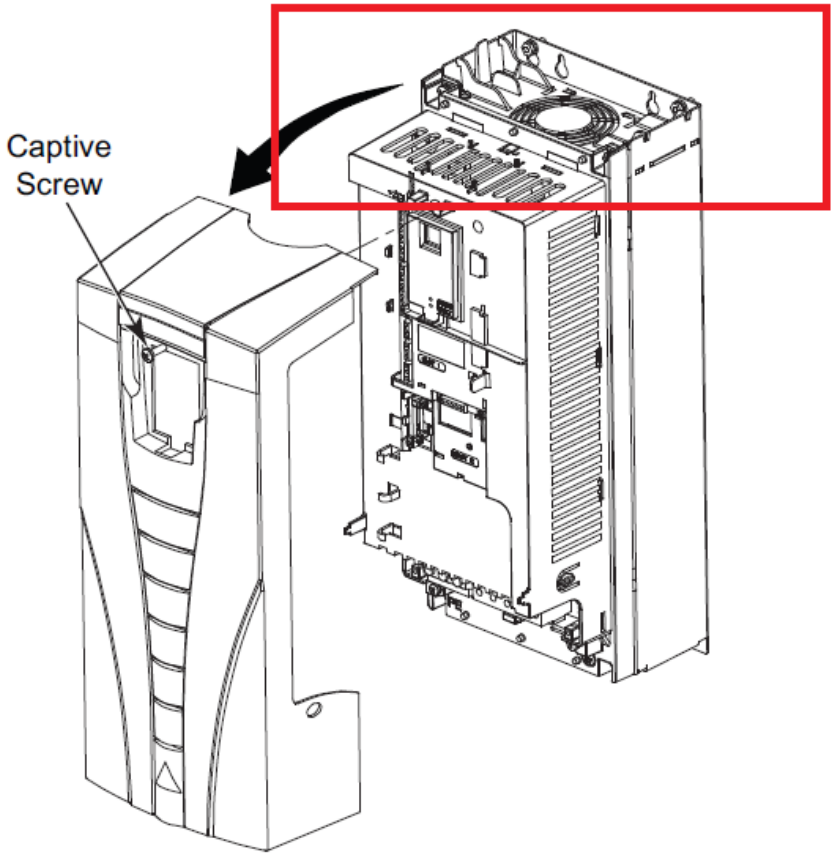


Fig. 38 — Remove ACH550 VFD Front Cover

VFD Maintenance

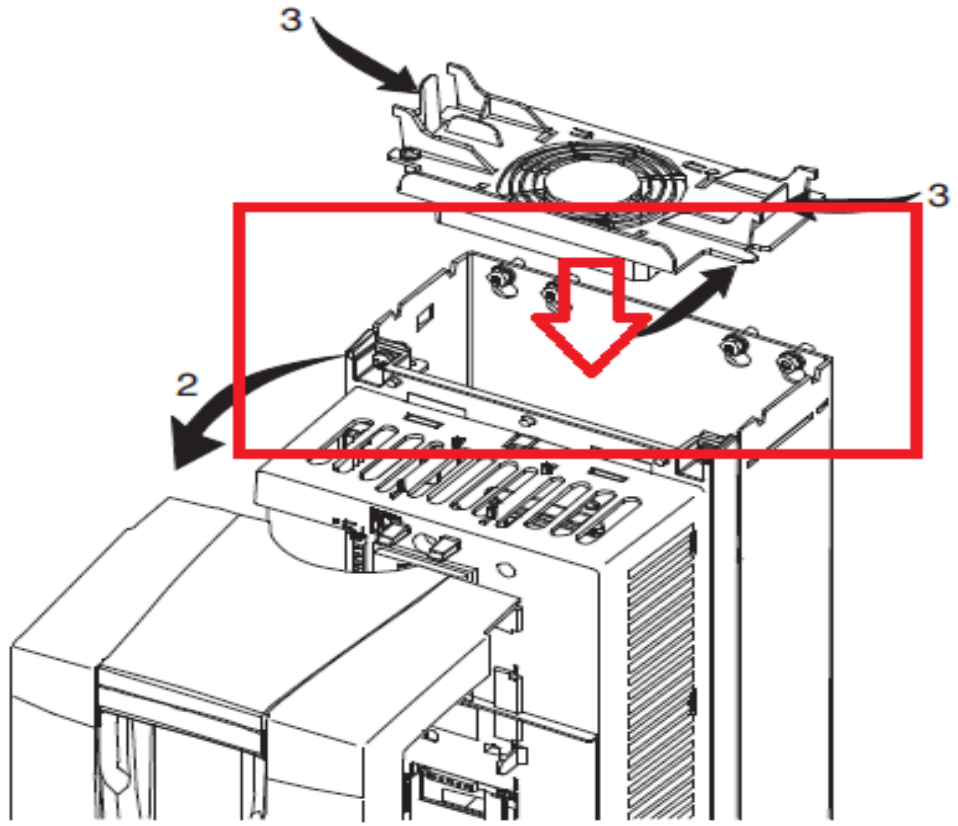


Fig. 39 — Remove Top Cover on ACH550 VFD

4. Blow clean compressed air (not humid) from bottom to top while simultaneously using a vacuum cleaner at the air outlet to trap the dust.
5. Replace the cooling fan.
6. Replace the drive cover.
7. Restore power.

VFD Maintenance

Use the following procedure to clean the heat sink on ASC320 VFDs:

1. Turn off and lock out unit power.
2. Insert a small straight blade screwdriver into the slot and press in to release the top cover as shown in Fig. 40.

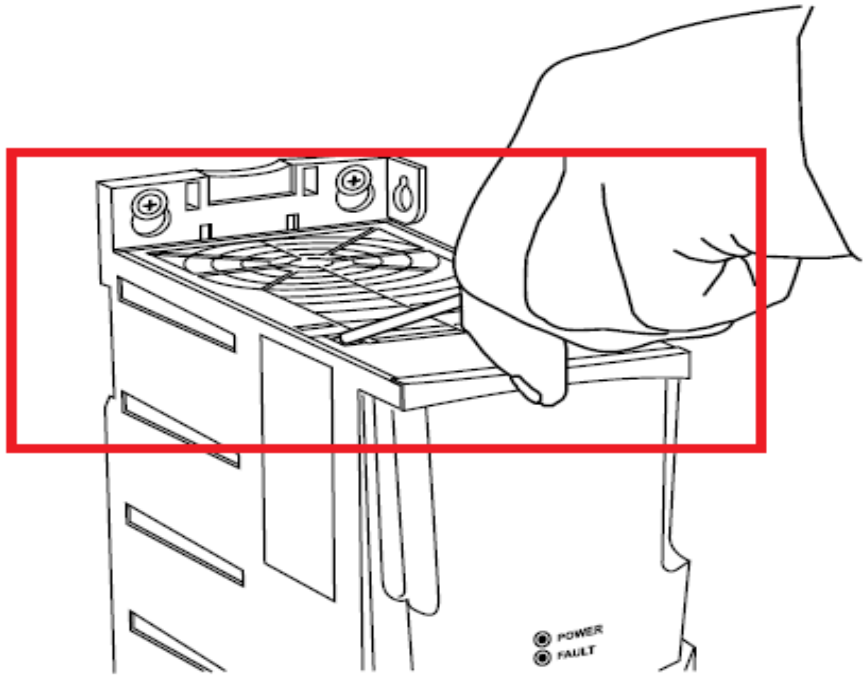
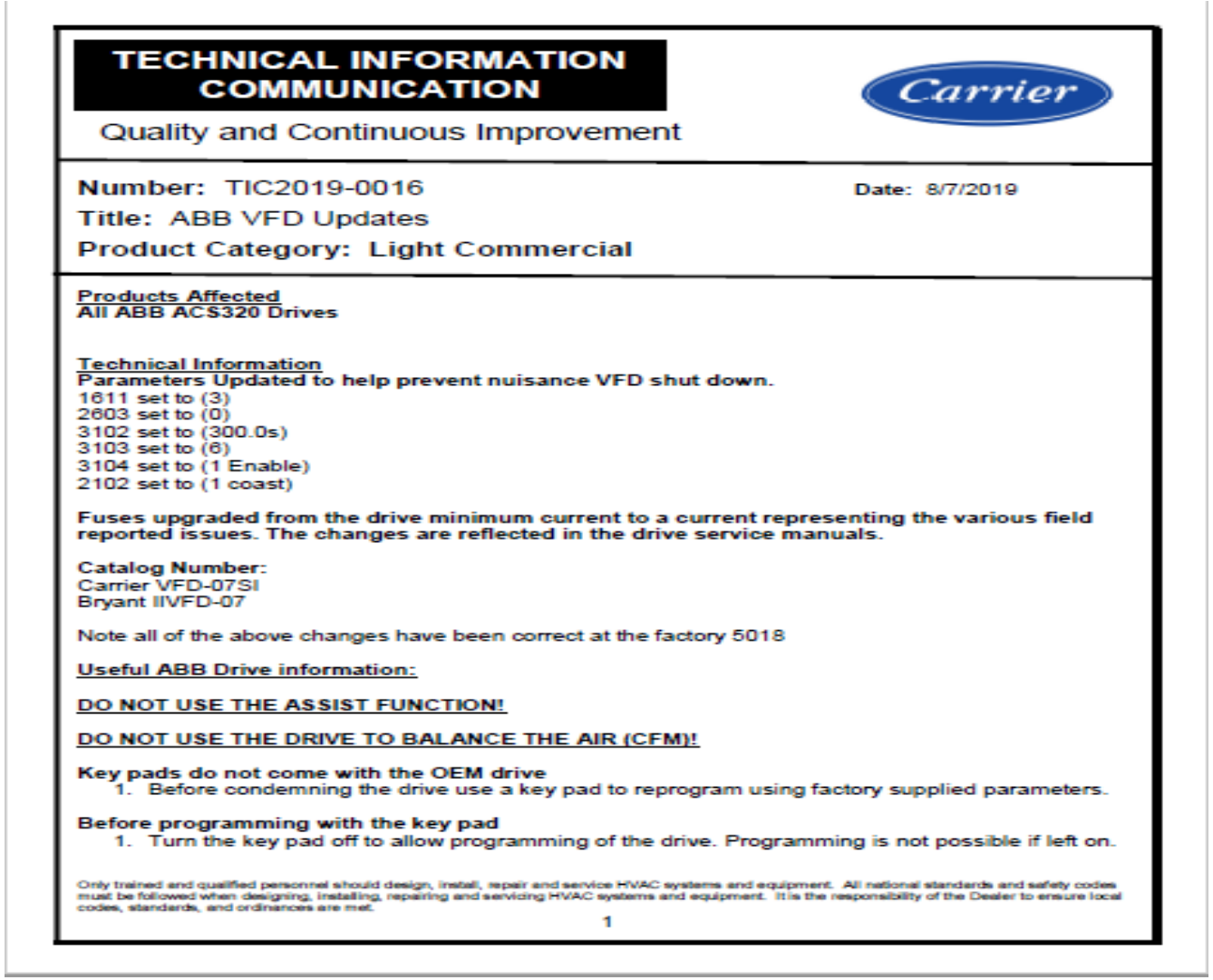


Fig. 40 — Remove Top Cover on ACS320 VFD

3. Blow clean compressed air (not humid) from top of ACS320 while simultaneously using a vacuum cleaner at the base to trap the dust.
4. Replace the top cover.
5. Restore power.

VFD TIC2019-0016



TECHNICAL INFORMATION COMMUNICATION

Quality and Continuous Improvement

Number: TIC2019-0016 **Date:** 8/7/2019

Title: ABB VFD Updates

Product Category: Light Commercial

Products Affected
All ABB ACS320 Drives

Technical Information
Parameters Updated to help prevent nuisance VFD shut down.
1611 set to (3)
2603 set to (0)
3102 set to (300.0s)
3103 set to (6)
3104 set to (1 Enable)
2102 set to (1 coast)

Fuses upgraded from the drive minimum current to a current representing the various field reported issues. The changes are reflected in the drive service manuals.

Catalog Number:
Carrier VFD-07SI
Bryant IIVFD-07

Note all of the above changes have been correct at the factory 5018

Useful ABB Drive information:

DO NOT USE THE ASSIST FUNCTION!

DO NOT USE THE DRIVE TO BALANCE THE AIR (CFM)!

Key pads do not come with the OEM drive
1. Before condemning the drive use a key pad to reprogram using factory supplied parameters.

Before programming with the key pad
1. Turn the key pad off to allow programming of the drive. Programming is not possible if left on.

Only trained and qualified personnel should design, install, repair and service HVAC systems and equipment. All national standards and safety codes must be followed when designing, installing, repairing and servicing HVAC systems and equipment. It is the responsibility of the Dealer to ensure local codes, standards, and ordinances are met.

1

VFD Drives

VFD unit for replacement. Wild Leg Power Supply requires a field supplied Delta-WYE transformer

This is less common power supply today but does occur in older city areas. Voltage reading look like this.

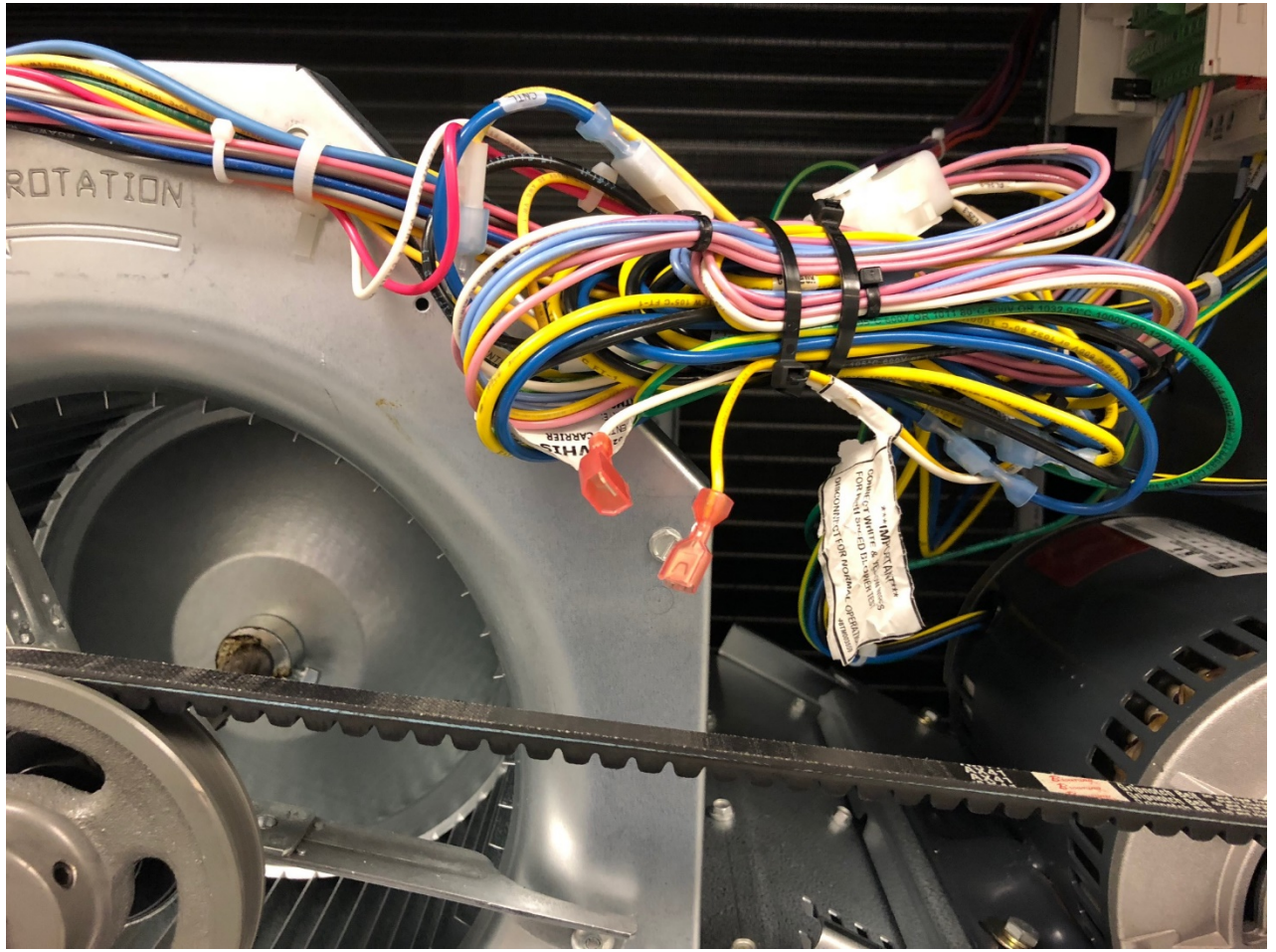
L1 to ground 120 volts

L2 to ground 240 volts

L3 to ground 120 volts

Note: the higher voltage on one leg with normal voltages on the other 2 legs.

Test and Balance VFD Bypass

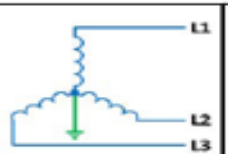
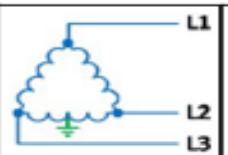


VFD Drives

VFD vs Power Supply

With new codes pushing the addition of VFDs to our light commercial rooftops, there is a stronger emphasis on determining the power supply of the system before installing the unit. Depending on the power supply, modifications may need to be made in the field to ensure proper operation of the VFD.

Please see the below information on types of power supplies and the changes made to the filter screws on the factory installed VFD or when an isolation transformer is required to be installed. Please also refer to TIC2018-0004 (found on HVACpartners) and to the VFD manufacturer's user manual for additional information.

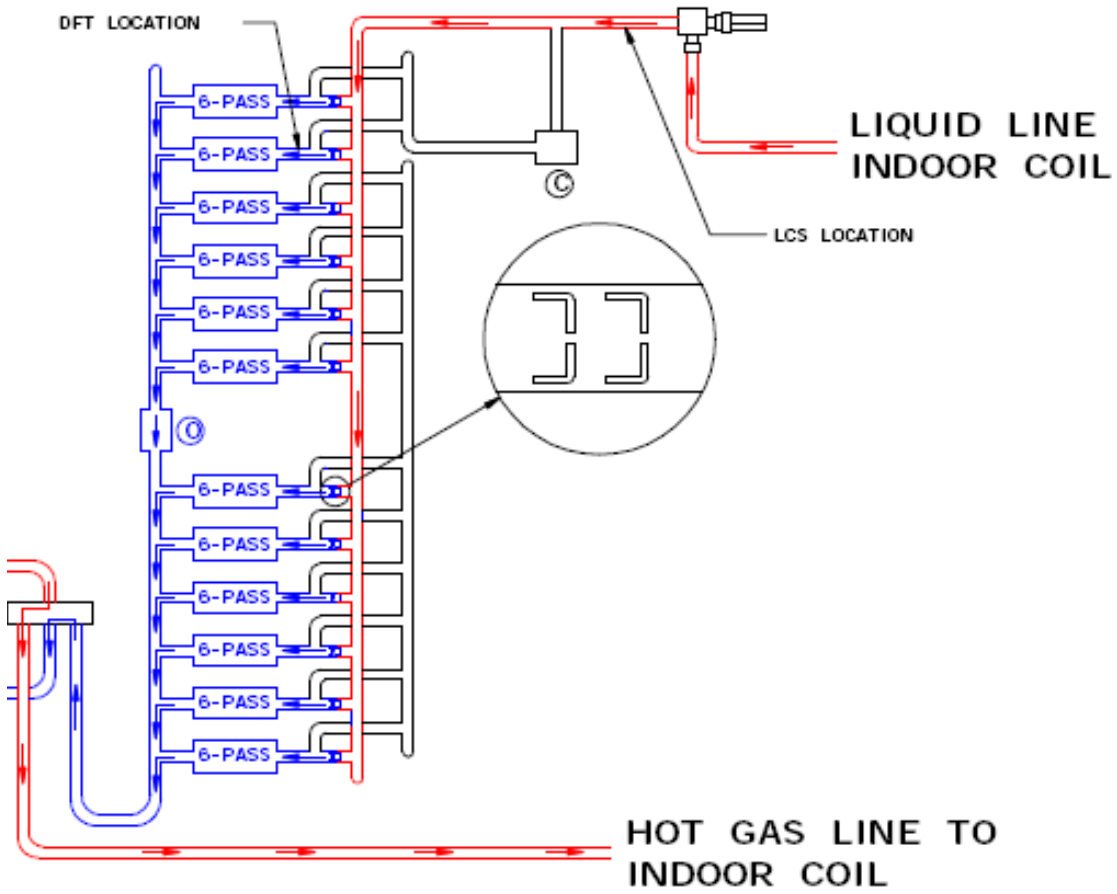
Power Supply Image				 All Leg Voltages Similar	 Typically 2 Legs - 120V or 277V and 1 Leg - 240V or 480V
Power Supply Type	Wye Transformer, Symmetrically Grounded	Wye Transformer, High Resistance Ground	Delta Transformer, Corner Grounded (Unsymmetric)	Delta Transformer, Side Grounded (Unsymmetric)	High Leg Delta Transformer, Side Grounded (Unsymmetric)
ABB Drive Changes*	Optional, See Drive Chart	Yes, See Drive Chart	Yes, See Drive Chart[1]	Yes, See Drive Chart	Yes, See Highlight Below and Drive Chart
Danfoss Drive Changes*	No	Yes, See Drive Chart	Yes, See Drive Chart[1]	Yes, See Drive Chart	Yes, See Highlight Below and Drive Chart

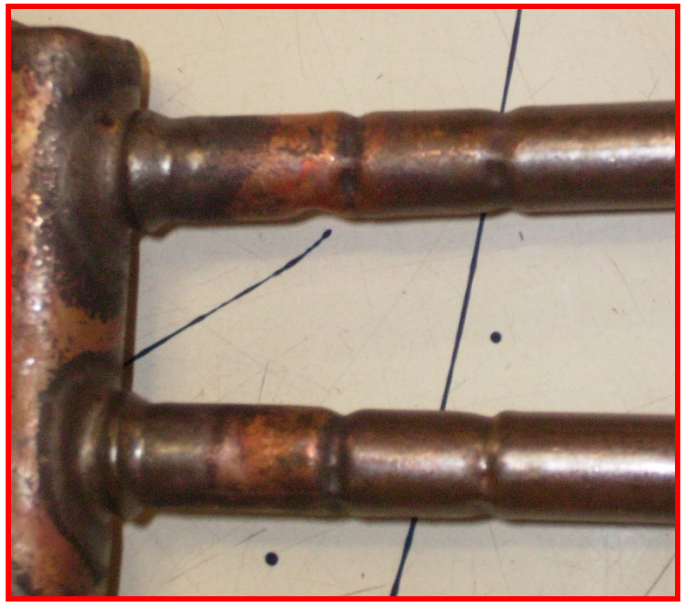
*- When measuring voltage between phases of the power supply, the measurement must be within a 2% tolerance in order for the VFD to operate properly.

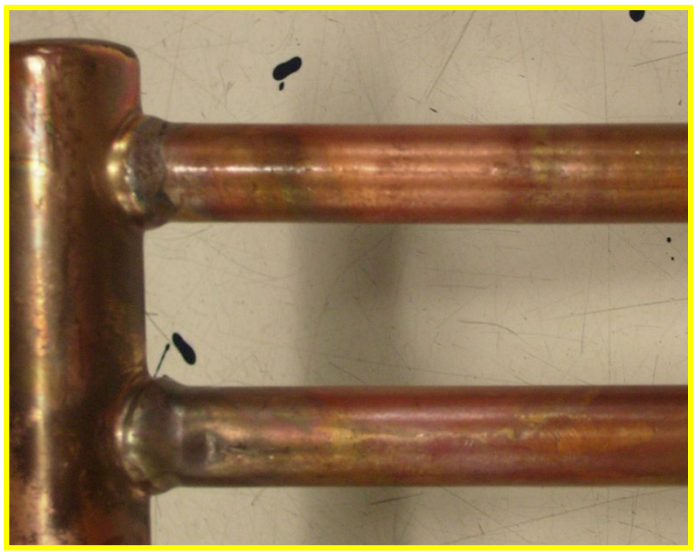
[1] - To help reduce noise an in-line reactor or isolation Delta-Wye transformer can be installed.

High Leg (Wild-Leg or Stinger-Leg) Power Supply - Installation of an isolation Delta-Wye transformer is required for proper operation of the VFD.

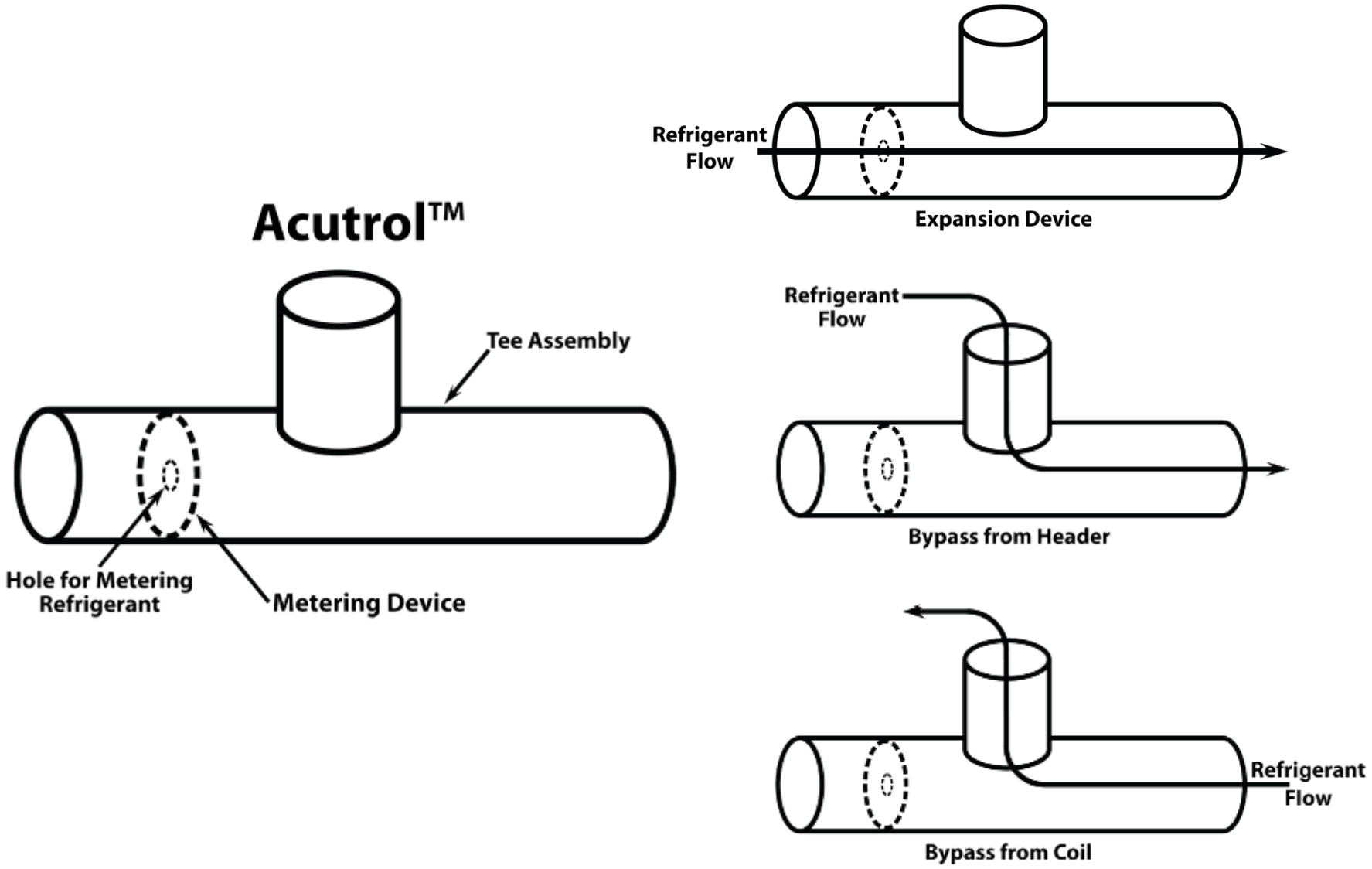
Accutrol Header



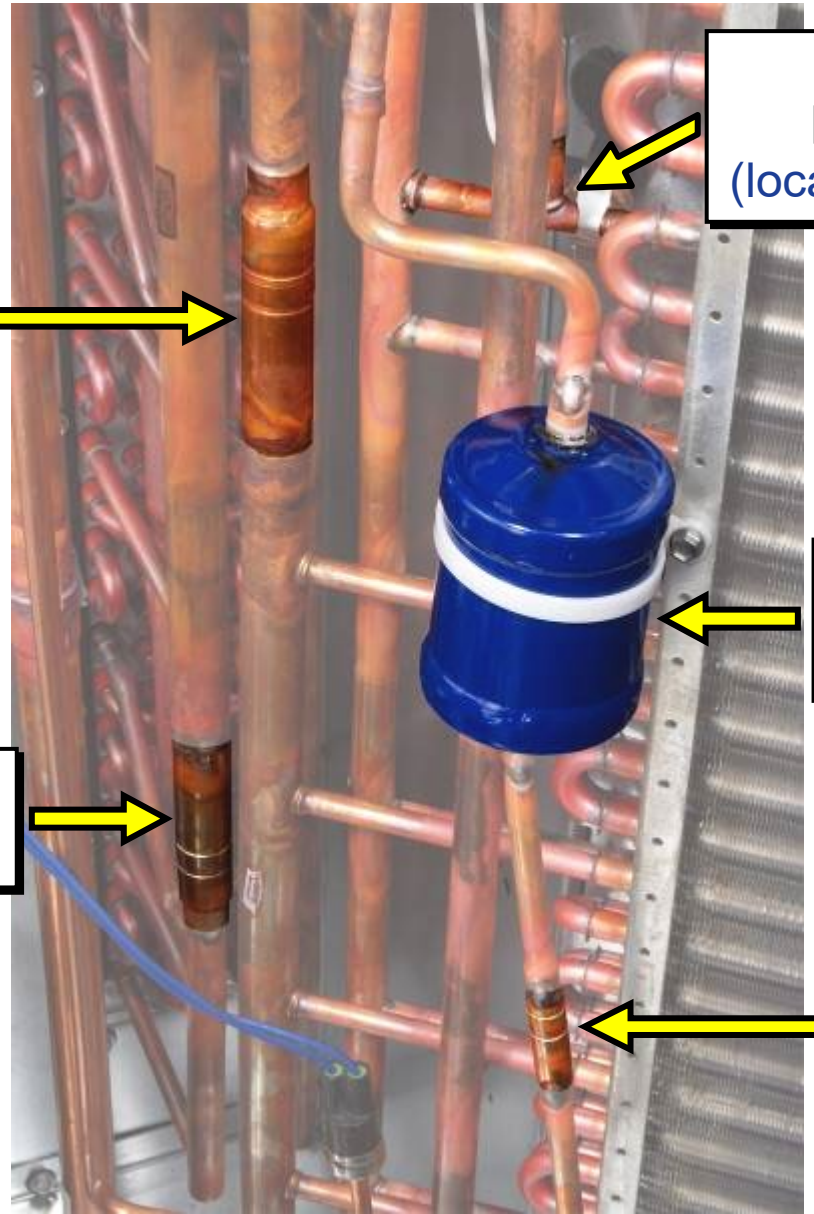




Acutrol™ Tee Assembly



Heat Pump Coils



Acutrol™
Metering Device
(located inside tee nipple)

Check Valve
Assembly

Liquid Line
Filter Drier

Check Valve
Assembly

Liquid Line
Check Valve

comfort | excellence

Accutrol Test

- Disconnect the power to the unit to prevent hazard of electrical shock.

- Disable the indoor fan and remove freeze stat from evap coil.
- Install jumper between R and Y
- Restore power to unit and monitor refrigerant pressures.
- Observe the short sections of tubing after the accutrols.
- They should all freeze up within 30-45 secs of each other.
- If one or more freeze later or not at all, replace header or entire coil.

High Flow Valve System

Figure 8. Coremax (FasTest) High Flow Valve Parts

Body part # EC39EZ065
Valve core part # EC39EZ067

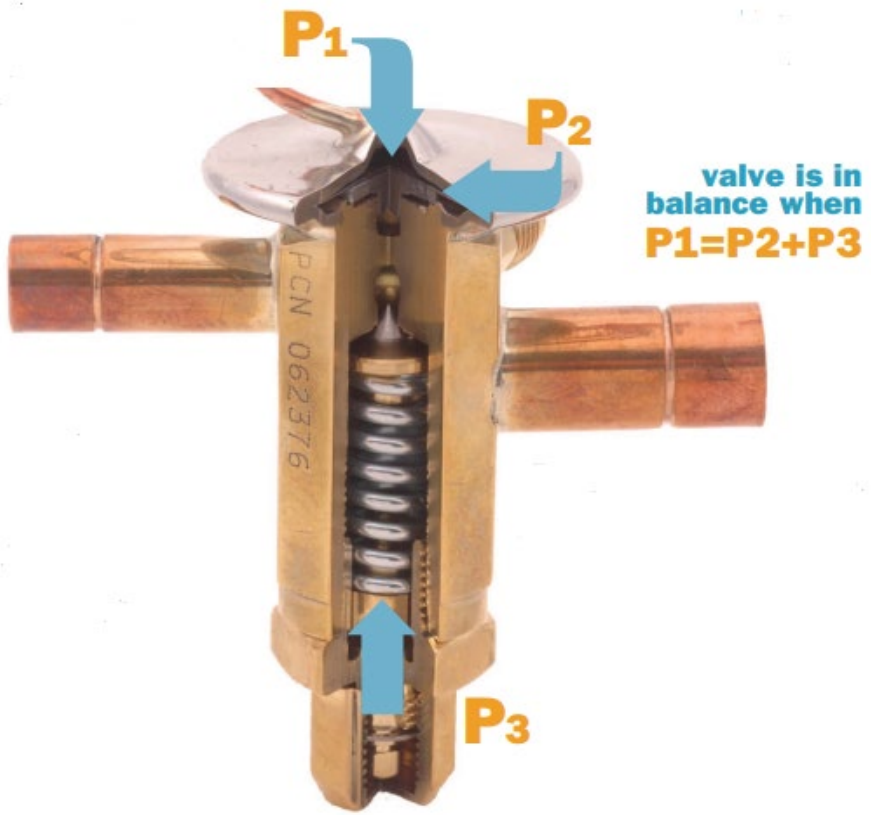
TXV's

- 3 forces that govern TXV operation
- P1 the pressure created by the

Remote bulb and the power assembly

- P2 the evaporator equalizer pressure
- P3 the equivalent spring pressure of

The superheat spring



- The valve will assume a stable position when forces are in Equilibrium (P1=P2+P3)

TXV Troubleshooting Flooding

- Undersized or inefficient compressor.
- Low superheat setting.
- Moisture.
- Dirt or debris.
- TXV seat leak.
- Oversized valve.
- Incorrect bulb position.
- Plugged equalizer tube

TXV Troubleshooting Hunting

- Valve oversized for application.
- Bulb location.
- Refrigerant distribution.
- Superheat adjustment.
- Moisture.

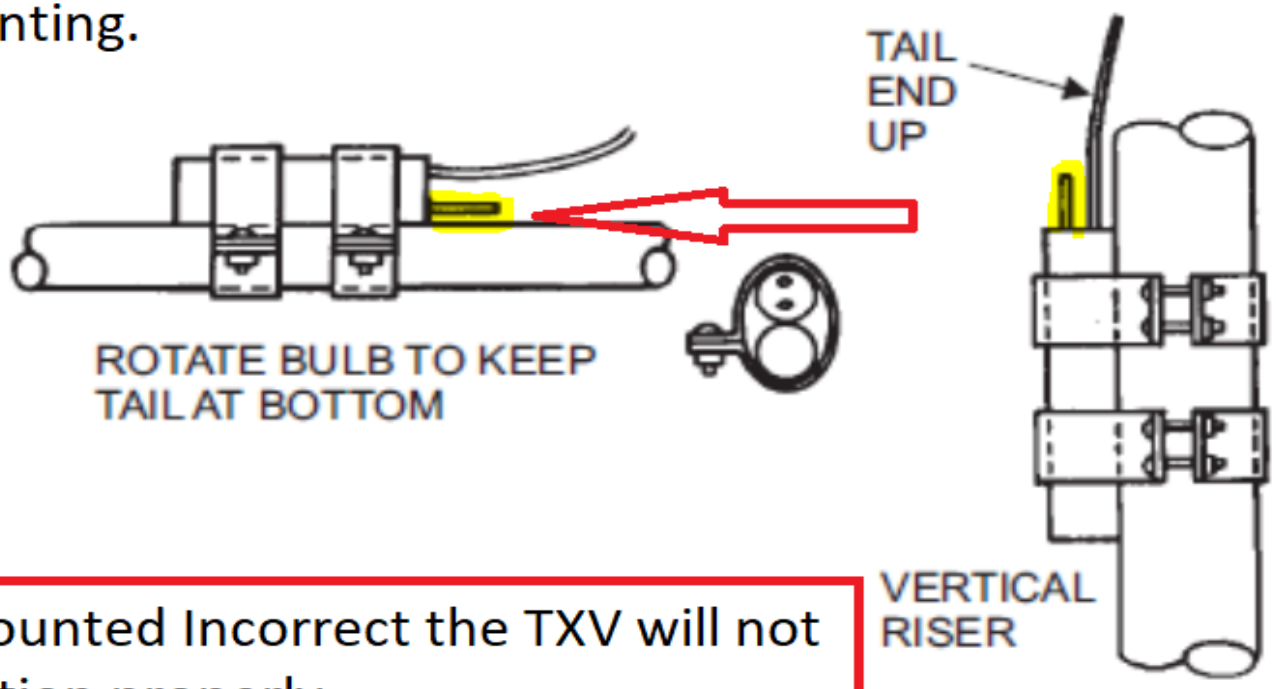
TXV Troubleshooting Starving

- Moisture.
- Dirt or debris.
- Insufficient Delta P across valve.
- Undercharged system.
- Flash gas at inlet to TXV.
- Valve too small.
- Superheat adjusted too high.
- Power assembly failure or partial loss of charge.

TXV Bulb Mounting

The Stub Must be on the bottom for horizontal mounting.

The tail end must come out of the top for vertical.



If Mounted Incorrect the TXV will not function properly

TXV Testing Procedure

- Step 1 remove the remote bulb of the expansion valve from the suction line.
- Step 2 start the system and cool the bulb in a container of ice water, closing the valve. As you cool the bulb, the suction pressure should fall and the suction temperature will rise.
- Step 3 next warm the bulb in a container of warm tap water . As you warm the bulb, the suction pressure should rise and the suction temperature will fall.
- Step 4 If a temperature or pressure change is noticed, the expansion valve is operating. No change is noticed, valve is restricted, the power element is faulty, or the equalizer tube is plugged.
- Step 5 recover the charge, replace the valve and drier, evacuate and recharge.

TXV Overfeeding

- Overfeeding by the expansion valve results in high suction pressure, cold suction line, and possible liquid slugging of the compressor.
- Check for overcharge
- Check the operation of the valve as described in the testing procedure.
- Check equalizer tube it may be plugged with brazing material or restricted.

TXV Underfeeding

- Underfeeding by the expansion valve results in low system capacity and low suction pressures. If these symptoms are observed
- Check for a restriction. Check the temperature across the drier as it may be restricted.
- Check the operation of the valve as described in the testing procedure.

Commercial Splits

Heat Pump

Air Conditioner

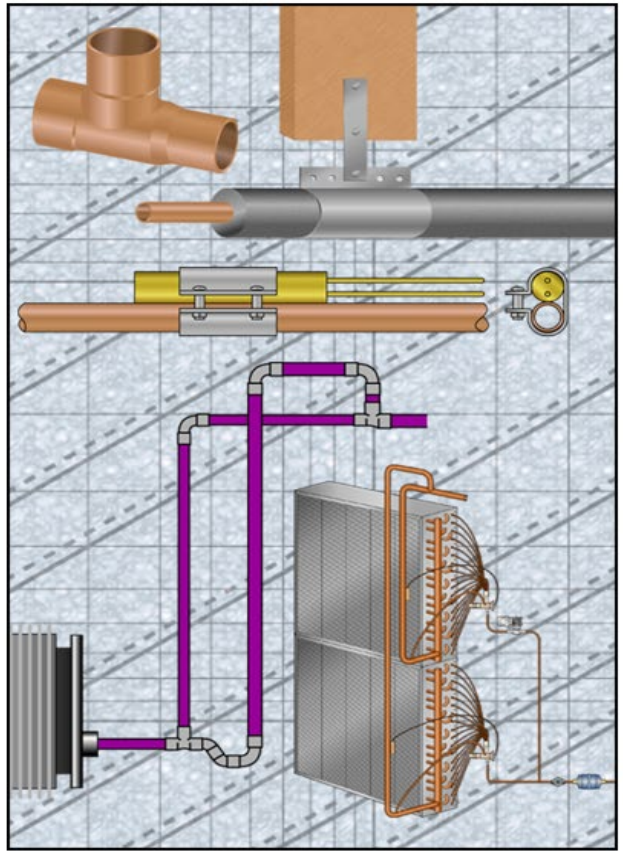
Commercial Splits

Heat Pump Air Handler

Cooling Only Air Handler

comfort | excellence

Commercial Splits



Refrigerant Piping Systems

Commercial Splits

- Refrigerant Piping Concerns
  - Application
  - Length of Piping
  - Routing & Obstacles
  - Pressure Drop vs. Capacity Loss
  - Oil Return at Minimum Capacity
  - System Charge
  - Liquid at the metering device
  - Protect the compressor
    - Liquid slugging oil & refrigerant
    - Off-cycle protection

comfort | excellence

Commercial Splits

Refrigerant Piping Design

- Improper line size can cause problems
  - Compressor Failures
    - Floodback
    - Slugging
    - Oil Loss
    - Overheating
  - Poor Evaporator Performance
    - Flash Gas At TXV
    - Low SST's
    - Frosting

comfort | excellence

Commercial Splits

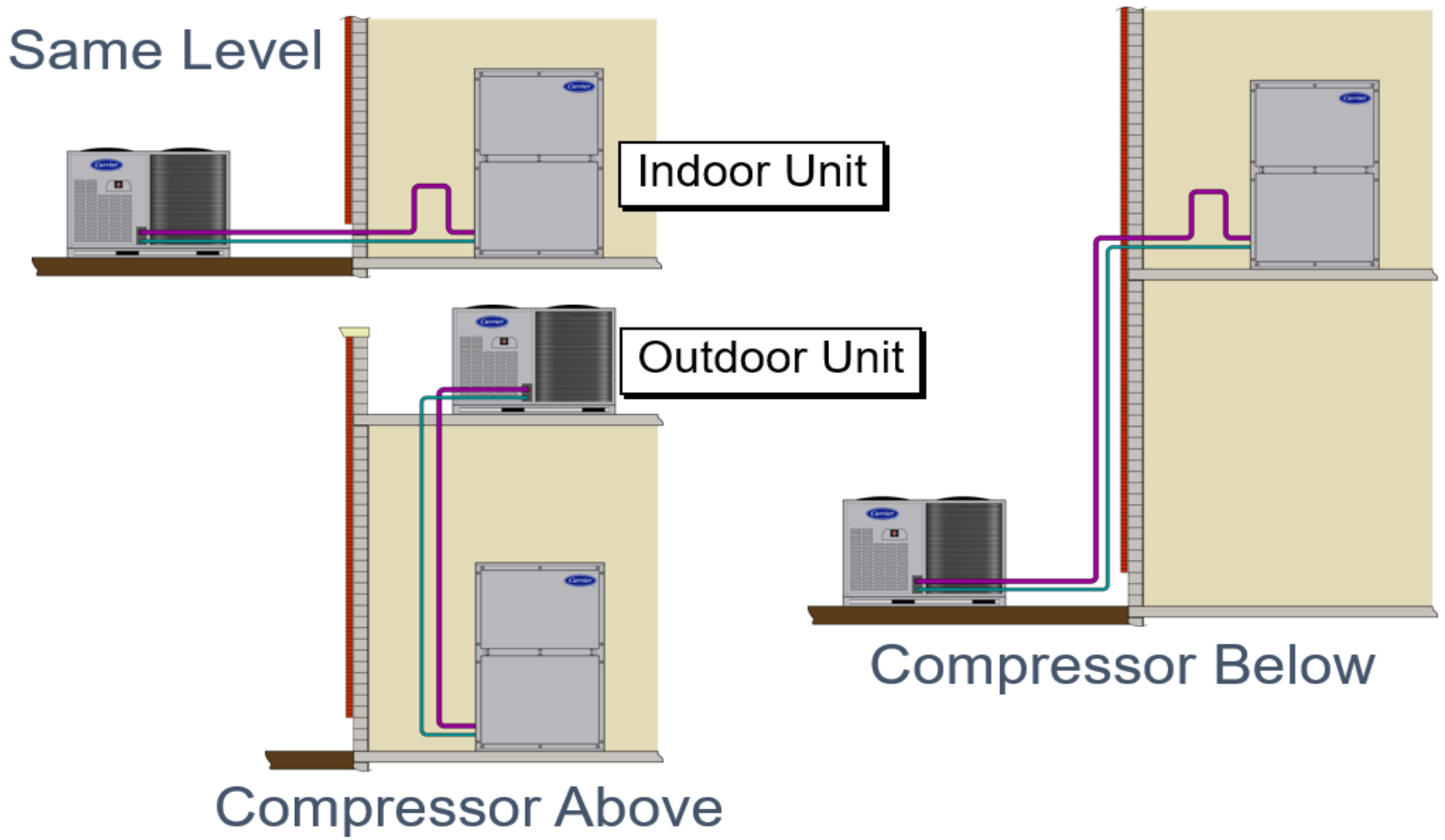
Piping Recommendations

1. Keep it simple, keep it short
2. Size piping based on the best compromise of pressure loss and cost
3. Design for oil return in vapor lines at minimum load conditions
4. Avoid oil and liquid refrigerant traps
5. Design for liquid at the expansion valve
6. Limit system charge to 4 lbs./ton
7. Support the piping adequately
8. Provide valves and access fittings for service
9. Insulate piping where needed

CE
comfort | excellence

Commercial Splits

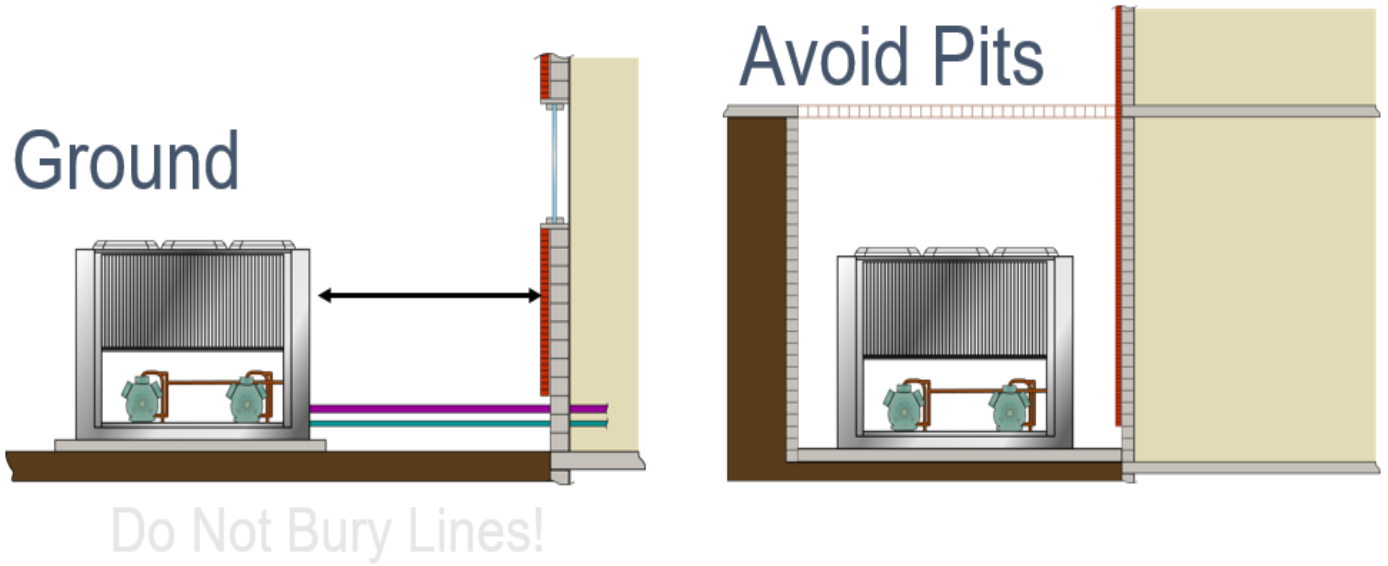
Typical Orientations



comfort | excellence

Commercial Splits

Outdoor Locations



Commercial Splits

Maximum Length of Refrigerant Piping

Max. Piping Length depends on the equipment

- Always keep both run and lift as short as possible.
- Commercial Air conditioning systems and most residential systems.
  - Maximum run 200 linear feet (250 equivalent feet)
  - Maximum lift depends unit model and refrigerant
- Commercial Heat pumps – 100 linear feet maximum.
- Equivalent feet = Linear feet of pipe + Equivalent feet of fittings, valves and specialties.
  - For estimating purposes use Linear ft. x 1.5.
- Consult Product Data and Installation Instructions for piping recommendations.
  - Use System Design Manual, ASHRAE design guide or Refrigerant Piping Design program for special applications or to verify if existing piping is adequate.

Commercial Splits

Fitting Losses in Equivalent Feet of Pipe

Normal Pipe or Tube Size (in.)	Smooth Bend Elbows						Smooth Bend Tees			
	90° Std*	90° Rad. †	90° Street*	45° Std*	45° Street*	180° Std*	Flow-Thru Branch	Straight-Thru Flow		
								No Reduction	Reduced ¼	Reduced ½
3/8	1.2	0.8	2.1	0.6	0.9	2.1	2.4	0.8	1.0	1.2
1/2	1.4	0.9	2.3	0.7	1.1	2.3	2.7	0.9	1.2	1.4
5/8	1.6	1.0	2.5	0.8	1.3	2.5	3.0	1.0	1.4	1.6
3/4	1.8	1.2	2.9	0.8	1.4	2.8	3.5	1.2	1.7	1.8
7/8	2.0	1.4	3.2	0.9	1.6	3.2	4.0	1.4	1.9	2.0
1 1/8	2.6	1.7	4.1	1.3	2.1	4.1	5.0	1.7	2.2	2.6
1 3/8	3.3	2.3	5.6	1.7	3.0	5.6	7.0	2.3	3.1	3.3
1 5/8	4.0	2.6	6.3	2.1	3.4	6.3	8.0	2.6	3.7	4.0
2 1/8	5.0	3.3	8.2	2.6	4.5	8.2	10.0	3.3	4.7	5.0
2 5/8	6.0	4.1	10.0	3.2	5.2	10.0	12.0	4.1	5.6	6.0
3 1/8	7.5	5.0	12.0	4.0	6.4	12.0	15.0	5.0	7.0	7.5
3 5/8	9.0	5.9	15.0	4.7	7.3	15.0	18.0	5.9	8.0	9.0
4 1/8	10.0	6.7	17.0	5.2	8.5	17.0	21.0	6.7	9.0	10.0
5 1/8	13.0	8.2	21.0	6.5	11.0	21.0	25.0	8.2	12.0	13.0
6 1/8	16.0	10.0	25.0	7.9	13.0	25.0	30.0	10.0	14.0	16.0

CE
comfort | excellence

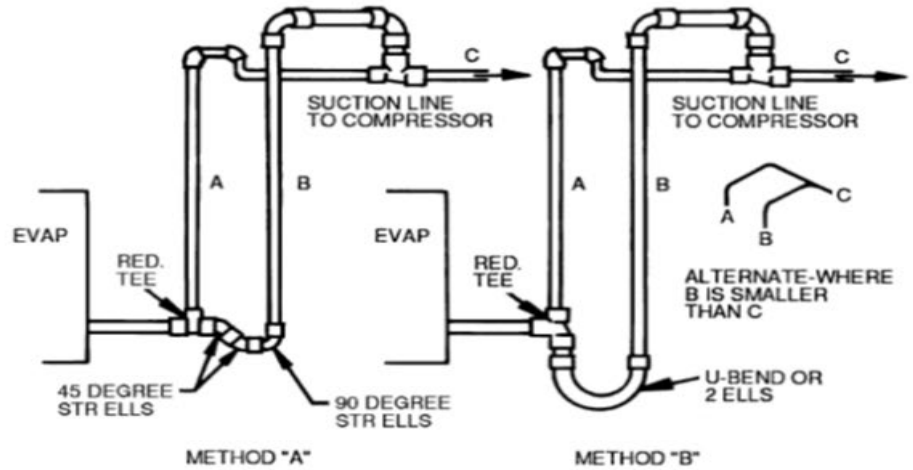
Commercial Splits

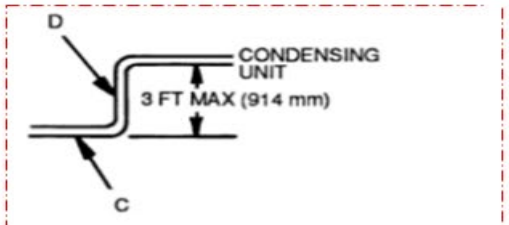
Refrigerant Piping Design

- Suction Line Design
  - Keep It Short and Simple
  - Design lines for a 2°F line loss. Remember this is only a guideline for sizing. In many situations a smaller size can be used without the increased pressure drop having significant impact on the system performance.
  - Pitch horizontal lines minimum 1/8 inch per foot in the direction of flow.
  - Use Suction Loop At Evaporators When Compressor Is Below To Prevent Drainage to Compressor
  - Use Double Suction Risers Sparingly
    - A Reduced Size Risers Works For Most Systems
    - Mainly Seen On Larger Systems With Accessory Unloaders.
  - Avoid intermediate traps in the risers or a trap at the base of a suction riser.

Commercial Splits

Double Suction Riser Detail





LEGEND

A	—	Pipe A, Suction Riser, without Trap
B	—	Pipe B, Suction Riser with Trap
C	—	Suction Line to Condensing Unit
D	—	Pipe D, Suction Riser Short Lift
RED.	—	Reducer
STR	—	Street

NOTES:
1. Short riser, pipe D, is used when routing suction line to condensing unit connection. See table at right.
2. See Tables 6A-9B for values of A, B, and C.

UNIT 38AH	PIPE D DIAMETER					
	Dual Circuit*				Single Circuit*	
	A		B			
	in.	mm	in.	mm	in.	mm
044	1 5/8	41	1 5/8	41	2 1/8	54
054	1 5/8	41	1 5/8	41	2 1/8	54
064	1 5/8	41	2 1/8	54	2 1/8	54
074	2 1/8	54	2 1/8	54	2 1/8	54
084	2 1/8	54	2 1/8	54	2 5/8†	67†
094, 104	2 1/8	54	2 1/8	54	—	—
124, 134	2 5/8	67	2 5/8	67	—	—

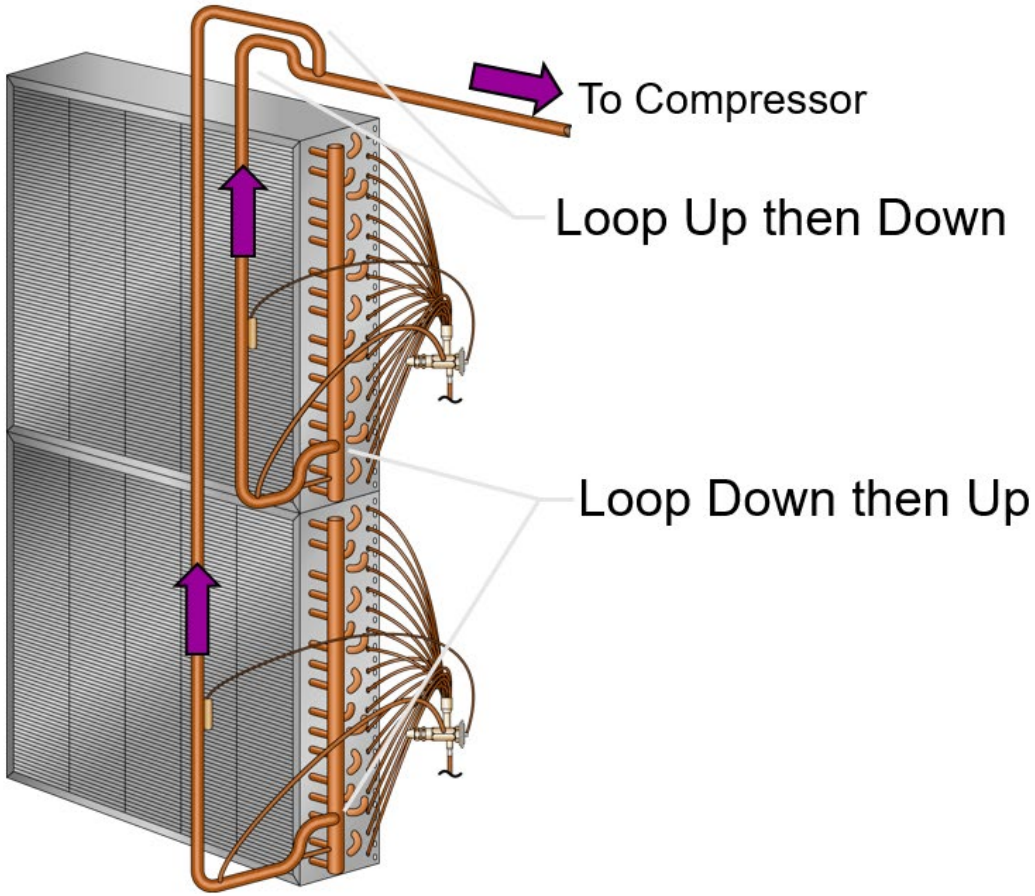
*Maximum length of riser is 3 ft (914 mm).
†Double suction riser required if accessory unloader is field installed.

Fig. 15 — Double Suction Riser Construction

Commercial Splits

Off-Cycle Protection

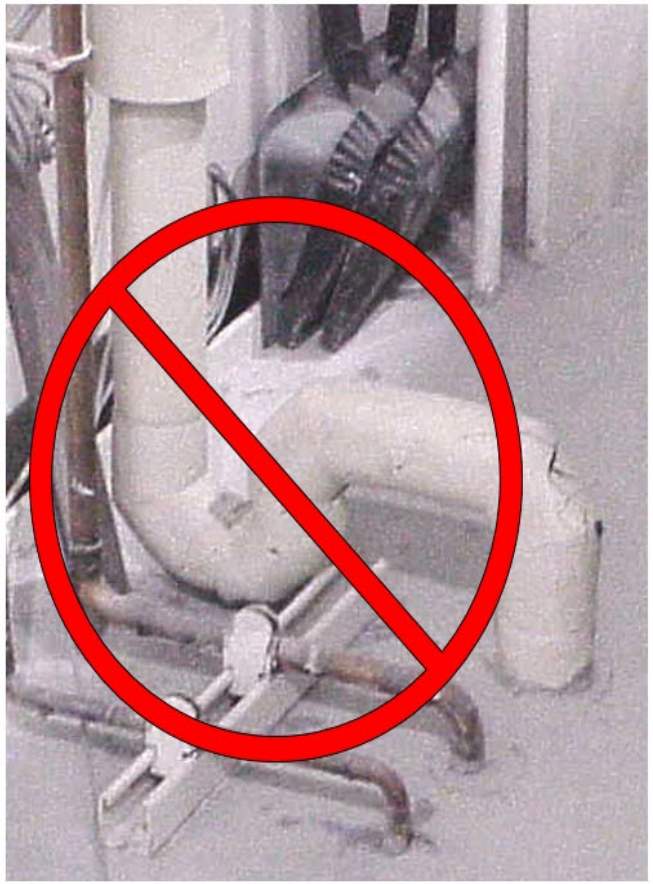
Multiple Evaporators On Common Suction Line



comfort | excellence

Commercial Splits

Watch Out For Suction Line Traps



comfort | excellence

Commercial Splits

Refrigerant Piping Design

- Suction Line Design
  - TXV Bulb Location Is Critical
    - Do Not Install On Common Line Of Multiple Circuit Evaporators
    - Install on Vertical Line After Two Elbows To Ensure Good Mixing
  - DO NOT Bury Refrigerant Lines!
  - Accumulators May Be Required In VAV, VVT and Other High Risk Applications
  - Vibration Eliminators are Not Recommended.

Commercial Splits

Suction Line Summary

1. Keep the path as short and simple as possible.
2. Design lines for a 2°F line loss. Remember this is only a guideline for sizing. In many situations a smaller size can be used without the increased pressure drop having significant impact on the system performance.
3. Check for oil return at the minimum load condition.
    a. Use a reduced riser size first, if does not work then use a double suction riser.
4. Pitch horizontal lines minimum 1/8 inch per foot in the direction of flow.
5. Loop the piping to prevent drain back to the compressor in the off cycle.
6. Do not put in intermediate traps in the risers or a trap at the base of a suction riser.
7. Insulate the entire suction line.
8. Provide valves to isolate the line for compressor service and provide gauge ports.
9. Install suction accumulator where necessary.

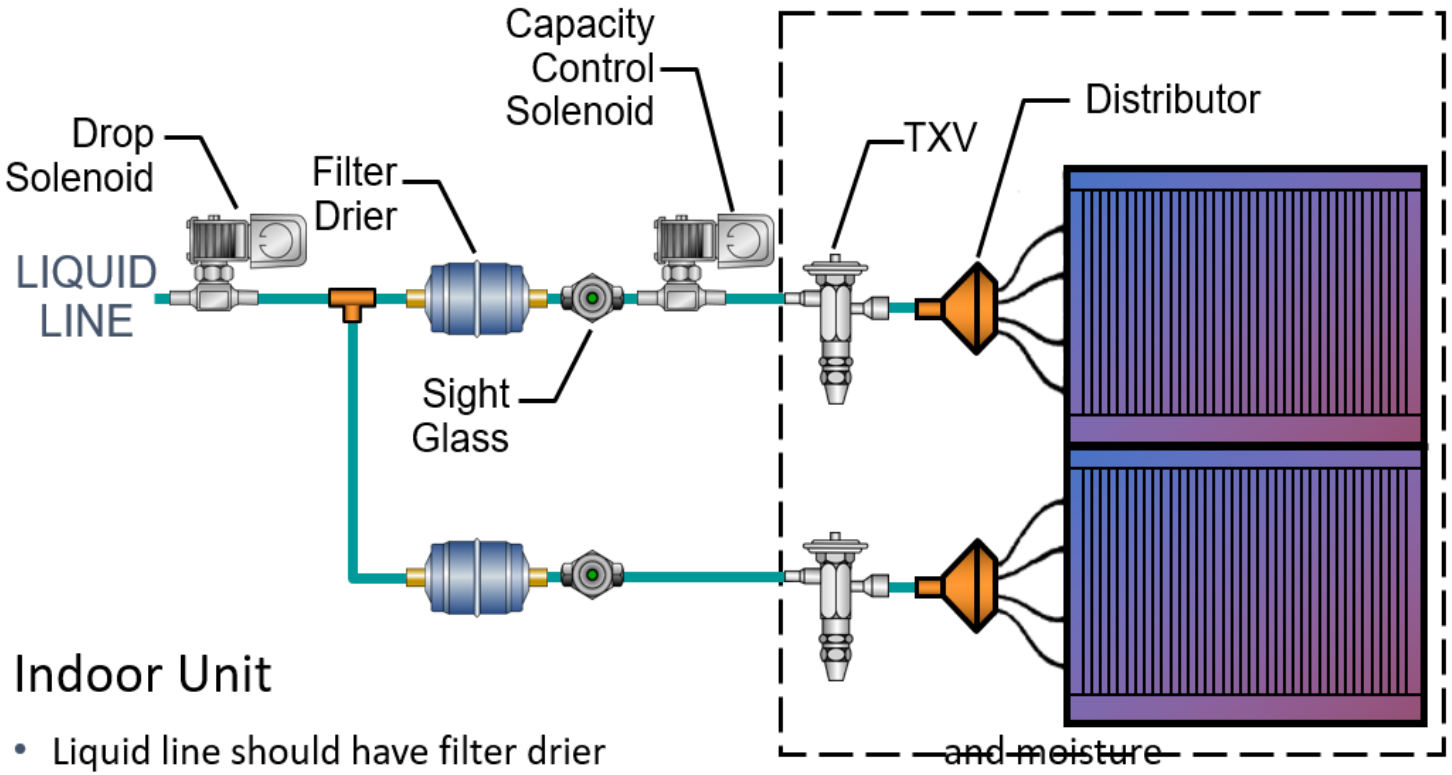
Commercial Splits

Refrigerant Piping Design

- Liquid Line Design
  - Horizontal liquid lines can run parallel to the suction line.
  - Do not exceed liquid lift recommendations
    - Risk of flashing before reaching the TXV
    - Loss of capacity
    - Increased head pressure due to static head
  - Smaller is better!
    - Use smallest line to reduce refrigerant charge.

Commercial Splits

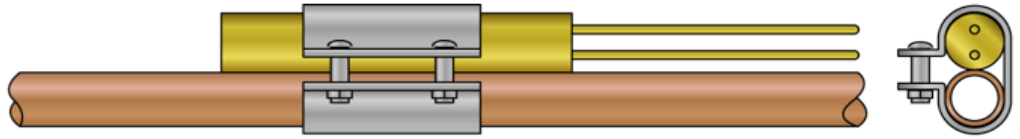
Liquid Line Requirements



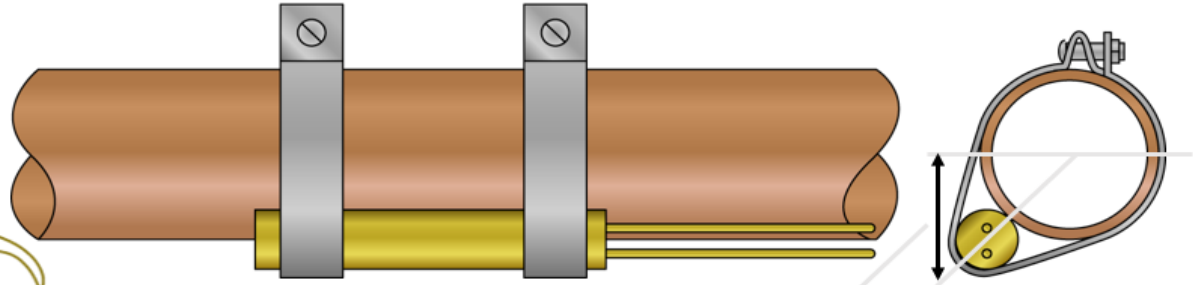
- Liquid line should have filter drier liquid indicator and may have drop solenoid
- With two circuits, units are equipped with capacity control valve(s)

Commercial Splits

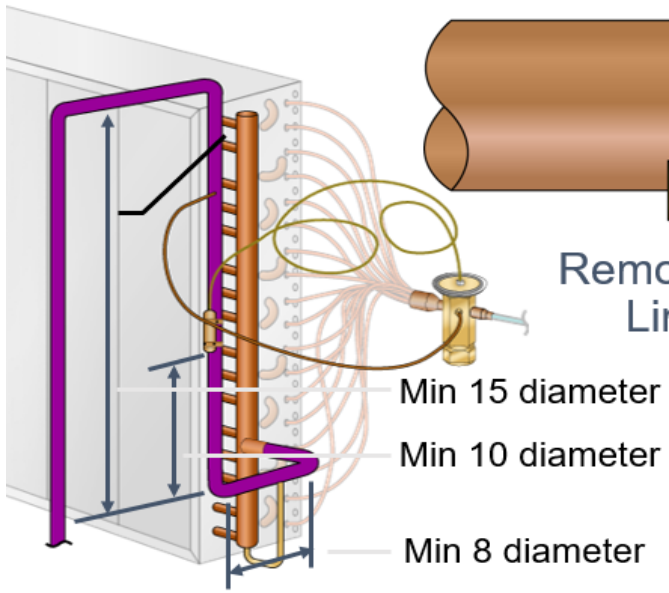
Mounting TXV Bulb on Suction Line



Remote Bulb on Small Suction Line (Less than 7/8 in.)



Remote Bulb on Large Suction Line (7/8 in. and Larger)



Commercial Splits

Install Liquid Line Solenoid Valves —

It is recommended that a bi-directional solenoid valve be placed in the main liquid line (see Figs. 5 & 6) between the outdoor unit and the indoor coil. Locate the solenoid valve at the end of the liquid line, near the outdoor unit connections, with flow direction arrow pointed at the outdoor unit. Refer to Table 5. (A liquid line solenoid valve is required when the liquid line length exceeds 75 ft [23 m].) This valve prevents refrigerant migration (which causes oil dilution) to the compressor during the off cycle, at low outdoor ambient temperatures. Wire the solenoid according to the unit label diagram.

comfort | excellence

Commercial Splits

- Please fully read the installation manual
- Correct piping is very critical

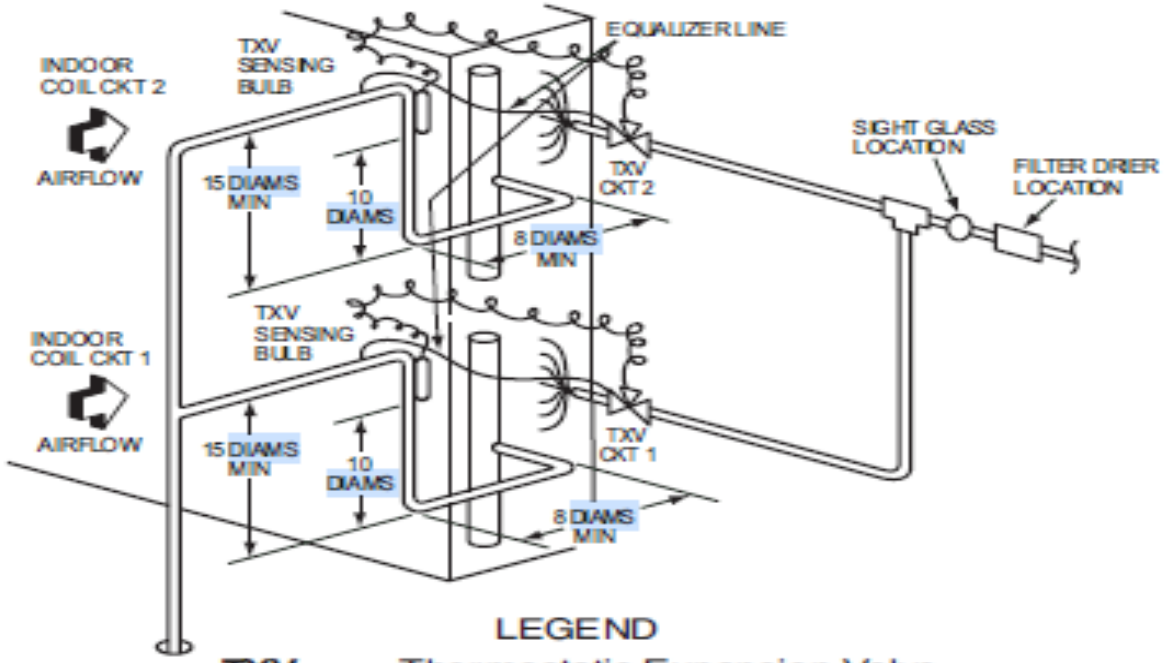


Fig. 6 – Location of Sight Glass(es) and Filter Driers (typical 38AUQ size 12)

Commercial Splits

- Factory charge is a holding charge only Refrigerant must be added.

Table 2 – 38AUQ*07-12 Piping Recommendations (Single-Circuit Unit)

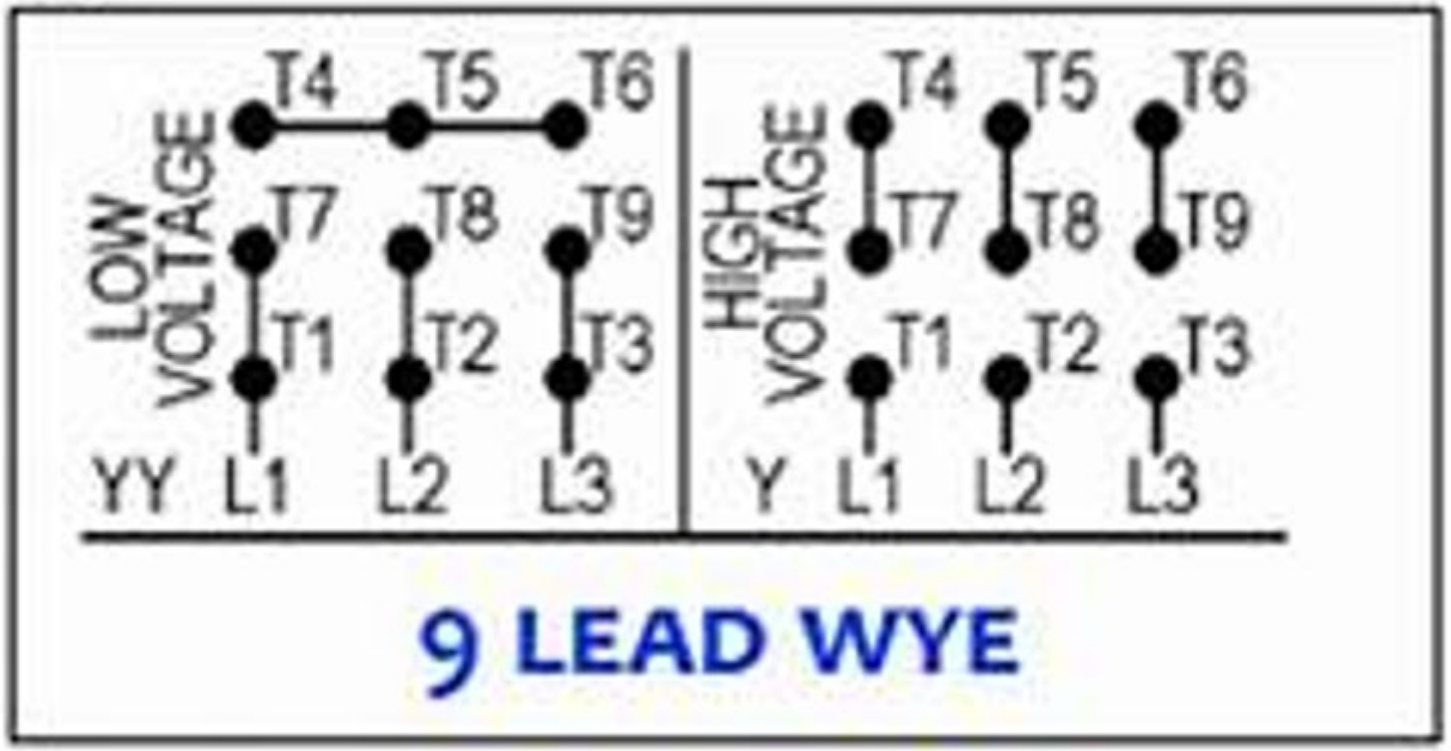
R-410A	Equivalent Length							
	Ft	0-38		38-75	75-113		113-150	
Model Nominal Capacity	Length Linear Length Equiiv	0-25 0-38		25-50 38-75	50-75 75-113		75-100 113-115	
38AUQ*07	Liquid Line	3/8		3/8	3/8	1/2	3/8	1/2
	Max Lift Cool Heat	 25 25		 50 50	 48 46	 75 60	 39 31	 100 60
	Vapor Line	7/8		7/8	1-1/8		1-1/8	
	Charge (lbs)	17.8		18.8	20.3	22.6	21.4	24.5
38AUQ*08	Liquid Line	1/2		1/2	1/2		1/2	
	Max Lift Cool Heat	 25 25		 50 50	 75 60		 100 60	
	Vapor Line	7/8	1-1/8	1-1/8	1-1/8		1-1/8	
	Charge (lbs)	20.9		23.0	24.9		26.8	

Commercial Splits

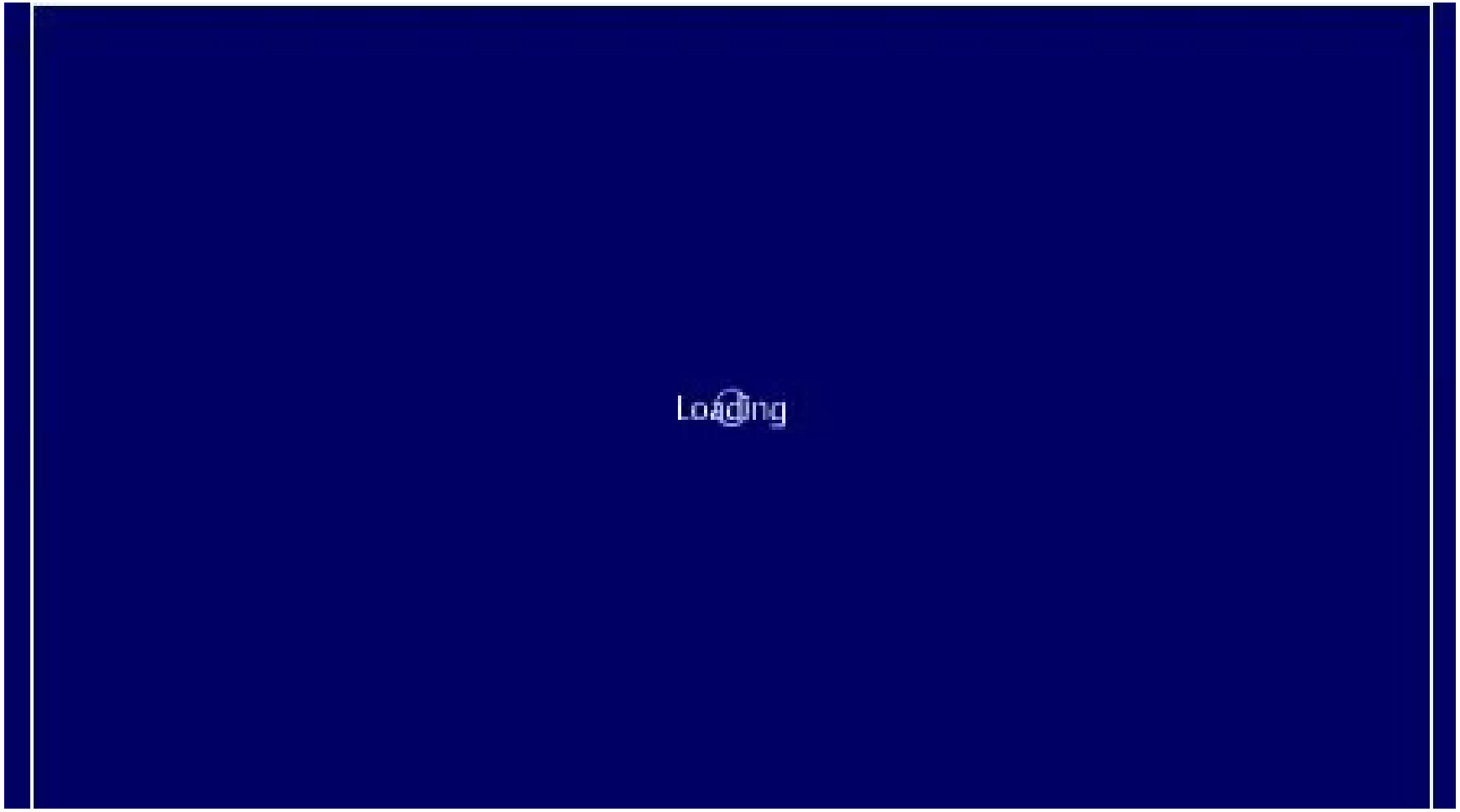
- 40RUA air handler is cooling only
- 40RUQ air handler for heat pump applications
- Unit voltages 208/230/460
- Motors come wired for 460
- 208/230 applications you must wire 9 lead motor for low voltage operation.

Commercial splits

- 9 Lead Motor wiring



Digital Scroll Compressors



comfort | excellence

Commercial Splits

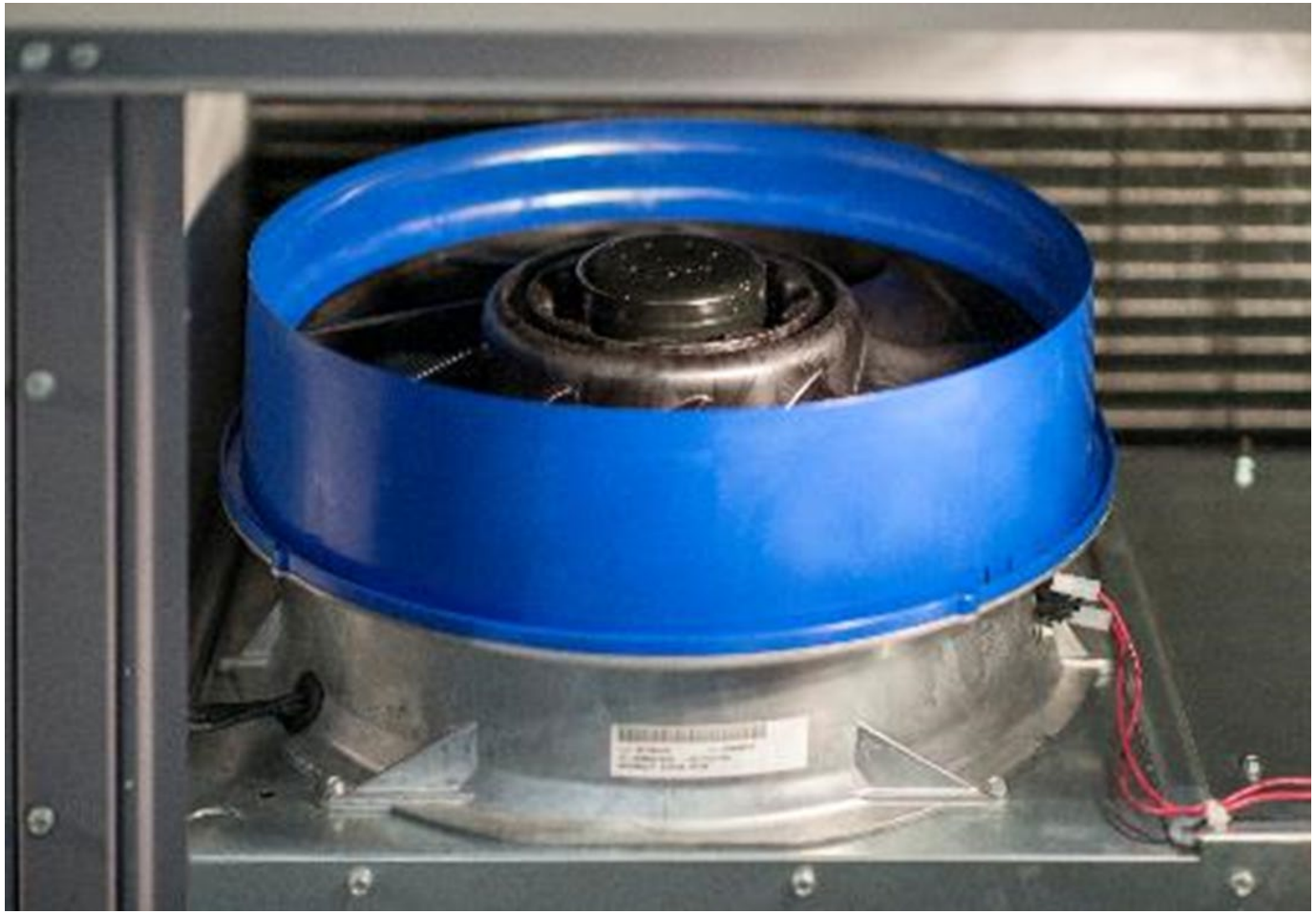
Copeland Digital Scroll

Digital compressor solenoid

Commercial Splits

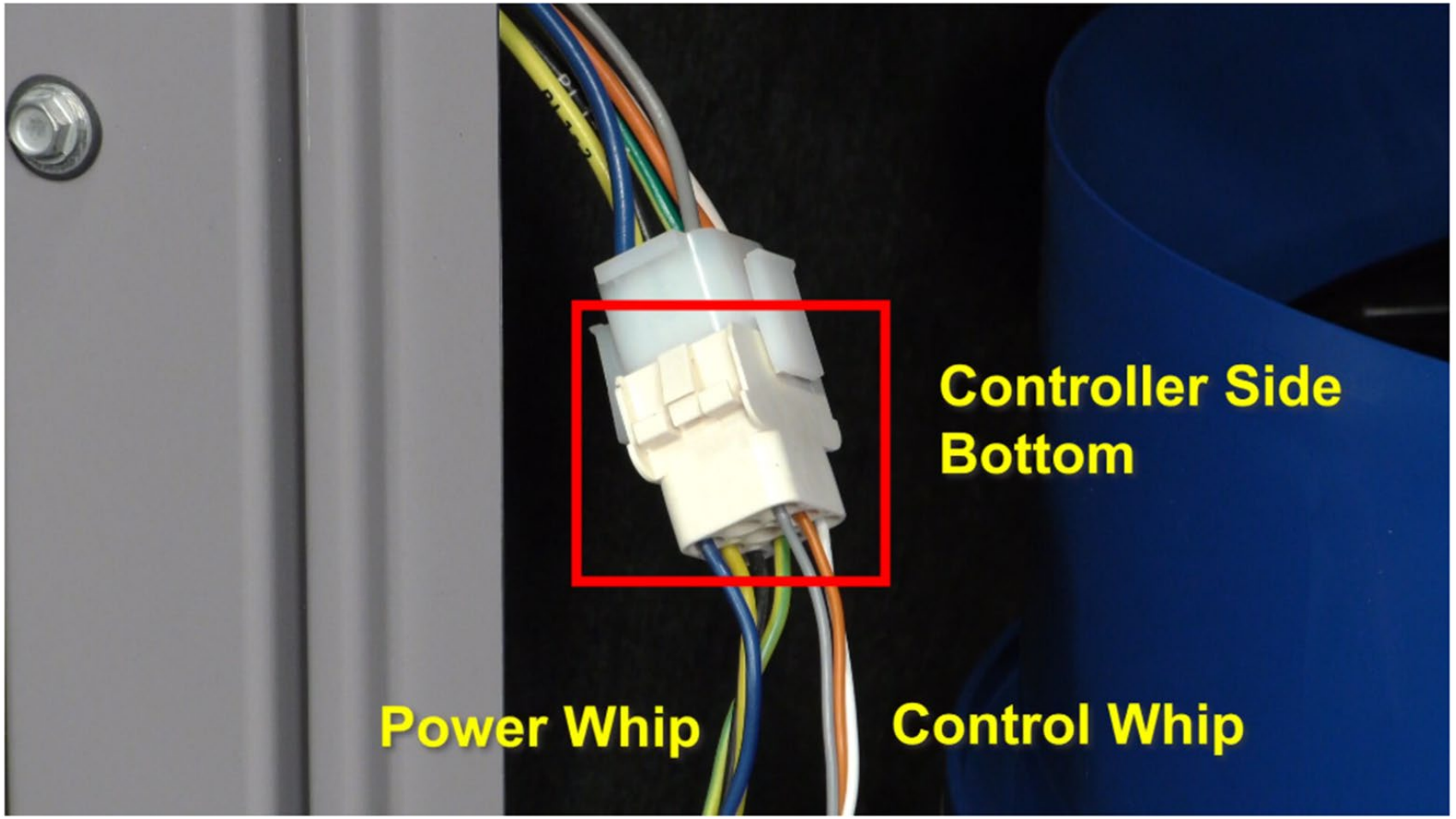
- Copeland Digital Scroll
- Some units have digital scroll compressors which are used for capacity control
- Digital Scroll operation
- Units with Digital scroll compressors will have DCS digital compressor solenoid and CTD cycle timer device to control loading and unloading

Eco Blue Axial Fan



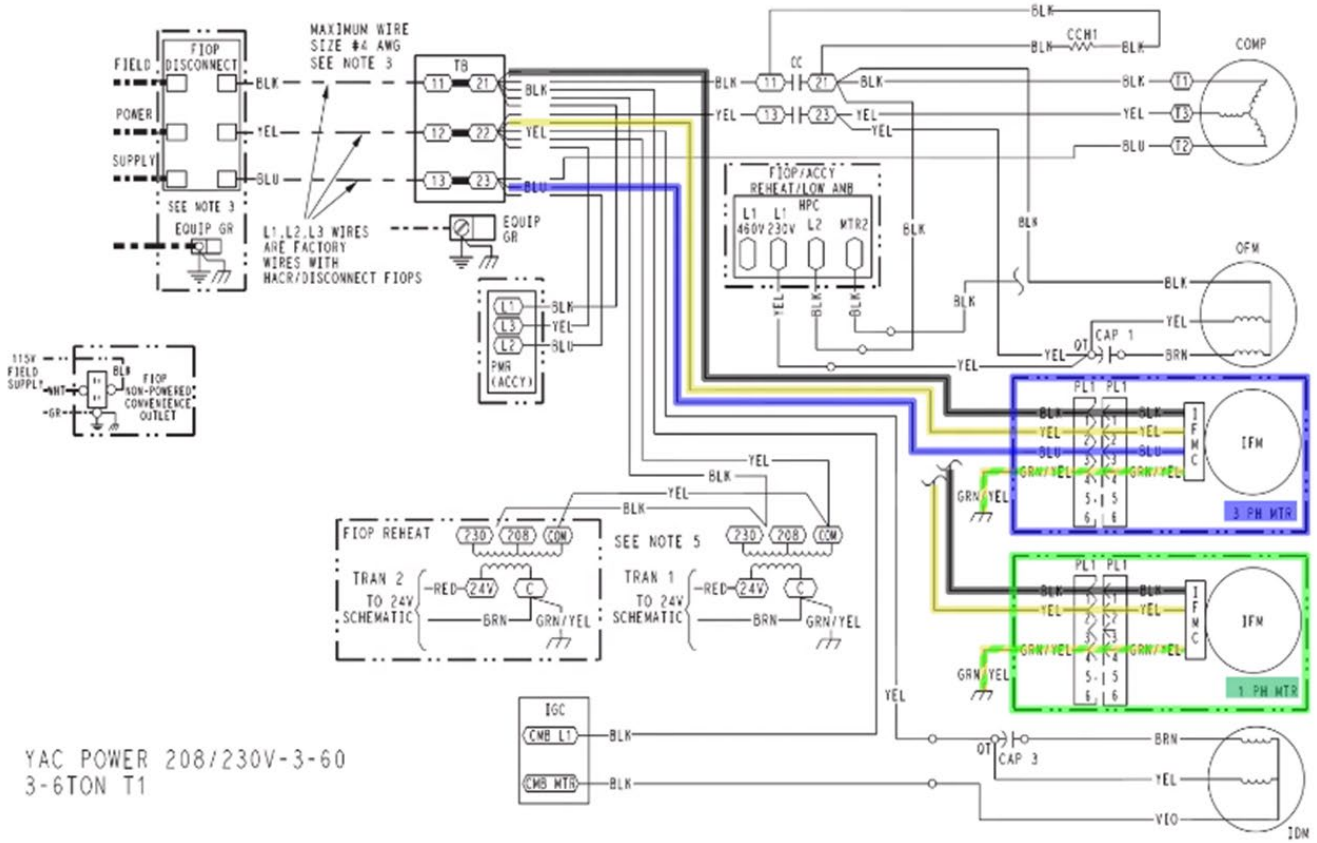
comfort | excellence

Eco Blue Axial Fan Troubleshooting

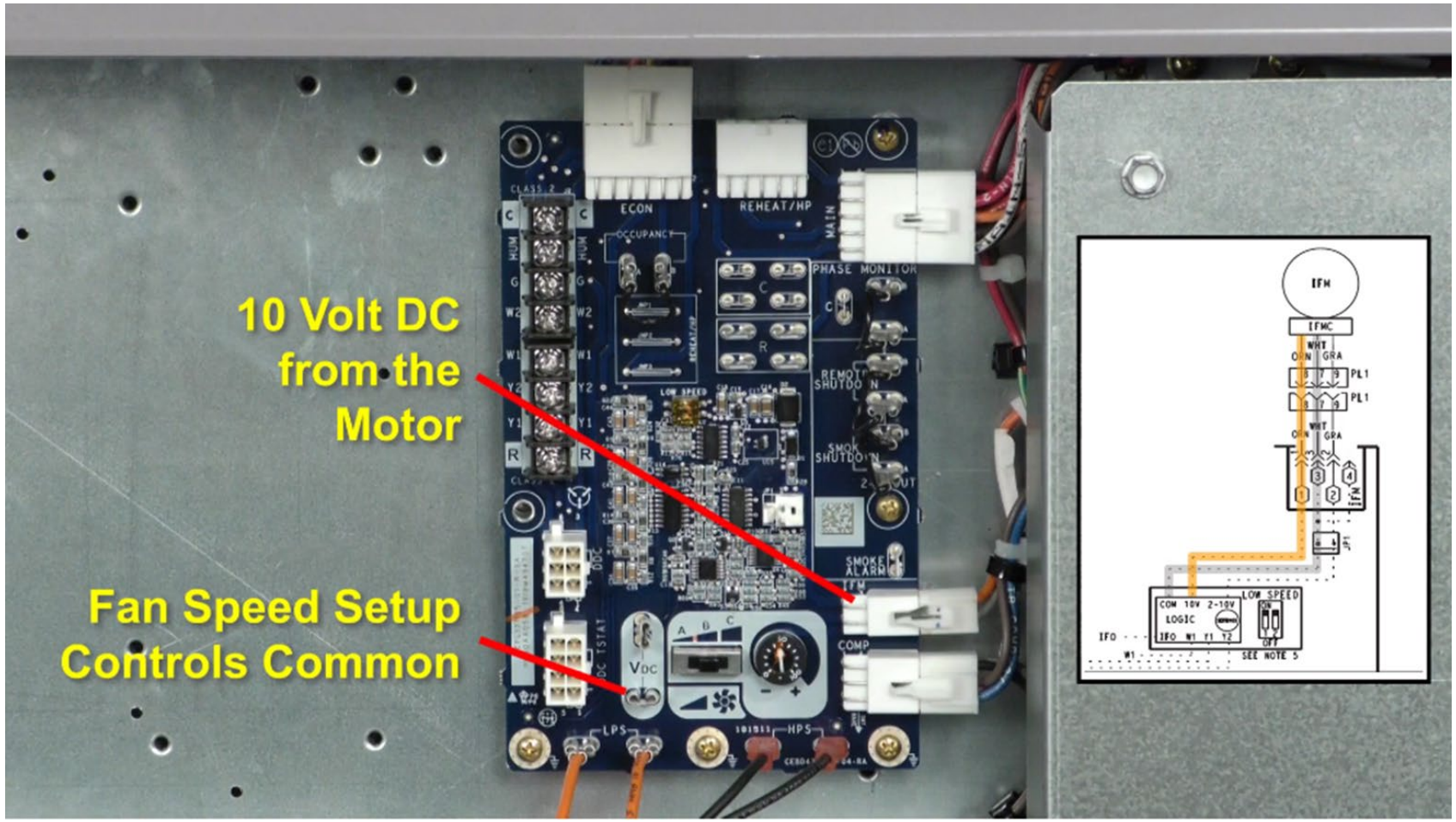


comfort | excellence

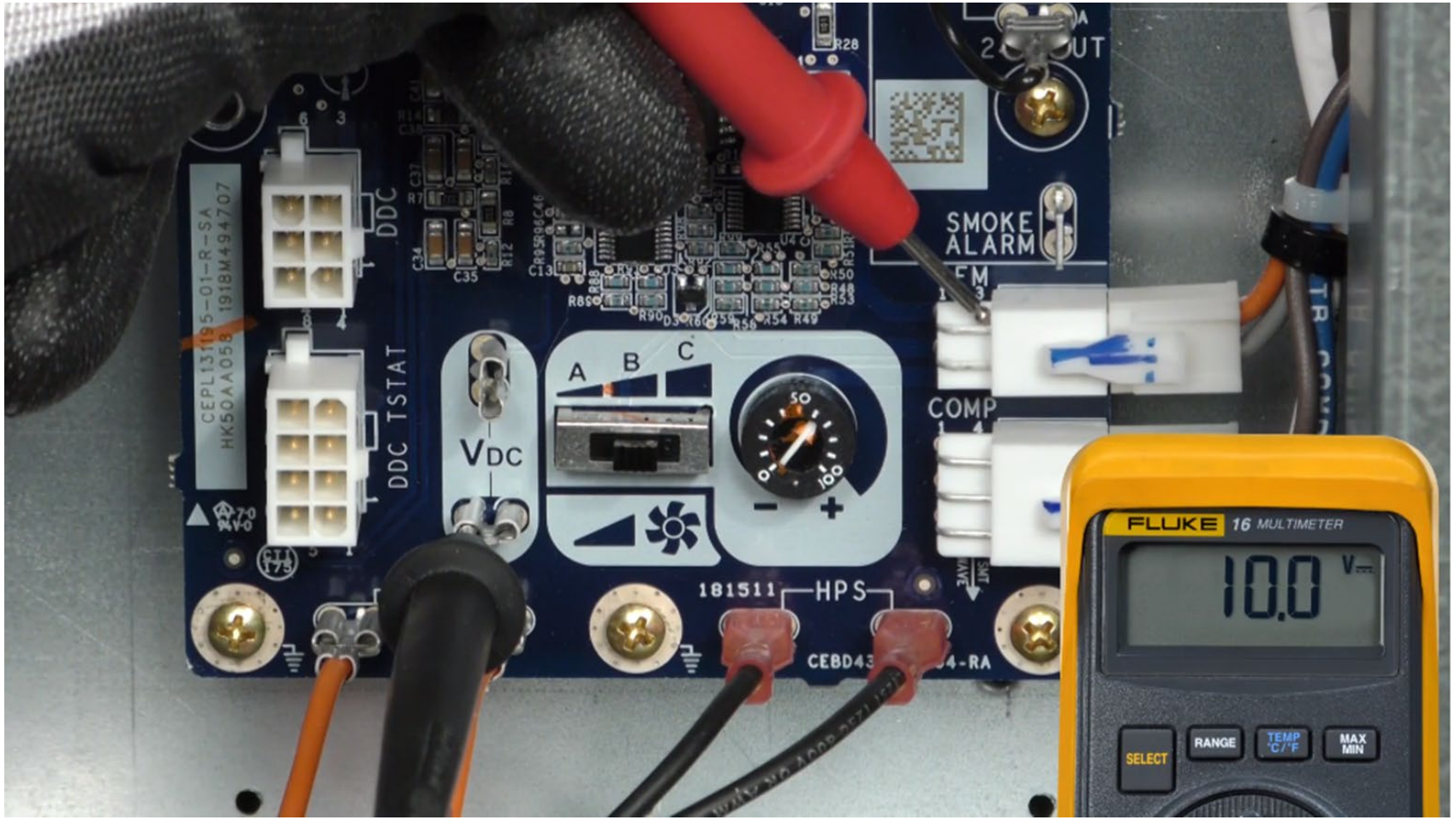
Eco Blue Axial Fan Troubleshooting



Eco Blue Axial Fan Troubleshooting

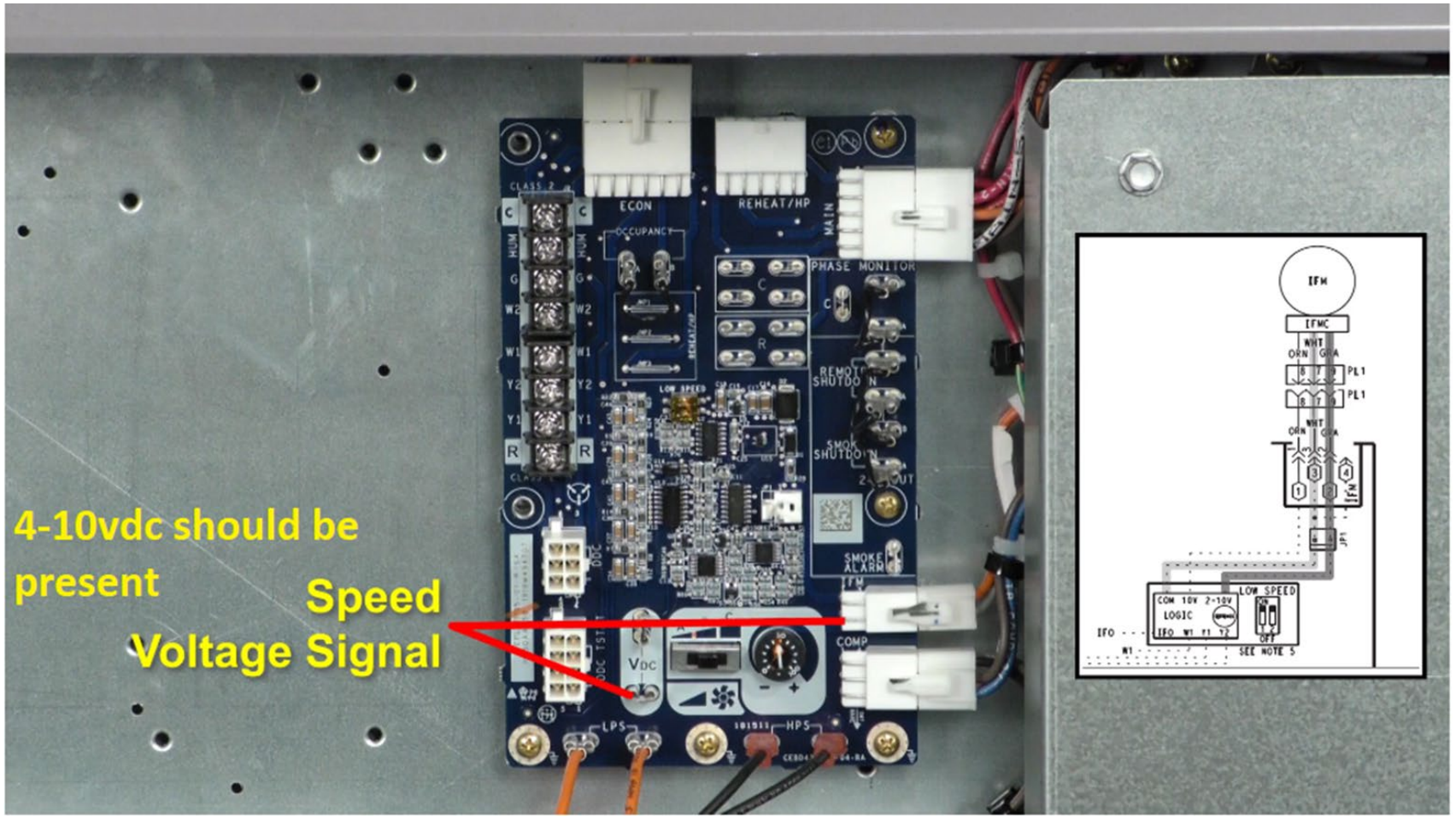


Eco Blue Axial Fan Troubleshooting



comfort | excellence

Eco Blue Axial Fan Troubleshooting



Eco Blue Axial Fan Airflow setting

comfort | excellence

You must set up the airflow at start up on Eco Blue axial fan units

QUESTIONS?

TEST

www.cematraining.com