TRUE VAV
O/M manual

PD 02/04/2022 - v 1.02
PN - IOM-0021

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Contact iAIRE At:

www.myiaire.com

Email: sales@myiaire.com
Phone: 844-348-9168

TRUE VAV PART NUMBERING SCHEME

12C - 3 4 5 6 7 8 9 10 11 12 13 - 14

Type (1,2)

VD - COOLING ONLY
VG - WITH GAS HEAT
VH - DX COOL w/ H.W. COILS
VP - WITH HEAT PUMP

Fan (4)

L - LOW/STD STATIC
M - MED STATIC
H - HIGH STATIC
E - EXTRA HIGH STATIC

Voltage (5)

G - 230VAC 1Φ
H - 230VAC 3Φ
K - 460VAC 3Φ
L - 575VAC 3Φ

Control (6)

A - DAT w/ VAV DUCT

Electric & Gas Heat (7,8,9)

XXX - ELECTRIC (kW)
XXX - GAS (mBH)

Heat Stages (10)

A - NO CONTROLS
B - 1 STAGE
C - 2 STAGE
D - 3 STAGE
E - 4 STAGE
M - MODULATING

Rooftop Units (3)

TC08	HC07	FC04
TC09	HC08	FC05
TC12	HC09	FC06
TC14	HC11	FC07
TC16	HC12	GC04
TC17	HC14	GC05
TC20	HC17	GC06
TC24	HC20	
TC28	HC24	
TC30	HC28	
TC18		
TC21		
TC25		
TC29		

Comm. Split (3)

COOLING	HEAT PUMP
AZ07RA07*	AQ07RQ07*
AZ08RA08*	AQ08RQ08*
AZ12RA12*	AQ12RQ12*
AZ14RA14*	AQ16RQ16**
AD12RA12**	AQ25RQ25**
AD14RA14**	
AD16RA16**	
AD25RA25**	
AP25RA30**	
AP27RA30**	
AP30RA30**	

* one circuit
**two circuit

Res. Split (3)

COOLING	HEAT PUMP
AB36FB6	HC36FB6
AB48FB6	HC42FB6
AB60FB6	HC48FB6
AC36FB3	HC60FB6
AC42FB6	
AC48FB6	
AC60FB6	

Disconnect (11,12)

00 - NO DISCONNECT
01 - 240V - 30A FUSE
02 - 240V - 60A FUSE
03 - 240V - 100A FUSE
04 - 240V - 150A FUSE
05 - 240V - 200A FUSE
06 - 240V - 300A FUSE
11 - 240V - 30A SWITCH
12 - 240V - 60A SWITCH
13 - 240V - 100A SWITCH
14 - 240V - 150A SWITCH
15 - 240V - 200A SWITCH
16 - 240V - 300A SWITCH
21 - 600V - 30A FUSE
22 - 600V - 60A FUSE
23 - 600V - 100A FUSE
24 - 600V - 150A FUSE
31 - 600V - 30A SWITCH
32 - 600V - 60A SWITCH
33 - 600V - 100A SWITCH
34 - 600V - 150A SWITCH

*if requested, size will be determined by factory

Configuration (13)

A - DOWN SUPPLY
DOWN RETURN

B - HORIZONTAL SUPPLY
DOWN RETURN

C - DOWN SUPPLY
HORIZONTAL RETURN

D - HORIZONTAL SUPPLY
HORIZONTAL RETURN

Options (14)

0 - NO OPTIONS
A - IONIZATION
B - WHOLE UNIT (UG)
C - ALL COILS (UG)
D - CONDENSER COIL (UG)
E - ERV
F - MERV 13 4" FILTER
G - 2 POS. OA DAMPER
H - BACNET
J - HINGED ACCESS DOORS
K - DW W/ POLY INSUL.
L - SS DRIP PAN
M - SS GAS HEAT EXCHANGER
N - DIRTY FILTER SWITCH
P - SERV. OUTLET (NON PWR)
Q - SERV. OUTLET (PWR)
R - SPLIT PWR FUSE DISC.
S - SPLIT PWR SWT DISC.
T - SMOKE SA
U - SMOKE RA
V - LOW AMBIENT BYPASS
W - ECONOMIZER
X - INTERTWINED EVAP. COIL
Y - START UP
1 - 365 DAY ANNUAL TIMER
3 - CONDEN. FLOW SWITCH
4 - AIRFLOW MONITORING
5 - HAIL GUARD
6 - FIXED POWERED EXHAUST
7 - PHASE MONITOR
8 - MOD POWERED EXHAUST
9 - CRATE

TRUE VAV NUMBERING SCHEME INSTRUCTIONS

How to Translate TRUE VAV Part Numbering Schemes

True VAV's part numbering scheme is composed of similar product identification, when compared to Carrier, in order to easily provide common options and features. By referencing the 2 character "type" in the beginning of each part number, it is easy to distinguish cooling only, gas heat, or heat pump models. A full list of Carrier unit model numbers is provided from by following the link in the web addresses listed below. Using the comparison below, an excerpt is provided from Carrier's technical guide to illustrate how a common unit can be traced from TRUE VAV to Carrier.

Asterisk

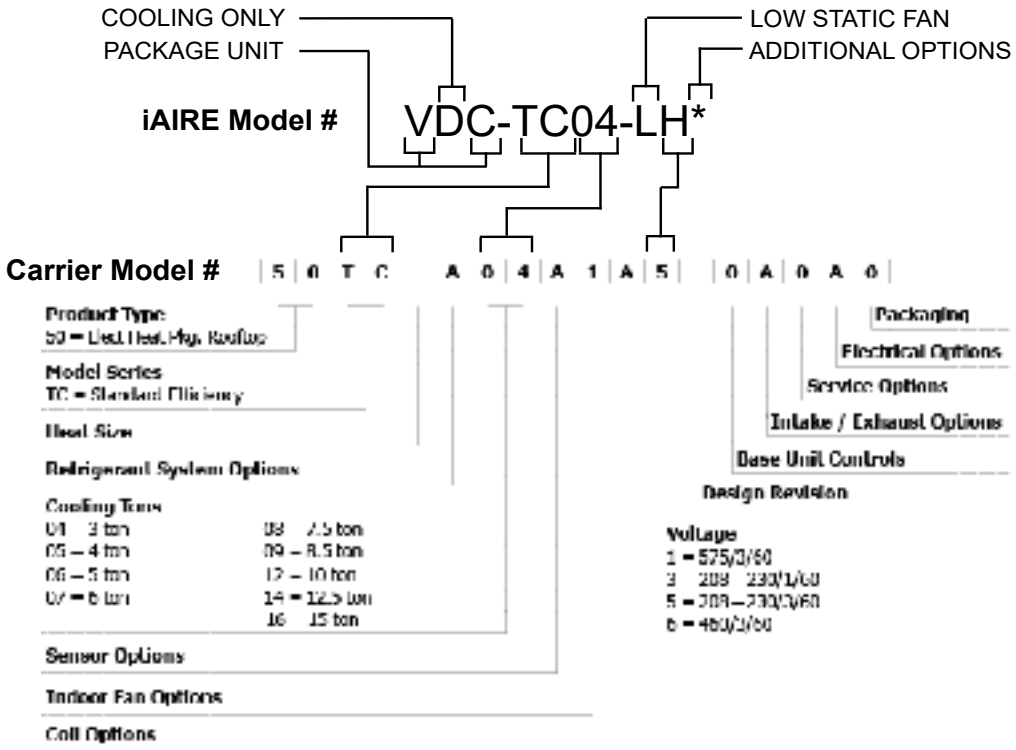
All part numbers and part number references will use an asterisk, * , to designate all characters which do not apply to the part number for the information being provided in that section. Where an asterisk appears in the middle of a part number, the missing characters are irrelevant to the information being provided. Where the asterisk appears at the end of a part number, the remaining part number characters are irrelevant to the information being provided.

To determine the specific Carrier unit you need, see below for how to determine which Carrier manual you will need.

For more information about Carrier Commercial Split Units go to: **http://www.carrier.com/building-solutions/en/us/products/split-systems/split-systems/**

For more information about Carrier Commercial Units go to: **http://www.carrier.com/building-solutions/en/us/products/packaged-outdoor/outdoor-packaged-units/**

For more information about Carrier Residential Units go to: **http://www.carrier.com/homecomfort/en/us/products/heating-and-cooling/packaged-products/**



START-UP REQUIREMENTS
! IMPORTANT !

To maintain factory warranty, all units must have an authorized factory start-up and the start-up paperwork on file.

For Questions, Contact iAIRE At:

www.myiaire.com

Email: sales@myiaire.com
Phone: 844-348-9168

Factory Start-up Request

HVAC Contractor: _____

Date: _____ Requested Start-up Date: _____

Project: _____ Qualified Technician: _____

iAIRE Model #: _____

iAIRE Serial #: _____

Project Address: _____

_____

Site Customer Contact: _____

Phone: _____

Email: _____

Note: The above start-up date needs to be scheduled with our office immediately. Allow three weeks lead time to schedule start-up. The items on both pages must be completed, signed-off & faxed/emailed to our office prior to the start-up date. Please fill out completely.

Proper equipment start-up is critical to customer comfort and equipment longevity. Utilize the following form to ensure that all the PRE-start-up procedures have been completed. The technician should initial each step as it has been completed and fill out the required start-up values. This form will provide the technician confidence that the system was thoroughly evaluated and installed properly. A separate checklist must be prepared and signed for all units to be started on the same date. Additional P.O. amount may be necessary for separate start-up dates. Please contact your Sales Engineer.

Note: The installing contractor's start-up technician must be present when iAIRE's start-up technici arrives on site for proper coordination and instructions on proper unit operation. The installing contractor is responsible for properly operating the unit after iAIRE's start-up technician leaves the job site.

Startup services require the installer to complete the manufacturers' PRE-start-up checklist on the next page prior to requesting startup.

After completeing this checklist, please scan and email back to iAIRE.
sales@myiaire.com

iAIRE, LLC | 2100 Consulate Drive, Suite 102, Orlando, FL 32837
www.myiaire.com | Toll Free 844-348-9168

Factory Pre-Startup Request

Item	General Inspection	Completed
	Inspect unit for shipping and/or rigging damage.	
	Is unit installed with proper clearances?	
	Is unit installed within slope limitations?	
	Check terminal screws and wiring connections for tightness.	
	Are filters installed correctly and clean?	
	Check Outdoor Air dampers if installed are in operating position. (When G terminal is shorted to R, 24V)	
	Have Refrigeration circuits been checked for leaks?	
	Is condensate drain trapped properly?	
	Is all field wiring (power and control) complete and sized accurately?	
	Is unit power correct voltage?	
	Mated ERV's that ship seperatly have power & comm wires connected to RTU?	
	Is space thermostat run with twisted shielded wire?	
	Are split systems completely wired? (Is twisted, shielded cable used?)	
	If G/E, is building natural gas available and piped to the unit?	
	Is there refrigerant in the unit / line set?	
	Have all shipping brackets / zip ties on condenser pipes been removed?	
Item	Air Moving Inspection	Completed
	Check alignment of drive components.	
	Check Supply Air fan belt tension.	
	Check blower pulley's and wheel's tight on shaft.	
	Check fan operates with proper rotation/direction.	
	Check VFD set for proper supply air CFM. (keypad display)	cfm
	VAV Duct or Building Pressure tube installed?	

Notes:_____

_____

_____

Installing Contractor Signature: _____

Printed Name: _____ **Date:** _____

NOTE: If start up technician shows up and the above tasks are not complete, an additional charge will be incurred.

GENERAL INSTRUCTIONS

An iAIRE's operation is a function of the options and control packages that the iAIRE unit is equipped with.

RECEIVING / INSPECTION

Check part # of iAIRE unit to ensure it is what was ordered.

Verify voltage/phases match.

At the time of delivery the iAIRE unit should be visually inspected for possible damage. If any damage is found it should be reported immediately to the last courier company, preferably in writing. iAIRE recommends leaving the iAIRE unit in its shipping packaging until the time of installation.

RIGGING

Utilize the Carrier factory information on rigging these units. If you need help accessing this information, please contact iAIRE customer service at:

sales@myiaire.com or 844-348-9168.

SAFETY CONSIDERATIONS

Installation and servicing of the iAIRE units can be hazardous due to system, pressure, electrical components and moving parts. Only trained and qualified service personnel should install, repair or service these units.

When working on iAIRE or other HVAC units observe precautions in the literature, tags and labels attached to the units, and any other safety precautions that may apply.

Follow all local, national and industry electrical codes when installing these units and accessories.

START-UP

SPACE / DISCHARGE AIR TEMP CONTROL PACKAGE START-UP

Physical Inspection (pre power-up)

Check part # of iAIRE unit to ensure it is what was ordered.

Verify voltage/phases match.

1. Verify condition of unit and note any installation or shipping damage to coils or cabinets.

2. Verify installation of condensate drain trap.

3. Verify power is available at disconnect and fuses are installed if required. Check incoming power to make sure it is within tolerance.

4. Verify that all airways are open. (Fire dampers and supply air registers.)

5. Check blower belt tension. (if available)

6. Confirm that the space sensor is installed. (Space Control units only, see wiring in figure "B" on installatoin wiring diagram pages. Space Sensors must be wired using shielded wire.

After power-up

1. Check incoming 3-phase power for a stinger leg if voltage is 208/230VAC. If so ensure that stinger leg (high voltage phase to ground) is the center leg.

2. Go to iAIRE controller and set both the heat and cool CFM. The heat CFM is the VFD % in the heat mode that the AHU fan will run. The cool CFM is the VFD % the AHU fan will run in all other modes.

3. Remove panel from outside air section and verify outside air damper is fully open. Set adjustment thumbwheel on damper motor for full opening. Check crank arms and balljoints on damper mechanism allow damper to open fully.

Charging

1. Locate Rawal device in condenser section. Locate the Rawal Device and close the ball valve. This will stop flow to the Rawal Device

2. Disconnect 2-pin signal plug from Sporlan IB circuit board. This will close the modulating hot gas valve to allow correct charging.

3. Invert refrigerant jug to provide liquid charge into suction line and proceed to charge unit for 10 degrees of subcooling and 20 degrees superheat. Depending on ambient conditions, evaporator leaving air temperature should be between 48-58˚F.

4. When charge is complete return signal connector to Sporlan IB board and re-open Rawal ball valve.

5. Disconnect jumper from terminal strip input to allow the iAIRE controller to take over machine.

6. Adjust sensor setpoint to a low setpoint to bring all cooling stages on and check if hot gas line warms up.

TEST PROCEDURE

Verify operation as described above by monitoring liquid line temperature and observing motor speed.

Heater check

1. Verify Kw of installed electric heaters.

2. Disconnect white space temperature sensor wire from terminal strip. (This will make the iAIRE controller see a space temperature of -40 degrees and start heaters) There is a five minute delay at start of heat cycle. With heater running check amperage and verify discharge air temperature.

3. Return white space temperature sensor wire to terminal strip.

Checking and adjusting system refrigerant charge.

Before connecting gauges to the systems suction and discharge service ports, make the following adjustments.

1. Before running blower and compressors, close the manual ball valve on the discharge of the #1 compressor Rawal valve to eliminate Hot Gas Bypass during the charging process.

2. If Low Ambient is installed, shut off ball valve to low ambient and open bypass around low ambient to isolate L.A. valve.

3. Before running blower and compressors, put iAIRE controller in TEST mode and manually set Hot Gas Valve % to 0.0% to direct all refrigerant to DX cooling.

a) Connect gauges. (Pre-load evacuated split systems with nominal weight of refrigerant)

b) Enable FAN and then Cool Stage 1 in TEST mode and allow several minutes for system to stabilize.

c) Note, high pressure saturation Temperature on gauge and the temperature of the Liquid Line leaving the condenser. (Condensing temperature should be 100-110 degrees minimum)

d) Calculate Sub cooling (Saturation Temp – Liquid line Temp = Sub cooling)

e) Charge systems for 12-15 degrees of sub cooling. Add refrigerant if sub cooling is low and remove if high. With all cooling stages enabled system should deliver 55 degree air, or less depending on ambient conditions.

f) Record sub cooling temperature _____ degrees

g) With controller still in TEST mode, increase the Hot gas valve position in increments until discharge air, (DAT) is raised to 70 - 72 degrees.

h) Record sub cooling temperature _____ Record evap saturation temperature _____

i) Open Rawal valve.

j) If Low Ambient is installed, open valve to low ambient and close valve to bypass Low Ambient.

k) Record sub cooling temperature _____ Record evap saturation temperature _____

l) Note: You can leave the TEST menu and enter the STATUS menu to check system temperatures at any time. TEST mode will remain active until it is manually disabled.
m)When charging and checks are complete, disable the TEST mode and open the Rawal valve.

n) Allow system to stabilize and check sub cooling again.

o) Add/Remove refrigerant as necessary to maintain about 4 degree of sub cooling.

p) Remove gauges and replace service port covers.

q) If charging for the first time note all required conditions in startup sheets and record weight of all refrigerant added.

Record Keeping
1. Record all readings and conditions in startup sheets and add notes to call attention to any issues for the unit installing contractor to attend to.

2. Have the startup documents signed by supervising foreman for mechanical contractor.

MODULATING GAS SETUP:
1: SEE APPENDIX “F” (pg.138) for standard carrier heat
2: SEE APPENDIX “J” (pg. 163) for High Heat Box.

SEQUENCE OF OPERATIONS

DAT
In the UNOCCUPIED mode, the outside air unit will be off and the outside air damper, if supplied, will be closed. Occupied or Unoccupied is signaled to the IAIRE controller via a normally open or normally closed contact on the OCCUPIED input with a clock or switch. An open contact on the input indicates OCCUPIED, a closed contact indicates UNOCCUPIED.

In the OCCUPIED mode, the outside air damper will open and the supply fan will ramp up to the configured fan speed (dependent on whether the unit is heating or cooling). The Fan input is monitored to determine if fan is operating or not. If not operating, the IAIRE controller will enter into an alarm state, start staging off compressors, and attempt to cycle the fan until it starts.

There is a configurable EAT Heat Lockout (default 58F). If the entering air temperature (EAT) is < or = to the lockout, then the heat stages will cycle to maintain the discharge air temperature DAT setpoint.

There is a configurable EAT Cool Lockout (default 61F). If the EAT is > or = to this lockout than Y1 is always on and Y2-Y4 is staged on depending on demand (if enabled), along with the modulated hot gas valve will be used to maintain the DAT.

If the EAT is > the EAT Heat Lockout (default 58F) and < the EAT Cool Lockout (default 61F), Y1 will stage on and the modulated hot gas will maintain DAT unless DAT setpoint = EAT then free-cooling will engage and Y1 will be off. While in this mode, if discharge humidity is > 50% then Y1 will stage on and if its >70% then Y2 will stage on as well.

SEQUENCE OF OPERATIONS NOTES

VAV control is set up for either duct static pressure control. There is a min CFM setting to maintain minimum airflow to keep the evaporator coil from freezing and a max CFM setting to make sure you cannot run more air than the unit can heat or cool.

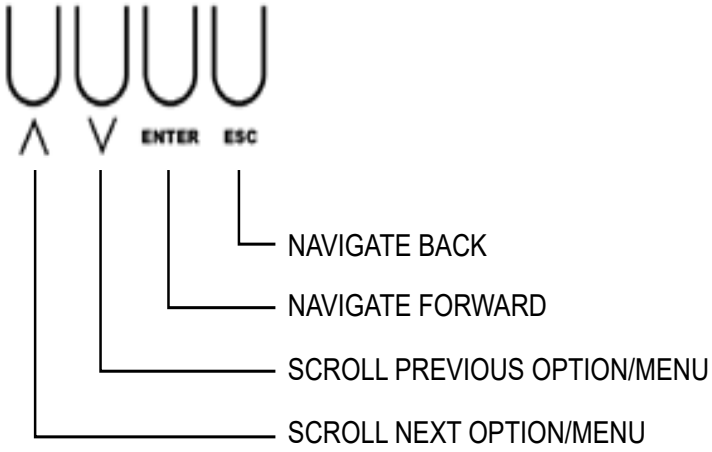
Duct static control tries to maintain a user set constant pressure in the discharge duct of the equipment.

WIRING AND ELECTRICAL

DAT default variables

EAT cool lockout	(61 degrees)
EAT heat lockout	(58 degrees)
DAT setpoint	(70 degrees)
EAT cool 2 lockout	(72 degrees)
LAT setpoint	(55 degrees) DX
EAH humidity lockout	(55% RH)

NAVIGATING ON AN iAIRE CONTROLLER



POWER ON THE CONTROLLER AND THE FIRST MENU IS **STATUS MENU**. TO NAVIGATE THROUGH THE OPTIONS, PRESS THE **UP ARROW** KEY. PRESS **ENTER** TO MAKE CHANGES IN ANY SUB MENU. TO GO BACK TO THE MAIN STATUS MENU, PRESS THE **ESC** BUTTON.

STATUS MENU

FAN STATUS

RANGE:
On/Off

NOTE: Supply Fan Status.

STARTUP STATUS

RANGE:
Started_Off

NOTE: Controller is enabled or disabled.

RANGE:
On/Off

NOTE: BAS Switch.

RANGE:
On/Off

NOTE: Test Mode.

ENTERING AIR TEMP STATUS

RANGE:
- 058 F_132 F

NOTE: View Entering (OA) Air Temp. Sensor failures register as -58F.

LEAVING AIR HUMIDITY

RANGE:
000_100

NOTE: DAT mode only.

ROOM AIR HUMIDITY STATUS

RANGE:
000_100

NOTE: View Room Humidity %.

ROOM SP AND TEMP STATUS

RANGE:
032 F_085 F

NOTE: View Room Temp Setpoint and Actual Temp.

DAT/LAT STATUS

RANGE:
- 058 F_132 F

NOTE: "Discharge Air Temp. of Unit / Leaving Air Temp. of Evaporator Sensor failures register as -58F."

DEHUMIDIFICATION STATUS

RANGE:
Disabled/Enabled

NOTE: Enabled because of Dehumidification call.

COOL MODE STATUS

RANGE:
Disabled/Enabled

NOTE: Enabled because of Cooling call.

HEAT MODE STATUS

RANGE:
Disabled/Enabled

NOTE: DAT mode only

HOT GAS STATUS

RANGE:
000_100

NOTE: View % of Modulating Hot Gas Reheat.

HEATING STAGES STATUS

RANGE:
W1 W2 W3

NOTE: View Number of Heating Stages called.

COOLING STAGES STATUS

RANGE:
Y1 Y2 Y3 Y4

NOTE: View Number of Cooling Stages called.

MODULATING HEAT STATUS

RANGE:
000_100

NOTE: View % of Modulating Gas or Electric Heat.

VAV STATUS MENU

DUCT PRESSURE

DEFAULT:
[enabled]

NOTE: Duct pressure 00.00 IN H2O. Fan speed (FAST) 100.

BULIDING PRESSURE

DEFAULT:
[enabled]

NOTE: Building pressure -00.50 IN H2O. Fan speed (FAST) 100.

TEST MODE MENU

HOT GAS TEST

RANGE: 0_100% **DEFAULT:** 000

NOTE: Allows test of modulating gas reheat valves. Must have Cool 1 Test stage enable to create any reheat.

VFD SPEED TEST

RANGE: 0_100% **DEFAULT:** 050

NOTE: Allows test of fan speed. Fan will not engage until Fan Test is Enabled.

COOL 1 TEST

RANGE: Enabled/Disabled **DEFAULT:** N/A

NOTE: Turns on relay to turn Compressor 1 on.

FAN TEST

RANGE: Enabled/Disabled **DEFAULT:** N/A

NOTE: Turns on supply fan contactor. Fan runs at VFD Speed Test %.

HEAT 1 TEST

RANGE: Enabled/Disabled **DEFAULT:** N/A

NOTE: Turns on relay to turn W1 on.

HEAT 2 TEST

RANGE: Enabled/Disabled **DEFAULT:** N/A

NOTE: Turns on relay to turn W2 on.

HEAT 3 TEST

RANGE: Enabled/Disabled **DEFAULT:** N/A

NOTE: Turns on relay to turn W3 on.

COOL 2 TEST

RANGE: Enabled/Disabled **DEFAULT:** N/A

NOTE: Turns on relay to turn Compressor 2 on.

COOL 3 TEST

RANGE: Enabled/Disabled **DEFAULT:** N/A

NOTE: Turns on relay to turn Compressor 3 on.

COOL 4 TEST

RANGE: Enabled/Disabled **DEFAULT:** N/A

NOTE: Turns on relay to turn Compressor 4 on.

MOD HEAT TEST

RANGE: 0_100% **DEFAULT:** 000

NOTE: Allows test of modulating gas heat valve. Must have W1 Test stages enabled to create any heat.

DAMPER TEST

RANGE: 0_100% **DEFAULT:** 000

NOTE: Allows test of damper air flow.

OA TEST

RANGE: 0_100% **DEFAULT:** 000

NOTE: Allows test of outside air flow.

EA TEST

RANGE: 0_100% **DEFAULT:** 000

NOTE: Allows test of exhaust air flow.

ERV WHEEL TEST

RANGE: On/Off **DEFAULT:** N/A

NOTE:

SETPOINTS MENU

VFD SPEED COOL %

RANGE: 0_100% (100% = 60 Hz)
DEFAULT: 060

NOTE: Supply fan speed in cooling mode.

VFD SPEED HEAT %

RANGE: 0_100% (100% = 60 Hz)
DEFAULT: 050

NOTE: Supply fan speed in heating mode.

EAT HEAT LOCKOUT

RANGE: 32 F_100 F
DEFAULT: 61 F

NOTE: Heating disabled until Outside Air Temp is at this setpoint or below. When enabled, Y1 will not come on.

LOCKOUT DEADBAND

RANGE: 01 F_ 60 F | 30 F_ 31 F
DEFAULT: 03_58 F

NOTE: Deadband/HeatLOCK

HUMIDITY STAGE 1 SETPOINT %

RANGE: 000_100
DEFAULT: 050

NOTE: Space or DAT humidity in which unit will force Y1 on to dehumify in dead band.

HUMIDITY STAGE 2 SETPOINT %

RANGE: 000_100
DEFAULT: 055

NOTE: Space or DAT humidity in which unit will force Y2 on to dehumify in cooling mode or dead band.

EAT COOL LCKOUT

RANGE: 000 F_100 F
DEFAULT: 061 F

NOTE: Cooling Disabled until Outside Air Temp is at this setpoint or above. When enabled, Y1 is always on.

DAT SETPOINT

RANGE: 000 F_100 F
DEFAULT: 070 F

NOTE: (DAT MODE ONLY) Temperature unit is trying to control to when in Discharge air mode (DAT).

ROOM TEMP SETPOINT

RANGE:
1. N/A
2. [enabled]
3. N/A
4. 60 F_90 F

DEFAULT:
1. SPACE MODE
2. Set Via I/O
3. Set Remotely
4. User Interface

NOTE:
1. Temperature unit is trying to control to when in SPACE MODE.
2. When this is enabled, unit is getting room setpoint temperature for iAIRE provided space sensor.
3. When this is enabled, unit is getting room setpoint temperature from BAS system.
4. When this is enabled, unit is getting room setpoint temperature from iAIRE controller in unit.

LAT SETPOINT

RANGE: 39 F_ 58 F
DEFAULT: 55 F

NOTE: Temperature unit is trying to control leaving air temperature off of evaporator coil when LAT overide is enabled.

SET DUCT PRESSURE

RANGE: 0.00 _ 5.00 IN H_2O
DEFAULT: 1.00

NOTE: Allows the change in pressure inside the duct.

SET BUILDING PRESSURE

RANGE: 0.00 _ 5.00 IN H_2O
DEFAULT: 1.00

NOTE: Allows the change in pressure inside the building.

CONFIGURATION MENUS

CONFIG HEAT AND COOL OFFSETS

OPTION: Cool Stage 2 On Offset
RANGE: -10F SP to +10F SP **DEFAULT:** +1F SP
NOTE: Allows user to set temp difference from setpoint that Y2 is enabled.

OPTION: Cool Stage 2 Off Offset
RANGE: -10F SP to +10F SP **DEFAULT:** -2F SP
NOTE: Allows user to set temp difference from setpoint that Y2 is disabled.

OPTION: Cool Stage 3 On Offset
RANGE: -10F SP to +10F SP **DEFAULT:** +3F SP
NOTE: Allows user to set temp difference from setpoint that Y3 is enabled.

OPTION: Cool Stage 3 Off Offset
RANGE: -10F SP to +10F SP **DEFAULT:** -1F SP
NOTE: Allows user to set temp difference from setpoint that Y3 is disabled.

OPTION: Cool Stage 4 On Offset
RANGE: -10F SP to +10F SP **DEFAULT:** +4F SP
NOTE: Allows user to set temp difference from setpoint that Y4 is enabled.

OPTION: Cool Stage 4 Off Offset
RANGE: -10F SP to +10F SP **DEFAULT:** 0F SP
NOTE: Allows user to set temp difference from setpoint that Y4 is disabled.

OPTION: Heat Stage 1 On Offset
RANGE: -10F SP to +10F SP **DEFAULT:** 0F SP
NOTE: Allows user to set temp difference from setpoint that W1 is enabled.

OPTION: Heat Stage 1 Off Offset
RANGE: -10F SP to +10F SP **DEFAULT:** +4F SP
NOTE: Allows user to set temp difference from setpoint that W1 is disabled.

OPTION: Heat Stage 2 On Offset
RANGE: -10F SP to +10F SP **DEFAULT:** -2F SP
NOTE: Allows user to set temp difference from setpoint that W2 is enabled.

OPTION: Heat Stage 2 Off Offset
RANGE: -10F SP to +10F SP **DEFAULT:** +2F SP
NOTE: Allows user to set temp difference from setpoint that W2 is disabled.

OPTION: Heat Stage 3 On Offset
RANGE: -10F SP to +10F SP **DEFAULT:** -3F SP
NOTE: Allows user to set temp difference from setpoint that W3 is enabled.

OPTION: Heat Stage 3 Off Offset
RANGE: -10F SP to +10F SP **DEFAULT:** +1F SP
NOTE: Allows user to set temp difference from setpoint that W3 is disabled.

OPTION: DeHumidify Off (Y1 Off) Offset
RANGE: -10F SP to +10F SP **DEFAULT:** Off 02F Below SP

CONFIG HEAT AND COOL TIMERS

OPTION: Cool 1 On Delay
RANGE: 000S _ 600S **DEFAULT:** 120S
NOTE: Allows user to set delay before Y1 comes on after controller deems Y1 is required.

OPTION: Cool 1 Off Delay
RANGE: 000S _ 600S **DEFAULT:** 060S
NOTE: Allows user to set delay before Y1 goes off after controller deems Y1 isn't required.

OPTION: Cool 2 On Delay
RANGE: 000S _ 600S **DEFAULT:** 120S
NOTE: Allows user to set delay before Y2 comes on after controller deems Y2 is required.

OPTION: Cool 2 Off Delay
RANGE: 000S _ 600S **DEFAULT:** 060S
NOTE: Allows user to set delay before Y2 goes off after controller deems Y2 isn't required.

OPTION: Cool 3 On Delay
RANGE: 000S _ 600S **DEFAULT:** 180S
NOTE: Allows user to set delay before Y3 comes on after controller deems Y3 is required.

OPTION: Cool 3 Off Delay
RANGE: 000S _ 600S **DEFAULT:** 030S
NOTE: Allows user to set delay before Y3 goes off after controller deems Y3 isn't required.

OPTION: Cool 4 On Delay
RANGE: 000S _ 600S **DEFAULT:** 180S
NOTE: Allows user to set delay before Y4 comes on after controller deems Y4 is required.

OPTION: Cool 4 Off Delay
RANGE: 000S _ 600S **DEFAULT:** 030S
NOTE: Allows user to set delay before Y4 goes off after controller deems Y4 isn't required.

OPTION: Heat 1 On Delay
RANGE: 000S _ 600S **DEFAULT:** 030S
NOTE: Allows user to set delay before W1 comes on after controller deems W1 is required.

OPTION: Heat 1 Off Delay
RANGE: 000S _ 600S **DEFAULT:** 005S
NOTE: Allows user to set delay before W1 goes off after controller deems W1 isn't required.

OPTION: Heat 2 On Delay
RANGE: 000S _ 600S **DEFAULT:** 005S
NOTE: Allows user to set delay before W2 comes on after controller deems W2 is required.

OPTION: Heat 2 Off Delay
RANGE: 000S _ 600S **DEFAULT:** 000S
NOTE: Allows user to set delay before W2 goes off after controller deems W2 isn't required.

OPTION: Heat 3 On Delay
RANGE: 000S _ 600S **DEFAULT:** 005S
NOTE: Allows user to set delay before W3 comes on after controller deems W3 is required.

OPTION: Heat 3 Off Delay
RANGE: 000S _ 600S **DEFAULT:** 000S
NOTE: Allows user to set delay before W3 goes off after controller deems W3 isn't required.

CONFIGURATION MENUS (cont.)

CONTROLLER MODE CONFIGURATION

OPTION: DAT MODE
RANGE: N/A **DEFAULT:** [enabled]
NOTE: Discharge Air Temp Controlled.

OPTION: SPACE MODE
RANGE: N/A **DEFAULT:** [disabled]
NOTE: 0-10vdc Space Sensor Controlled.

CONFIGURE # OF CONTROL BOARDS

OPTION: 1 CONTROL BOARD
RANGE: N/A **DEFAULT:** [enabled]
NOTE: Main Controller basic I/O.

OPTION: 2 CONTROL BOARDS
RANGE: N/A **DEFAULT:** [disabled]
NOTE: Accessory Controller additional I/O.

CONFIGURE # OF HEAT STAGES

OPTION: # of Heat Stages 1
RANGE: N/A **DEFAULT:** [enabled]
NOTE: Set number of heat stages in unit. If no heat stages select 1 stage.

OPTION: # of Heat Stages 2
RANGE: N/A **DEFAULT:** [disabled]
NOTE:

OPTION: # of Heat Stages 3
RANGE: N/A **DEFAULT:** [disabled]
NOTE:

MAX REHEAT REQUIREMENT

OPTION: Yes, Max Needed
RANGE: N/A **DEFAULT:** [enabled]
NOTE:

OPTION: No Max Needed
RANGE: N/A **DEFAULT:** [disabled]
NOTE: If No max is needed is selected, HGR valve will go from 0-100%.

CONFIGURE HEAT PUMP

OPTION: No Heat Pump
RANGE: N/A **DEFAULT:** [enabled]
NOTE: This is selected for even heat pump if the heat pump logic turns on Y1 & O on W1 command.

OPTION: Yes, Heat Pump
RANGE: N/A **DEFAULT:** [disabled]
NOTE: This is selected if the heat pump requires both Y1 & W1(O) signal to run.

LAT OVERRIDE

OPTION: LAT Override OFF
RANGE: N/A **DEFAULT:** [enabled]
NOTE: When enabled, forces the unit to run to try and maintain LAT temperature over other commands.

OPTION: LAT Override ON
RANGE: N/A **DEFAULT:** [disabled]
NOTE:

REHEAT MIN

RANGE: 001_100 **DEFAULT:** 002
NOTE: If Reheat min is set to 0%, the unit can vapor lock due to lack of fluid flow through reheat coil.

REHEAT MAX

RANGE: 001_100 **DEFAULT:** 075
NOTE: If Reheat max is more that 75%, many times the unit will loose ability to cool.

REHEAT MULTIPLIER

RANGE: .1_1 **DEFAULT:** .8
NOTE: % Modulating reheat signal = (((Act temp - setpoint temp)+ Reheat Offset)/Reheat Gain) * Reheat Multiplier.

REHEAT GAIN

RANGE: -20_20 **DEFAULT:** 03
NOTE: % Modulating reheat signal = (((Act temp - setpoint temp)+ Reheat Offset)/Reheat Gain) * Reheat Multiplier.

REHEAT OFFSET

RANGE: -10_10 **DEFAULT:** 01
NOTE: % Modulating reheat signal = (((Act temp - setpoint temp)+ Reheat Offset)/Reheat Gain) * Reheat Multiplier.

BAS CONFIG

OPTION: No BAS
RANGE: N/A **DEFAULT:** [enabled]
NOTE: Unit Operates as Standalone.

OPTION: Yes, BAS Active
RANGE: N/A **DEFAULT:** [disabled]
NOTE: Unit is Operated by Building Automation System.

FAN INPUT

OPTION: Fan is Enabled
RANGE: N/A **DEFAULT:** [selected]
NOTE: Unit has a feedback to ensure supply fan is on. If not unit will not run and go into alarm.

OPTION: Fan is Disabled
RANGE: N/A **DEFAULT:** N/A
NOTE: If this is selected, it ignores the feedback from fan and runs unit regardless of feedback.

COMM SETUP

OPTION: Cks Only
RANGE: N/A **DEFAULT:** [enabled]
NOTE: Default V.4+.

OPTION: Repeating
RANGE: N/A **DEFAULT:** [disabled]
NOTE: Used when V3 Main Board is replaced w/ V4 Board.

HUMIDITY MODE CONFIG

OPTION: 0-10V/0-100%
RANGE: N/A **DEFAULT:** [enabled]
NOTE:

OPTION: 0-10V/20-80%
RANGE: N/A **DEFAULT:** [disabled]
NOTE:

OPTION: User Defined
RANGE: N/A **DEFAULT:** [disabled]
NOTE: Allows user to set up different humidity sensors if required.

HUMIDITY LOW SP

RANGE: 001 _ 080 **DEFAULT:** 020
NOTE: USER DEFINED

CONFIGURATION MENUS cont.)

HUMIDITY HIGH SP

RANGE: 020 _ 100 **DEFAULT:** 080

NOTE: USER DEFINED

SUPPLEMENTAL HEAT

OPTION: No Supp Heat

RANGE: N/A **DEFAULT:** [enabled]

NOTE: Allows unit to bring on stages of heat if HGR does not have enough heat to get unit to Space or DAT set point temperature.

OPTION: W1 Supp. Heat

RANGE: N/A **DEFAULT:** [disabled]

NOTE: W1 will be supplemental heat.

OPTION: W2 Supp. Heat

RANGE: N/A **DEFAULT:** [disabled]

NOTE: W2 will be supplemental heat - This would be selected if unit has a heat pump since W1 is Y1 & O.

OPTION: W3 Supp. Heat

RANGE: N/A **DEFAULT:** [disabled]

NOTE: W3 will be supplemental heat.

HUM OVERRIDE ON DELAY

RANGE: 000S _ 600S **DEFAULT:** 180S

NOTE: When Y2 is called on because of humidity, this is the delay the unit will keep Y2 off before it turns on.

HUM OVERRIDE OFF DELAY

RANGE: 000S _ 600S **DEFAULT:** 120S

NOTE: When Y2 is on because of humidity and is no longer needed, this is the delay the unit will keep Y2 on before it shuts it off.

ALLOW HUM OFF OVERRIDE DELAY

RANGE: 000S _ 600S **DEFAULT:** 300S

NOTE: When Y2 is on because of humidity and the space temperature is below set point, this is the delay the unit will keep Y2 on before it shuts it off.

FREEZE PROTECTION

RANGE: Off < 33_45 F **DEFAULT:** 039

NOTE: On at 39 F.

FREEZE TIMER

RANGE: 000S_600S **DEFAULT:** 300S

NOTE: Freeze time 300 seconds.

WATER GUARD CONFIG

RANGE: Disabled/Enabled **DEFAULT:** Disabled

NOTE:

CONFIGURATION MENU (SPACE ONLY)

ROOM TEMP TYPE

OPTION: GreyStone

RANGE: N/A **DEFAULT:** [enabled]

NOTE: Allows user to select what type of space sensor is being used.

OPTION: User Defined

RANGE: N/A **DEFAULT:** [disabled]

NOTE: Allows user to create custom curve to utilize their own space sensor. Signal is 0-10V.

OPTION: Tongdy 32F-122F

RANGE: N/A **DEFAULT:** [disabled]

NOTE:

OPTION: Tongdy 32F-140F

RANGE: N/A **DEFAULT:** [disabled]

NOTE:

ROOM TEMP LOW

RANGE: -040 _ 080 **DEFAULT:** 032

ROOM TEMP HIGH

RANGE: 000 _ 140 **DEFAULT:** 095

ROOM SETPOINT SOURCE

OPTION: I/O

RANGE: 60 F_90 F **DEFAULT:** [enabled]

NOTE: When this is enabled, unit is getting room setpoint temperature for iAIRE provided space sensor.

OPTION: Remotely

RANGE: BAS Controlled **DEFAULT:** [disabled]

NOTE: When this is enabled, unit is getting room setpoint temperature from BAS system.

OPTION: User Interface

RANGE: 60 F_90 F **DEFAULT:** [enabled]

NOTE: When this is enabled, unit is getting room setpoint temperature from iAIRE controller in unit.

ROOM SETPOINT LOW

RANGE: 050 _ 082 **DEFAULT:** 062

ROOM SETPOINT HIGH

RANGE: 062 _ 130 **DEFAULT:** 082

CONFIGURATION MENUS
(2 Control Boards Only)

MOD HEAT CONFIG

OPTION: Electric
RANGE: N/A **DEFAULT:** [enabled]
NOTE: This is selected if unit is all electric unit.

OPTION: Gas 1
RANGE: N/A **DEFAULT:** [disabled]
NOTE: This is selected if unit is a 1 stage gas heat unit or a unit with a high high heat unit.

OPTION: Gas 2
RANGE: N/A **DEFAULT:** [disabled]
NOTE: This is selected if the unit has a 2 stage gas heat unit.

CONFIGURE # OF COOLING STAGES

OPTION: 1
RANGE: N/A **DEFAULT:** [enabled]
NOTE: Select # of cooling stages the unit has.

OPTION: 2
RANGE: N/A **DEFAULT:** [disabled]
NOTE:

OPTION: 3
RANGE: N/A **DEFAULT:** [disabled]
NOTE:

OPTION: 4
RANGE: N/A **DEFAULT:** [disabled]
NOTE:

CONFIGURE HEAT TYPE

OPTION: Non-Mod Heat
RANGE: N/A **DEFAULT:** [enabled]
NOTE: Select if the unit has modulating heat or not.

OPTION: Mod Heat
RANGE: N/A **DEFAULT:** [disabled]
NOTE:

MODULATED HEAT MIN

RANGE: 000 _ 100 **DEFAULT:** 000
NOTE: Sets minimum % output from contoller to modulating heat valve.

MODULATED HEAT MAX

RANGE: 000 _ 100 **DEFAULT:** 100
NOTE: Sets minimum % output from contoller to modulating heat valve - This will limit max firing of heater.

MODULATED HEAT GAIN

RANGE: -20 _ 20 **DEFAULT:** 04
NOTE: % Modulating heat signal = (((Act temp - setpoint temp)+ Mod Heat Offset)/Moulated Heat Gain) * Mod Heat Multiplier.

MODULATED HEAT OFFSET

RANGE: -10 _ 10 **DEFAULT:** 00
NOTE: % Modulating heat signal = (((Act temp - setpoint temp)+ Mod Heat Offset)/Moulated Heat Gain) * Mod Heat Multiplier.

MODULATED HEAT MULTIPLIER

RANGE: .1 _ 1 **DEFAULT:** 1
NOTE: % Modulating heat signal = (((Act temp - setpoint temp)+ Mod Heat Offset)/Moulated Heat Gain) * Mod Heat Multiplier.

CONFIGURATION MENUS (Config VAV)

VAV MODE CONFIGURATION

OPTION: VAV mode off
RANGE: N/A **DEFAULT:** [enabled]
NOTE:

OPTION: Duct Pressure
RANGE: N/A **DEFAULT:** [disabled]
NOTE:

OPTION: Build. Pressure
RANGE: N/A **DEFAULT:** [disabled]
NOTE:

(if duct or build pressure is [enabled])

SET MIN FAN SPEED

RANGE: 000_100 **DEFAULT:** 40
NOTE:

SET MAX FAN SPEED

RANGE: 000_100 **DEFAULT:** 100
NOTE:

ADJUST FAST RATE

RANGE: 000_100 **DEFAULT:** 001
NOTE: X * 0.5 seconds

ADJUST SLOW RATE

RANGE: 000_050 **DEFAULT:** 005
NOTE: X * 0.5 seconds

SELECT SLOW POINT

RANGE: 000_100 **DEFAULT:** 013
NOTE:

SELECT TRANSDUCER TYPE

RANGE: 0in to +1in_-5in to 5in **DEFAULT:** 0in to +2in
NOTE:

SELECT DAMPER/ FAN CONTROL

OPTION: Fan Control
RANGE: N/A **DEFAULT:** [enabled]
NOTE:

OPTION: Damper Control
RANGE: N/A **DEFAULT:** [disabled]
NOTE:

CONFIGURATION MENUS (Config ERV)

ERV MODE CONFIGURATION

OPTION: ERV mode off
RANGE: N/A **DEFAULT:** [enabled]
NOTE:

OPTION: ERV mode
RANGE: N/A **DEFAULT:** [disabled]
NOTE:

(if ERV mode is [enabled])

SET OA FAN SPEED

RANGE: 000_100 **DEFAULT:** 50
NOTE:

SET EA FAN SPEED

RANGE: 000_100 **DEFAULT:** 50
NOTE:

SET DAMPER POSITION

RANGE: 000_100 **DEFAULT:** 100
NOTE:

ALARMS MENU

BAS COMM OK

RANGE: N/A **DEFAULT:** N/A

FILTER OK

RANGE: N/A **DEFAULT:** N/A

FRZ1 FAULT

RANGE: N/A **DEFAULT:** N/A

FRZ2 SENSOR OK

RANGE: N/A **DEFAULT:** N/A

NOTE: [Enabled] two stages of cooling.

FAN FAULT

RANGE: N/A **DEFAULT:** N/A

ACCESSORY BOARD MENUS

ACC V5.00NR1

NOTE: Addr [Changes based on "set address input"][CKS/FILTER]

SAVE ADDRESS

RANGE: 0_6 **DEFAULT:** 0

NOTE:

SET RX MODE

RANGE: N/A **DEFAULT:** N/A

NOTE: Options: Filter, CKS [Setting]

DIAGNOSTIC MENU

DAT DIAGNOSTIC MENU

OPTION: Menu 1
RANGE: N/A **DEFAULT:** N/A
NOTE:
1 000 0 0 000 0
00 0 0 000 1 000

OPTION: Menu 2
RANGE: N/A **DEFAULT:** N/A
NOTE:
'-58.44 000 01000
0 0 000 M=2

OPTION: Menu 3
RANGE: N/A **DEFAULT:** N/A
NOTE:
'-58.04 70 02 00
1 0 0 0 000 2 0

OPTION: Menu 4
RANGE: N/A **DEFAULT:** N/A
NOTE:
'-58.04 00000000
'-58 70 02 0010
000 000 000 000
10 00 000 000 m2

OPTION: Menu 5
RANGE: N/A **DEFAULT:** N/A
NOTE:
'-58.04 01000000
0010 000 070 M=
000 000 000
Heat Timers

OPTION: Menu 6
RANGE: N/A **DEFAULT:** N/A
NOTE:
'000 0000 0000 00
000 000 000 000

OPTION: Menu 7
RANGE: N/A **DEFAULT:** N/A
NOTE:
'LAT 000 000 000
C000 000 000 000
'-58 000 000 000
055 0000 0000

OPTION: Menu 8
RANGE: N/A **DEFAULT:** N/A
NOTE:
'-58.4 00 0000000
000 000 000 000
'-58.4 00 0000000
200 000 0 00 000

OPTION: Menu 9
RANGE: N/A **DEFAULT:** N/A
NOTE:
'-58.4 00 0000000
0000 0000 -001
0.3

MISC CONTROLLER INFORMATION

- Solid red light indicates unit shutdown.
- Flashing red light indicates alarm with no unit shutdown.
- Mode 1: Cooling
- Mode 2: Heating
- Mode 3: Unit in free cooling

Accessory Board Addresses:

0: 1st main accessory board
1: UPC
2: ERV accessory board

3 PHASE RTU WIRING
w/ VFD Driven Compressor

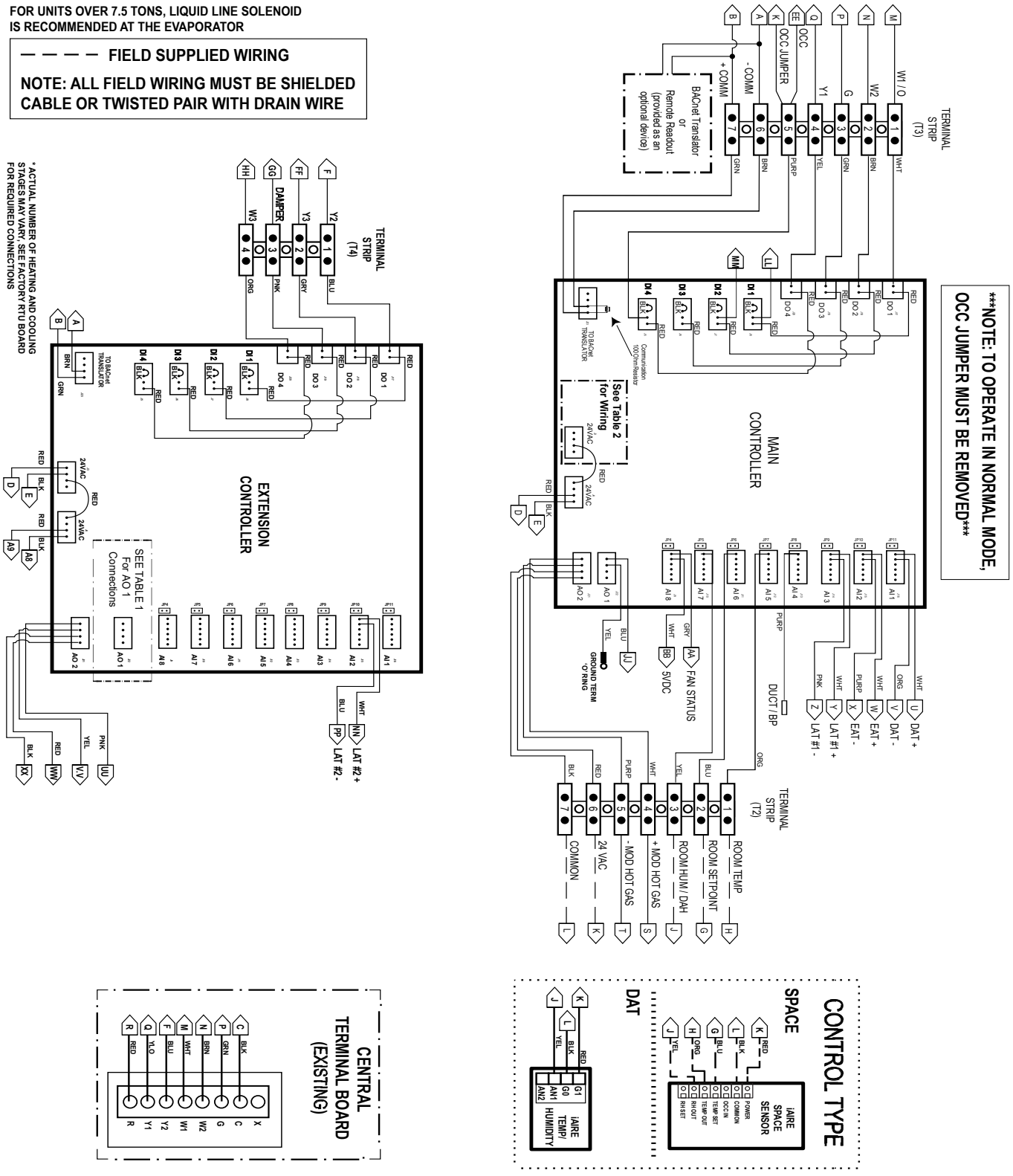
SCH-0020-E

REVISION: V06.00

FOR UNITS OVER 7.5 TONS, LIQUID LINE SOLENOID IS RECOMMENDED AT THE EVAPORATOR

— — — — FIELD SUPPLIED WIRING

NOTE: ALL FIELD WIRING MUST BE SHIELDED CABLE OR TWISTED PAIR WITH DRAIN WIRE



3 PHASE RTU WIRING
w/ VFD Driven Compressor

SCH-0020-E

REVISION: V05.03

— — — —FIELD SUPPLIED WIRING

NOTE: ALL FIELD WIRING MUST BE SHIELDED CABLE OR TWISTED PAIR WITH DRAIN WIRE

3-PHASE RTU WIRING

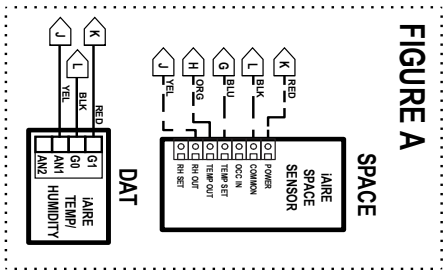
SCH-0006-E

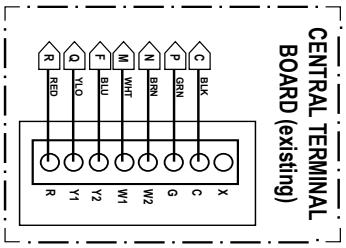
REVISION: V05.07

FOR UNITS OVER 7.5 TONS, LIQUID LINE SOLENOID IS RECOMMENDED AT THE EVAPORATOR

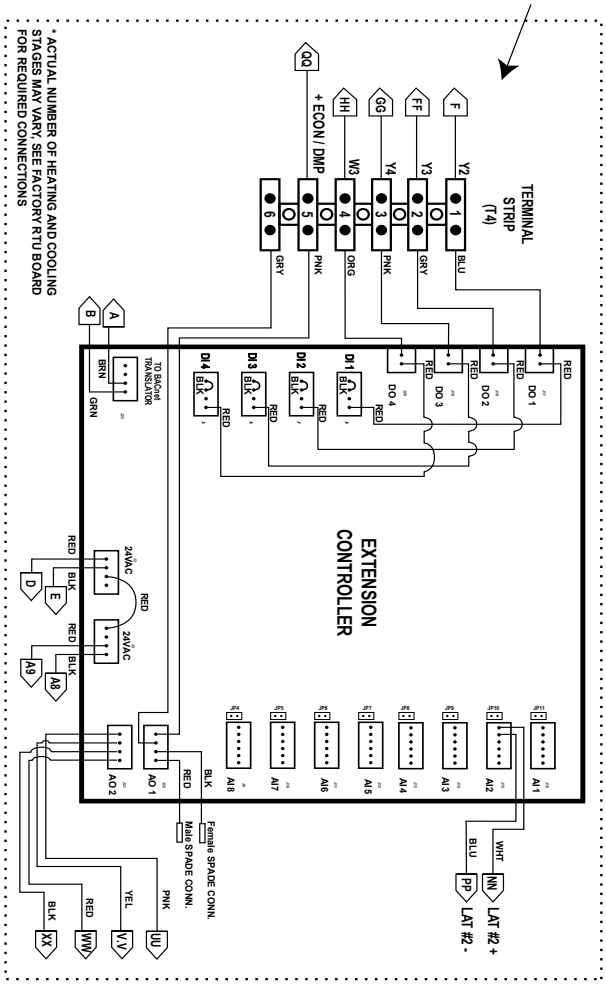
— — — — FIELD SUPPLIED WIRING

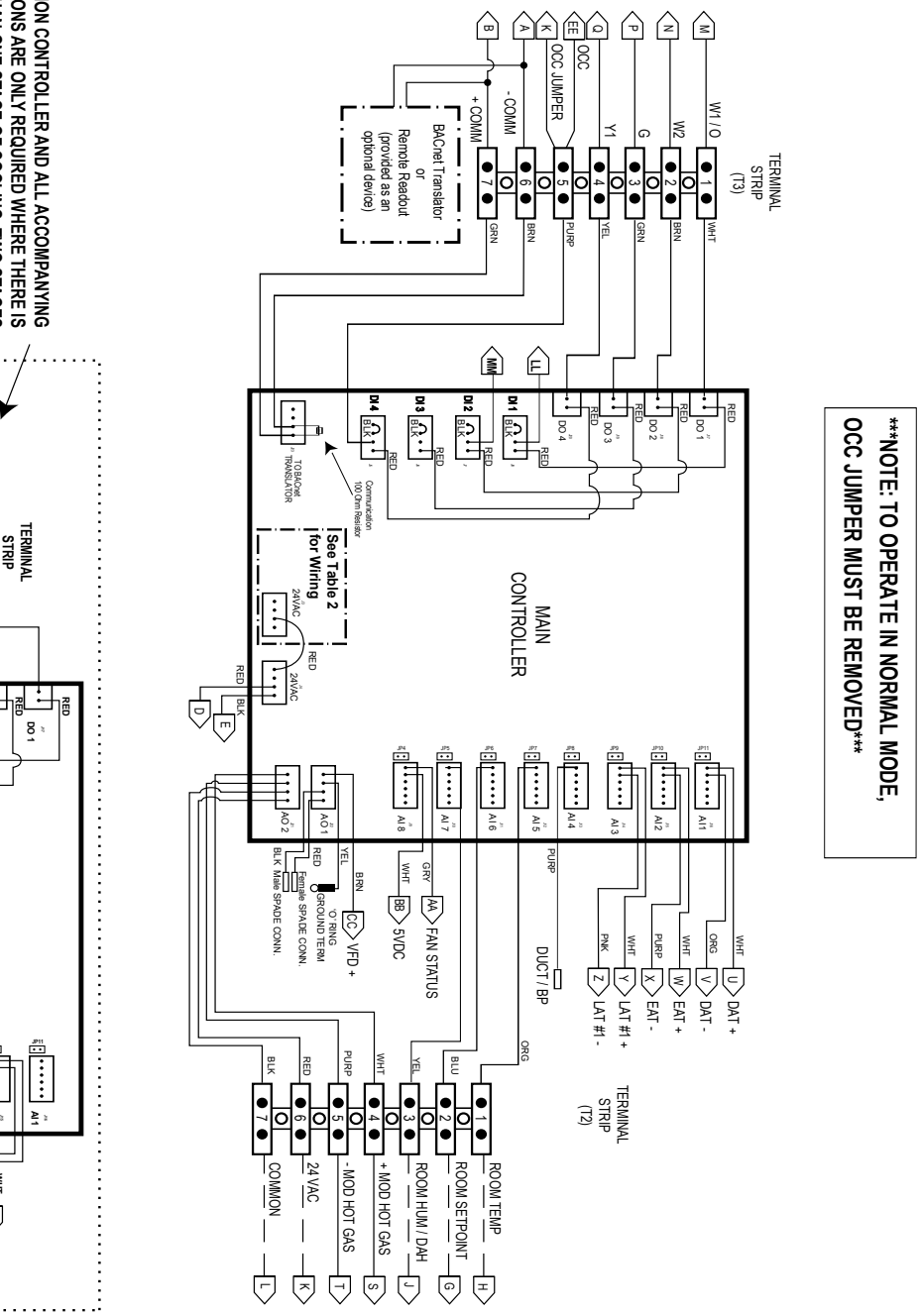
NOTE: ALL FIELD WIRING MUST BE SHIELDED CABLE OR TWISTED PAIR WITH DRAIN WIRE





EXTENSION CONTROLLER AND ALL ACCOMPANYING CONNECTIONS ARE ONLY REQUIRED WHERE THERE IS MORE THAN ONE STAGE OF COOLING, TWO STAGES OF HEAT, OR MODULATING HEAT.



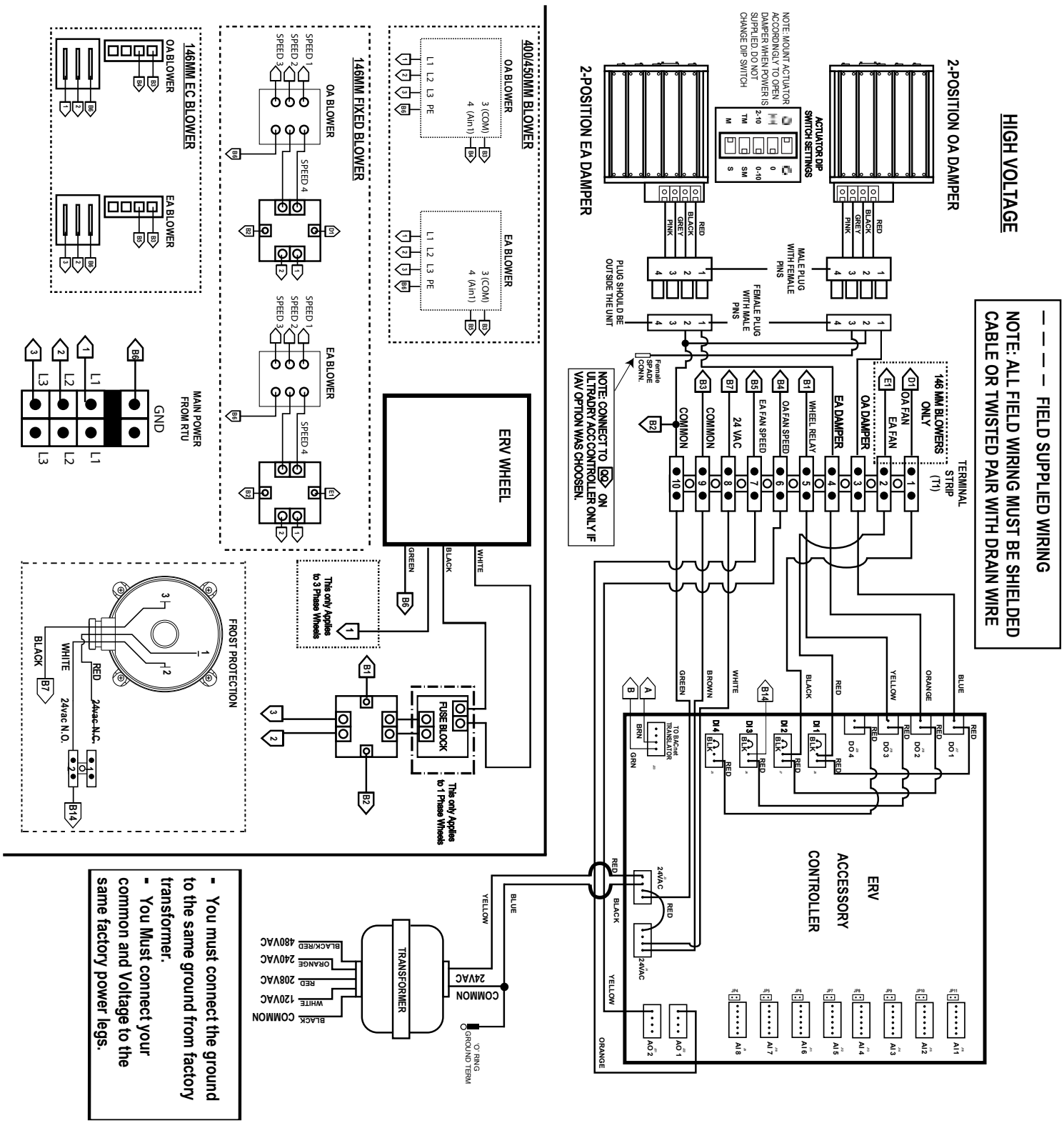


*****NOTE: TO OPERATE IN NORMAL MODE, OCC JUMPER MUST BE REMOVED*****

MATED ERV ELECTRO-MECHANICAL WIRING

SCH-0009-E

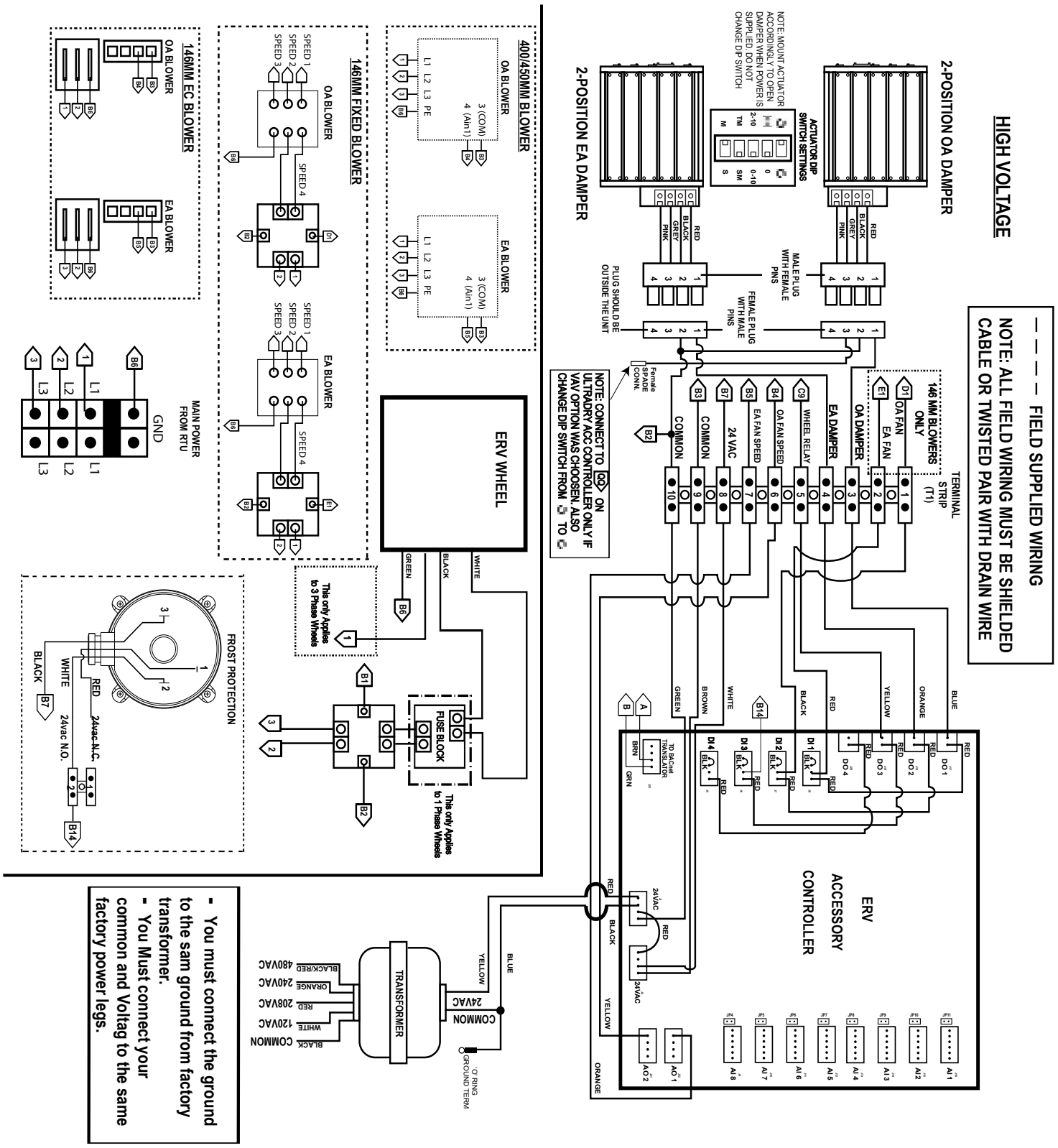
REVISION: V05.09



MATED ERV IAQ / ECON / DCV WIRING

SCH-0010-E

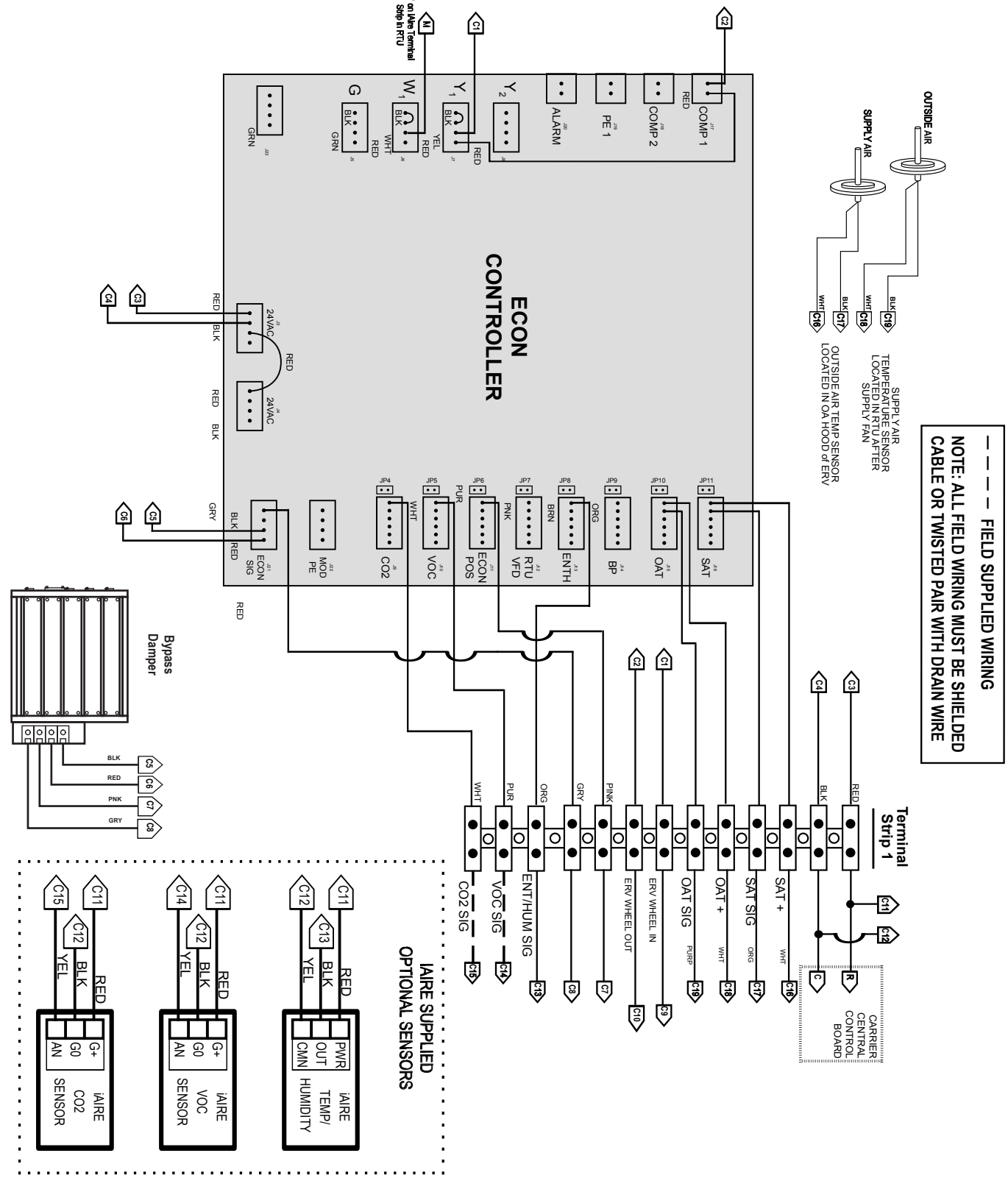
REVISION: V05.11



RV IAQ / ECON / DCV WIRING

SCH-0010-E

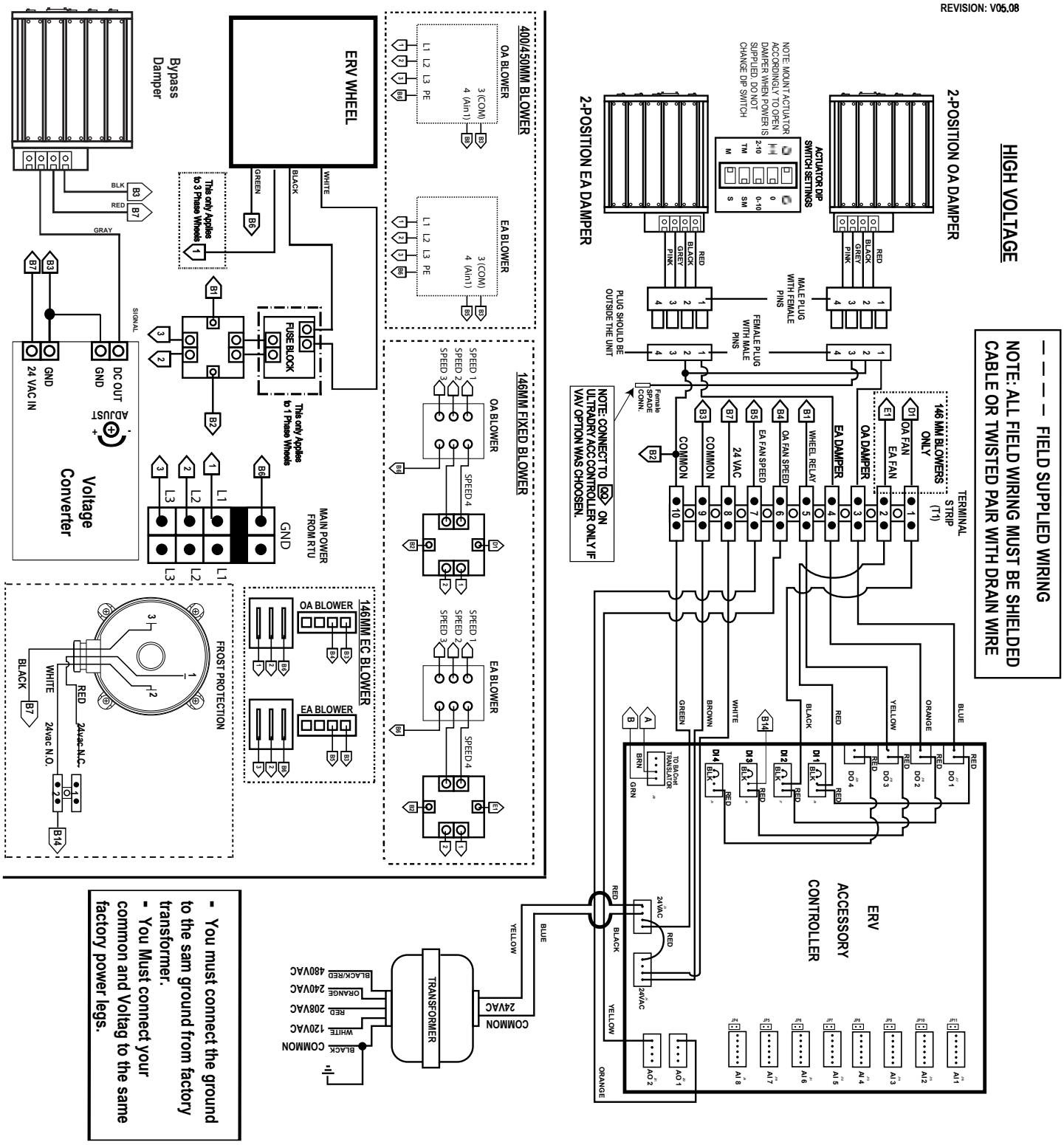
REVISION: V05.11



ERV ELECTRO-MECHANICAL w/ BYPASS DAMPER

SCH-0011-E

REVISION: V05.08

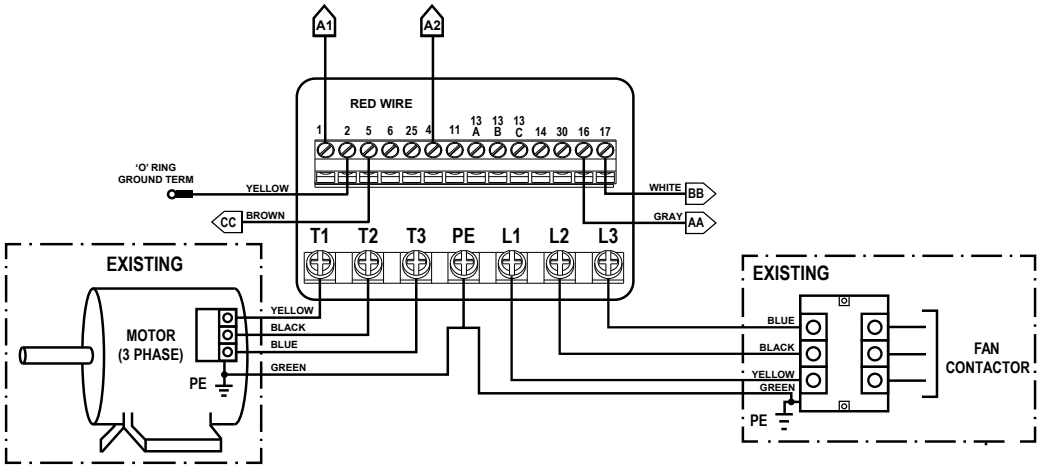


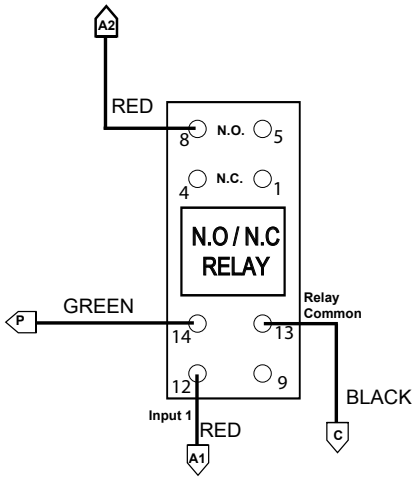
- You must connect the ground to the sam ground from factory transformer.
- You Must connect your common and Voltag to the same factory power legs.

LENZE VFD w/ NO IDF CONTACTOR

SCH-0012-E

Revision: V05.01





VFD PARAMETERS	
P100 = 1	(CONTROL SOURCE = TERMINAL STRIP)
P101 = 1	(REF. SOURCE = 0-10 VDC)
P110 = 6	(START METHOD = LAST KNOWN
P140 = 5	FREQ.)(RELAY OUTPUT = FAULT
P157 = 1	LOCKOUT)
P158 = 1	(IF TB5 < P158 = F_FRU (FAULT))

(0-10V MONITORING LEVEL = 1 VDC)

RESD. SPLIT WIRING

SCH-0013-E

USE FOR UNITS: 24ABB & FV4C
SCHEMATIC REFERENCE #: SCH-0003

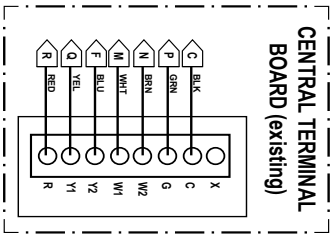
REVISION: V05.03

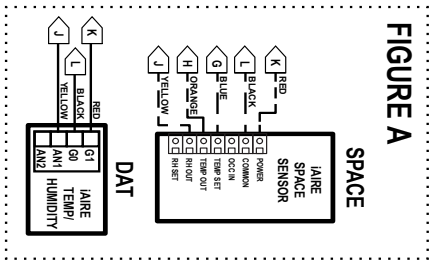
FOR UNITS OVER 7.5 TONS, LIQUID LINE SOLENOID IS RECOMMENDED AT THE EVAPORATOR

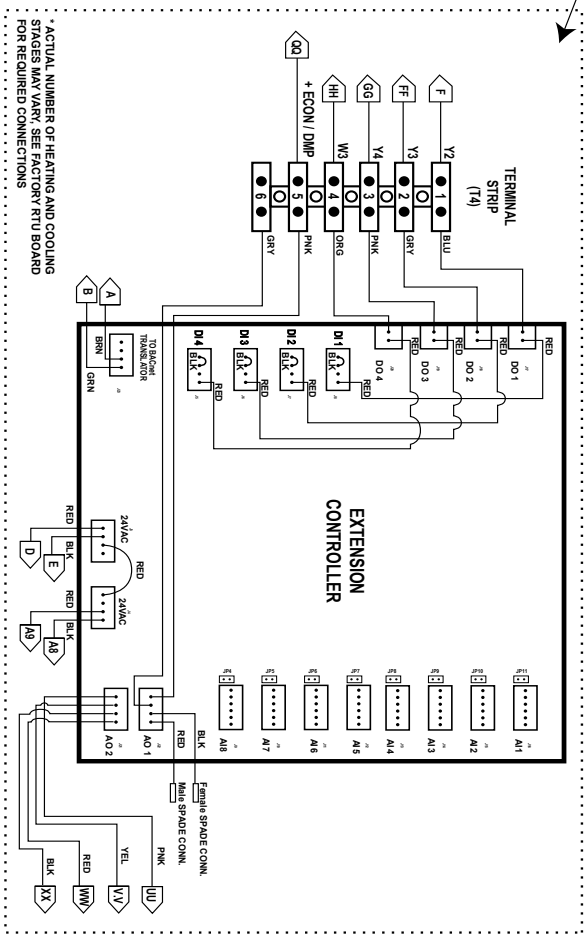
— — — — FIELD SUPPLIED WIRING

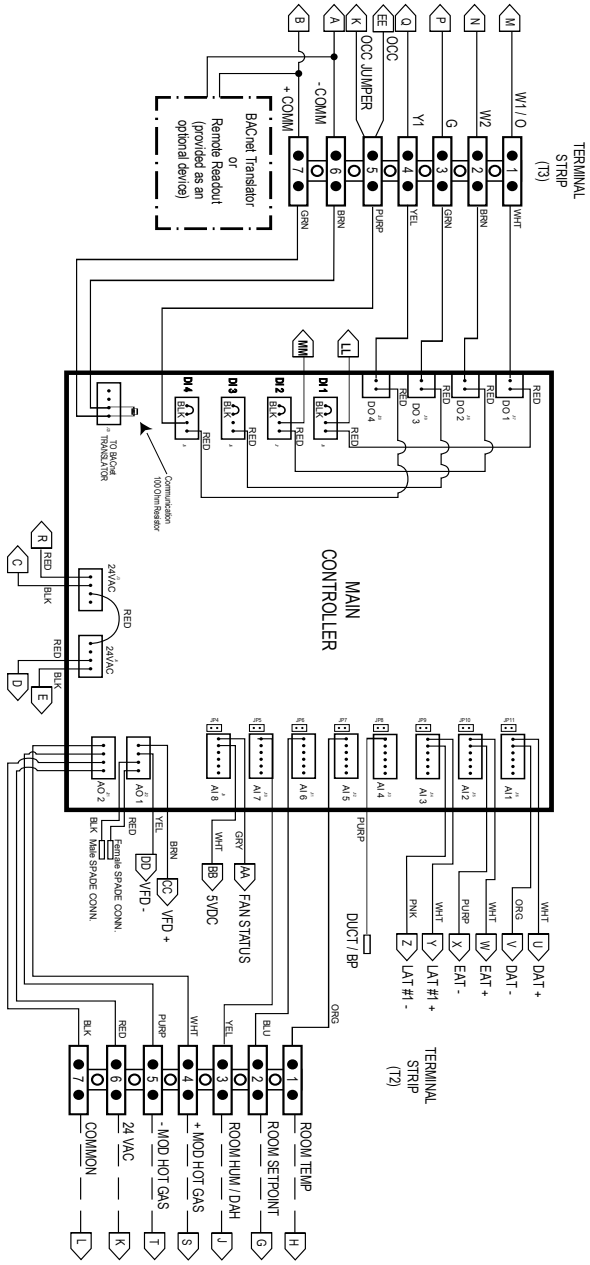
NOTE: ALL FIELD WIRING MUST BE SHIELDED CABLE OR TWISTED PAIR WITH DRAIN WIRE

EXTENSION CONTROLLER AND ALL ACCOMPANYING CONNECTIONS ARE ONLY REQUIRED WHERE THERE IS MORE THAN ONE STAGE OF COOLING, TWO STAGES OF HEAT, OR MODULATING HEAT.









AIR HANDLER UNIT

*****NOTE: TO OPERATE IN NORMAL MODE, OCC JUMPER MUST BE REMOVED*****

3 Phase Res SPLIT WIRING

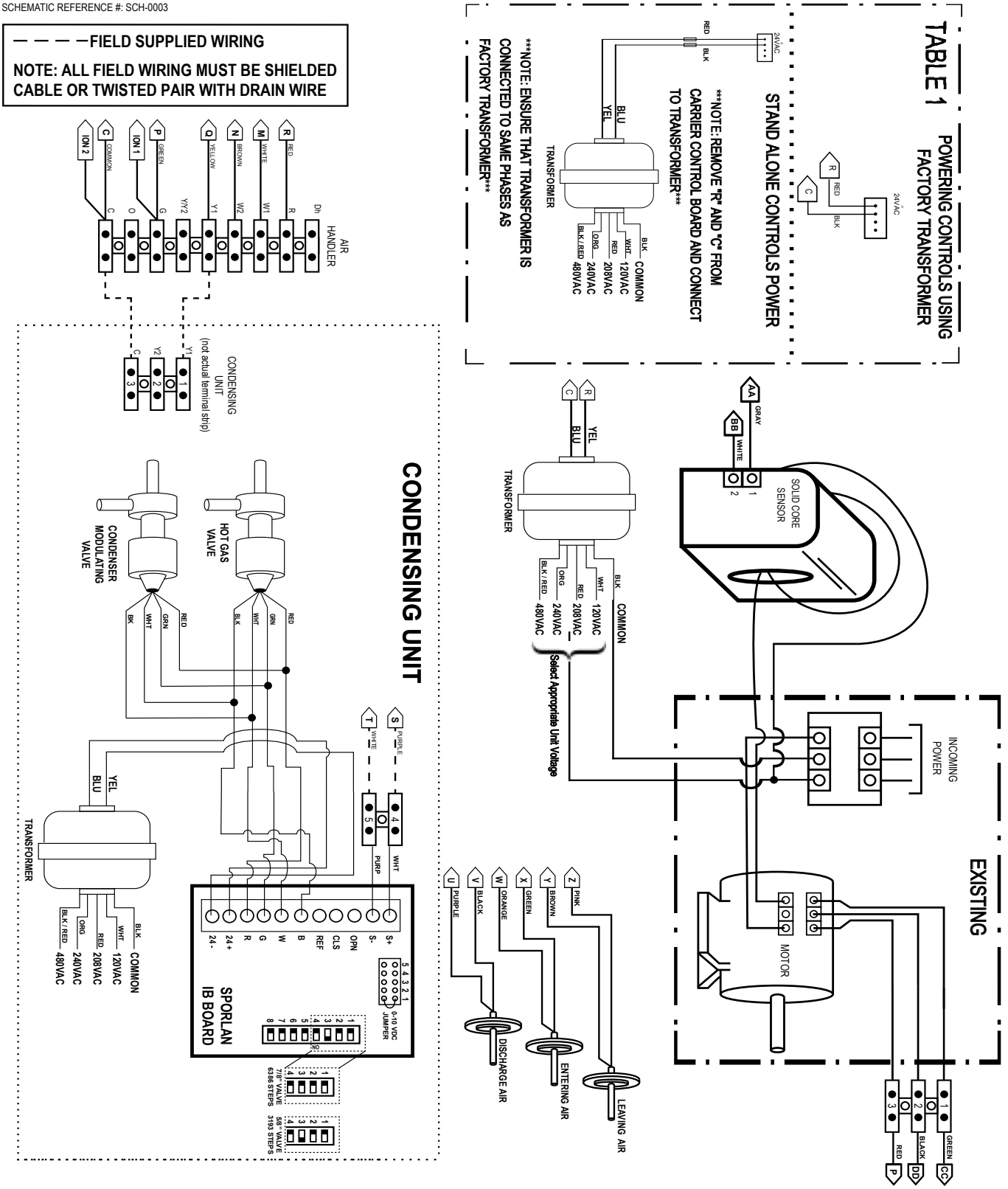
SCH-0013-E

REVISION: V05.03

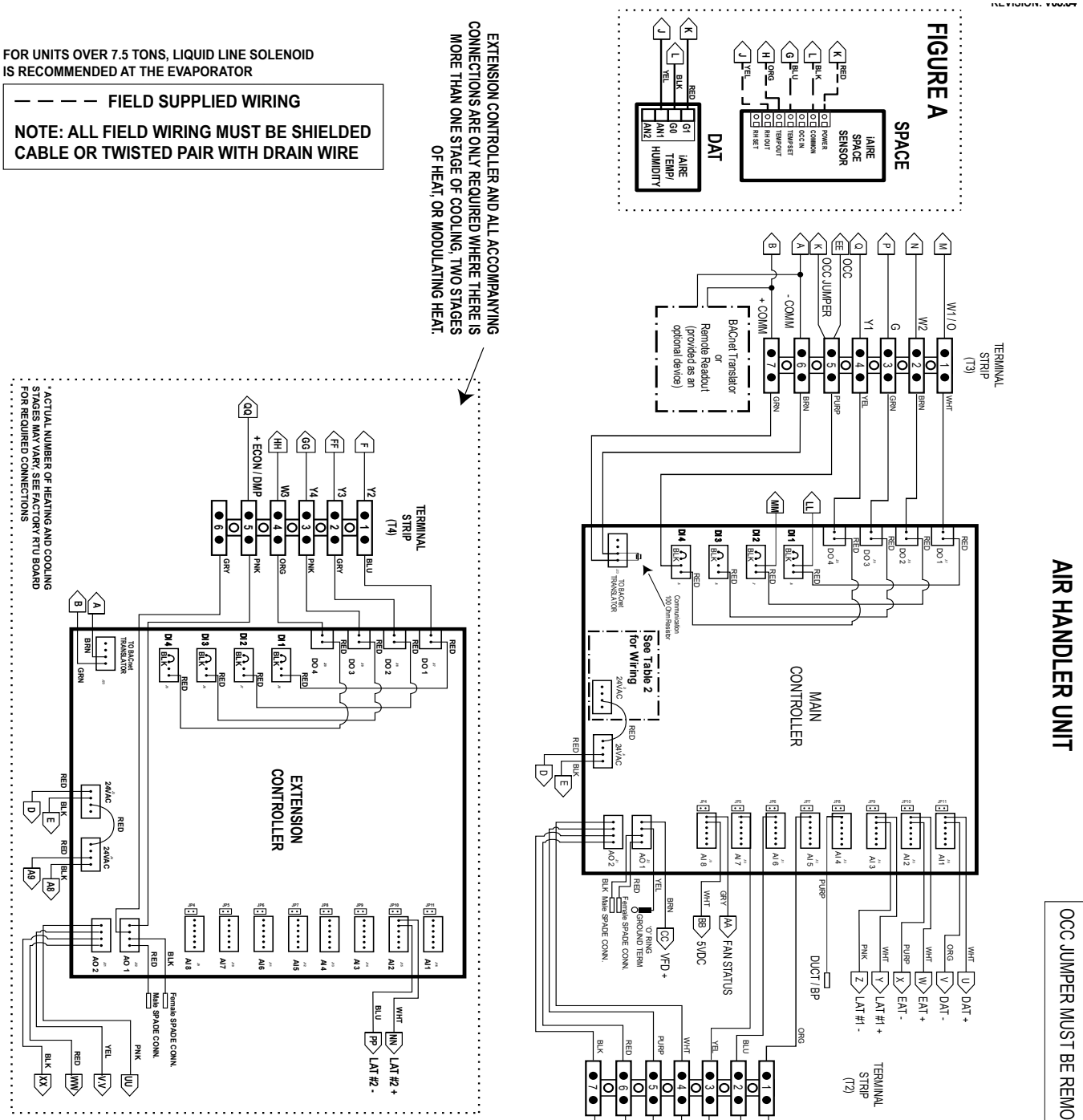
USE FOR UNITS: 24ABB & FV4C
SCHEMATIC REFERENCE #: SCH-0003

— — — —FIELD SUPPLIED WIRING

NOTE: ALL FIELD WIRING MUST BE SHIELDED CABLE OR TWISTED PAIR WITH DRAIN WIRE



3-Phase Commercial Split Wiring



3-PHASE COMM. SPLIT WIRING SCH-0015-E

REVISION: V05.04

FIELD SUPPLIED WIRING

NOTE: ALL FIELD WIRING MUST BE SHIELDED CABLE OR TWISTED PAIR WITH DRAIN WIRE

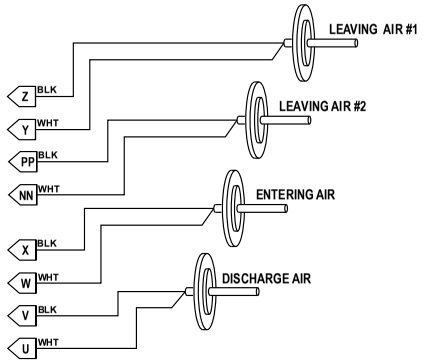
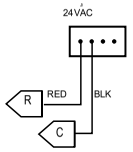
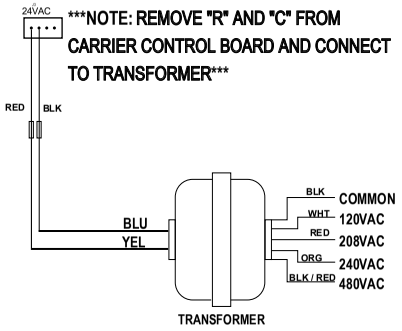


TABLE 1

POWERING CONTROLS USING FACTORY TRANSFORMER

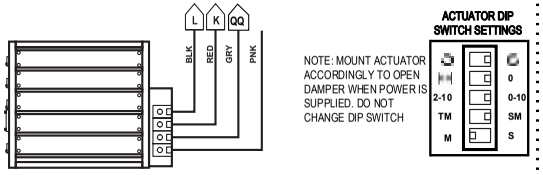


STAND ALONE CONTROLS POWER

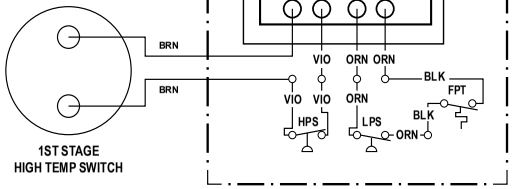


NOTE: ENSURE THAT TRANSFORMER IS CONNECTED TO SAME PHASES AS FACTORY TRANSFORMER

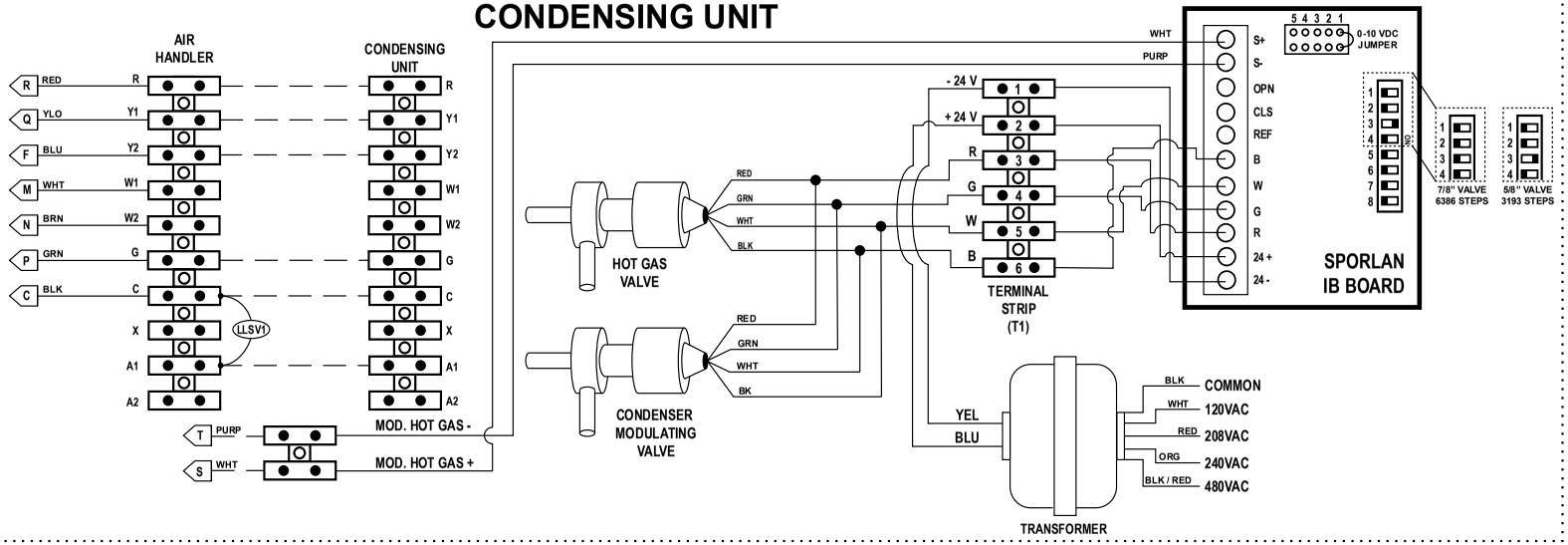
IAIRE SUPPLIED DAMPER



CENTRAL TERMINAL BOARD (existing)



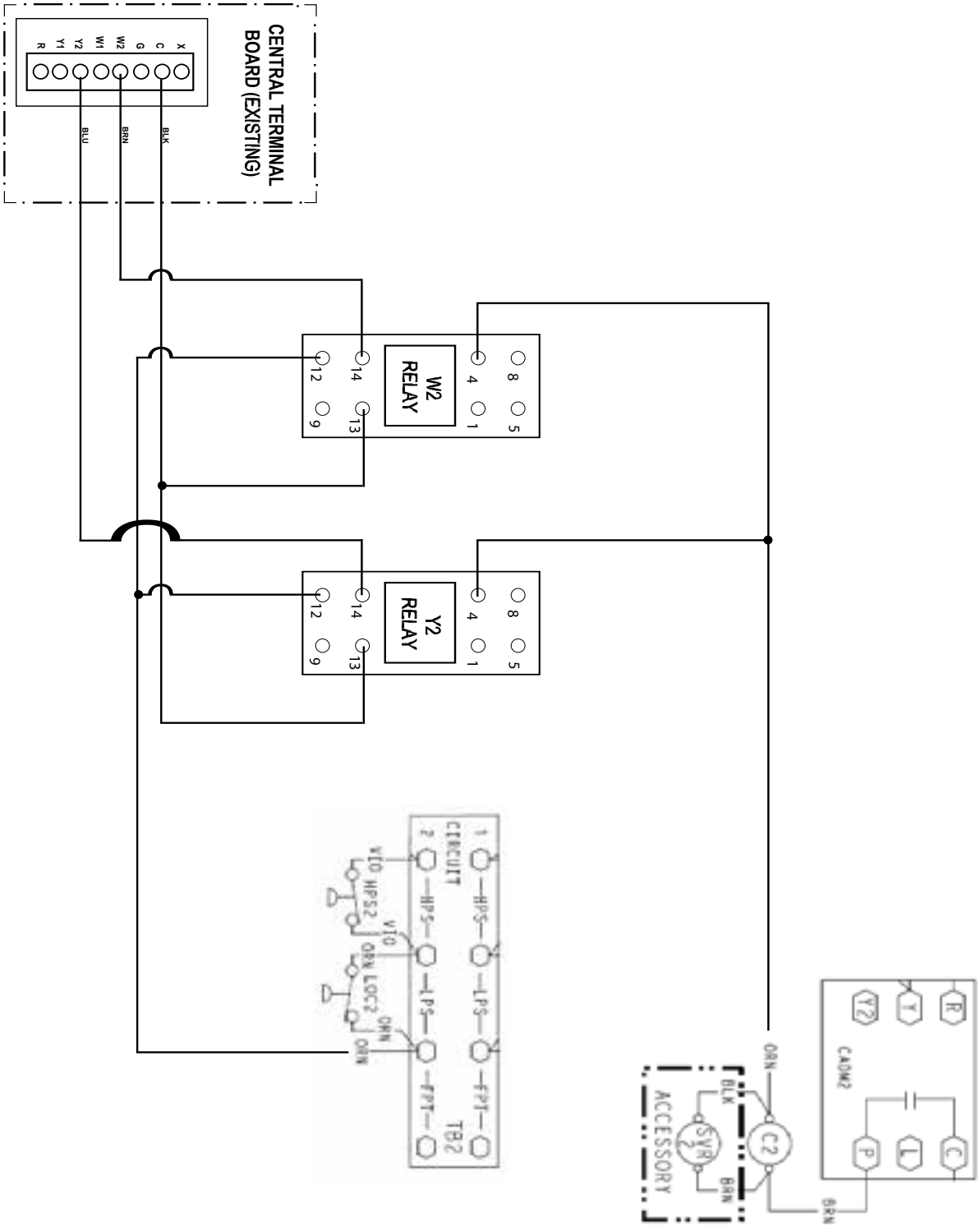
CONDENSING UNIT



*Additional Comm Split wiring if unit is a heat pump.

3-PHASE COMM. SPLIT WIRING SCH-0015-E

REVISION: V05.04



3-PHASE RTU WIRING - HEAT PUMP

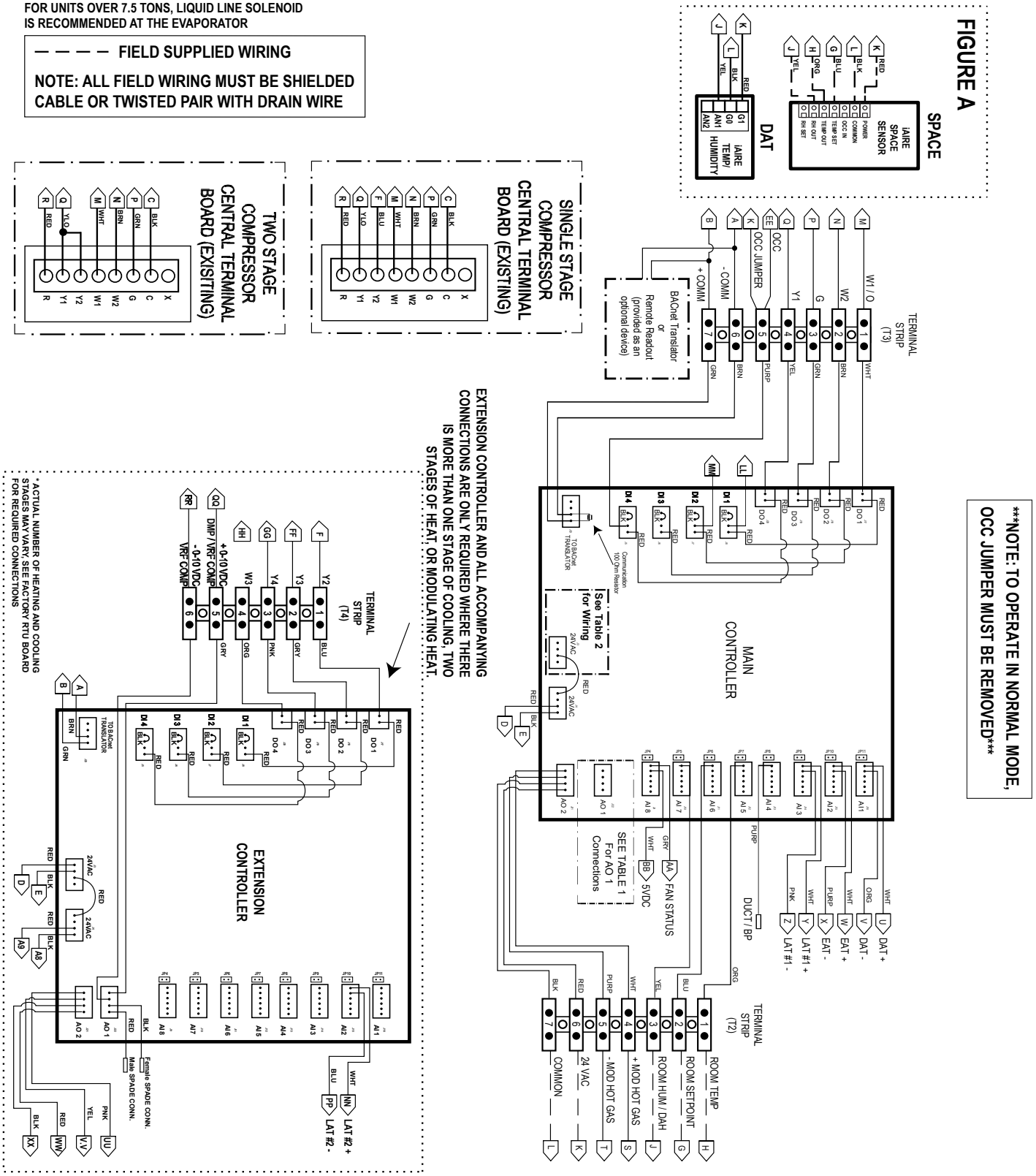
SCH-0016-E

REVISION: V05.03

FOR UNITS OVER 7.5 TONS, LIQUID LINE SOLENOID IS RECOMMENDED AT THE EVAPORATOR

— — — — FIELD SUPPLIED WIRING

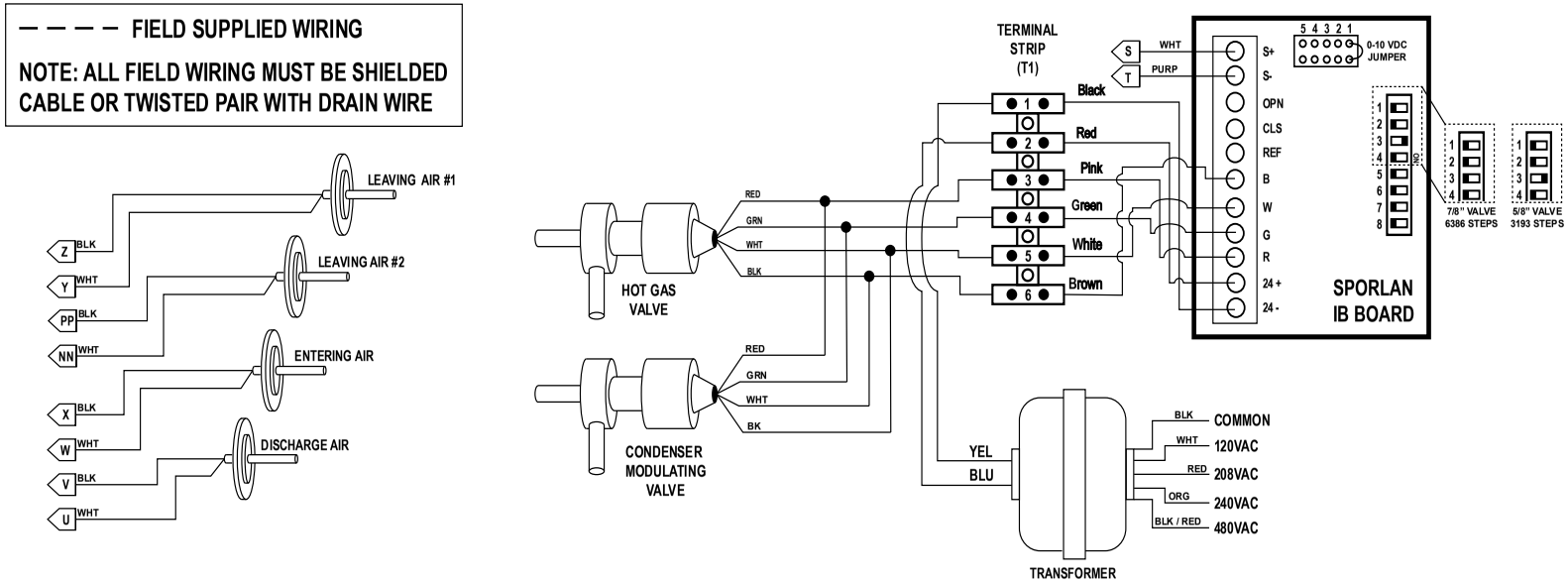
NOTE: ALL FIELD WIRING MUST BE SHIELDED CABLE OR TWISTED PAIR WITH DRAIN WIRE

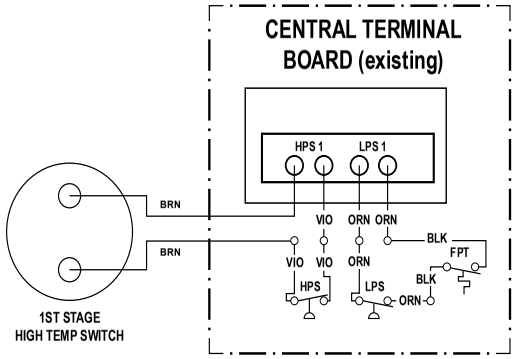


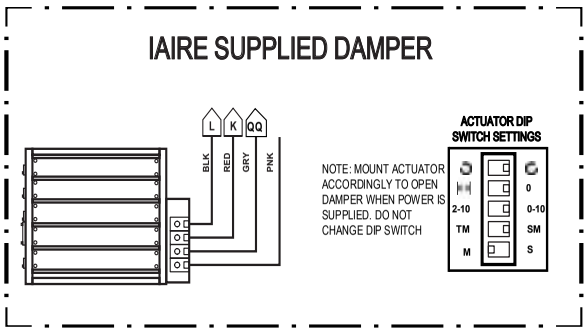
PHASE RTU WIRING - HEAT PUMP

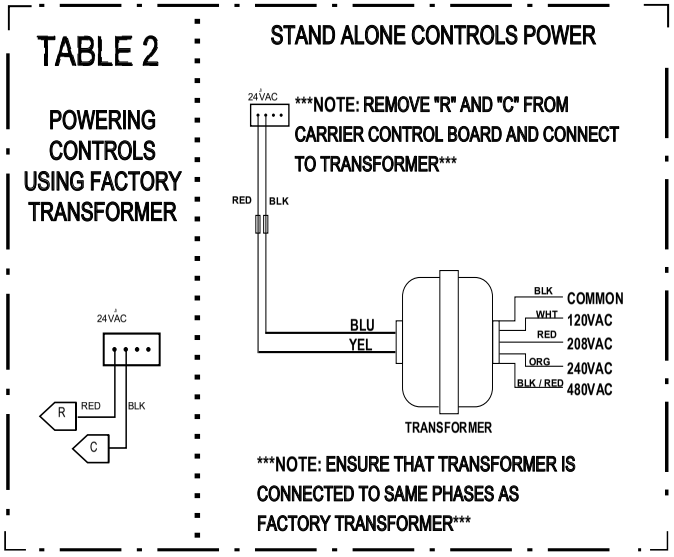
SCH-0016-E

REVISION: V05.03





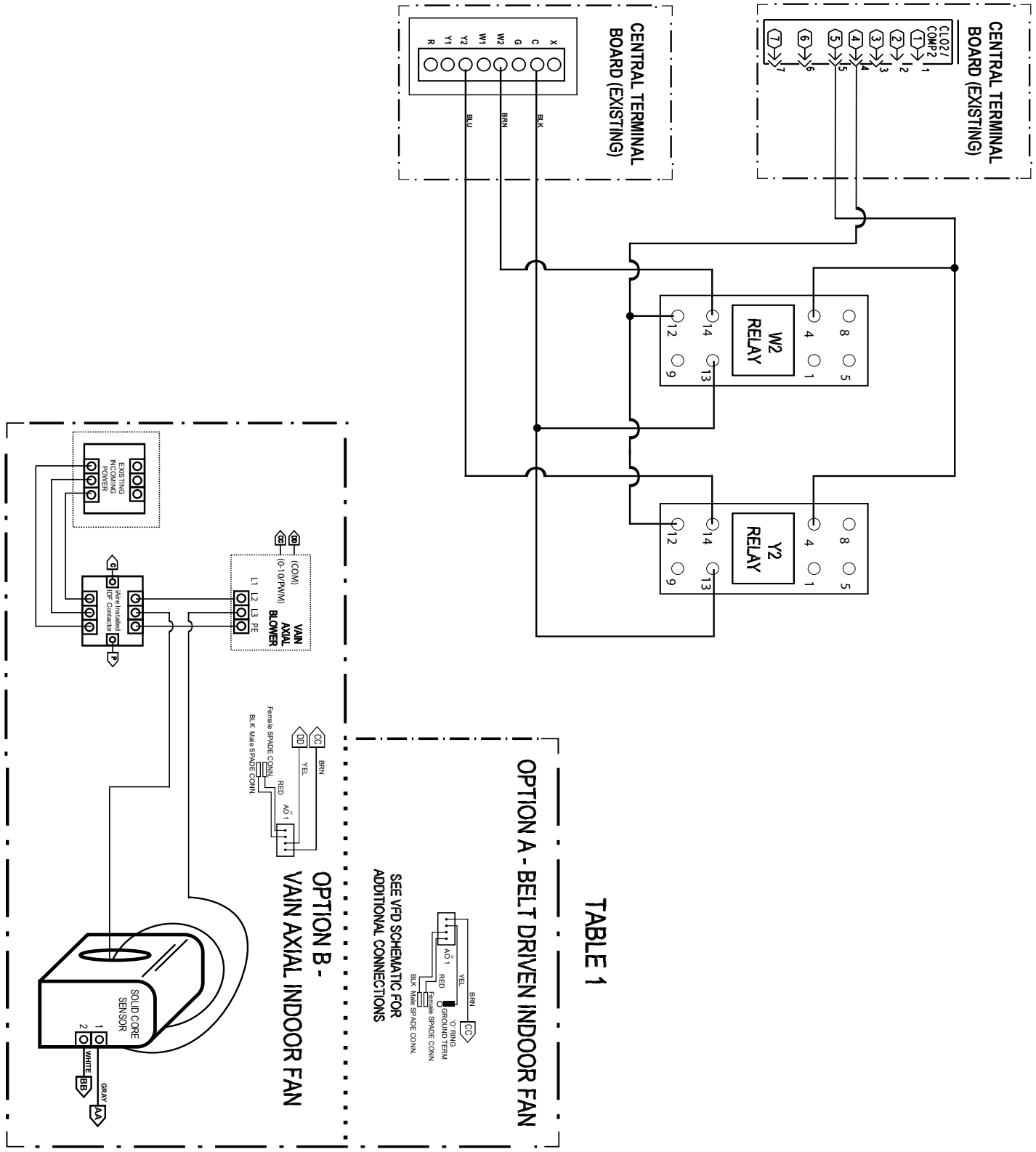




PHASE RTU WIRING- HEAT PUMP

SCH-0016-E

REVISION: V05.03

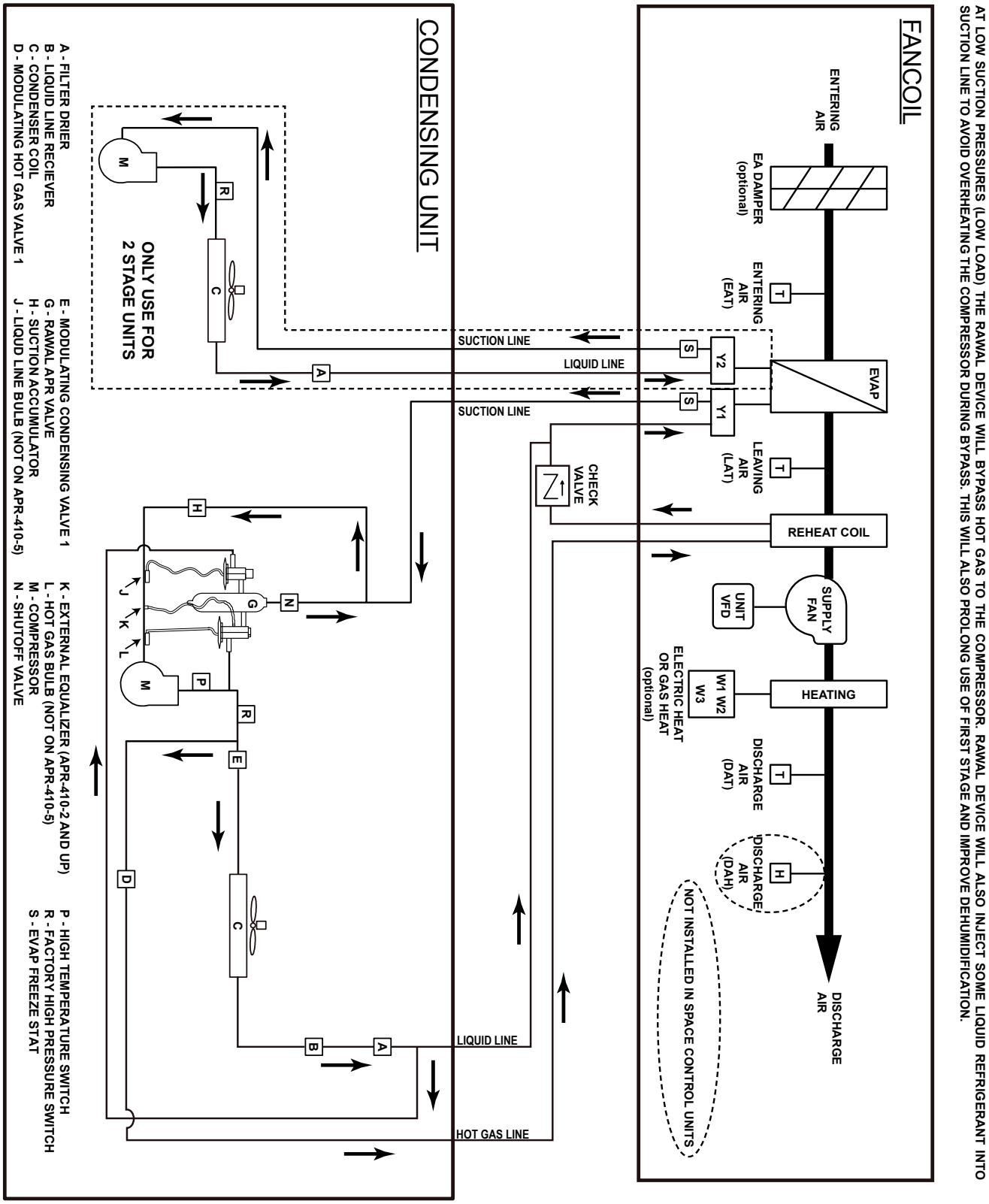


RTU PIPING DIAGRAM

SCH-0001-P

REVISION: V05.02

SAFETIES
AT LOW SUCTION PRESSURES (LOW LOAD) THE RAWAL DEVICE WILL BYPASS HOT GAS TO THE COMPRESSOR. RAWAL DEVICE WILL ALSO INJECT SOME LIQUID REFRIGERANT INTO SUCTION LINE TO AVOID OVERHEATING THE COMPRESSOR DURING BYPASS. THIS WILL ALSO PROLONG USE OF FIRST STAGE AND IMPROVE DEHUMIDIFICATION.



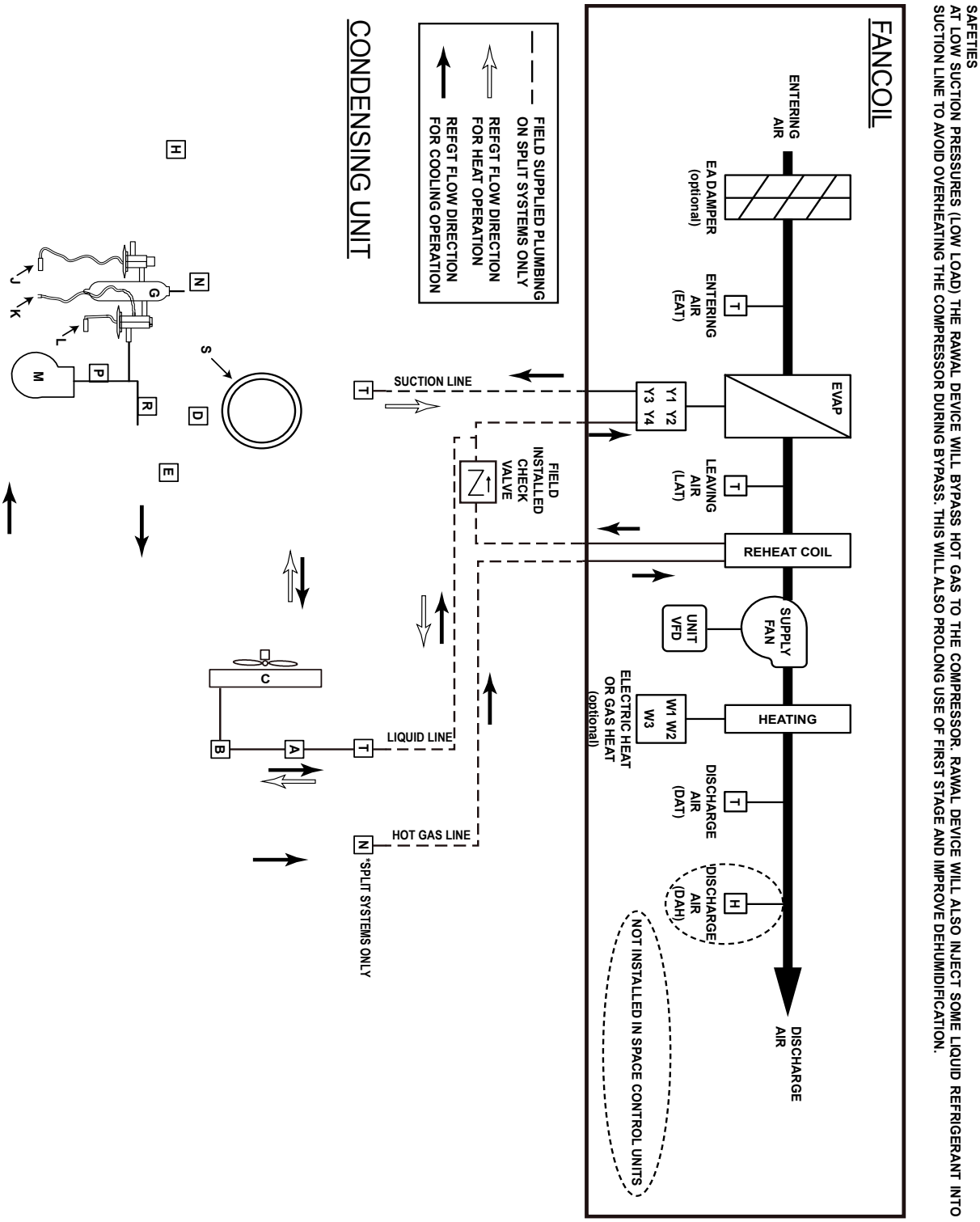
RTU HP PIPING DIAGRAM

SCH-0002-P

REVISION: V05.01

SAFETIES

AT LOW SUCTION PRESSURES (LOW LOAD) THE RAWAL DEVICE WILL BYPASS HOT GAS TO THE COMPRESSOR. RAWAL DEVICE WILL ALSO INJECT SOME LIQUID REFRIGERANT INTO SUCTION LINE TO AVOID OVERHEATING THE COMPRESSOR DURING BYPASS. THIS WILL ALSO PROLONG USE OF FIRST STAGE AND IMPROVE DEHUMIDIFICATION.

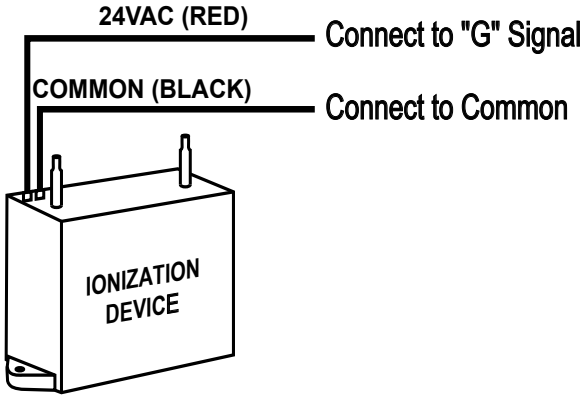


A - FILTER DRIER
B - LIQUID LINE RECIEVER
C - CONDENSER COIL
D - MODULATING CONDENSING VALVE 1
E - MODULATING HOT GAS VALVE 1
G - RAWAL APR VALVE
H - SUCTION ACCUMULATOR
J - LIQUID LINE BULB (NOT ON APR-410-5)
K - EXTERNAL EQUALIZER (APR-410-2 AND UP)
L - HOT GAS BULB (NOT ON APR-410-5)
M - COMPRESSOR
N - SHUTOFF VALVE
P - RAWAL HIGH TEMPERATURE SWITCH
Q - LOW-AMBIENT CONTROL OPTION
R - FACTORY HIGH PRESSURE SWITCH
S - REVERSING VALVE
T - FACTORY MAINTENANCE VALVE

IONIZATION OPTION WIRING

SCH-0001-O

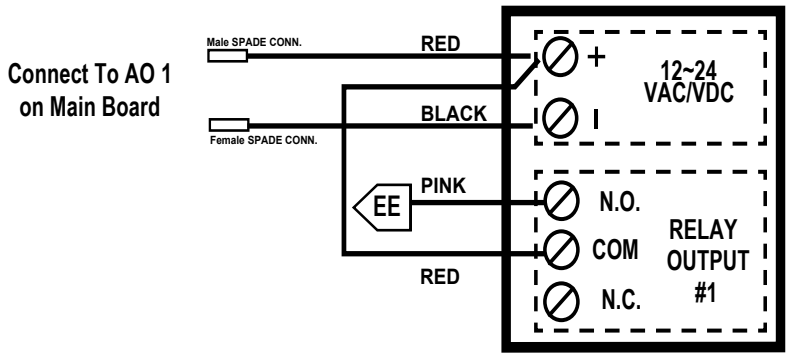
REVISION: V05.01



24 HOUR CLOCK OPTION WIRING

SCH-0002-O

REVISION: V5.0.0.1

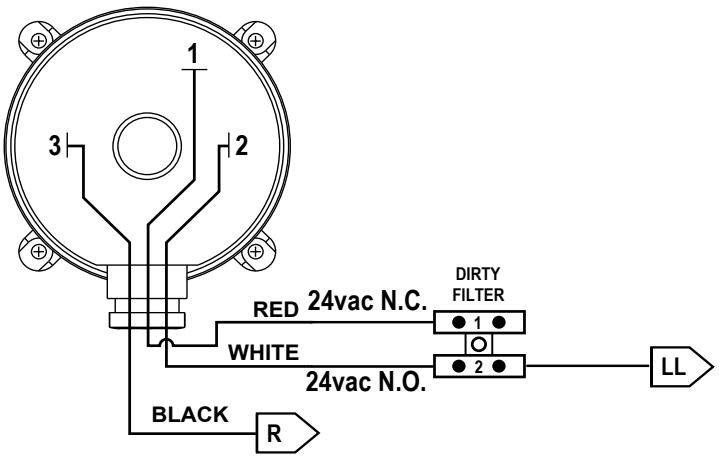


DIRTY FILTER SWITCH OPTION WIRING

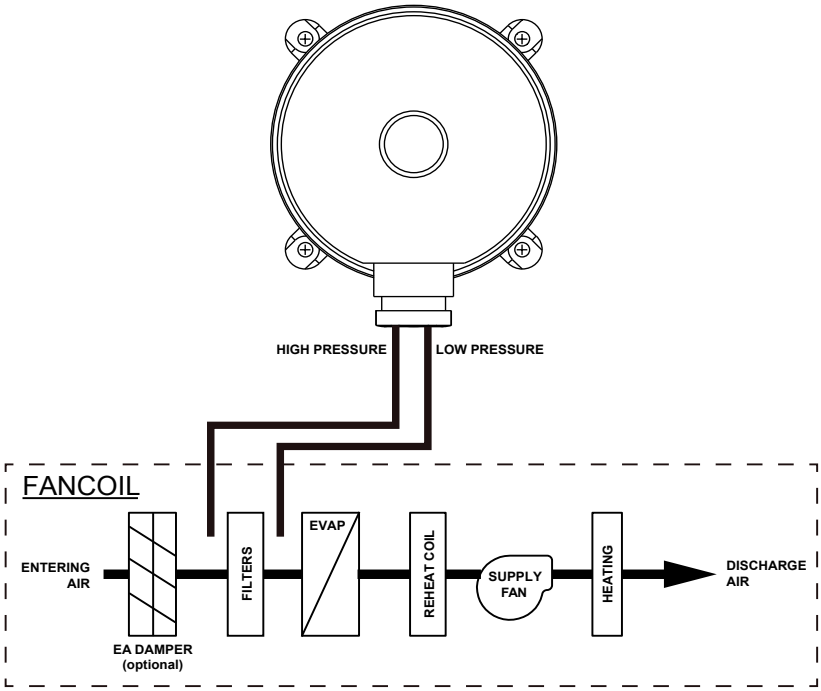
SCH-0003-O

REVISION: V5.0.0.1

WIRING



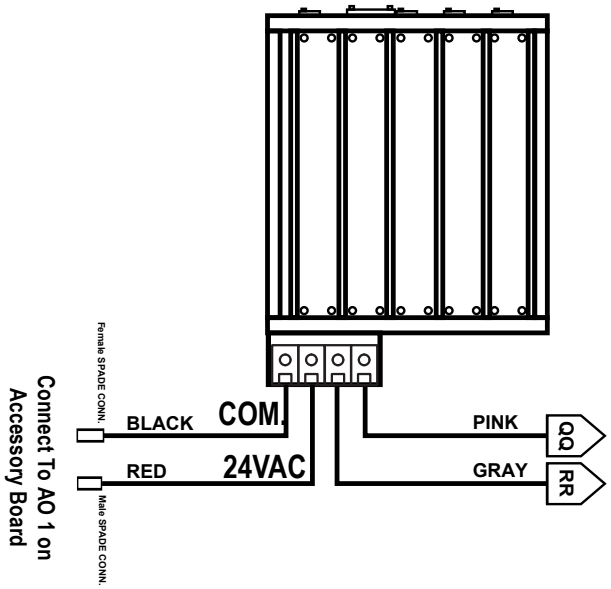
PRESSURE TUBES



2-POS DAMPER OPTION WIRING

SCH-0004-O

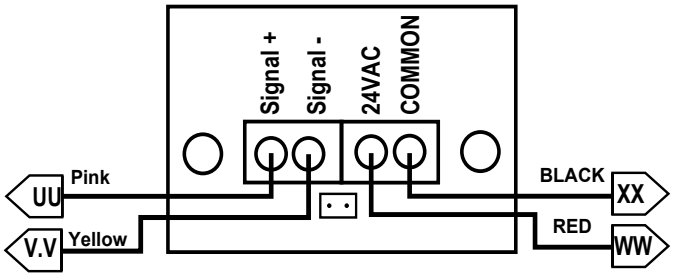
REVISION: V5.0.0.1



MOD GAS HEAT OPTION WIRING

DIP Switches
A three (3) position DIP switch is located on the PCB (see Figure 2). Change the signal type and offset by changing the position of DIP switches. (For DIP switch position and corresponding current/voltage ranges, see Table below). IAIRE uses 0-10V Setup

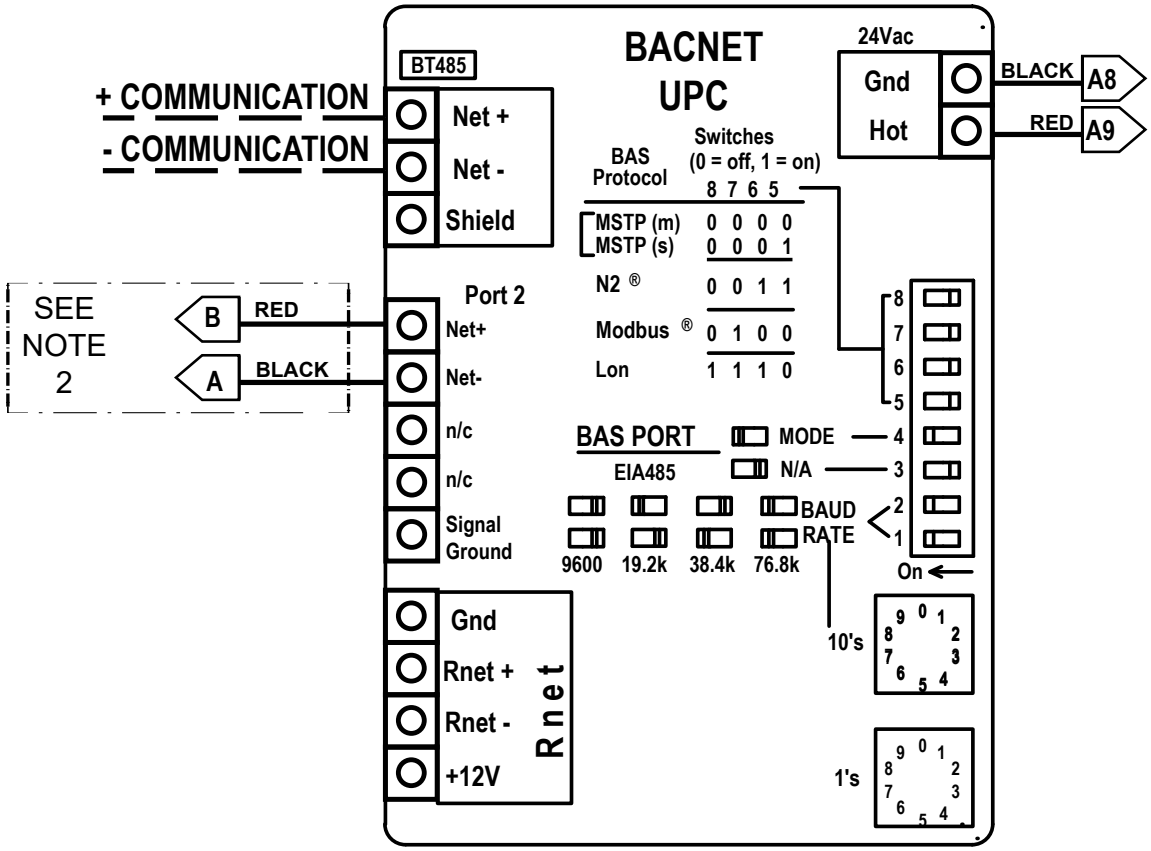
DIP Switch Position Table			
Control Signal	**SW1 Signal**	**SW2 Offset**	**SW3 Characteristic**
0-10 V	OFF	OFF	OFF
2-10 V	OFF	ON	OFF
0-20 mA	ON	OFF	OFF
4-20 mA	ON	ON	OFF



BACNET OPTION WIRING

SCH-0006-O

REVISION: V5.0.0.5



— — —FIELD SUPPLIED WIRING

NOTE 1: BacNet Communication Has 3 Minute Delay upon Power Up

NOTE 2: All Communication Wires Between BacNet and iAire Controllers must be Shielded Wire

BACNET POINTS LIST

OBJECT ID	iAIRE POINT NAME	POINT TYPE	BACNET OBJECT NAME	OBJECT TYPE	DEFAULT SET POINTS	READ ACCESS
1	FAN STATUS AV	ANALOG	fan_status_av	AV	0%	READ ONLY
1	FAN FAULT	DIGITAL	fan_fault	BV	N/A	READ ONLY
1	UNIT CONTROL		unit_control	MSV	N/A	READ ONLY
2	ENTERING AIR TEMP	ANALOG	ea_temp	AV	58.6°F	READ ONLY
2	COOLING 1	DIGITAL	cooling_1	BV	N/A	READ ONLY
3	LEAVING AIR TEMP	ANALOG	la_temp	AV	57.6°F	READ ONLY
3	COOLING 2	DIGITAL	cooling_2	BV	N/A	READ ONLY
4	DISCHARGE AIR TEMP	ANALOG	da_temp	AV	57.6°F	READ ONLY
4	COOLING 3	DIGITAL	cooling_3	BV	N/A	READ ONLY
5	HUMIDITY	ANALOG	humidity	AV	0%rh	READ ONLY
5	COOLING 4	DIGITAL	cooling_4	BV	N/A	READ ONLY
6	VERSION D3.0	ANALOG	version_number	AV	No Units	READ ONLY
6	HEATING 1	DIGITAL	heating_1	BV	N/A	READ ONLY
7	HOT GAS REHEAT	ANALOG	hot_gas_reheat	AV	0%	READ ONLY
7	HEATING 2	DIGITAL	heating_2	BV	N/A	READ ONLY
8	VFD SPEED	ANALOG	vfd_speed	AV	50%	READ ONLY
8	HEATING 3	DIGITAL	heating_3	BV	N/A	READ ONLY
9	ROOM TEMP	ANALOG	room_temp	AV	32°F	READ ONLY
9	FAN ENABLE	DIGITAL	fan_enable	BV	N/A	READ ONLY
10	ROOM TEMP SETPOINT	ANALOG	room_temp_stp	AV	62°F	READ ONLY
10	DIRTY FILTER	DIGITAL	dirty_filter	BV	N/A	READ ONLY
11	DUCT OR BUILDING PRESSURE	ANALOG	duct_or_buildingpressure	AV	0 in H_2O	READ ONLY
11	WATER GUARD	DIGITAL	water_guard	BV	N/A	READ ONLY
12	FREEZE1	DIGITAL	freeze_1	BV	N/A	READ ONLY
13	FREEZE2	DIGITAL	freeze_2	BV	N/A	READ ONLY
14	BAS VFD SPEED COOL	ANALOG	bas_vfd_speed_cool	AV	50%	READ / WRITE
14	FAN STATUS BV	DIGITAL	fan_status_bv	BV	N/A	READ ONLY
15	BAS VFD SPEED HEAT	ANALOG	bas_vfd_speed_heat	AV	50%	READ / WRITE
16	BAS DAT SETPOINT	ANALOG	bas_dat_stp	AV	72°F	READ / WRITE
17	BAS ROOM SETPOINT	ANALOG	bas_room_setpoint	AV	72°F	READ / WRITE
18	BAS HUMIDITY LOCKOUT	ANALOG	bas_humidity_lout	AV	50%rh	READ / WRITE
19	BAS HUMIDITY LOCKOUT 2	ANALOG	bas_humidity_lout2	AV	55%rh	READ / WRITE
20	BAS EAT COOL LOCKOUT	ANALOG	bas_eat_cool_lout	AV	61°F	READ / WRITE
21	BAS EAT DEAD BAND	ANALOG	bas_eat_dead_band	AV	3°F	READ / WRITE
22	BAS SWITCH (OCC)	ANALOG	bas_switch	AV	1	READ / WRITE
23	BAS LAT SETPOINT	ANALOG	bas_lat_sp	AV	55°F	READ / WRITE
24	VFD SPEED COOL	ANALOG	vfd_speed_cool	AV	%	READ ONLY
25	VFD SPEED HEAT	ANALOG	vfd_speed_heat	AV	%	READ ONLY
26	DAT SETPOINT	ANALOG	dat_stp	AV	°F	READ ONLY
27	ROOM SETPOINT	ANALOG	roomsetpoint	AV	°F	READ ONLY
28	HUMIDITY LOCKOUT	ANALOG	humidity_lockout	AV	%rh	READ ONLY
29	HUMIDITY LOCKOUT 2	ANALOG	humidity_lockout2	AV	%rh	READ ONLY
30	LAT SP	ANALOG	lat_sp	AV	°F	READ ONLY
31	EAT COOL LOCKOUT	ANALOG	eat_cool_lockout	AV	°F	READ ONLY
32	EAT HEAT LOCKOUT	ANALOG	eat_heat_lout	AV	°F	READ ONLY
34	SWITCH	ANALOG	switch	AV	N/A	READ ONLY
35	BAS PRESSURE SETPOINT	ANALOG	bas_pressure_sp	AV	1.2 in H_2O	READ / WRITE
36	PRESSURE SETPOINT	ANALOG	pressure_setpoint	AV	in H_2O	READ ONLY
37	MINIMUM FAN SPEED	ANALOG	minimum_fan_speed	AV	%	READ ONLY

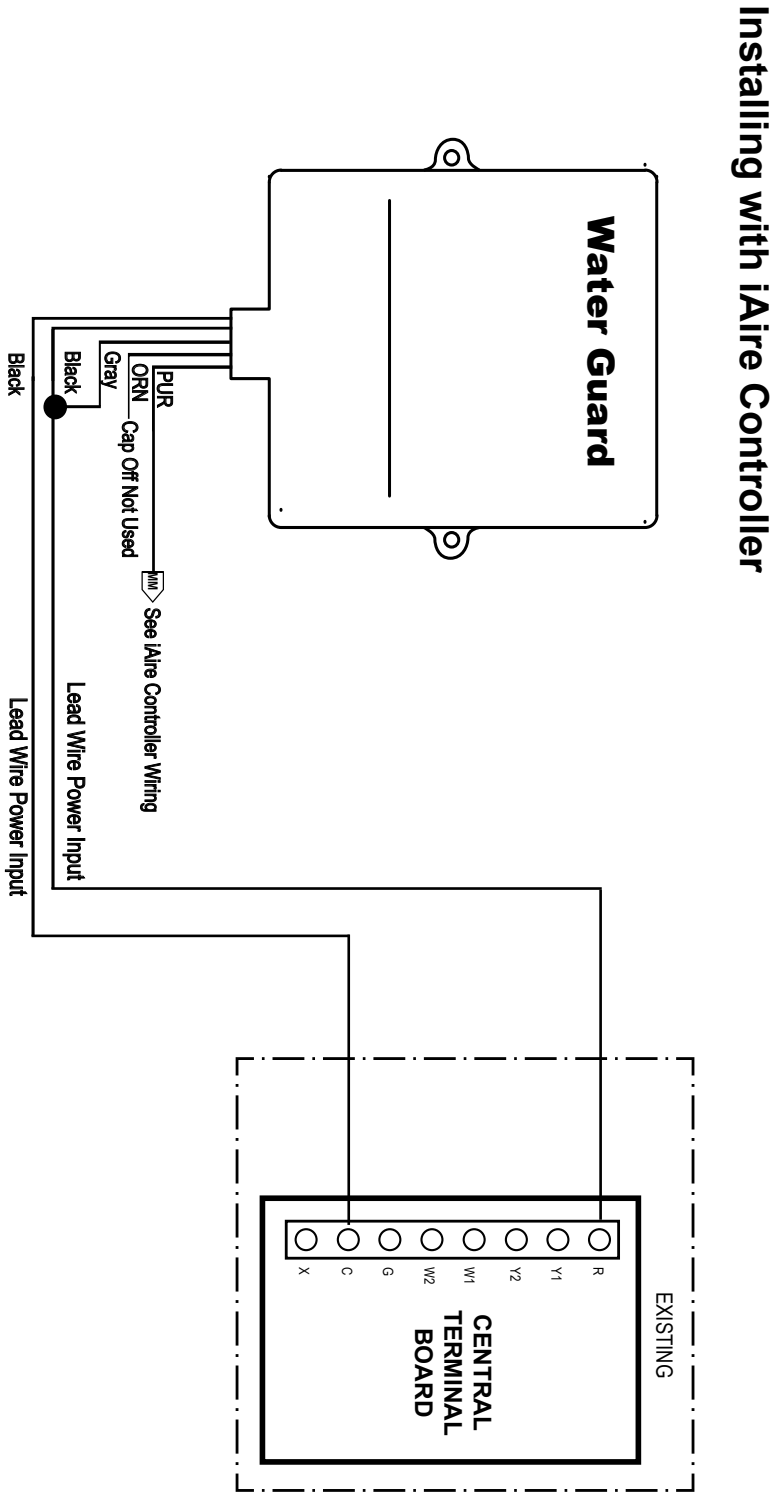
BACNET POINTS LIST (cont.)

OBJECT ID	iAIRE POINT NAME	POINT TYPE	BACNET OBJECT NAME	OBJECT TYPE	DEFAULT SET POINTS	READ ACCESS
38	BAS MINIMUM FAN SPEED	ANALOG	bas_min_fan_speed	AV	40%	READ / WRITE
39	MAXIMUM FAN SPEED	ANALOG	maximum_fan_speed	AV	100%	READ ONLY
40	BAS MAXIMUM FAN SPEED	ANALOG	bas_max_fan_speed	AV	80%	READ / WRITE
41	OA FAN SPEED	ANALOG	outsideair_fan_speed	AV	50%	READ ONLY
42	BAS OA FAN SPEED	ANALOG	bas_oa_fan_speed	AV	50%	READ / WRITE
43	EAFAN SPEED	ANALOG	exhaustair_fan_speed	AV	50%	READ ONLY
44	BAS EA FAN SPEED	ANALOG	bas_ea_fan_speed	AV	50%	READ / WRITE
45	DAMPER POSITION	ANALOG	damper_position	AV	0%	READ ONLY
46	BAS DAMPER POSITION	ANALOG	bas_damper_position	AV	100%	READ / WRITE
47	FREEZE PROTECTION	ANALOG	freeze_protection	AV	39°F	READ ONLY
48	BAS FREEZE PROTECTION	ANALOG	bas_freeze_protection	AV	39°F	READ / WRITE

WATER GUARD OPTION WIRING

SCH-0007-O

REVISION: V05.02



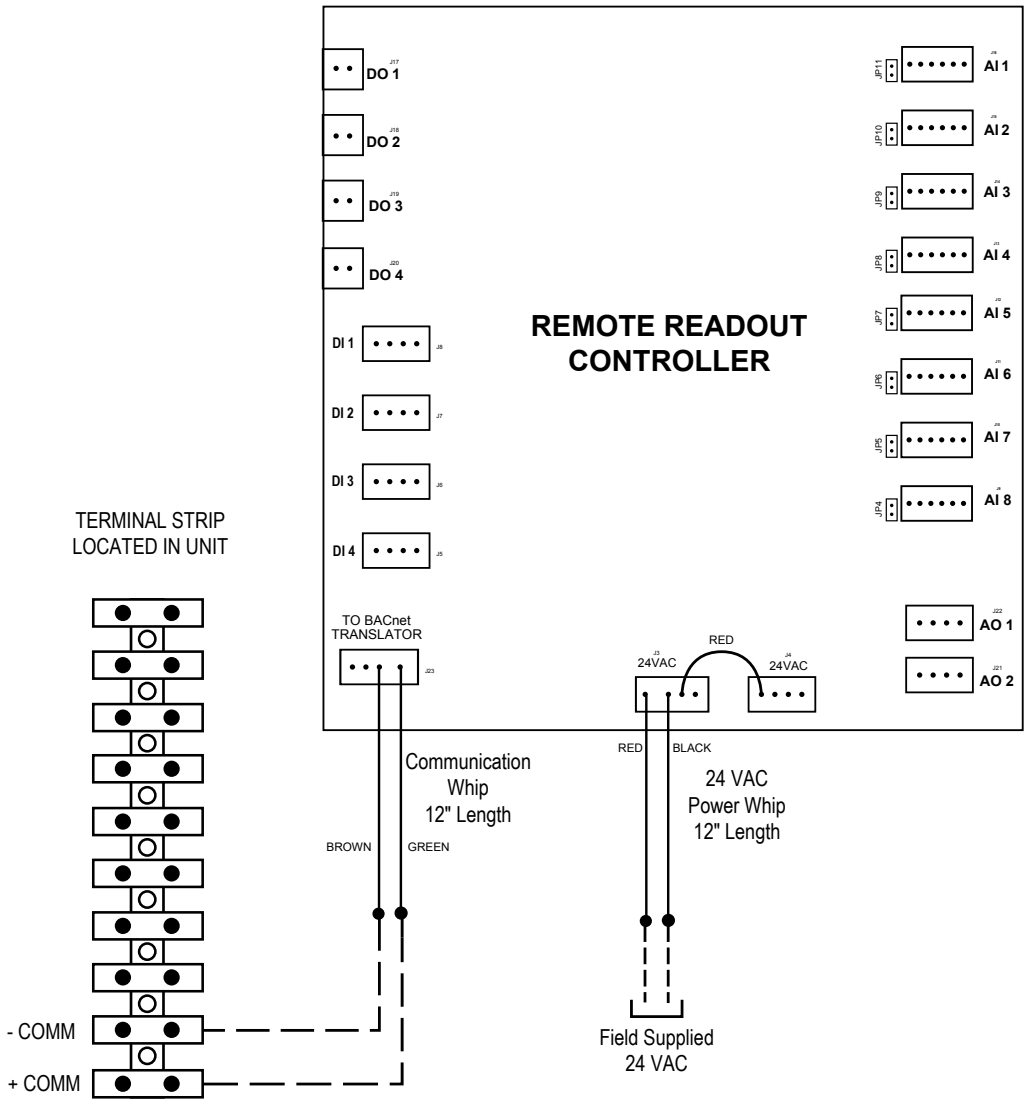
REMOTE READOUT OPTION WIRING

SCH-0008-O

REVISION: V5.0.0.2

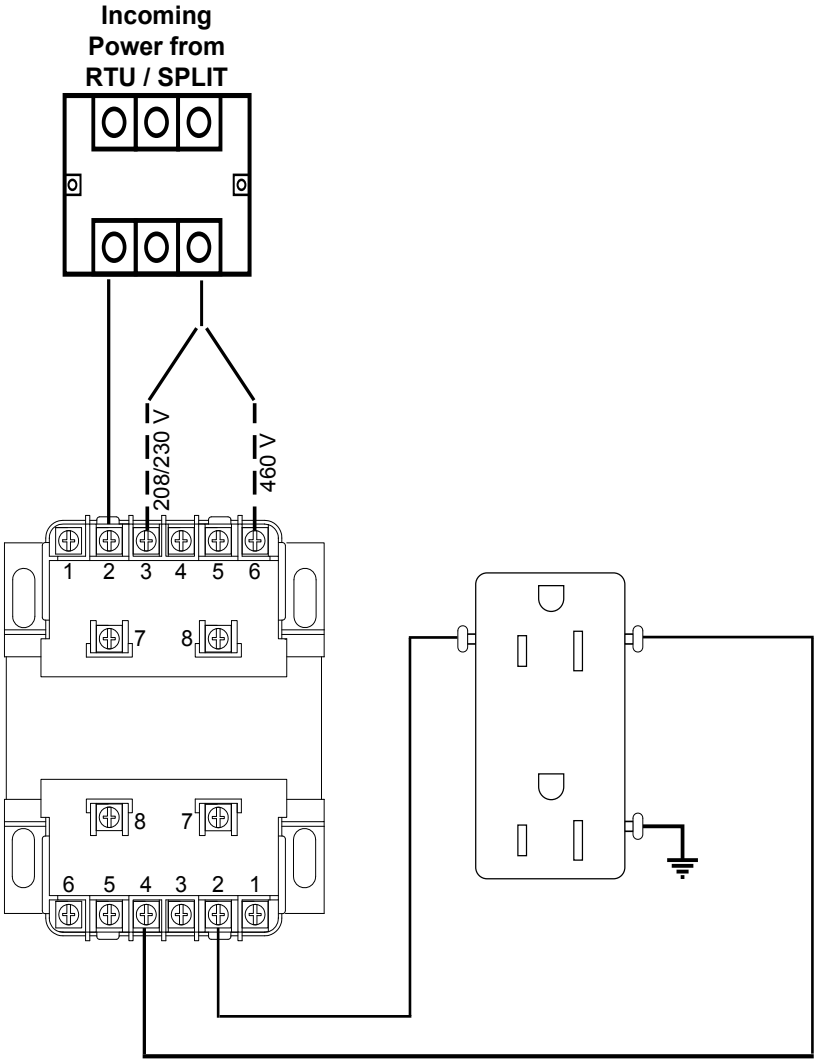
FIELD SUPPLIED WIRING

Note: All Ports on board must have connectors installed to prevent accidental shock or shorts in field.



POWERED SERVICE OUTLET OPTION WIRING SCH-0010-O

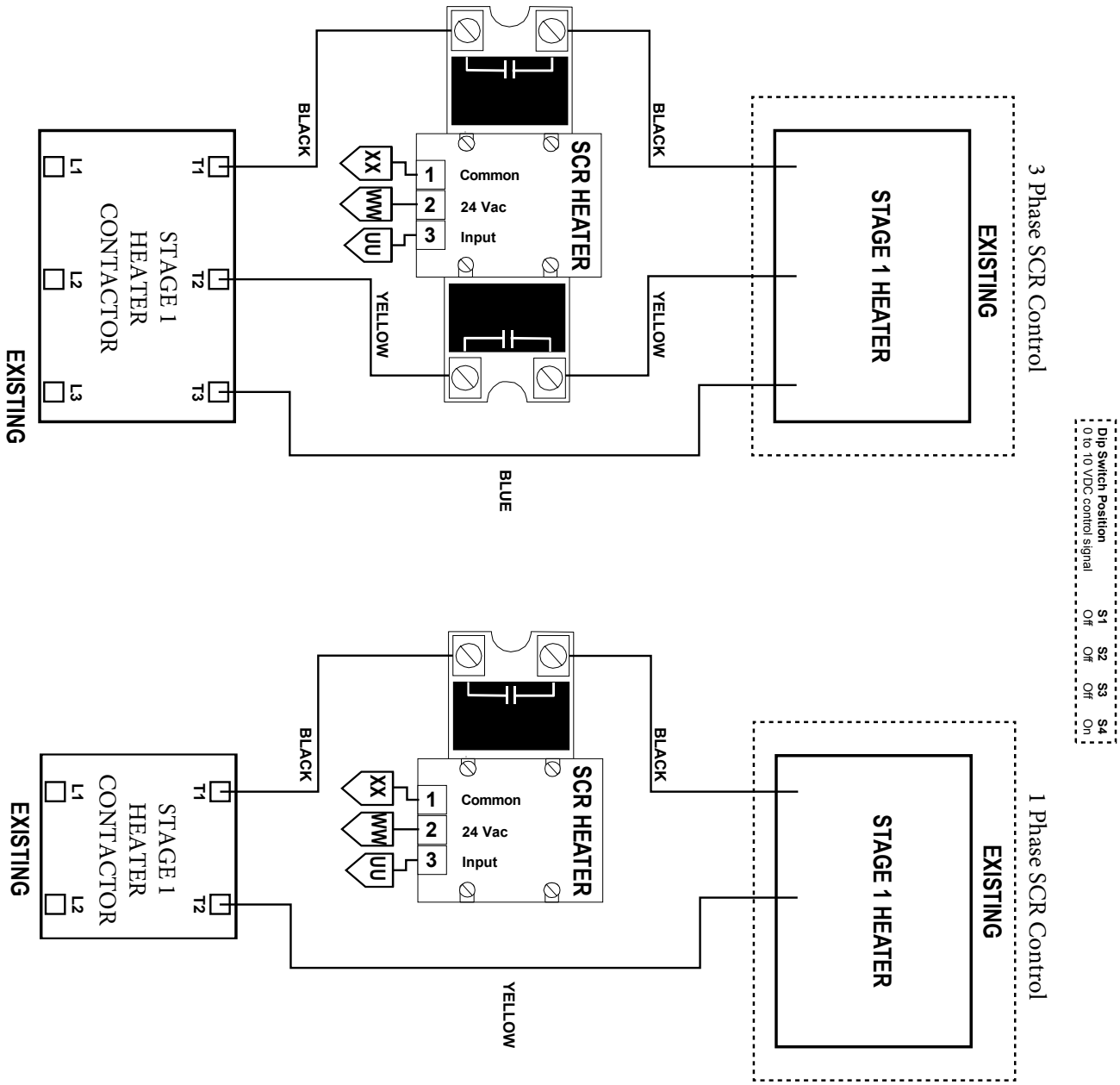
REVISION: V5.0.0.1



SCR HEAT OPTION WIRING

SCH-0011-O

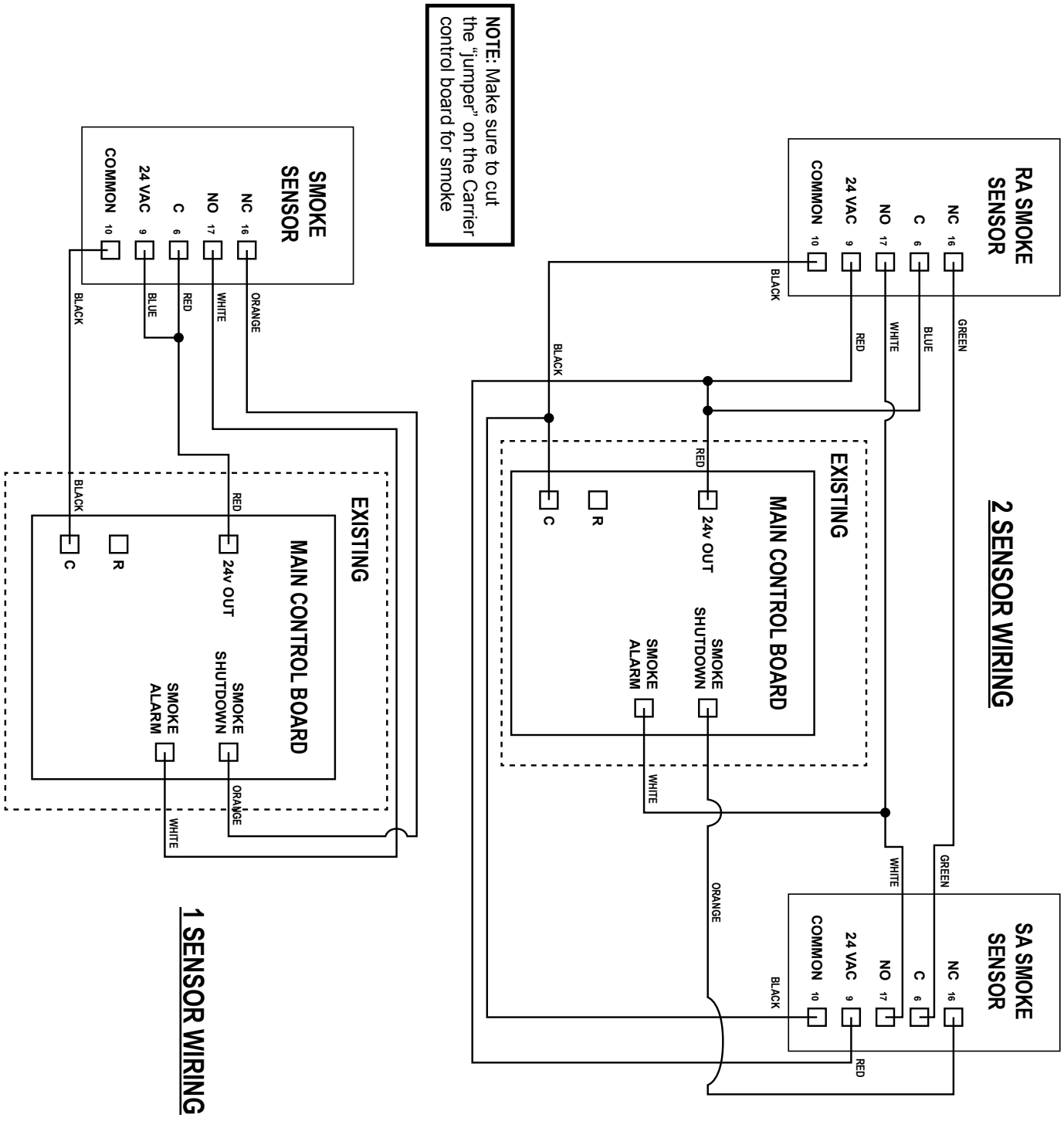
REVISION: V5.0.0.1



SMOKE SENSOR OPTION WIRING

SCH-0012-O

REVISION: V3-2.0.3

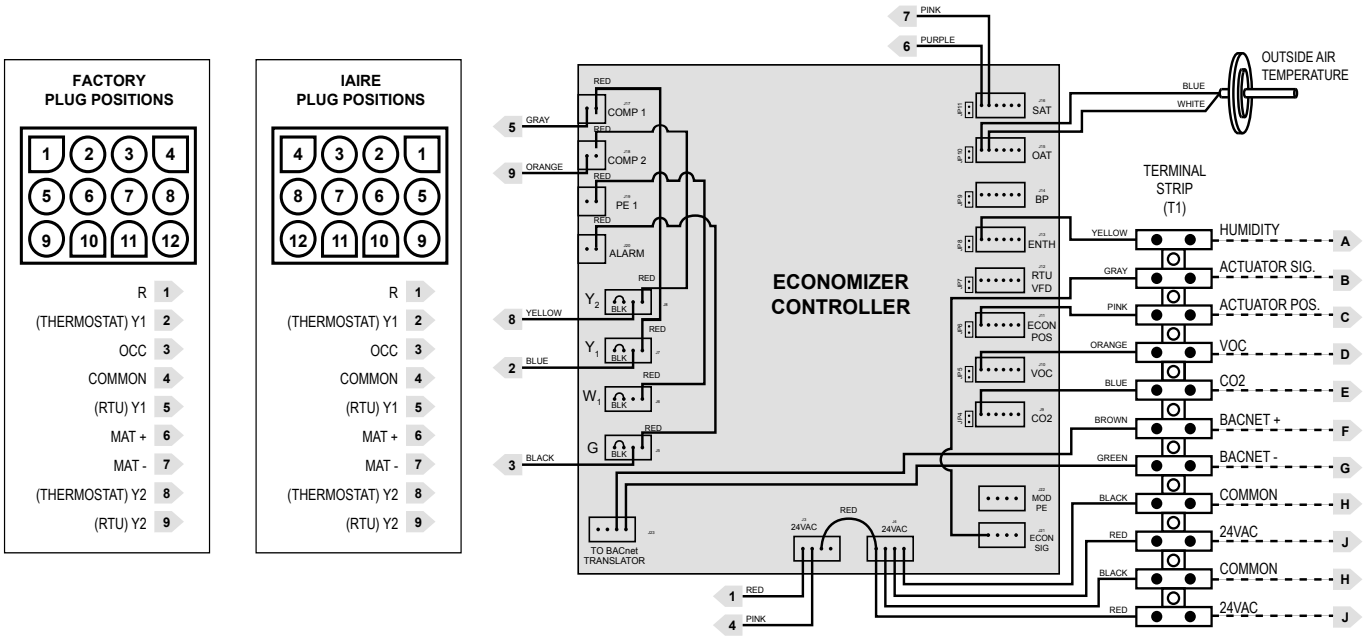


ECONOMIZER WIRING DIAGRAM (RTU ONLY)

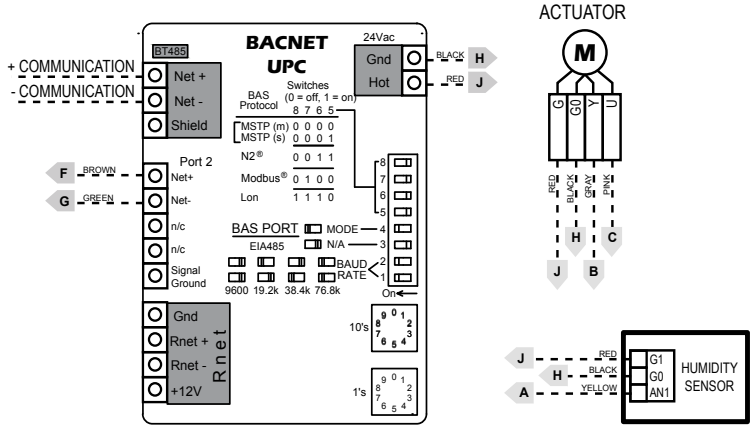
SCH-0013-O
Revision: V-5.0.0.1

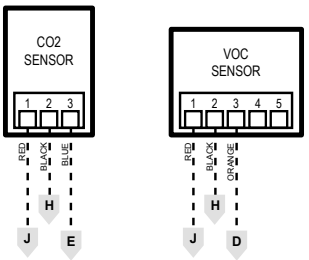
- - - - - - FIELD SUPPLIED WIRING

Note: All field wiring must be shielded cable or twisted pair with drain wire



OPTIONS

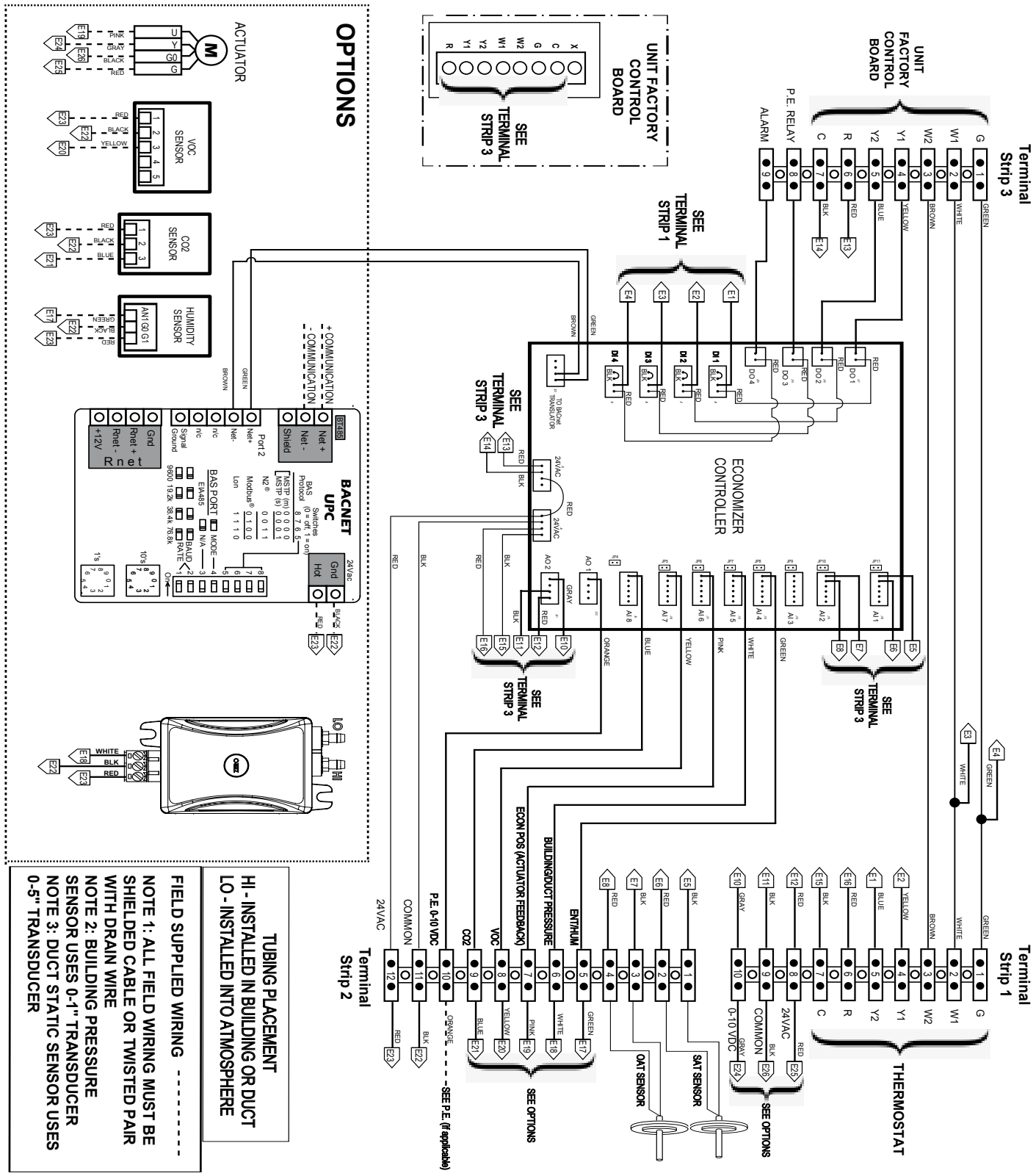




ECONOMIZER CONTROL SCHEMATIC

SCH-0014-O

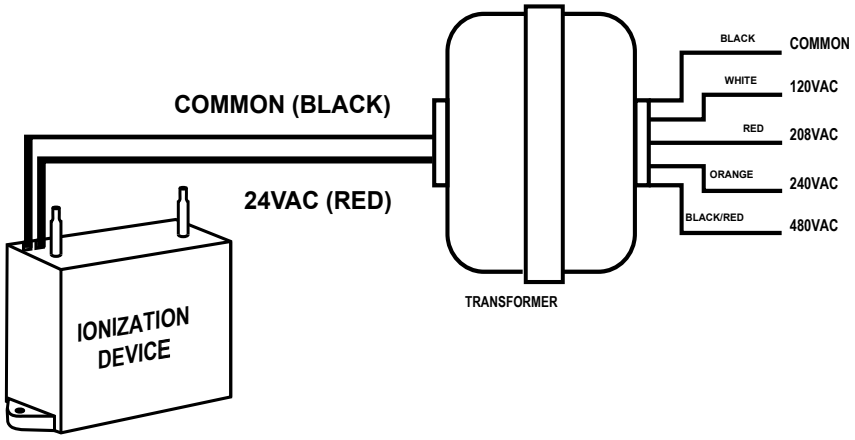
REVISION V-05.02



STANDALONE IONIZATION WIRING

SCH-0015-O

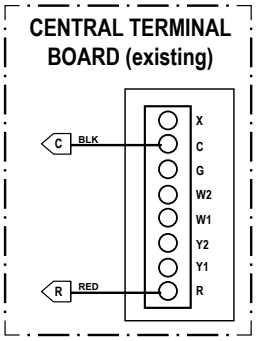
REVISION: V3-2.0.0



DUCT STATIC AND BUILDING PRESSURE - ULTRADRY OPTION

SCH-0017-O

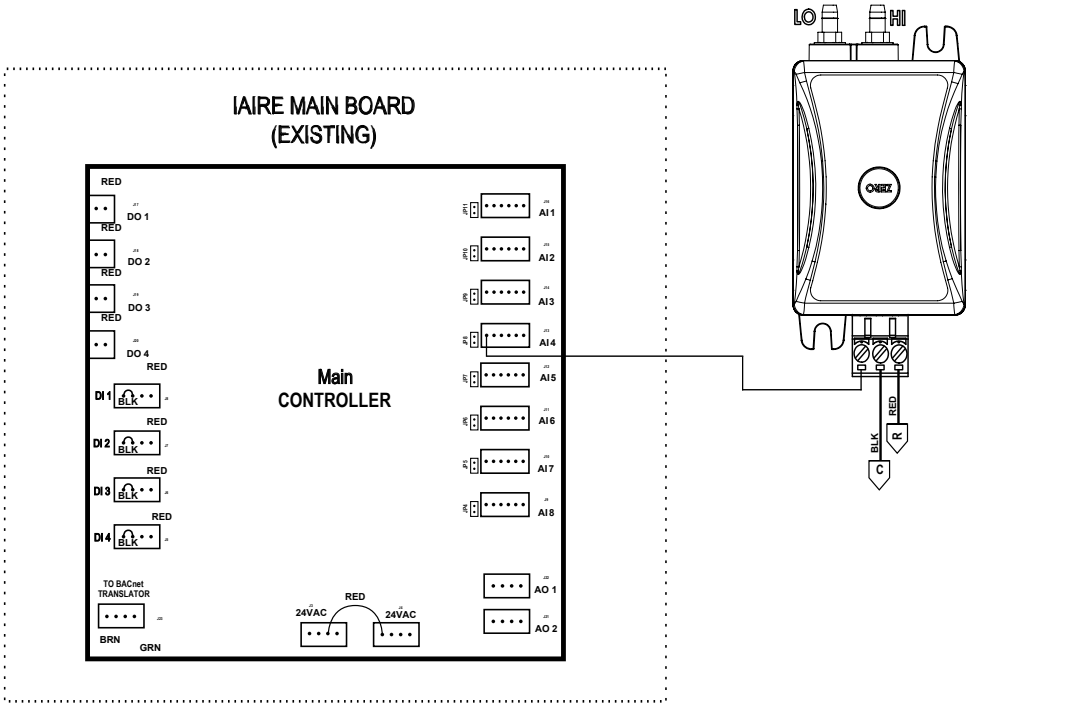
REVISION: V5.0.0.1



– – – –FIELD SUPPLIED WIRING

NOTE 1: ALL FIELD WIRING MUST BE SHIELDED CABLE OR TWISTED PAIR WITH DRAIN WIRE
NOTE 2: BUILDING PRESSURE SENSOR USES 0-1" TRANSDUCER
NOTE 3: DUCT STATIC SENSOR USES 0-5" TRANSDUCER

TUBING PLACEMENT
HI - INSTALLED IN BUILDING OR DUCT
LO - INSTALLED INTO ATMOSPHERE



High Heat Box Wiring

SCH-0022-O

REVISION: V5.0.0.2

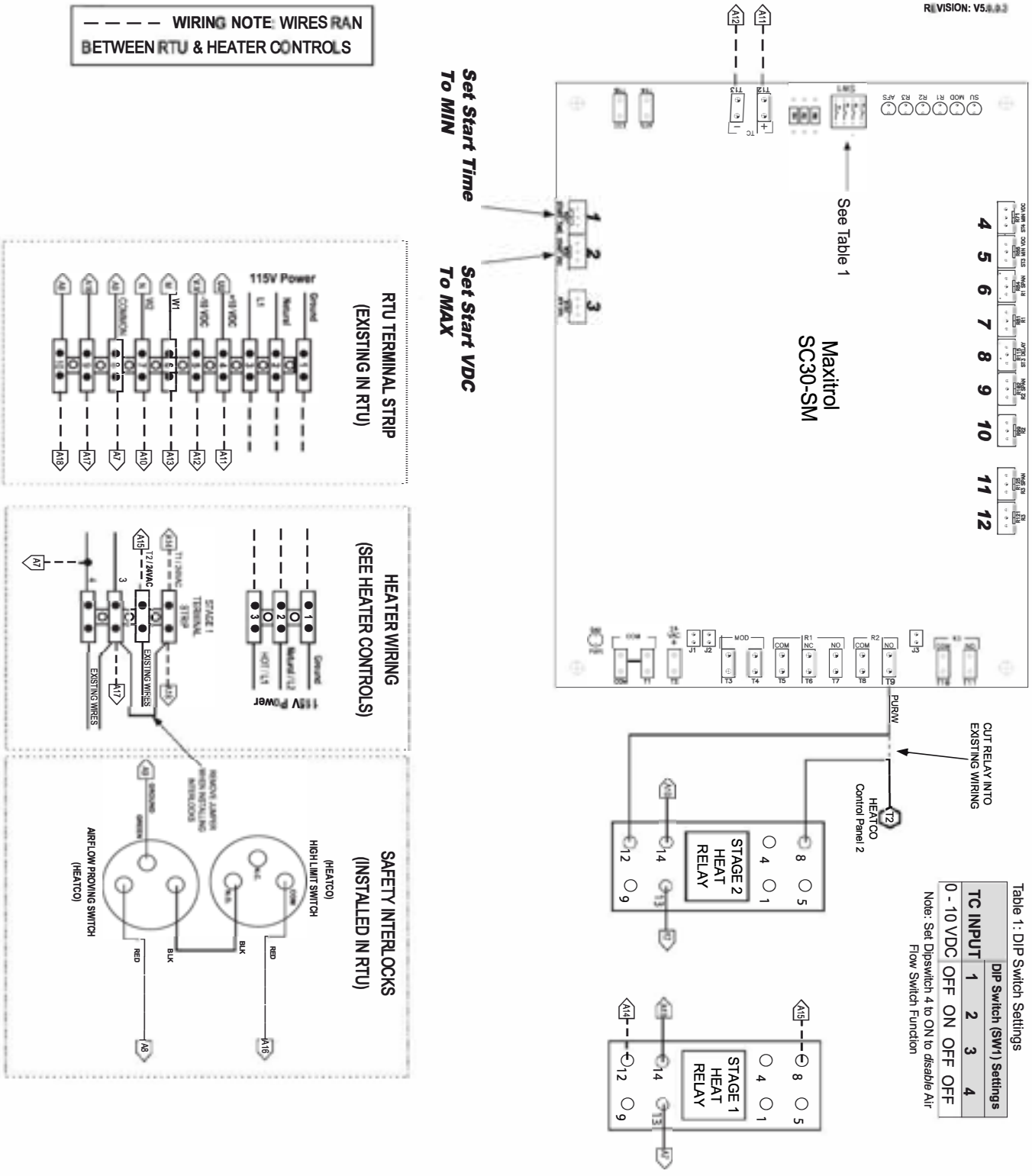


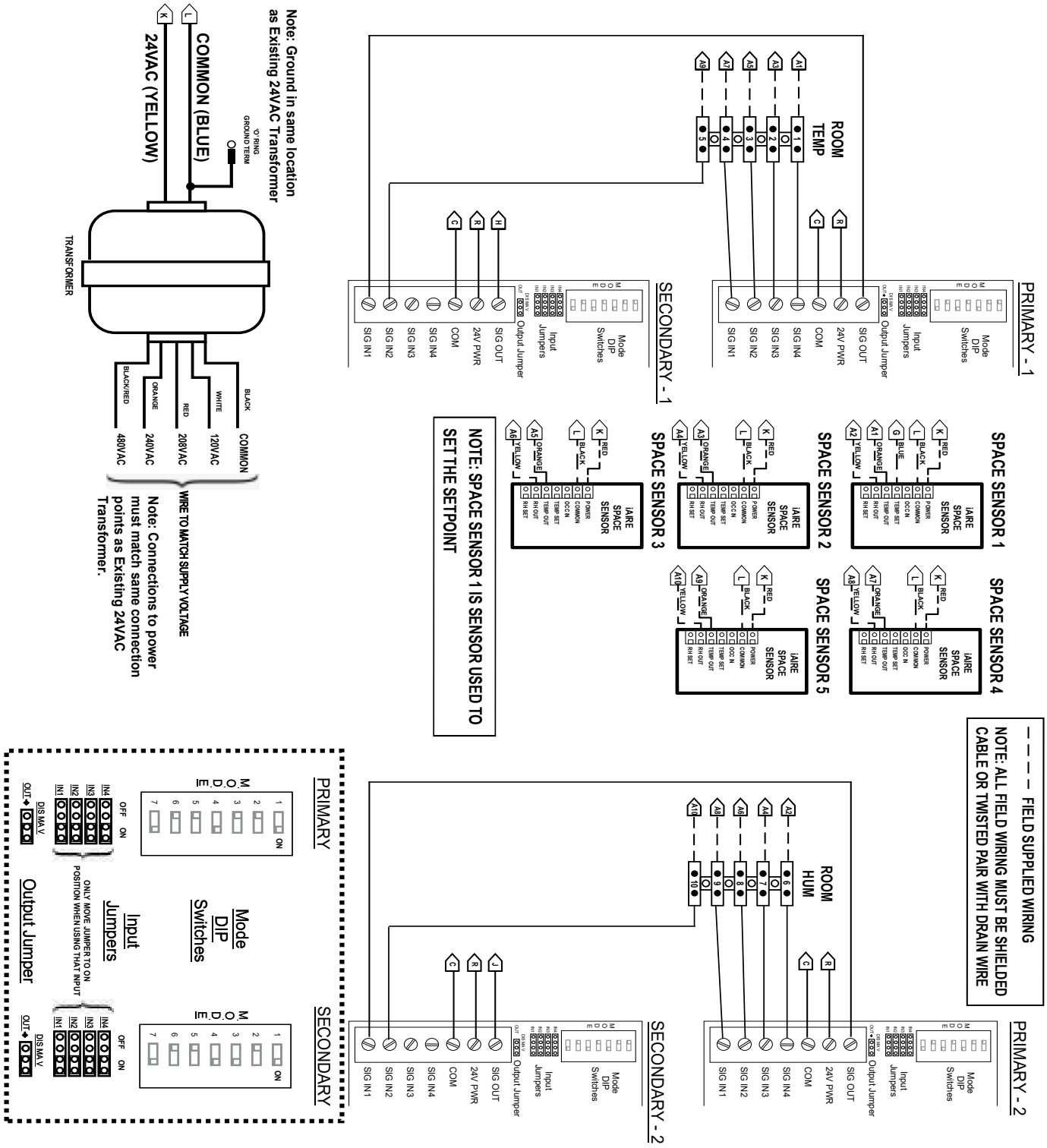
Table 1: DIP Switch Settings

TC INPUT	DIP Switch (SW1) Settings			
	1	2	3	4
0 - 10 VDC	OFF	ON	OFF	OFF

Note: Set Dipswitch 4 to ON to *disable* Air Flow Switch Function

Room Averaging Sensor Wiring - 5 Areas SCH-0023-O

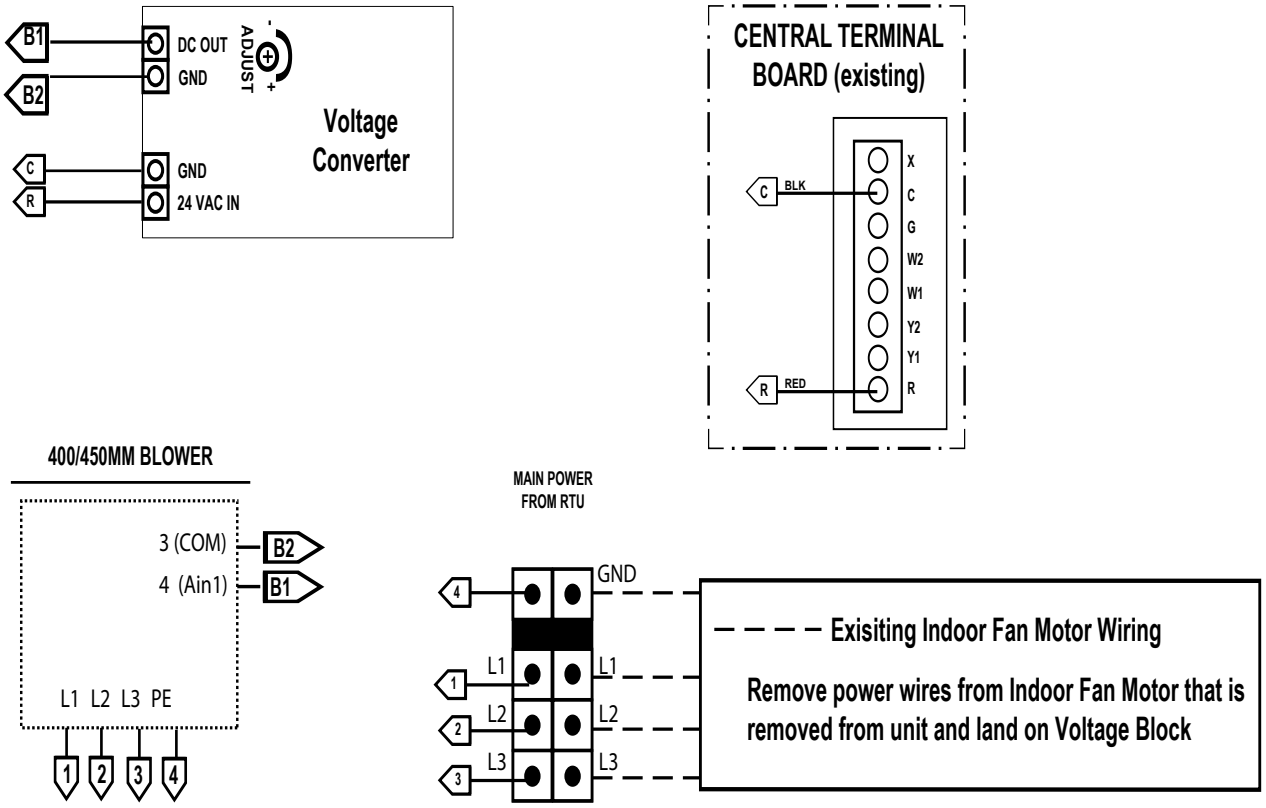
REVISION: V05.02



HIGH STATIC FAN INSTALL

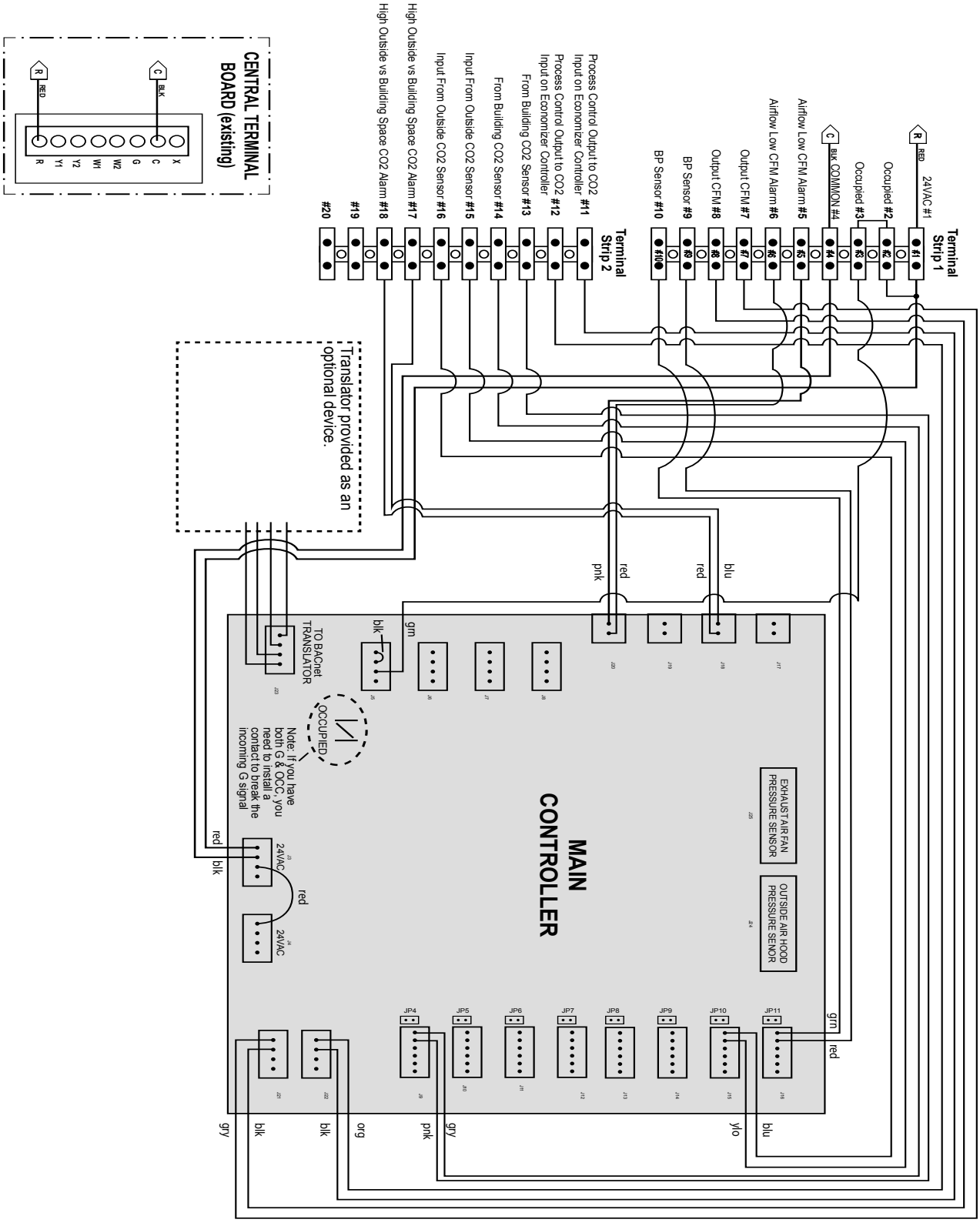
SCH-0024-O

REVISION: V5.0.0.1



AIRFLOW HOOD WIRING DIAGRAM

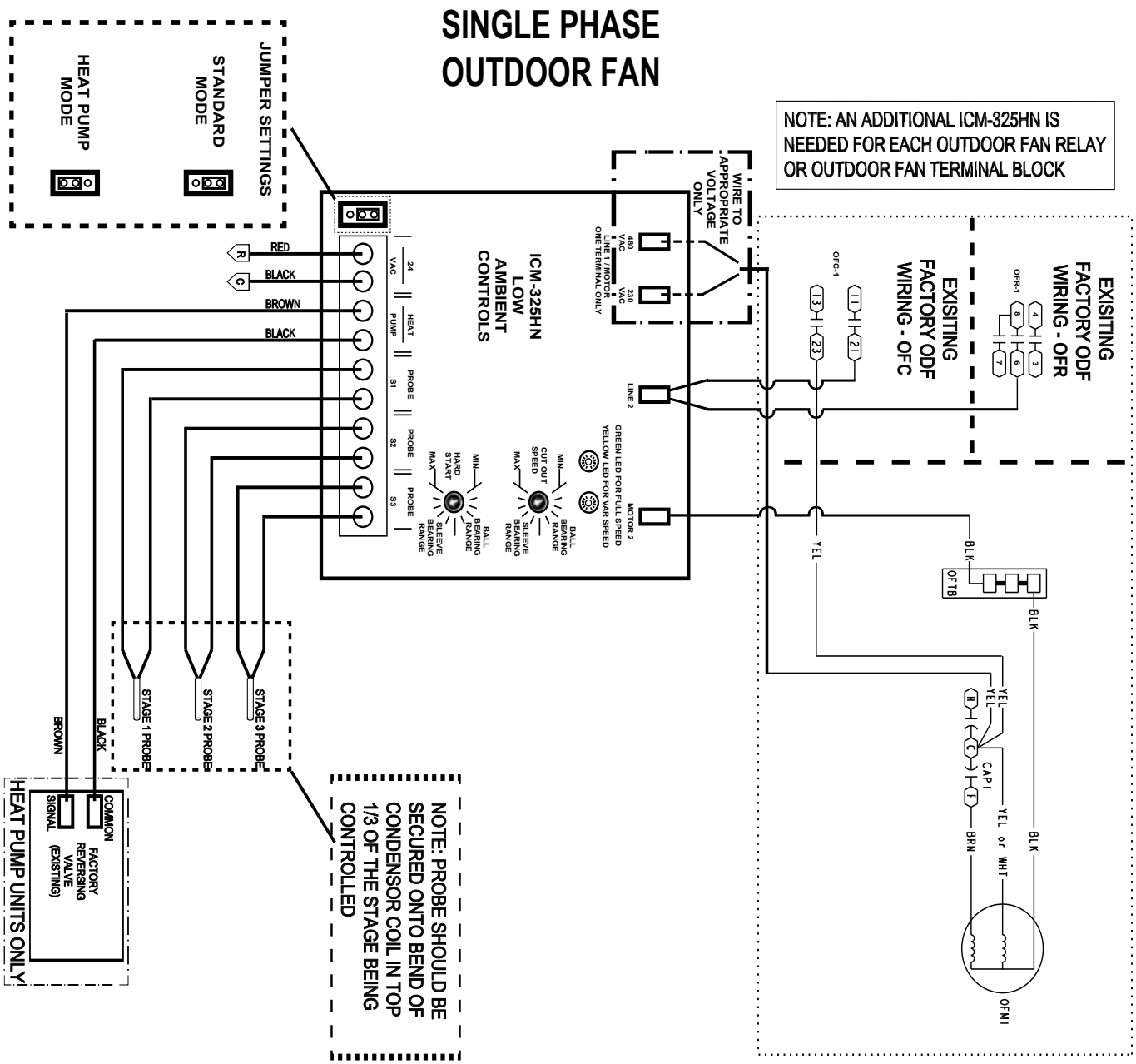
12/19/2013 v 1.2



LOW AMBIENT
SINGLE PHASE OUTDOOR FAN

SCH-0027-O

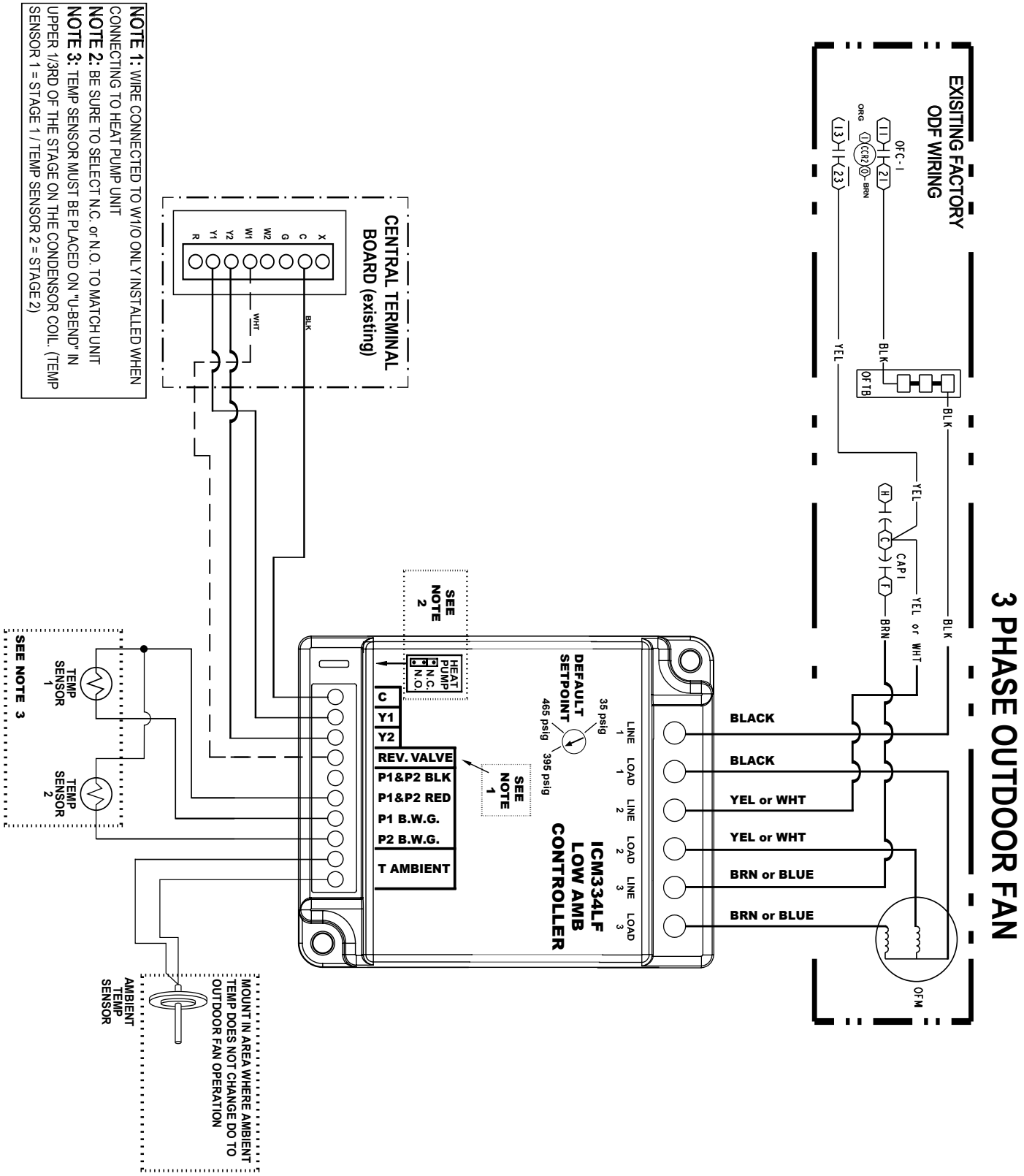
REVISION: V5.0.0.3



LOW AMBIENT - 3 PHASE FAN

SCH-0034-O

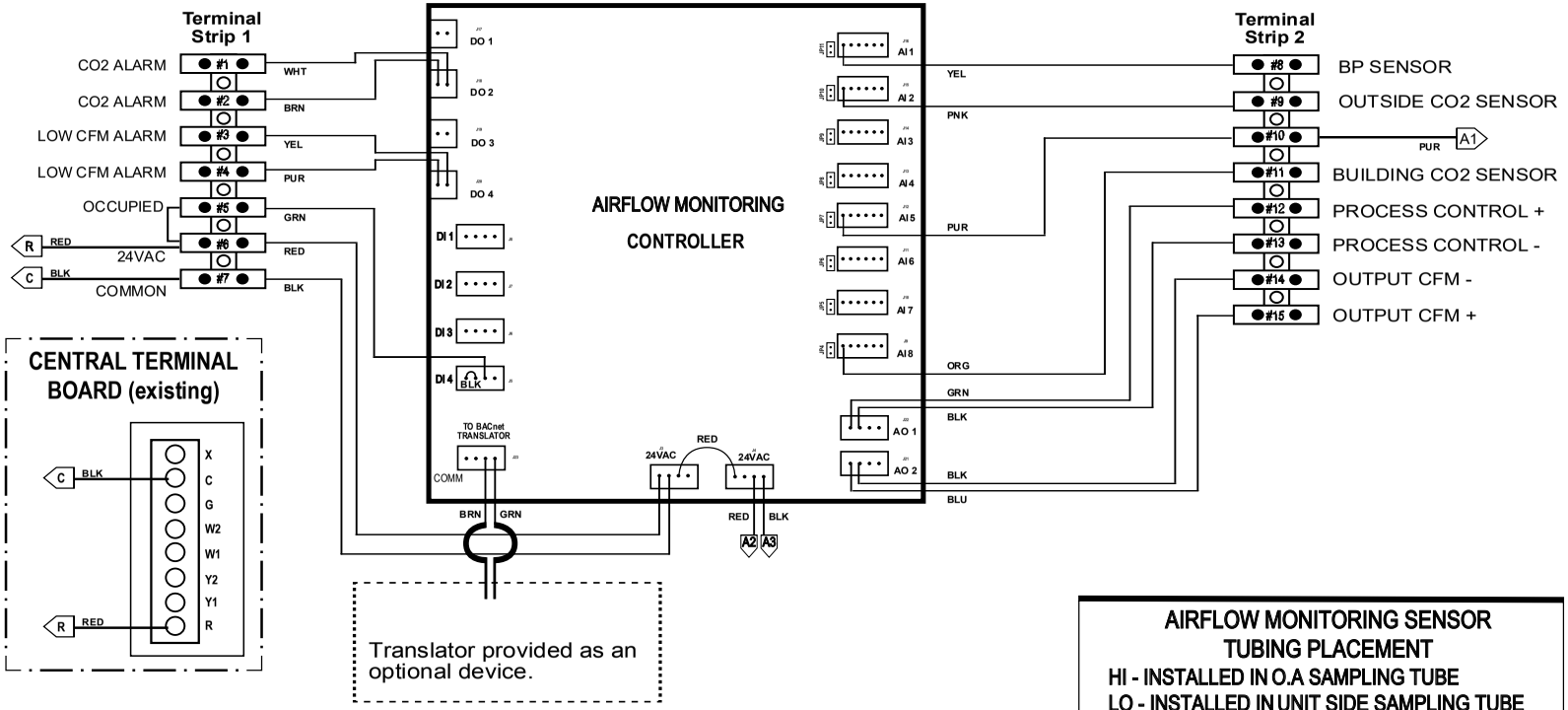
REVISION: V5.0.0.2



AIRFLOW MONITORING - NON BOARD MOUNT

SCH-0028-O

REVISION: V5.0.0.1



NOTES:

NOTE 1: Process Control Output Connects to CO2 Input on iAire Economizer Controller

NOTE 2: CO2 Alarm is based on High Outside C02 vs Building Space CO2

NOTE 3: All Field Wiring Must Be Shielded Cable or Twisted Pair with Drain Wire

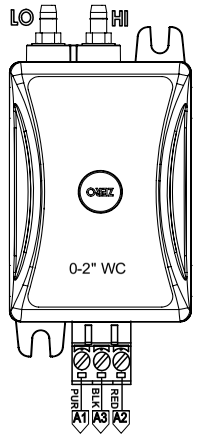
NOTE 4: If you have both G and OCC, you will need to install a contact to break the incoming G signal

NOTE 5: If supplying OCCUPIED Signal, Remove Jumper on Terminal Strip 1 locations #5 & #6

AIRFLOW MONITORING SENSOR TUBING PLACEMENT

HI - INSTALLED IN O.A SAMPLING TUBE

LO - INSTALLED IN UNIT SIDE SAMPLING TUBE



REFRIGERANT PIPING GUIDELINES

IMPORTANT: The information below is intended for general information on refrigerant piping only. Reference specific AHU and condensing units manuals for specific piping details.

The design of a refrigerant piping system should:

Ensure proper refrigerant feed to evaporators; Provide practical refrigerant line sizes without excessive pressure drop; Prevent excessive amounts of lubricating oil from being trapped in any part of the system; Protect the compressor at all times from loss of lubricating oil; Prevent liquid refrigerant or oil slugs from entering the compressor during operating and idle time; and Maintain a clean and dry system.

REFRIGERANT LINE VELOCITIES

Economics, pressure drop, noise, and oil entrapment establish feasible design velocities in refrigerant lines. These are:
Suction line - 700 to 4,000 fpm
Discharge line - 500 to 3,500 fpm
Condenser drain line - 100 fpm or less
Liquid line - 125 to 450 fpm

Minimum Discharge- Line Velocities		
Refrigerant Velocity, fpm		
Nominal Pipe Size, in.	Riser	Horizontal
7/8	375	285
1-1/8	430	325
1-3/8	480	360
1-5/8	520	390
2-1/8	600	450

Higher gas velocities are sometimes found in relatively short suction lines on comfort air conditioning or other applications where the operating time is only 2,000 to 4,000 hrs per year and where the low initial cost of the system may be more significant than low operating cost.

Industrial or commercial refrigeration applications, where equipment runs almost continuously, should be designed with low refrigerant velocities for the most efficient compressor performance and low equipment operating cost.

The liquid line from the condenser to the receivers should be sized for 100 fpm or less to ensure positive gravity flow without incurring a backup of liquid flow. Liquid lines from the receivers to the evaporator should be sized to maintain velocities below 300 fpm, thus minimizing or preventing liquid hammer when solenoids or other electrically operated valves are used.

LINE SIZING

In sizing refrigerant lines, cost considerations favor keeping the line size as small as possible. However, suction and discharge line pressure drops cause loss of compressor capacity and increased power usage.

Excessive liquid line pressure drops can cause the liquid refrigerant to flash, resulting in faulty expansion valve operation. Refrigeration systems are designed so that friction pressure losses do not exceed a pressure differential equivalent to a corresponding change in the saturation boiling temperature.

The primary measure for determining pressure drop is a change in saturation temperature. Pressure drop in a refrigerant line causes a reduction in system efficiency. Correct sizing must be based on minimizing cost and maximizing efficiency.

Pressure drop calculations are determined as normal pressure loss associated with a change in saturation temperature of the refrigerant. Typically, the refrigeration system will be sized for pressure losses of 2°F differential or less for each segment of the discharge, suction, and liquid lines. An HFC refrigerant liquid line is sized for pressure losses of 1° differential or less.

IMPORTANT: The information above is intended for general information on refrigerant piping only. Reference specific AHU and condensing units manuals for specific piping details.

TROUBLESHOOTING

1. The unit does not come on.
   a. Check to make sure there is power to the unit.
   b. Check to make sure the disconnect is on.
   c. Check to make sure the jumper between pins on terminal strip 1 is removed.
      i. If other wires are attached to pins, make sure there is not a short or the unit will not turn on. This is the location for remote start/stop.
   d. Check to make sure the circuit breaker or the 24V power supply is not tripped.

2. Fan speed is not correct.
   a. Go to the iAIRE controller and adjust the fan speed up or down as required.

3. The unit is tripping out on high heat and requires a manual reset.
   The air speed needs to be raised to prevent the heat from being too hot in the unit.

APPENDIX A (VFD)

Lenze
AC Tech

SMVector - Frequency Inverter
Operating Instructions

1 Safety Information

General

Some parts of Lenze AC Tech controllers can be electrically live and some surfaces can be hot. Non-authorized removal of the required cover, inappropriate use, and incorrect installation or operation creates the risk of severe injury to personnel and/or damage to equipment.

All operations concerning transport, installation, and commissioning as well as maintenance must be carried out by qualified, skilled personnel who are familiar with the installation, assembly, commissioning, and operation of variable frequency drives and the application for which it is being used.

Installation

Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport, handling, installation or maintenance. Do not touch any electronic components or contacts. This drive contains electrostatically sensitive components, which can easily be damaged by inappropriate handling. Static control precautions must be adhered to during installation, testing, servicing and repairing of this drive and associated options. Component damage may result if proper procedures are not followed.

To ensure proper operation, do not install the drive where it is subjected to adverse environmental conditions such as combustible, oily, or hazardous vapors; corrosive chemicals; excessive dust, moisture or vibration; direct sunlight or extreme temperatures.

This drive has been tested by Underwriters Laboratory (UL) and is UL Listed in compliance with the UL508C Safety Standard. This drive must be installed and configured in accordance with both national and international standards. Local codes and regulations take precedence over recommendations provided in this and other Lenze AC Tech documentation.

The SMVector drive is considered a component for integration into a machine or process. It is neither a machine nor a device ready for use in accordance with European directives (reference machinery directive and electromagnetic compatibility directive). It is the responsibility of the end user to ensure that the machine meets the applicable standards.

Electrical Connection

When working on live drive controllers, applicable national safety regulations must be observed. The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, protective earth [PE] connection). While this document does make recommendations in regards to these items, national and local codes must be adhered to.

The documentation contains information about installation in compliance with EMC (shielding, grounding, filters and cables). These notes must also be observed for CE-marked controllers. The manufacturer of the system or machine is responsible for compliance with the required limit values demanded by EMC legislation.

Application

The drive must not be used as a safety device for machines where there is a risk of personal injury or material damage. Emergency Stops, over-speed protection, acceleration and deceleration limits, etc must be made by other devices to ensure operation under all conditions.

The drive does feature many protection devices that work to protect the drive and the driven equipment by generating a fault and shutting the drive and motor down. Mains power variances can also result in shutdown of the drive. When the fault condition disappears or is cleared, the drive can be configured to automatically restart, it is the responsibility of the user, OEM and/or integrator to ensure that the drive is configured for safe operation.

Safety Information

Explosion Proof Applications

Explosion proof motors that are not rated for inverter use lose their certification when used for variable speed. Due to the many areas of liability that may be encountered when dealing with these applications, the following statement of policy applies:

Lenze AC Tech Corporation inverter products are sold with no warranty of fitness for a particular purpose or warranty of suitability for use with explosion proof motors. Lenze AC Tech Corporation accepts no responsibility for any direct, incidental or consequential loss, cost or damage that may arise through the use of AC inverter products in these applications. The purchaser expressly agrees to assume all risk of any loss, cost or damage that may arise from such application.

Operation

Systems including controllers must be equipped with additional monitoring and protection devices according to the corresponding standards (e.g. technical equipment, regulations for prevention of accidents, etc.). The controller may be adapted to your application as described in this documentation.

DANGER!

- After the controller has been disconnected from the supply voltage, live components and power connection must not be touched immediately, since capacitors could be charged. Please observe the corresponding notes on the controller.
- Close all protective covers and doors prior to and during operation.
- Do not cycle input power to the controller more than once every two minutes.
- For SMVector models that are equipped with a Disconnect Switch (11th character in model number is L or M), the Disconnect Switch is intended as a motor service disconnect and does not provide branch circuit protection to the inverter or motor. When servicing the motor, it is necessary to wait 3 minutes after turning this switch to the off position before working on motor power wiring as the inverter stores electrical power. To service the inverter, it is necessary to remove mains ahead of the drive and wait 3 minutes.

Safety Notifications

All safety information given in these Operating Instructions includes a visual icon, a bold signal word and a description.

Signal Word! (characterizes the severity of the danger)

NOTE (describes the danger and informs on how to proceed)

Icon	Signal Word	Meaning	Consequences if ignored
	DANGER!	Warns of hazardous electrical voltage.	Death or severe injuries.
	WARNING!	Warns of potential, very hazardous situations.	Risk of severe injury to personnel and/or damage to equipment.
	WARNING! Hot Surface	Warns of hot surface and risk of burns. Labels may be on or inside the equipment to alert people that surfaces may reach dangerous temperatures.	Risk of severe injury to personnel.
STOP	**STOP!**	Warns of potential damage to material and equipment.	Damage to the controller/drive or its environment.
	NOTE	Designates a general, useful note.	None. If observed, then using the controller/ drive system is made easier.

Safety Information

Harmonics Notification in accordance with EN 61000-3-2, EN 61000-3-12:

Operation in public supply networks (Limitation of harmonic currents i.a.w. EN 61000-3-2, Electromagnetic Compatibility (EMC) Limits). Limits for harmonic current emissions (equipment input current up to 16A/phase).

Directive	Total Power connected to Mains (public supply)	Additional Measures Required for Compliance (2)
EN 61000-3-2	< 0.5kW	with mains choke
	0.5 ... 1kW	with active filter
	> 1kW	complies without additional measures
EN 61000-3-12	16 ... 75amp	Additional measures are required for compliance with the standard

(1) For compliance with EMC regulations, the permissable cable lengths may change.

(2) The additional measures described only ensure that the controller meets the requirements of the EN 61000-3-2. The machine/system manufacturer is responsible for the machine's compliance with the regulations.

Safety Information in accordance with EN 61800-5-1:

DANGER! Hazard of Electrical Shock
Capacitors retain charge for approximately 180 seconds after power is removed. Allow at least 3 minutes for discharge of residual charge before touching the drive.

WARNING!
- This product can cause a d.c. current in the PE conductor. Where a residual current-operated (RCD) or monitoring (RCM) device is used for protection in case of direct or indirect contact, only an RCD or RCM Type B is allowed on the supply side of this product.
- Leakage Current may exceed 3.5mA AC. The minimum size of the PE conductor shall comply with local safety regulations for high leakage current equipment.
- In a domestic environment, this product may cause radio interference in which case supplementary mitigation measures may be required.

NOTE
Control and communications terminals provide **reinforced insulation** (i.e. considered SELV or PELV, providing protection in case of direct contact) when the drive is connected to a power system rated up to 300VAC between phase to ground (PE) and the applied voltage on Terminals 16 and 17 is less than 150VAC between phase to ground. Otherwise, control and communications terminals provide **basic insulation**.

Safety Information in accordance with UL:

Note for UL approved system with integrated controllers: UL warnings are notes which apply to UL systems. The documentation contains special information about UL.

c UL us
Warnings!

- Suitable for use on a circuit capable of delivering not more than 200,000 rms symmetrical amperes, at the maximum voltage rating marked on the drive.
- Use minimum 75 °C copper wire only.
- Shall be installed in a pollution degree 2 macro-environment.
- NEMA 1 (IP31) models shall be installed in a pollution degree 2 macro-environment.
- All models are suitable for installation in a compartment handling Conditioned Air (i.e., plenum rated).

Torque Requirements (in accordance with UL) are listed in section 3.2.1, Power Connections.

2 Technical Data

2.1 Standards and Application Conditions

Conformity	CE	Low Voltage (2006/95/EC) & EMC (2004/108/EC) Directives
Approvals	UL508C	Underwriters Laboratories -Power Conversion Equipment
Input voltage phase imbalance	≤ 2%	
Supported Power Systems	TT TN	– For central grounded systems, operation is permitted without restrictions. – For corner grounded 400/500V systems, operation is possible but reinforced insulation to control circuits is compromised.
Humidity	≤ 95% non-condensing	
Temperature range	Transport	-25 … +70°C
	Storage	-20 … +70°C
	Operation	-10 … +55°C (with 2.5%/°C current derating above +40°C)
Installation height	0 - 4000m a.m.s.l.	(with 5%/1000 m current derating above 1000m a.m.s.l.)
Vibration resistance	acceleration resistant up to 1.0g	
⚠ **Earth leakage current**	> 3.5 mA to PE	
Max Permissable Cable Length (1)	<= 4.0 Hp (3.0 kW)	30 meters shielded, 60 meters un-shielded
	=> 5.0 Hp (3.7 kW)	50 meters shielded, 100 meters un-shielded.
Enclosure	IP31/NEMA 1	IP65/NEMA 4X
	NEMA 1 and NEMA 4X model enclosures are plenun rated in accordance with UL 508C and are suitable for installation in a compartment handling conditioned air.	
Protection measures against	short circuit, earth fault, phase loss, over voltage, under voltage, motor stalling, over temperature, motor overload	
Compliance with EN 61000-3-2 Requirements (2)	< 0.5kW	with mains choke
	0.5 ... 1kW	with active filter
	> 1kW	without additional measures
Compliance with EN 61000-3-12 Requirements (2)	16 ... 75amp	Additional measures required for compliance with EN 61000-3-12

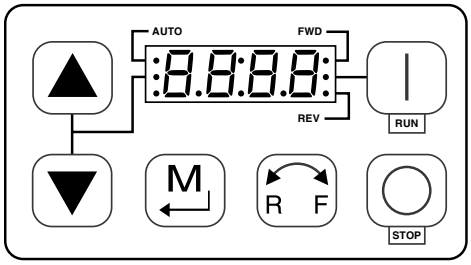
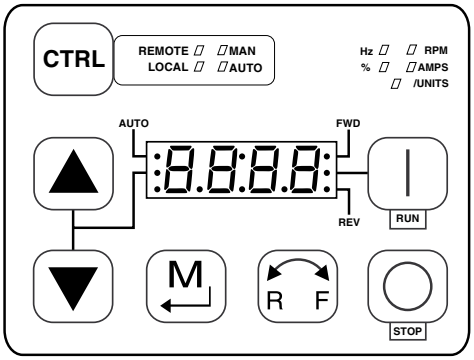
Operation in public supply networks (Limitation of harmonic currents i.a.w. EN 61000-3-2, Electromagnetic Compatibility (EMC) Limits). Limits for harmonic current emissions (equipment input current up to 16A/phase).

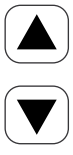
(1) The stated cable lengths are permissible at default carrier frequencies (refer to parameter P166).

(2) The additional measures described only ensure that the controller meets the requirements of the EN 61000-3-2. The machine/system manufacturer is responsible for the machine's compliance with the regulations.

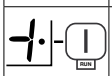
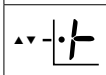
4 Commissioning

4.1 Local Keypad & Display

SMV Models: 0.33-10HP (0.25-7.5kW)	SMV Models: 15HP (11kW) and greater
	
4-Character Display	4-Character plus CTRL Display

Display	START BUTTON
	In Local Mode (P100 = 0, 4, 6), this button will start the drive.
	STOP BUTTON
	Stops the drive, regardless of which mode the drive is in. ⚠ **WARNING!** When JOG is active, the STOP button will not stop the drive!
	ROTATION
	In Local Mode (P100 = 0, 4, 6), this selects the motor rotation direction: - The LED for the present rotation direction (FWD or REV) will be on - Press R/F; the LED for the opposite rotation direction will blink - Press M within 4 seconds to confirm the change - The blinking direction LED will turn on, and the other LED will turn off When rotation direction is changed while the drive is running, the commanded direction LED will blink until the drive is controlling the motor in the selected direction. Rotation is set in P112. When P112 = 0, rotation is forward only. When P112 = 1 rotation is forward and reverse.
	MODE
	Used to enter/exit the Parameter Menu when programming the drive and to enter a changed parameter value.
	UP AND DOWN BUTTONS
	Used for programming and can also be used as a reference for speed, PID setpoint, or torque setpoint. When the ▲ and ▼ buttons are the active reference, the middle LED on the left side of the display will be on.

Commissioning

Display	INDICATING LEDs (on 4-character display)
	FWD LED: Indicate the present rotation direction is forward. Refer to ROTATION description above.
	REV LED: Indicate the present rotation direction is reverse. Refer to ROTATION description above.
	AUTO LED: Indicates that the drive has been put into Auto mode from one of the TB13 inputs (P121…P124 set to 1…7). Indicates that PID mode is active (if PID mode is enabled). Indicates that sequencer mode is active (if sequencer mode is enabled).
	RUN LED: Indicates that the drive is running.
	▲ ▼ LED: Indicates that the ▲ ▼ are the active reference.
	NOTE If the keypad is selected as the auto reference (P121…P124 is 6) and the corresponding TB-13 input is closed, the AUTO LED and ▲ ▼ LEDs will both be on.
	FUNCTIONS THAT FOLLOW ARE APPLICABLE TO SMV DRIVES 15HP (11kW) AND HIGHER
CTRL	**CTRL** The CTRL pushbutton selects the start and speed reference control sources for the drive. Press [M] mode button to accept the new control mode selection.

CTRL LEDs		START CONTROL	REFERENCE CONTROL
REMOTE ☐ ■ MAN LOCAL ■ ☐ AUTO	[LOCAL] [MAN]	Keypad	P101 Settings
REMOTE ☐ ☐ MAN LOCAL ■ ■ AUTO	[LOCAL] [AUTO]	Keypad	Terminal 13x Settings
REMOTE ■ ■ MAN LOCAL ☐ ☐ AUTO	[REMOTE] [MAN]	Terminal Strip	P101 Settings
REMOTE ■ ☐ MAN LOCAL ☐ ■ AUTO	[REMOTE] [AUTO]	Terminal Strip	Terminal 13x Settings
If P100 = 6 the CTRL button is used to toggle start control between the terminal strip [REMOTE] and the keypad [LOCAL]		- REM/LOC LED indicating the present start control source is ON - Press [CTRL]; the LED for other start control source will blink - Press [M] within 4 sec to confirm the change - Blinking LED will turn ON (the other LED will turn OFF)	
If P113 = 1 the CTRL button is used to toggle reference control between the TB-13x setup [AUTO] and P101 [MANUAL]		- AUT/MAN LED indicating present reference control is ON - Press [CTRL]; the other reference control will blink - Press [M] within 4 sec to confirm change - Blinking LED will turn ON (the other LED will turn OFF)	
If P100 = 6 and P113 = 1, it is possible to change the start and reference control sources at the same time			

Display	START CONTROL	
	The REMOTE/LOCAL LEDs indicate the current start control source. If the start control source is a remote keypad or the network, then both LEDs will be OFF.	
	REFERENCE CONTROL	
	The AUTO/MANUAL LEDs indicate the current reference control source.	
	IF P113 = 0 or 2, the AUTO/MANUAL LEDs will match the AUTO LED on the 4-character display. IF P113 = 0 and no AUTO reference has been setup on the terminal strip, the MANUAL LED will turn ON and the AUTO LED will turn OFF.	
	IF P113 = 1, the AUTO/MANUAL LEDS show the commanded reference control source as selected by the [CTRL] button. If the [CTRL] button is used to set the reference control source to AUTO but no AUTO reference has been setup on the terminal strip, reference control will follow P101 but the AUTO LED will remain ON.	
	UNITS LEDs	
	HZ: current display value is in Hz	In Speed mode, if P178 = 0 then HZ LED will be ON. If P178 > 0, the Units LEDs follow the setting of P177 when the drive is in run (non-programming) mode. In Torque mode, the HZ LED will be ON when the drive is in run (non-programming) mode. In Pid mode, the Units LEDs follow the setting of P203 when the drive is in run (non-programming) mode. If P179 > 0, the Units LEDs will show the unit of the diagnostic parameter that is being displayed.
	%: current display value is in %	
	RPM: current display value is in RPM	
	AMPS: current display value is in Amps	
	/UNITS current display value is a per unit (i.e./sec, /min, /hr, etc.)	

4.2 Drive Display and Modes of Operation

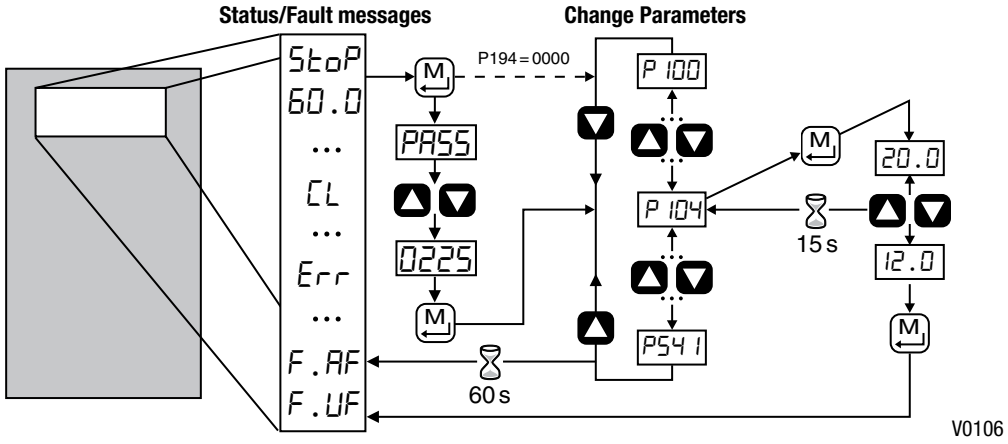
Speed Mode Display
In the standard mode of operation, the drive frequency output is set directly by the selected reference (keypad, analog reference, etc.). In this mode, the drive display will show the drive's output frequency.

PID Mode Display
When the PID mode is enabled and active, the normal run display shows the actual PID setpoint. When PID mode is not active, the display returns to showing the drive's output frequency.

Torque Mode Display
When the drive is operating in Vector Torque mode, the normal run display shows the drive's output frequency.

Alternate (Run-Screen) Display
When P179 (Run Screen Display) is set to a value other than 0, one of the diagnostic parameters (P501…P599) is displayed. Example: if P179 is set to 1, then diagnostic parameter P501 (Software version) is displayed. If P179 =2, then P502 (Drive ID) is displayed.

4.3 Parameter Setting



4.4 Electronic Programming Module (EPM)

The EPM contains the drives operational memory. Parameter settings are stored in the EPM and setting changes are made to the “User settings” in the EPM.

An optional EPM Programmer (model EEPM1RA) is available that allows:

- An EPM to be copied directly to another EPM.
- An EPM to be copied to the memory of the EPM Programmer.
- Stored files can be modified in the EPM Programmer.
- Stored files can be copied to another EPM.

EPM Module
in SMV Drive

As the EPM Programmer is battery operated, parameter settings can be copied to an EPM and inserted into a drive without power being applied to the drive. This means that the drive will be fully operational with the new settings on the next application of power.

Additionally, when the drives parameter settings are burned into an EPM with the EPM Programmer, the settings are saved in two distinct locations; the “User settings” and the “OEM default settings”. While the User settings can be modified in the drive, the OEM settings cannot. Thus, the drive can be reset not only to the “factory” drive default settings (shown in this manual), but can be set to the Original Machine settings as programmed by the OEM.

The user area contents of the EPM are what are copied into the OEM space by the EPM programmer. When parameter modifications are made to the drive and then a copy made via the EPM Programmer, these are the settings that will be available by the OEM selections from P199. The EPM Programmer is the only way to load the OEM area of the EPM.

While the EPM can be removed for copying or to use in another drive, it must be installed for the drive to operate (a missing EPM will trigger an F_F I fault)

5 Troubleshooting and Diagnostics

5.1 Status/Warning Messages

Status / Warning		Cause	Remedy
br	DC-injection brake active	DC-injection brake activated • activation of digital input (P121...P124 = 18) • automatically (P110 = 2, 4...6) • automatically (P111 = 1, 3)	Deactivate DC-injection brake • deactivate digital input • automatically after P175 time has expired
bF	Drive ID warning	The Drive ID (P502) stored on the EPM does not match the drive model.	• Verify motor data (P302…P306) and perform Auto Calibration. • Set drive mode (P300) to 0 or 1 • Reset the drive (P199 to 3 or 4) and reprogram.
CAL	Motor Auto-calibration active	Refer to P300, P399	Motor Auto-calibration is being performed
cE	An EPM that contains valid data from a previous software version has been installed	An attempt was made to change parameter settings	Parameter settings can only be changed after the EPM data is converted to the current version (P199 = 5)
CL	Current Limit (P171) reached	Motor overload	• Increase P171 • Verify drive/motor are proper size for application
dEC	Decel Override	The drive has stopped decelerating to avoid tripping into *HF* fault, due to excessive motor regen (2 sec max).	If drive trips into *HF* fault: • Increase P105, P126 • Install Dynamic Braking option
Err	Error	Invalid data was entered, or an invalid command was attempted	
FCL	Fast Current Limit	Overload	Verify drive/motor are proper size for application
FSt	Flying Restart Attempt after Fault	P110 = 5,6	
OE	OEM Settings Operation warning	An attempt was made to change parameter settings while the drive is operating in OEM Settings mode.	In OEM Settings mode (P199 = 1), making changes to parameters is not permitted.
OF	OEM Defaults data warning	An attempt was made to use (or reset to) the OEM default settings (P199 = 1 or 2) using an EPM without valid OEM data.	Install an EPM containing valid OEM Defaults data
LC	Fault Lockout	The drive attempted 5 restarts after a fault but all attempts were unsuccessful (P110 = 3...6)	• Drive requires manual reset • Check Fault History (P500) and correct fault condition
PdEC	PID Deceleration Status	PID setpoint has finished its ramp but the drive is still decelerating to a stop.	
PId	PID Mode Active	Drive has been put into PID Mode.	Refer to P200
SLP	Sleep Mode is active	Refer to P240...P242	
SP	Start Pending	The drive has tripped into a fault and will automatically restart (P110 = 3...6)	To disable Auto-Restart, set P110 = 0...2
SPd	PID Mode disabled.	Drive has been taken out of PID Mode. Refer to P200.	
StoP	Output frequency = 0 Hz (outputs U, V, W inhibited)	Stop has been commanded from the keypad, terminal strip, or network	Apply Start command (Start Control source depends on P100)

(1) The drive can only be restarted if the error message has been reset.

5.2 Drive Configuration Messages

When the Mode button is pressed and held, the drive's display will provide a 4-digit code that indicates how the drive is configured. If the drive is in a Stop state when this is done, the display will also indicate which control source commanded the drive to Stop (the two displays will alternate every second).

Configuration Display			
Format = x.y.zz	**x = Control Source:** L = Local Keypad t = Terminal Strip r = Remote Keypad n = Network	**y = Mode:** S = Speed mode P = PID mode t = Torque mode C = Sequencer mode	**zz = Reference:** CP = Keypad ▲ ▼ EU = 0-10 VDC (TB-5) E I = 4-20 mA (TB-25) JG = Jog nt = Network OP = MOP P 1 ... P7 = Preset 1...7 0 1 ... 16 = Sequencer Segment
	Example: L_S_CP = Local Keypad Start control, Speed mode, Keypad speed reference t_P_EU = Terminal Strip Start control, PID mode, 0-10 VDC setpoint reference t_C_ 12 = Terminal Strip Start control, Sequencer Operation (Speed mode), Segment #12 n_t_P2 = Network Start control, Vector Torque mode, Preset Torque #2 reference n_S_03 = Network Start control, Speed mode, Speed reference from Sequencer segment #03		
Stop Source Display			
Format = x_StP	L_StP = Stop command came from Local Keypad t_StP = Stop command came from Terminal Strip r_StP = Stop command came from Remote Keypad n_StP = Stop command came from Network		

5.3 Fault Messages

The messages below show how they will appear on the display when the drive trips. When looking at the Fault History (P500), the F_ will not appear in the fault message.

Fault		Cause	Remedy (1)
F_AF	High Temperature fault	Drive is too hot inside	• Reduce drive load • Improve cooling
F_AL	Assertion Level fault	• Assertion Level switch is changed during operation • P120 is changed during operation • P100 or P121...P124 are set to a value other than 0 and P120 does not match the Assertion Level Switch.	• Make sure the Assertion Level switch and P120 are both set for the type of input devices being used, prior to setting P100 or P121...P124. Refer to 3.2.3 and P120.
F_bF	Personality fault	Drive Hardware	• Cycle Power • Power down and install EPM with valid data • Reset the drive back to defaults (P199 = 3, 4) and then re-program • If problem persists, contact factory technical support
F_CF	Control fault	An EPM has been installed that is either blank or corrupted	
F_cF	Incompatible EPM fault	An EPM has been installed that contains data from an incompatible parameter version	
F_cFt	Forced Translation fault	An EPM from an old drive put in new drive causes drive to trip F_cFT fault.	Press [M] (mode button) twice to reset

Troubleshooting and Diagnostics

Fault		Cause	Remedy (1)
F_dbF	Dynamic Braking fault	Dynamic braking resistors are overheating	• Increase active decel time (P105, P126, P127). • Check mains voltage and P107
F_EF	External fault	• P121…P124 = 21 and that digital input has been opened. • P121…P124 = 22 and that digital input has been closed.	• Correct the external fault condition • Make sure digital input is set properly for NC or NO circuit
F_F 1	EPM fault	EPM missing or defective	Power down and replace EPM
F_F2 ... F_F 12	Internal faults		Contact factory technical support
F_Fnr	Control Configuration Fault	The drive is setup for REMOTE KEYPAD control (P100=2 or 5) but is not setup to communicate with a remote keypad	Set P400 = 1, or P600 = 1
		The drive is setup for NETWORK ONLY control (P100=3) but is not setup for network communications	Set P400 or P600 to a valid network communications protocol selection
F_FoL	TB25 (4-20 mA signal) Threshold fault	4-20 mA signal (at TB-25) drops below the value set in P164.	• Check signal/signal wire • Refer to parameters P163 and P164.
F_GF	OEM Defaults data fault	Drive is powered up with P199 =1 and OEM settings in the EPM are not valid.	Install an EPM containing valid OEM Defaults data or change P199 to 0.
F_HF	High DC Bus Voltage fault	Mains voltage is too high	Check mains voltage and P107
		Decel time is too short, or too much regen from motor	Increase active decel time (P105, P126, P127) or install Dynamic Braking option
F_ IL	Digital Input Configuration fault (P121... P124)	More than one digital input set for the same function	Each setting can only be used once (except settings 0 and 3)
		Only one digital input configured for MOP function (Up, Down)	One input must be set to MOP Up, another must be set to MOP Down
		PID mode is entered with setpoint reference and feedback source set to the same analog signal	Change PID setpoint reference (P121…P124) or feedback source (P201).
		One of the digital inputs (P121…P124) is set to 10 and another is set to 11…14.	Reconfigure digital inputs
		One of the digital inputs (P121…P124) is set to 11 or 12 and another is set to 13 or 14.	
		PID enabled in Vector Torque mode (P200 = 1 or 2 and P300 = 5)	PID cannot be used in Vector Torque mode
F_JF	Remote keypad fault	Remote keypad disconnected	Check remote keypad connections
F_LF	Low DC Bus Voltage fault	Mains voltage too low	Check mains voltage
F_n Id	No Motor ID fault	An attempt was made to start the drive in Vector or Enhanced V/Hz mode prior to performing the Motor Auto-calibration	Refer to parameters P300…P399 for Drive Mode setup and calibration.
F_nEF	Module communication fault	Communication failure between drive and Network Module.	Check module connections
F_nF 1 ... F_nF9	Network Faults	Refer to the module documentation. for Causes and Remedies.	

Troubleshooting and Diagnostics

Fault		Cause	Remedy (1)
F_OF	Output fault: Transistor fault	Output short circuit	Check motor/motor cable
		Acceleration time too short	Increase P104, P125
		Severe motor overload, due to: • Mechanical problem • Drive/motor too small for application	• Check machine / system • Verify drive/motor are proper size for application
		Boost values too high	Decrease P168, P169
		Excessive capacitive charging current of the motor cable	• Use shorter motor cables with lower charging current • Use low capacitance motor cables • Install reactor between motor and drive.
		Failed output transistor	Contact factory technical support
F_OF1	Output fault: Ground fault	Grounded motor phase	Check motor and motor cable
		Excessive capacitive charging current of the motor cable	Use shorter motor cables with lower charging current
F_PF	Motor Overload fault	Excessive motor load for too long	• Verify proper setting of P108 • Verify drive and motor are proper size for application
F_rF	Flying Restart fault	Controller was unable to synchronize with the motor during restart attempt; (P110 = 5 or 6)	Check motor / load
F_SF	Single-Phase fault	A mains phase has been lost	Check mains voltage
F_UF	Start fault	Start command was present when power was applied (P110 = 0 or 2).	• Must wait at least 2 seconds after power-up to apply Start command • Consider alternate starting method (P110).
F_FAU	TB5 (0-10V signal) Threshold fault	0-10V signal (at TB5) drops below the value set in P158.	• Check signal/signal wire • Refer to parameters P157 and P158

(1) The drive can only be restarted if the error message has been reset.

Variable Frequency Drive (VFD)
Factory–Installed Option
2–Speed Motor Control
for 2–Stage Cooling Rooftop Units

Carrier
turn to the experts

Installation, Setup & Troubleshooting Supplement

This document provides supplemental installation, setup and troubleshooting information for the Variable Frequency Drive (VFD) factory-installed option. It is to be used with the base unit Installation Instructions for 48/50TC, 50TCQ, 48/50HC, 50HCQ, and 40RU 2-Stage cooling units, sizes 07 – 30. Units equipped with the VFD are identified by an indicator in the unit's model number (see the unit's nameplate). Use Table 1 to identify whether or not a given unit is equipped with the factory-installed VFD option.

NOTE: Read the entire instruction manual before starting the installation.

C11526

Fig. 1 - Variable Frequency Drive (VFD)

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SAFETY CONSIDERATIONS

⚠ CAUTION

CONFIGURATION OVERRIDE HAZARD

DO NOT USE ABB OR CARRIER START-UP ASSISTANT ON THIS VFD APPLICAITON! Use of start-up assistant will override the factory VFD configurations!

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloths for brazing operations and have a fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes and appropriate national electrical codes (in USA, ANSI/NFPA70, National Electrical Code (NEC); in Canada, CSA C22.1) for special requirements.

It is important to recognize safety information. This is the safety-alert symbol . When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol.

DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death.

CAUTION is used to identify unsafe practices, which **may** result in minor personal injury or product and property damage.

NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could cause personal injury or death.

Before performing service or maintenance operations on unit, always turn off main power switch to unit and install lock(s) and lockout tag(s). Unit may have more than one power switch. Ensure electrical service to rooftop unit agrees with voltage an amperage listed on the unit rating plate.

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts and servicing air conditioning equipment.

GENERAL

Staged Air Volume (SAV) Indoor Fan Speed System

The Staged Air Volume (SAV) system utilizes a Fan Speed control board and Variable Frequency Drive (VFD) to automatically adjust the indoor fan motor speed in sequence with the unit's ventilation, cooling and heating operation. Per ASHRAE 90.1 2010standard section 6.4.3.10.b, during the first stage of cooling operation the SAV system will adjust the fan motor to provide two-thirds (2/3) of the design airflow rate for the unit. When the call for the second stage of cooling is required, the SAV system will allow the design airflow rate for the unit established (100%). During the heating mode, the SAV system will allow total design airflow rate (100%) operation. During ventilation mode, the SAV system will operate the fan motor at 2/3 speed.

Identifying Factory Option

This supplement only applies to units that meet the criteria detailed in Table 1. If the unit does not meet that criteria, discard this document.

Table 1 – Model-Size / VFD Option Indicator

Model / Sizes	Position in Model Number	VFD FIOP Indicator
48/50TC / 08–30	17	G, J
50TCQ / 08–24	17	G, J
48/50HC / 08–28	17	G, J
50HCQ / 08–12	17	G, J
40RUA / 07–30	9	T
40RUS / 08–30	9	T
40RUQ / 07–25	9	T

NOTE: See Figs. 2 and 3 (on page 3) for examples of typical Model Number Nomenclature.

NOTE: 07 size scheduled for late 2015 production.

NOTE: 48/50LC units are not covered in this document; VFDs are standard equipment on belt drive LC units. VFD instructions for the 48/50LC series are found in the Installation Instructions for the LC base units.

Unit Installation with SAV Option

48/50HC, TC Rooftop — Refer to the base unit installation instructions for standard required operating and service clearances.

40RU without Remote VFD Keypad — Additional service clearance is required on the rear for 40RU fan coil unit equipped with the SAV option. Increase the recommended rear panel clearance to 30 inches.

40RU with Remote VFD Keypad — Refer to the base unit installation instructions for standard required operating and service clearances. Install the accessory Remote VFD Keypad before positioning the 40RU unit in its final operating location.

NOTE: The Remote VFD Keypad is a field-installed option. It is not included as part of the Factory installed VFD option.

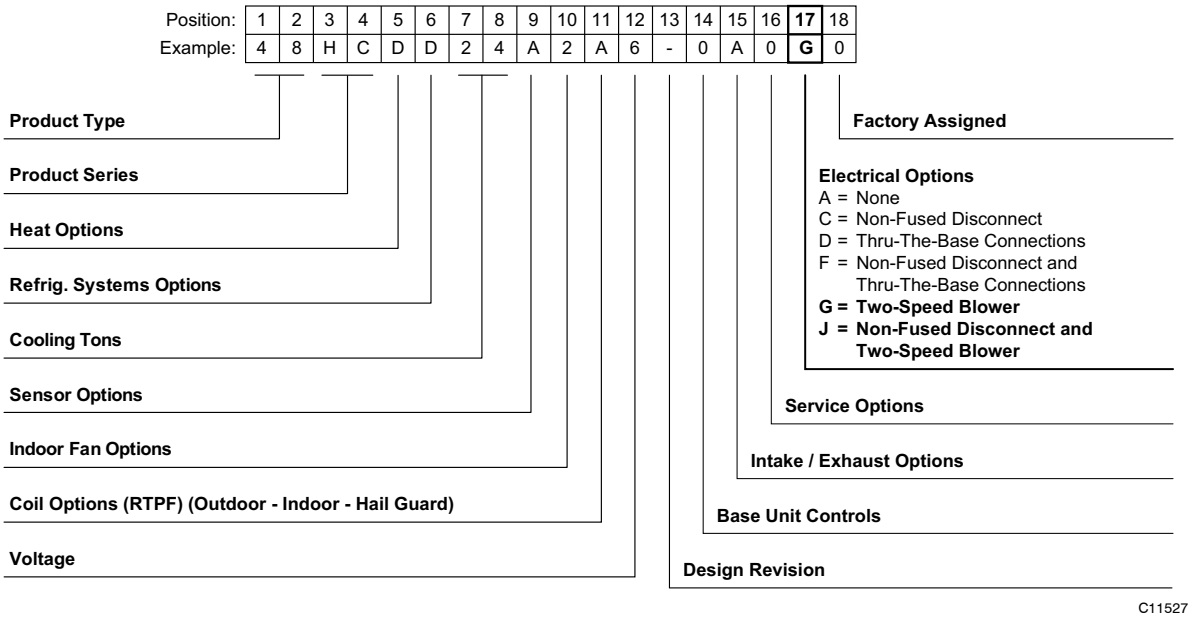

Fig. 2 - Model Number Nomenclature Example, 48/50–Series

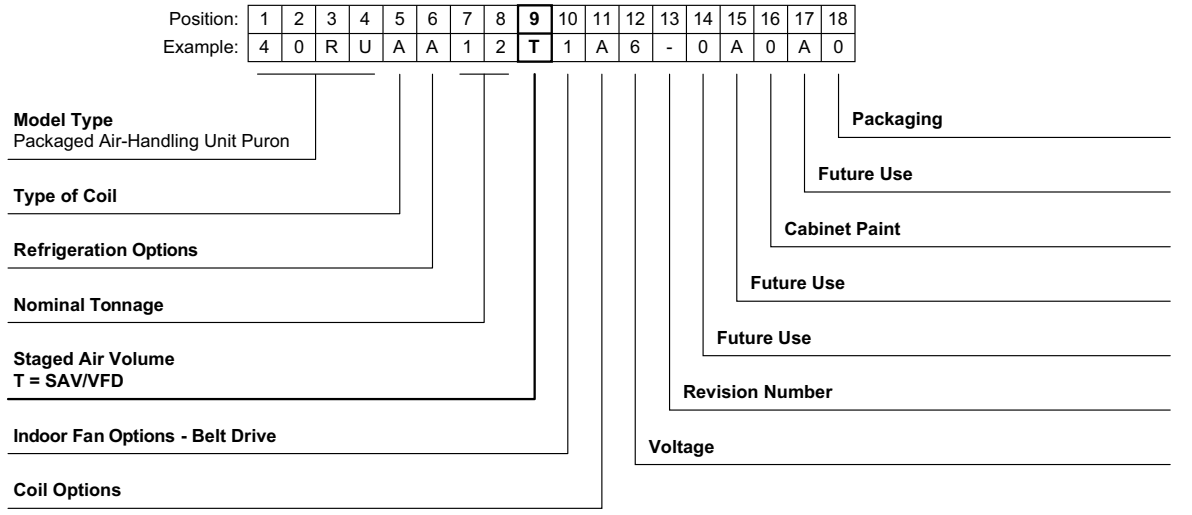

Fig. 3 - Model Number Nomenclature Example, 40RU–Series

IMPORTANT: **Do NOT** change units equipped with the VFD option to operate at less than the pre-set two-thirds minimum Hz setting (40 Hz). For example do not change a unit equipped with a standard static motor to operate at less than 40Hz (which is two-thirds of its 60Hz rating).

Tables 2 through 10 list the minimum recommended CFM per fan motor type (Single Speed or 2-Speed) for the units covered in this document.

Table 2 – 48TC Min CFM Per Fan Motor Type

Model – Size	Single Speed Fan Motor	2–Speed Fan Motor (at high speed)	2–Speed Fan Motor (at low speed)
48TC 08	2250	2250	1485
48TC 09	2550	2873	1896
48TC 12	3000	3380	2231
48TC 14	3600	4225	2789
48TC 16	4500	5625	3713
48TC 17	4500	4500	2970
48TC 20	5250	5250	3465
48TC 24	6000	6000	3960
48TC 28	7500	8450	5577
48TC 30	8250	8250	5445

Table 3 – 50TC Min CFM Per Fan Motor Type

Model – Size	Single Speed Fan Motor	2–Speed Fan Motor (at high speed)	2–Speed Fan Motor (at low speed)
50TC 08	2250	2250	1485
50TC 09	2550	2873	1896
50TC 12	3000	3380	2231
50TC 14	3600	4225	2789
50TC 16	4500	5625	3713
50TC 17	4500	4500	2970
50TC 20	5250	5250	3465
50TC 24	6000	6000	3960
50TC 28	7500	8450	5577
50TC 30	8250	8250	5445

Table 4 – 50TCQ Min CFM Per Fan Motor Type

Model – Size	Single Speed Fan Motor	2–Speed Fan Motor (at high speed)	2–Speed Fan Motor (at low speed)
50TCQ 08	2250	2535	1673
50TCQ 09	2550	2873	1896
50TCQ 12	3000	3000	1980
50TCQ 14	3750	4225	2789
50TCQ 17	4500	5070	3346
50TCQ 24	6000	6760	4462

Table 5 – 48HC Min CFM Per Fan Motor Type

Model – Size	Single Speed Fan Motor	2–Speed Fan Motor (at high speed)	2–Speed Fan Motor (at low speed)
48HC 08	2250	2535	1673
48HC 09	2550	2550	1683
48HC 11	3000	3380	2231
48HC 12	3000	3380	2231
48HC 14	3750	4225	2789
48HC 17	4500	5070	3346
48HC 20	5250	5915	3904
48HC 24	6000	7500	4950
48HC 28	7500	8450	5577

Table 6 – 50HC Min CFM Per Fan Motor Type

Model – Size	Single Speed Fan Motor	2–Speed Fan Motor (at high speed)	2–Speed Fan Motor (at low speed)
50HC 08	2250	2535	1673
50HC 09	2550	2550	1683
50HC 11	3000	3380	2231
50HC 12	3000	3380	2231
50HC 14	3750	4225	2789
50HC 17	4500	5070	3346
50HC 20	5250	5915	3904
50HC 24	6000	7500	4950
50HC 28	7500	8450	5577

Table 7 – 50HCQ Min CFM Per Fan Motor Type

Model – Size	Single Speed Fan Motor	2–Speed Fan Motor (at high speed)	2–Speed Fan Motor (at low speed)
50HCQ 08	2250	2250	1485
50HCQ 09	2550	2873	1896
50HCQ 12	3000	3380	2231

Table 8 – 40RUA Min CFM Per Fan Motor Type

Model – Size	Single Speed Fan Motor	2–Speed Fan Motor (at high speed)	2–Speed Fan Motor (at low speed)
40RUA 07	1800	2030	1338
40RUA 08	2250	2535	1673
40RUA 12	3000	3380	2231
40RUA 14	3750	4225	2789
40RUA 16	4500	4500	2970
40RUA 25	6000	6000	3960
40RUA 28	7500	8450	5577
40RUA 30	9000	9295	6135

Table 9 – 40RUS Min CFM Per Fan Motor Type

Model – Size	Single Speed Fan Motor	2–Speed Fan Motor (at high speed)	2–Speed Fan Motor (at low speed)
40RUS 08	2250	2535	1673
40RUS 10	2550	2873	1896
40RUS 12	3000	3380	2231
40RUS 14	3750	4225	2789
40RUS 16	4500	4500	2970
40RUS 25	6000	6000	3960
40RUS 28	7500	8450	5577
40RUS 30	9000	9295	6135

Table 10 – 40RUQ Min CFM Per Fan Motor Type

Model – Size	Single Speed Fan Motor	2–Speed Fan Motor (at high speed)	2–Speed Fan Motor (at low speed)
40RUQ 07	1800	2030	1338
40RUQ 08	2250	2535	1673
40RUQ 12	3000	3380	2231
40RUQ 16	4500	4500	2970
40RUQ 25	6000	6000	3960

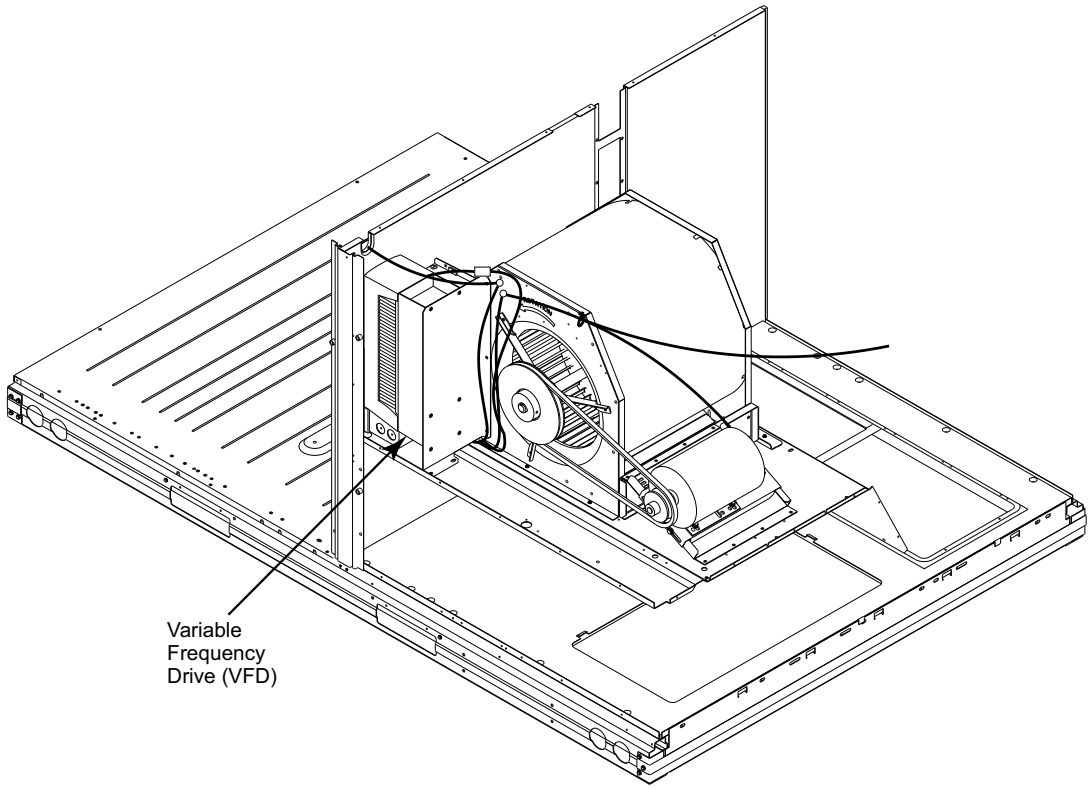

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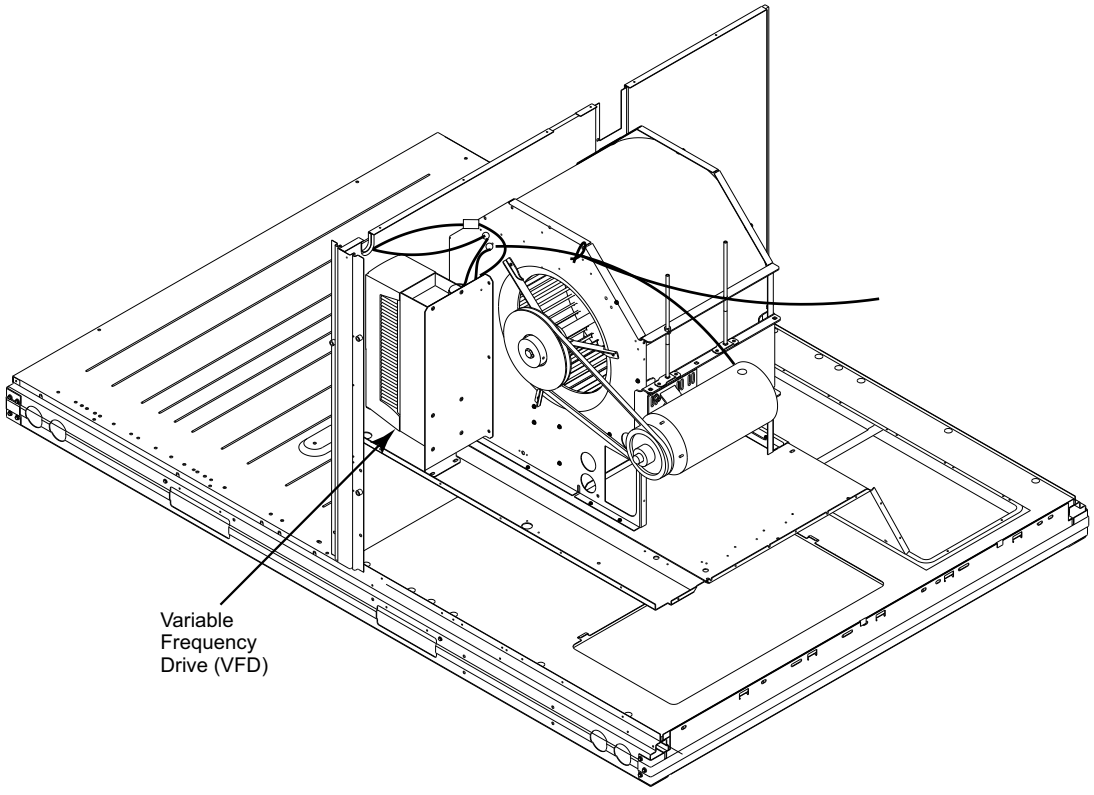
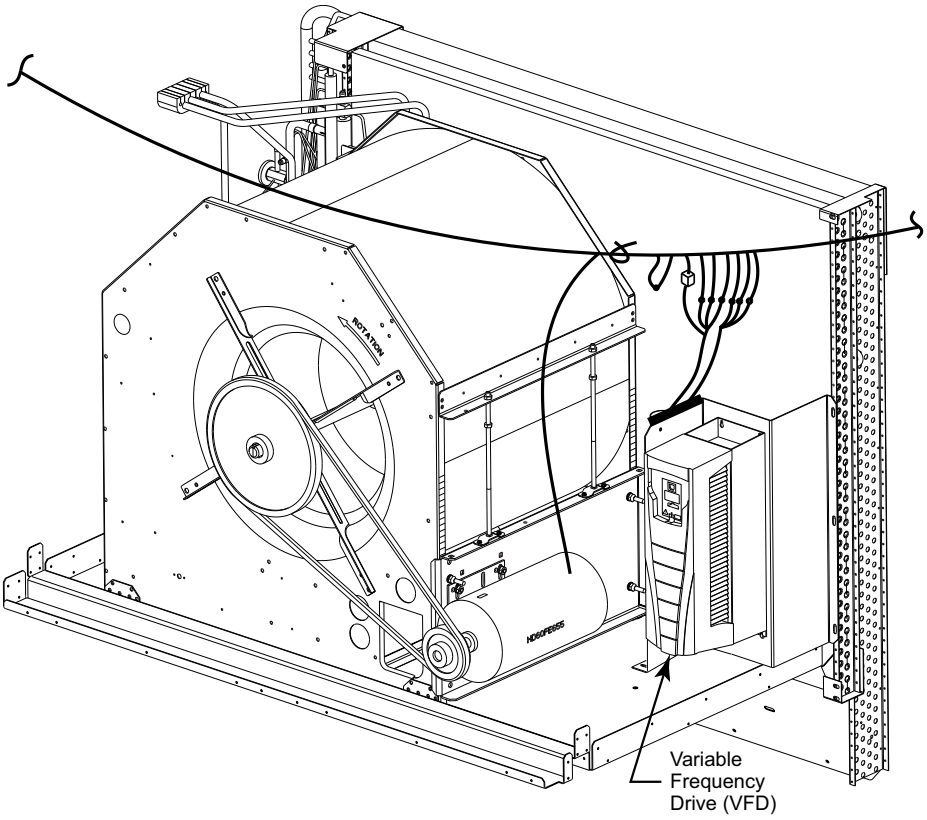
Fig. 4 - VFD Location for the following units: 48/50TC 08-12, 50TCQ 08-09, 48/50HC 08-09 and 50HCQ 08



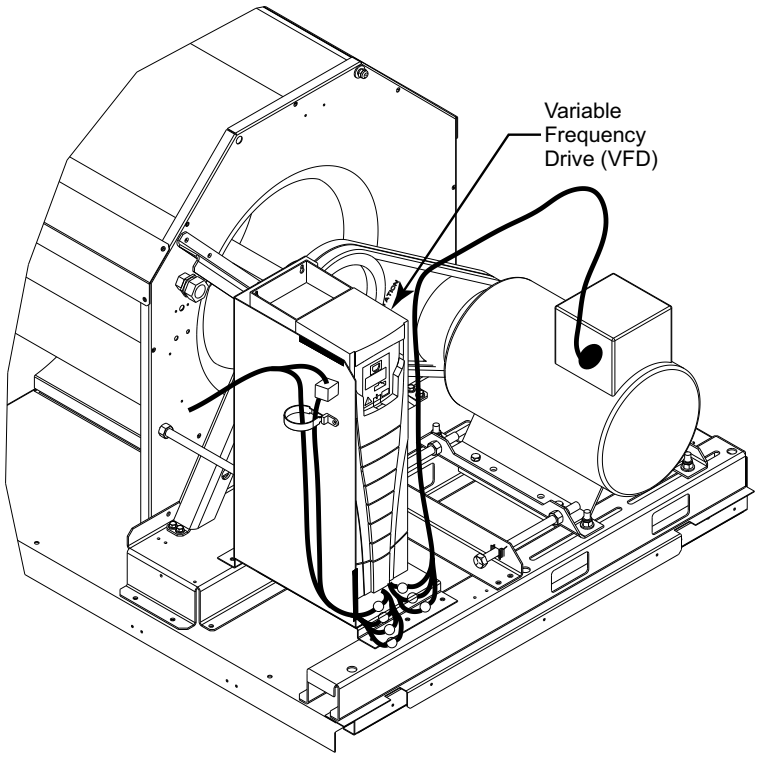
C11529

Fig. 5 - VFD Location for the following units: 48/50TC 14, 50TCQ 12, 48/50HC 12 and 50HCQ 09



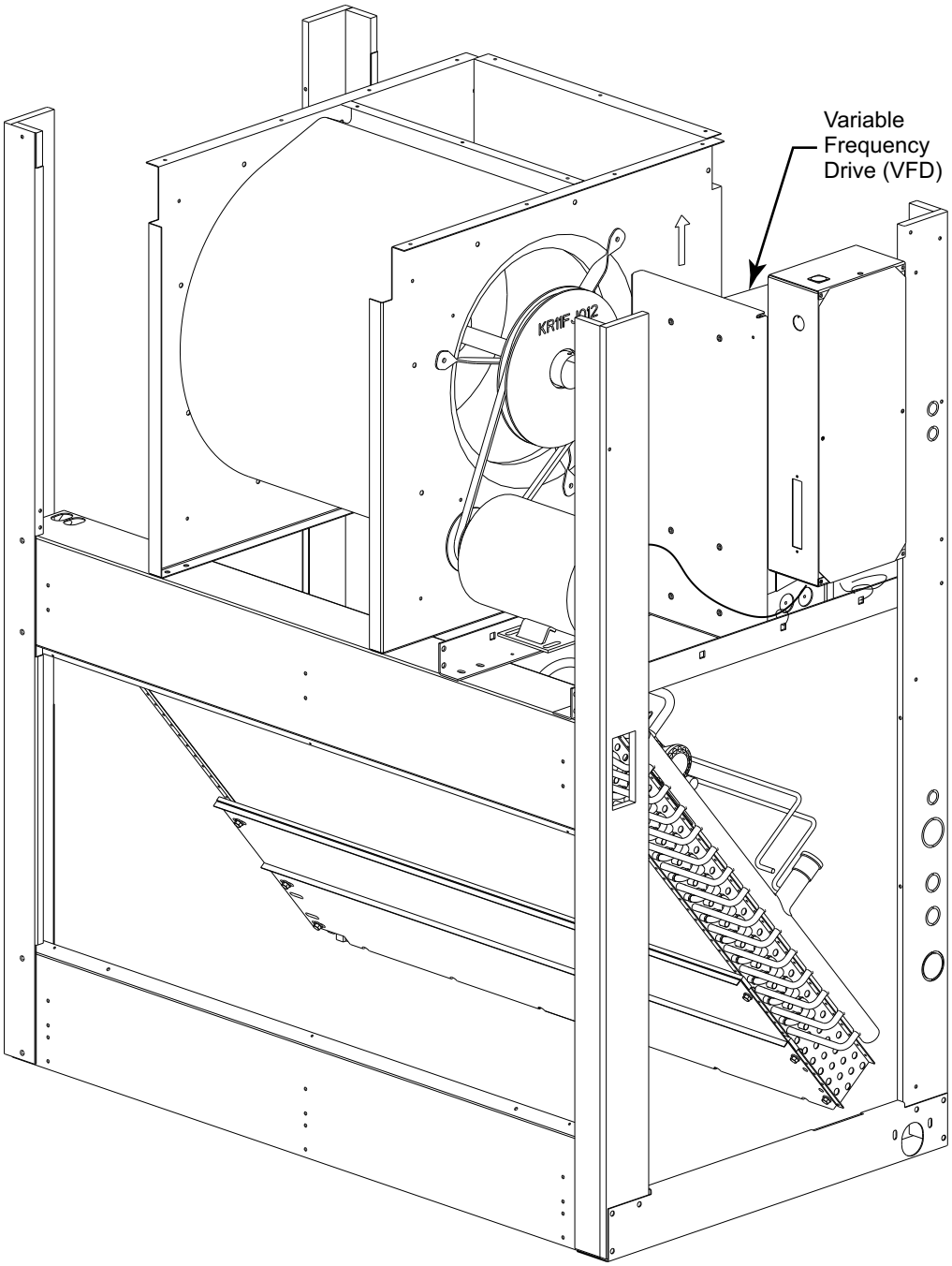
C11530

Fig. 6 - VFD Location for the following units: 48/50TC 16, 50TCQ 14, 48/50HC 14 and 50HCQ 12



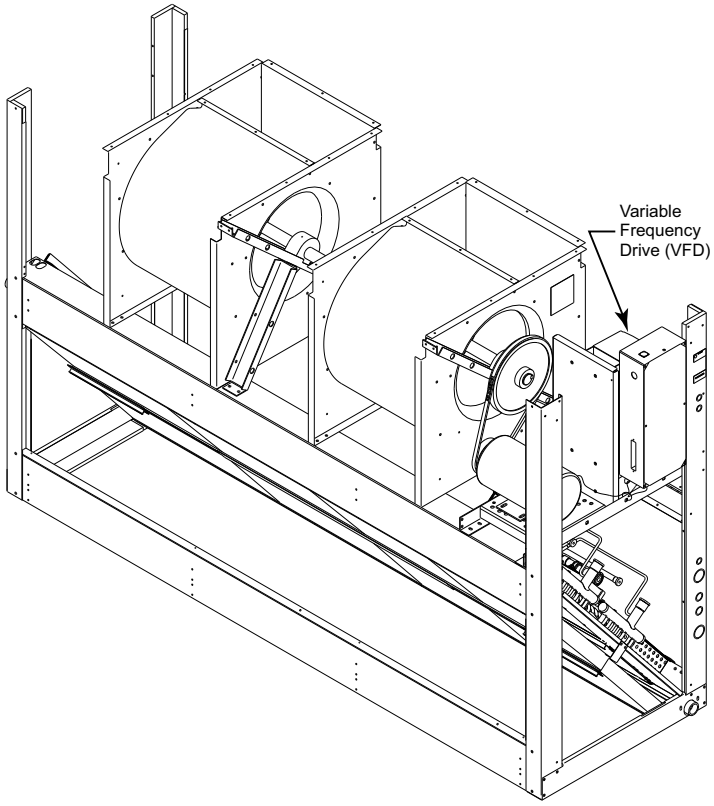
C11531

Fig. 7 - VFD Location for the following units: 48/50TC 17-30, 50TCQ 17-24 and 48/50HC 17-28



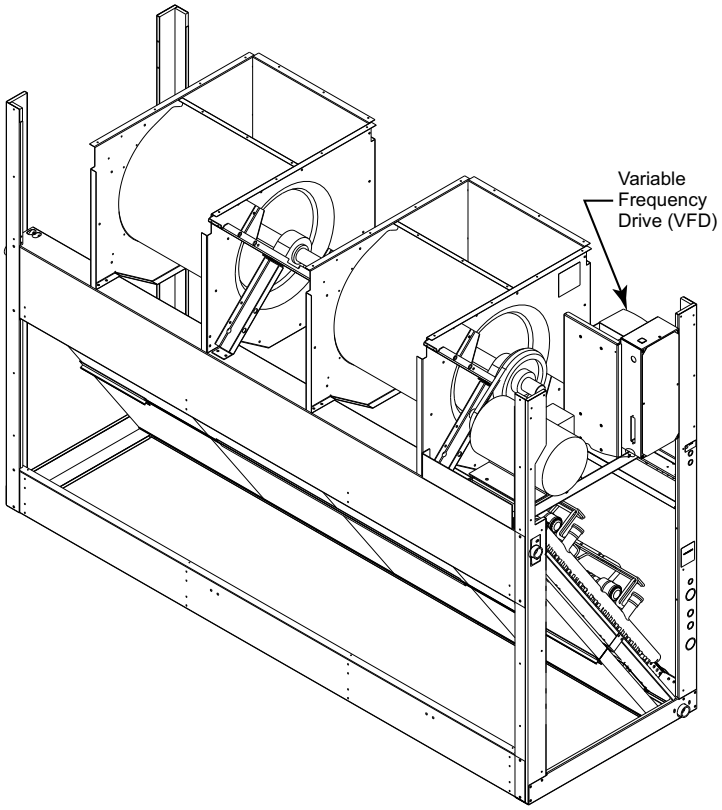
C11532

Fig. 8 - VFD Location for the following units: 40RUA/RUQ 07-12 and 40RUS 08-12



C11533

Fig. 9 - VFD Location for the following units: 40RUA/RUS 14-25, 40RUQ 16-25



C11534

Fig. 10 - VFD Location for the following units: 40RUA/RUS 28-30

Pre-Start Check, SAV Option

1. Remove the access panel to reach the VFD.
   - 48/50 Series: Blower compartment panel
   - 40RU: Rear access panel

NOTE: See Figs. 4 through 10 for VFD location in the units covered by this document.

2. Read all safety, caution and warning labels.
3. Inspect wiring at the VFD for loose or disconnected wires at the terminal strip and for wires in contact with sharp edges and moving parts (pulley, belt,).

START-UP, SAV Option

Compressor Rotation:

Units equipped with a VFD on the indoor fan motor cannot use rotation direction of the indoor fan motor and fan to visually confirm a correct phase connection to the unit and compressors. Pressure gages MUST BE USED during cooling system start-up to confirm correct compressor rotation and operation.

Indoor Fan Motor:

Raise the cooling set point at the space thermostat to higher than space temperature. Switch the thermostat's FAN switch to CONT (Continuous) position. Fan motor will start, run at reduced speed.

Check for fan rotation direction. To reverse the fan rotation, disconnect all power to unit and then switch two motor power leads between the VFD and the motor. Restore unit power and recheck fan rotation direction.

Check fan motor speed. Motor shaft should be rotating at 1150-1180 RPM (19.2-19.7 r/s).

Switch the thermostat's FAN switch to AUTO position. Fan motor will stop.

Cooling with SAV:

1st Stage (Y1): Set the thermostat FAN switch to AUTO and the SYSTEM switch to COOL. Slowly lower the cooling setpoint until first stage compressor starts. Indoor fan motor also starts, runs at reduced speed.

2nd Stage (Y2): Lower the cooling setpoint until second stage compressor starts. Indoor fan motor will switch to high speed.

Check fan motor speed. Motor shaft should be rotating at 1725-1760 RPM (28.8-29.3 r/s).

Confirm compressors are running at correct rotation by checking suction and discharge pressures. To reverse the compressor rotation, disconnect unit power and switch two of the unit's main power leads. Restore unit power and recheck compressor operation.

Reset thermostat cooling setpoint to a position above space temperature. Both compressors will shut off. Indoor fan motor will stop immediately.

40RU, 50-Series units: Indoor fan motor will stop immediately.

48-Series units: Indoor fan operation will continue for 45-seconds, then stop.

Operating Sequences, SAV Option

Ventilation (Fan only)

Ventilation mode occurs when the indoor fan runs without accompanying cooling or heating system operation. The thermostat's FAN selection switch will be in CONT (Continuous) position; no demand for cooling or heating will be present.

48-Series units: The thermostat's G terminal is energized with 24-v. This signal is conveyed to the 48-Series unit's Central Terminal Board (CTB) at the field connection TSTAT terminal strip at terminal G. The 24-v signal follows an internal trace path through jumper JMP6 to connector CONTL BOARD pin 1. A harness wire connects pin 1 to IGC board terminal G. The IGC energizes its fan relay, energizing IGC terminal IFO. This 24-v signal follows a harness conductor back to the CTB's CONTL BOARD connector at pin 6 and pin 7. Pin 7 is connected to the Fan Speed Board at connector J1 pin 4. Relay K3 is energized. A 24-VDC signal is passed to the VFD terminal 14. The VFD starts the indoor fan motor and runs it at 40HZ for reduced/low speed operation.

50HC, TC-Series units: The thermostat's G terminal is energized with 24-v. This signal is conveyed to the 50HC,TC-Series unit's Control Terminal Board (CTB) at the field connection TSTAT terminal strip at terminal G. The 24-v signal follows an internal trace path through jumper JMP6 to connector CONTL BOARD pin 1. A harness wire connects pin 1 to the Fan Speed Board at connector J1 pin 4. Relay K3 is energized. A 24-VDC signal is passed to the VFD terminal 14. The VFD starts the indoor fan motor and runs it at 40HZ for reduced/low speed operation.

50TCQ, HCQ-Series: The thermostat's G terminal is energized with 24-v. This signal is conveyed to the 50HCQ,TCQ-Series unit's Control Terminal Board (CTB) at the field connection TSTAT terminal strip at terminal G. The 24-v signal follows an internal trace path to connector REHEAT/DEFROST pin 1. A harness wire connects pin 1 to DFB board terminal P2-3. The DFB energizes its fan relay, energizing DFB terminal P3-8. This 24-v signal follows a harness conductor back to the CTB's REHEAT/DEFROST pin 2. An internal trace path connects pin 2 to CONTL BOARD connector at pin 1. Pin 1 is connected to the Fan Speed Board at connector J1 pin 4. Relay K3 is energized. A 24-VDC signal is passed to the VFD terminal 14. The VFD starts the indoor fan motor and runs it at 40HZ for reduced/low speed operation.

Cooling (FAN switch in AUTO)

1st Stage (Y1): When the thermostat initiates a call for 1st Stage Cooling by closing its Y1 contacts, the thermostat also energizes its G terminal. Follow the sequence under Ventilation above. Fan Speed Relay board relay K3 is energized, causing the VFD to start the indoor fan motor and run at 40HZ for reduced fan speed operation.

When space temperature drops to satisfy the thermostat Y1 demand, contact Y1 opens de-energizing terminal G. Relay K3 is de-energized. The relay board output at J2-2 to the VFD is removed and indoor fan motor ramps down to stop.

2nd Stage (Y2): If space temperature continues to rise, thermostat Y2 demand will be initiated. Contact Y2 will close, sending a 24-v signal to CTB's TSTAT terminal strip at Y2. An internal path passes this signal to connector DDC/TSTAT pin 6. A harness wire carries this signal to Fan Speed Relay board pin J1-3. Relay K2 is energized. The relay board's output to VFD at pin J2-2 is de-energized and the output at J2-3 is energized, causing the VFD to shift its output to the indoor fan motor to 60HZ. The indoor fan motor ramps up to full/high speed operation.

When the space temperature drops to satisfy thermostat Y2 demand, contact Y2 opens de-energizing terminal Y2. Relay K2 is de-energized, removing the VFD input at terminal 15. Fan Speed Board output at pin J2-2 is restored to the VFD at terminal 14; VFD shifts back to 40HZ output to the indoor fan motor and motor shifts back to reduced speed operation.

Heating

When the thermostat initiates a call for 1st Stage Heating by closing its W1 contacts, a 24-v signal is conveyed to the CTB's TSTAT terminal strip at W1. An internal path passes this signal to connector DDC/TSTAT pin 5. A harness wire carries this signal to Fan Speed Relay board pin J1-2. Relay K1 is energized. The relay board's output to VFD at pin J2-3 is energized, providing a 24-VDC signal to VFD terminal 15. The VFD starts the indoor fan motor, runs at 60HZ for full/high speed operation.

When space temperature rises to satisfy the thermostat W1 demand, contact W1 opens de-energizing terminal W1. Relay K1 is de-energized. The relay board output at J2-3 to the VFD is removed.

40RU, 50-Series: Indoor fan motor ramps down to stop.

48-Series: The IGC's fan-off delay sequence will energize relay K3 for 45-seconds, causing the VFD to operate the indoor fan motor at 40HZ (low speed) for 45-seconds, then indoor fan motor will ramp down to stop.

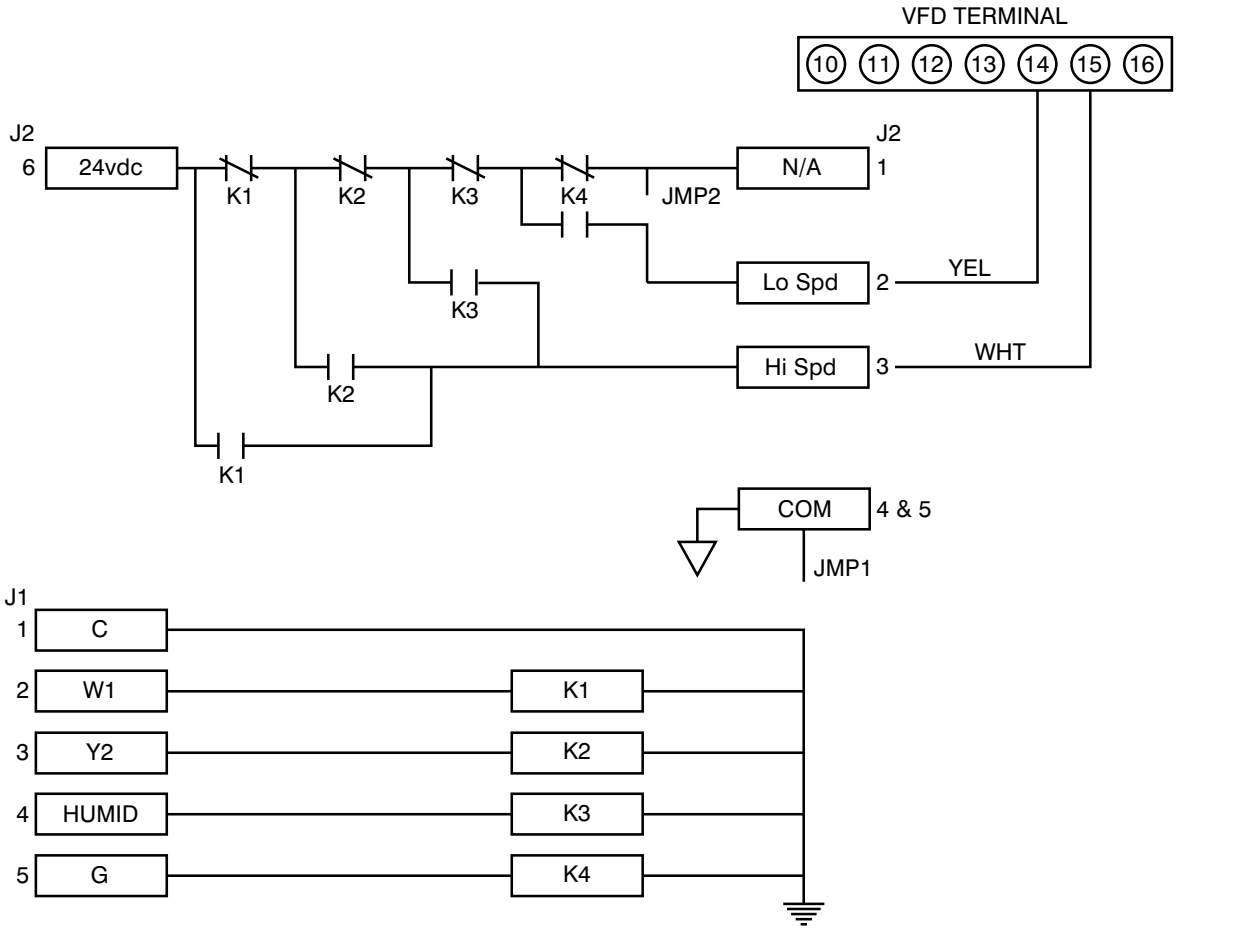


Fig. 11 - Connection Schematic – Fan Speed Relay Board and VFD.

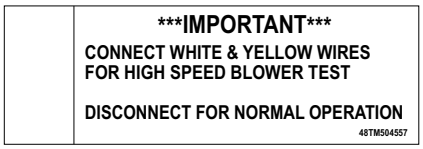
Operating Fan for Test & Balance

During the Test and Balance procedure, it is necessary to operate the supply fan in High Speed without concurrent operation of the Cooling or Heating systems. Use the following procedure to force the fan speed to High.

CAUTION — MOVING PARTS

Unit without Accessory Keypad:

1. Set the space thermostat to SYSTEM OFF and FAN in AUTO.
2. Disconnect unit power. Lock-out/tag out.
3. Open the fan access panel and locate the VFD (see Figs. 4 through 10 for your specific unit).
4. Locate and connect the WHT and YEL wires extending from the VFD. The two wires are bundled together using the label shown in Fig. 12.



C150116

Fig. 12 - High Speed Test Label

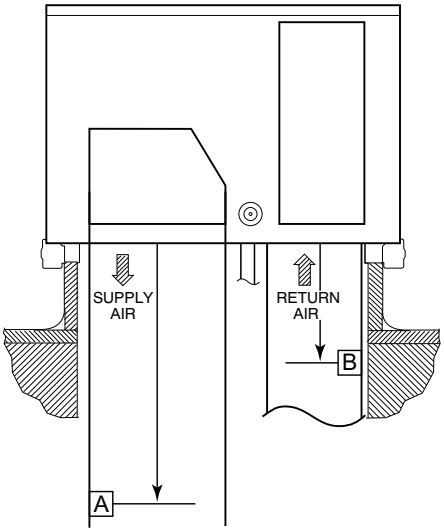
5. Locate pressure ports or pitot tubes in the return duct and supply duct to measure external static pressure. See Fig. 13 for typical locations.
6. Restore unit power.
7. Set the space thermostat to FAN CONT.
8. Check the motor speed with stroboscope or similar tool. Motor shaft speed must be in 1725-1760 RPM (28.8-29.3 r/s) range for High Speed.
9. Replace the fan access panel.
10. Perform Test & Balance procedure.
11. Adjust the supply fan speed according to base unit instructions to deliver the project selection CFM value. Ensure the selection CFM value is not lower that the "Min CFM Per Fan Motor Type" for this unit-size as found in Tables 2 through 10 on page 3.

To restore the unit to ready-to-start condition, disconnect the unit power and lock-out/tag-out, set the space thermostat to FAN AUTO, remove the test pressure ports from the external duct locations, and disconnect the WHT and YEL wires. Replace the supply fan access panel. Restore unit power.

Unit with Accessory VFD Keypad:

1. Set the space thermostat to SYSTEM OFF and FAN in AUTO.
2. Disconnect unit power. Lock-out/tag out.
3. Open the fan access panel (see Figs. 4 through 10 for your specific unit).
4. Locate pressure ports or pitot tubes in the return duct and supply duct to measure external static pressure. See Fig. 13 for typical locations.
5. Restore unit power.
6. Set the space thermostat to FAN CONT.
7. At the VFD keypad, tap the HAND key and then tap the UP arrow button to increase the motor speed until 60.0 is displayed on the display screen.
8. Check the motor speed with stroboscope or similar tool. Motor shaft speed must be in 1725-1760 RPM (28.8-29.3 r/s) range for High Speed.
9. Replace the fan access panel.
10. Perform Test & Balance procedure.
11. Adjust the supply fan speed according to base unit instructions to deliver the project selection CFM value. Ensure the selection CFM value is not lower that the "Min CFM Per Fan Motor Type" for this unit-size as found in Tables 2 through 10 on page 3.

To restore the unit to ready-to-start condition, tap the DOWN arrow button to reduce motor speed until the 40.0 is displayed on the display screen and then tap the AUTO key. Disconnect the unit power and lock-out/tag-out, set the space thermostat to FAN AUTO. Remove the test pressure ports from the external duct locations. Restore unit power.



C12013

ARI PRESSURE LOCATIONS					
MODEL	SIZES	IN Supply Air [A]	IN Return Air [B]	MM Supply Air [A]	MM Return Ai [B]
48/50HC	04–06	32	10	830	260
	07–12	43.5	12	1100	310
	14	64.5	14	1640	350
	17–28	83	19	2110	490
48/50TC	04–07	32	10	830	260
	08–14	43.5	12	1100	310
	16	64.5	14	1640	350
	17–30	83	19	2110	490
50HCQ	04–06	32	10	1100	310
	07–09	43.5	12	1100	310
	12	44.5	13	1130	330
50TCQ	04–07	32	10	830	260
	08–12	43.5	12	1100	310
	14	44.5	14	1130	350
	17–24	83	19	2110	490

Fig. 13 - Measuring External Static Pressure — Distance Below Unit Base

Service

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution will result in equipment damage.

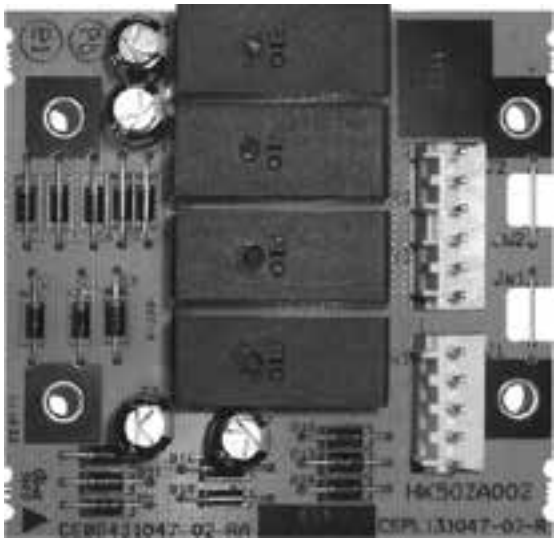
Do NOT exceed the recommended minimum Hz or CFM settings. Operating these units at a Hz setting below 40 Hz or at a CFM below the minimums listed in Tables 2 through 10 (see page 3) will result in damage to the unit.

Figs. 4 through 10 show the location of the VDF option in the various units covered by this document.

Staged Air Volume (SAV) Option Components – The SAV factory option is comprised of three major components and related connecting harnesses:

1. Fan Speed Relay Board
2. Variable Frequency Drive
3. Indoor Fan Motor, designed for use with VFD

Fan Speed Relay Board – This board (PNO HK50ZA002) is designated as the VFD Fan Board on the unit wiring diagram labels. It is a small (3.0 x 3.12 in, 76 x 79 mm) printed circuit board with four SPDT control relays. See Fig. 14. There is no software on this board. The relay board is located in the unit's main control box; refer to unit label diagram for Component Location view.



C150081

Fig. 14 - VFD Fan Board

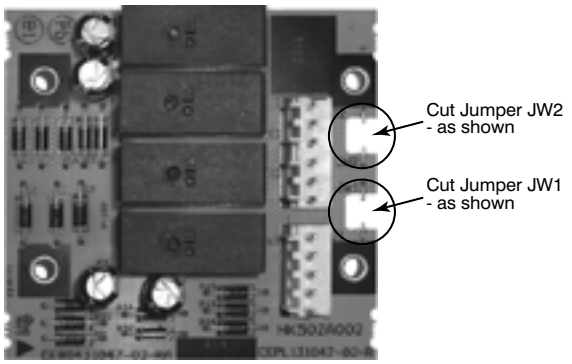
The board is arranged in two separate circuits with individual pin connectors. Connector J1 is connected to the 24-vac input signal circuit with the four relay coils. Connector J2 is connected to the 24-VDC output circuit that connects to the VFD's terminal strip. See Fig. 11 for a simplified connection schematic for Fan Speed Relay board and the VFD.

In this SAV application, there are three inputs to the relay board, originating from the space thermostat's G, Y2 and W1 terminals. An input from terminal G (for continuous fan operation for ventilation or from a Y1 call) will result in the VFD starting the indoor fan motor and running the motor at LOW speed. An input from either Y2 or W1 will result in the VFD running the indoor fan motor at HIGH speed. See Table 11 for relay operation for each unit mode. Relay K4 is not used in this 2-speed application.

Table 11 – 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)

Configuration Jumpers – The relay board has two configuration jumpers, marked JW1 and JW2. For this 2-speed motor application, both jumpers must be cut and open (see Fig. 15). Factory-installed boards will have these jumpers cut. Service replacement boards have these jumpers intact; servicer must cut both jumpers when installing a new service board. Failure to cut these jumpers will cause continuous fan motor operation.



C150082

Fig. 15 - Jumpers JW1 & JW2 Cut for Two-Speed Fan Board Configuration

Variable Frequency Drive – The VFD is used to switch the indoor fan motor speed between full/high speed (60HZ motor operation) and reduced/low speed (40HZ motor operation) as required by ASHRAE 90.1 requirements for two-stage HVAC units. The VFD is factory-configured to match the current and power requirements for each motor selection and all wiring connections are completed by the factory; no field adjustments or connections are necessary.

While the basic VFD retains all of its standard capabilities, the SAV 2-speed application uses only a limited portion of these features to provide two discrete output speeds to the motor. Consequently the VFD is not equipped with a keypad. A keypad is available as an accessory (PNO CRDISKIT001A00) for field-installation

or expanded service access to VFD parameter and troubleshooting tables. Refer to Appendix for expanded discussion on VFD parameters and factory settings.

⚠ CAUTION

CONFIGURATION OVERRIDE HAZARD

DO NOT USE ABB OR CARRIER START-UP ASSISTANT ON THIS VFD APPLICAITON! Use of start-up assistant will override the factory VFD configurations!

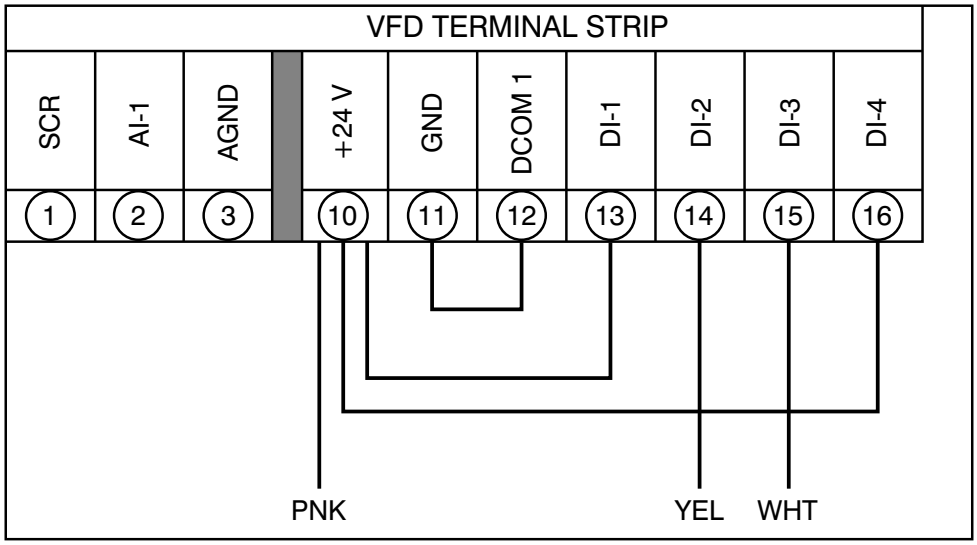
The SAV control circuit inputs to the VFD are 24-VDC signals. This voltage is sourced from the VFD at its terminal 10 (+24 V). SAV speed inputs are received at terminals 14 (DI-2) for low speed (40HZ) motor operation and 15 (DI-3) for high speed (60HZ) motor operation. When neither input is present, the VFD will shut the fan motor off. There is no separate indoor fan contactor required in this application.

The VFD used in the SAV system has soft start capabilities to slowly ramp up the speeds, eliminating any high inrush of air volume during speed changes. It also has internal over current protection for the fan motor.

Indoor Fan Motor – The indoor fan motors used with the VFD are specially manufactured for use with VFD power circuits. The motor winding insulation is specially formulated to resist breakdown due to voltage stress issues. The motor shaft includes grounding rings to prevent damage to bearings caused by grounding currents. Replace these motors with Factory Authorized Parts available from Replacement Components Division (RCD).

Table 12 – VFD Terminal Designations

TERMINAL	FUNCTION
U1 V1 W1	Three–Phase main circuit input power supply
U2 V2 W2	Three–Phase AC output to motor, 0V to maximum input voltage level
11 (GND) 12 (COMMON)	Factory–supplied jumper
10 (24VDC) 13 (DI–1)	Run (factory–supplied jumper)
10 (24VDC) 16 (DI–4)	Start Enable 1 (factory–supplied jumper). When opened, the drive goes to emergency stop
14 (DI–2) 15 (D1–3)	Factory wired for 24Vdc input from Fan Speed Board



C13808

Fig. 16 - VFD Wiring

Central Terminal Board Jumpers — 48/50-Series only

The Central Terminal Board (CTB) is a large printed circuit board that is located in the unit control box. This printed circuit board contains multiple termination strips and connectors to simplify factory control box wiring and field control connections. Terminals are clearly marked on the board surface. See Fig 17 for Part Number HK50AA051.

The CTB contains no software and no logic. But it does include seven configuration jumpers that are cut to configure the board to read external optional and accessory controls, including that the unit is a heat pump.

Table 13 – CTB Jumpers

Jumper	Control Function	Note
JMP1	Phase Monitor	
JMP2	Occupancy Control	
JMP3	Smoke Detector Shutdown	
JMP4	Remote Shutdown	
JMP5	Heat Pump / Reheat	50HCQ, TCQ default: Cut
JMP6	Heat Pump / Reheat	50HCQ, TCQ default: Cut
JMP7	Heat Pump / Reheat	50HCQ, TCQ default: Cut

Jumpers JMP5, JMP6 and JMP7 are located in notches across the top of the CTB (see Fig. 17). These jumpers are intact on units with gas heat or electric heat. These jumpers are factory cut on all heat pump units and on units with Humidi-MiZer (reheat) option.

Table 14 – Jumper Configuration

	Unit Type / Model		
Configuration Jumper	Gas Heat 48HC, TC*	Electric Heat 50 HC, TC*	Heat Pump 50HCQ, TCQ
JMP5	Intact	Intact	Cut
JMP6	Intact	Intact	Cut
JMP7	Intact	Intact	Cut

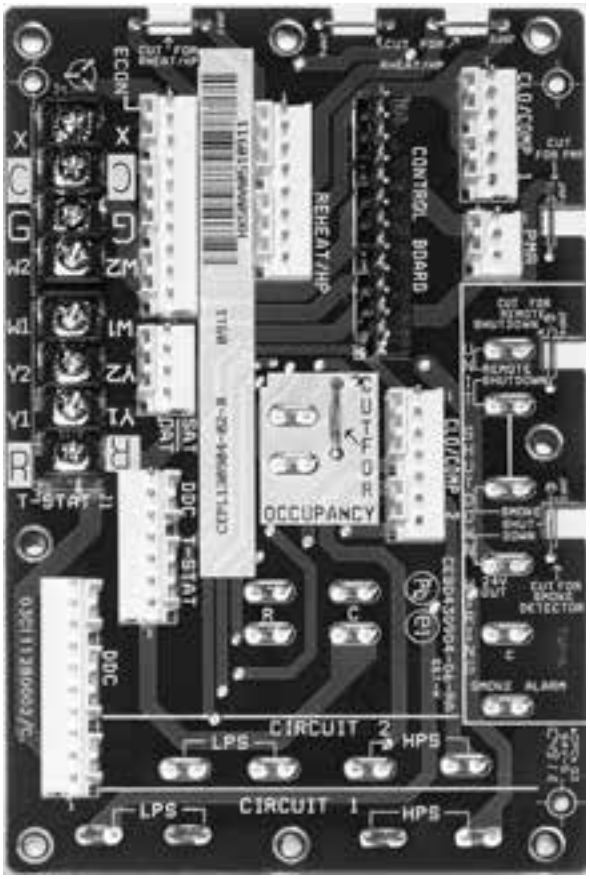
*Unit without Humidi–MiZer (Reheat)

Factory-installed boards will have these jumpers factory-cut where required. Service replacement boards have these jumpers intact; servicer must cut these jumpers as indicated in Table 14 when installing a replacement board.

VFD ALARMS AND FAULTS TROUBLESHOOTING –

The VFD has two LEDs on its front panel that indicate VFD operating status. These LEDs are GREEN and RED.

- GREEN LED ON STEADY: Power ON to VFD
- GREEN LED FLASHING: Alarm condition detected
- RED LED ON (Steady or Flashing): Fault condition detected



C11509

Fig. 17 - Central Terminal Board (CTB)

Alarms – Alarms are advisory in nature. These indicate a problem has been detected by the VFD's diagnostics but this problem will not require that the VFD and its motor be shut down. Typical fault condition on the SAV application might be loose connections at the VFD terminal board or damaged conductors between the Fan Speed Board connector J2 and the VFD terminal strip. See Table 21 in the Appendix section for a full list.

Clear the Alarm LED: Shut off power to the VFD for five minutes. Restore power and recheck the GREEN LED. If this LED is still flashing, connect the accessory remote display-keypad kit and follow the troubleshooting instructions in the Appendix, page 26.

Faults – A fault is a significant internal situation for the VFD or its motor. If the motor was running when the fault was detected, it was shutdown. See Table 20 in the Appendix section for a full list of Faults, display codes and troubleshooting guides. Connect the accessory remote display-keypad kit and follow the troubleshooting instructions in the Appendix.

Clear the Fault LED: Shut off power to the VFD for five minutes. Restore power and recheck the RED LED.

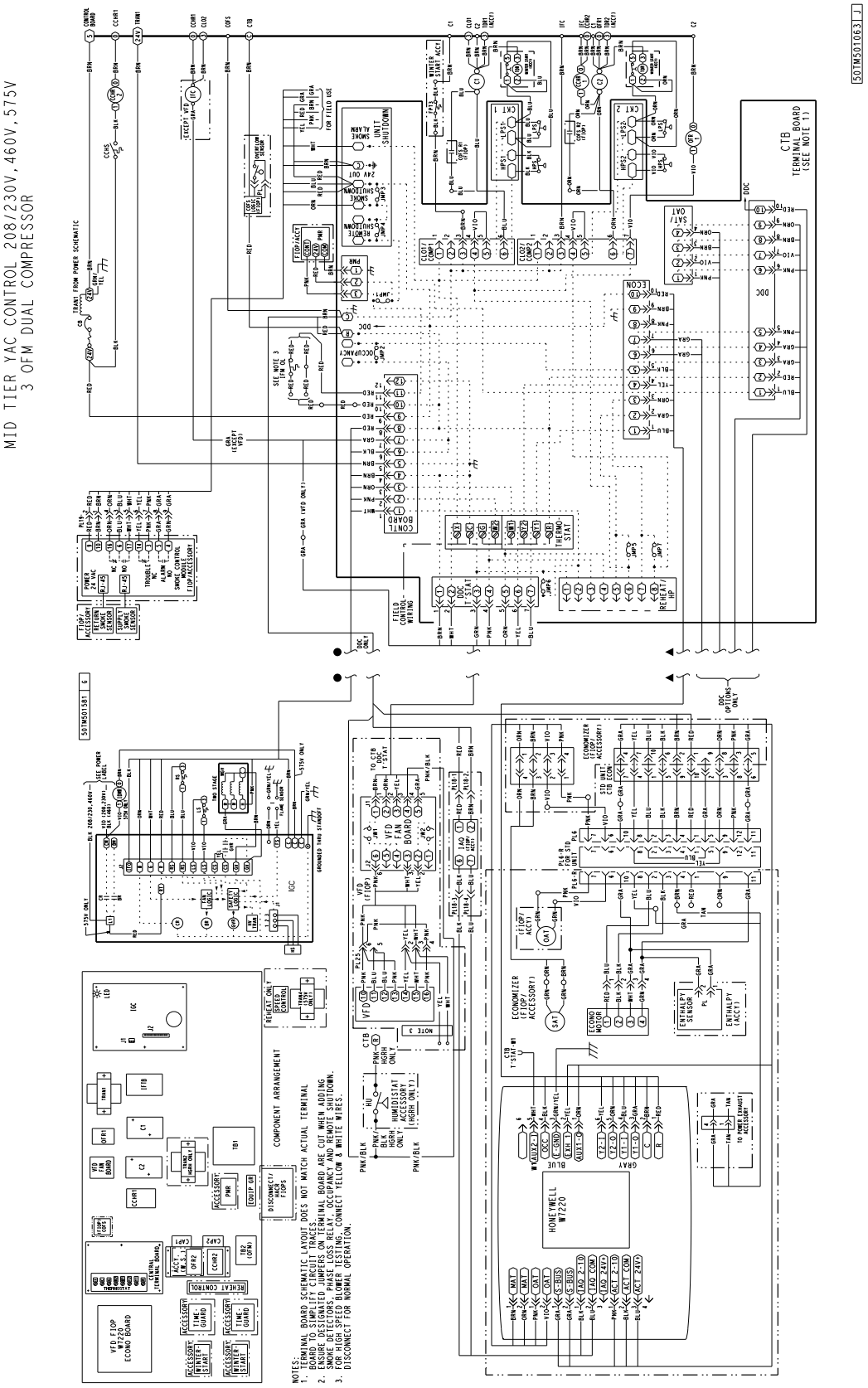


Fig. 18 - Typical Wiring Diagram - Single Package Rooftop Unit (48HC*14 with VFD shown)

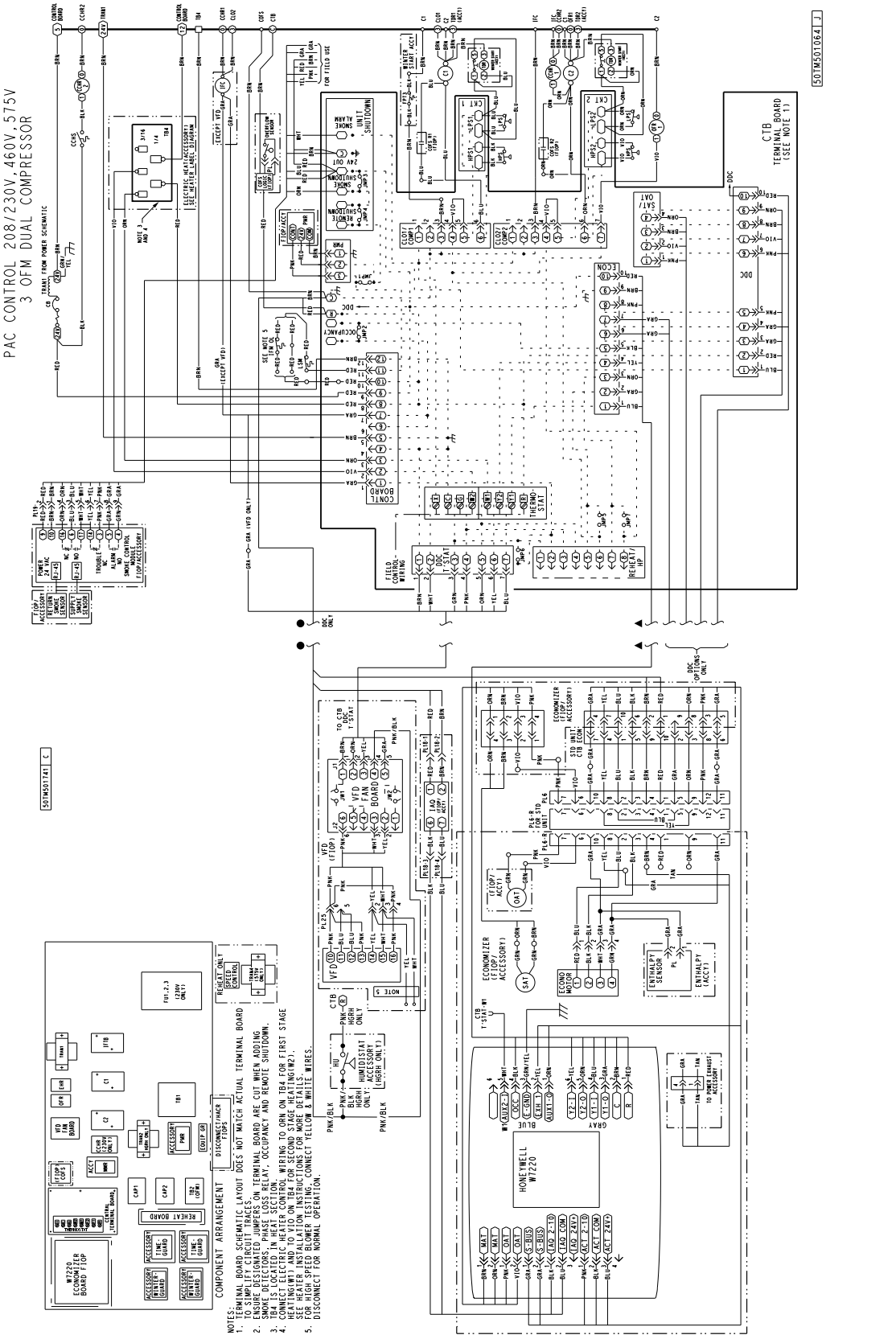


Fig. 19 - Typical Wiring Diagram - Single Package Rooftop Unit (50HC*14 with VFD shown)

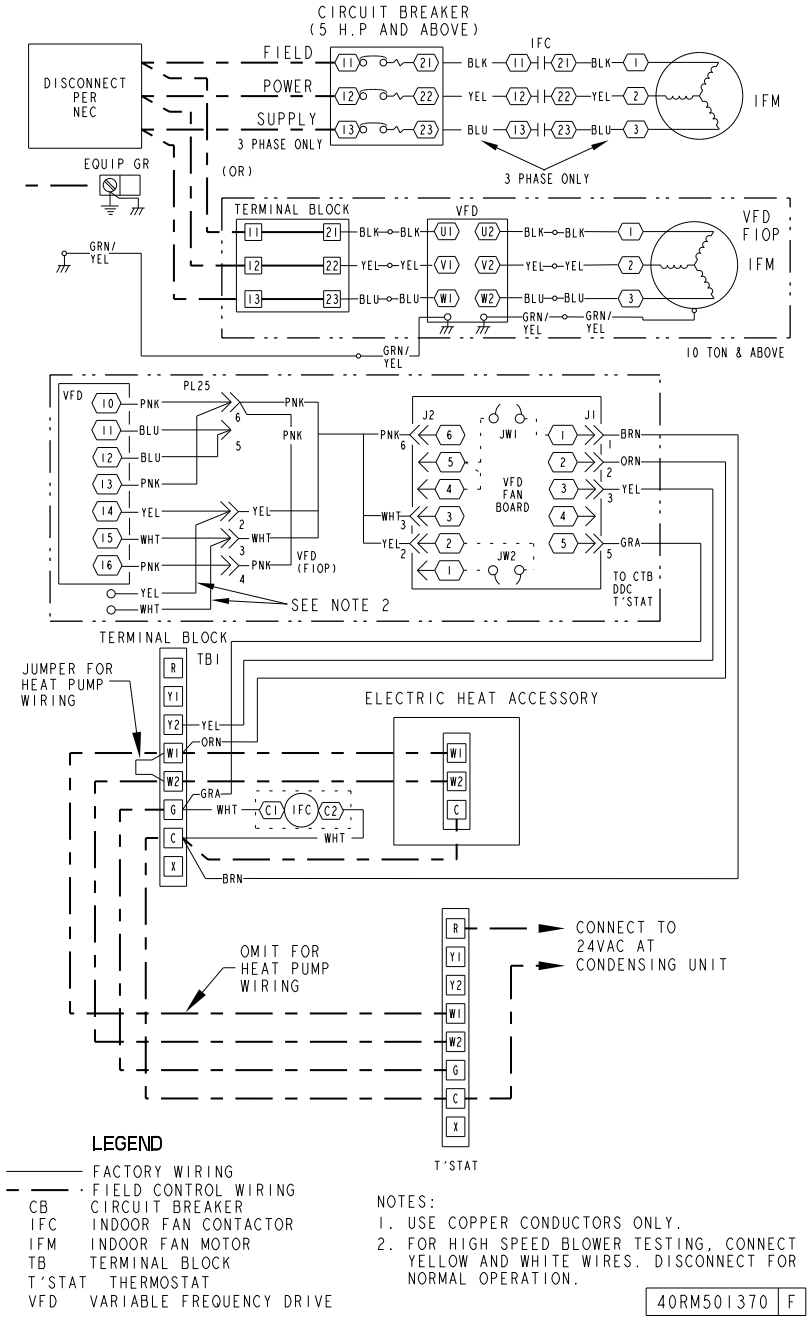


Fig. 20 - Typical Wiring Diagram - Split System Air-Handling Unit (40RU with VFD shown)

VFD Maintenance

If installed in an appropriate environment, the VFD requires very little maintenance.

Table 15 lists the routine maintenance intervals recommended by Carrier.

Table 15 – MAINTENANCE INTERVALS

MAINTENANCE	INTERVAL
Heat sink temperature check and cleaning	Every 6 to 12 months (depending on the dustiness of the environment)
Main cooling fan replacement	Every five years
HVAC Control panel battery change	Every ten years

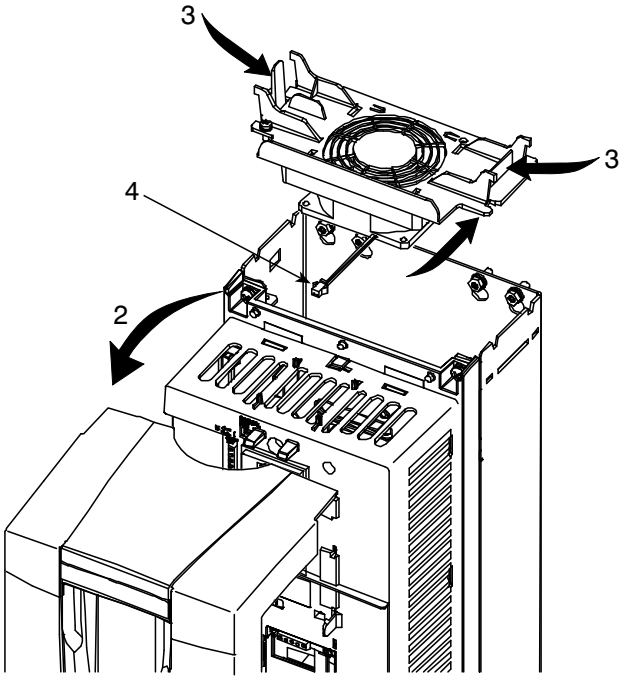
VFD Module Fan Replacement

The main cooling fan of the VFD has a life span of abut 60,000 operating hours at maximum rated operating temperature and drive load. The expected life span doubles for each 18°F drop in the fan temperature (fan temperature is a function of ambient temperatures and drive loads).

The VFD module fan cools the heat sink. Fan failure can be predicted by the increasing noise from fan bearings and the gradual rise in the heat sink temperature in spite of heat sink cleaning. If the drive is operated in a critical part of a process, fan replacement is recommended once these symptoms start appearing. Replacement fans are available from Carrier.

Use the following procedure to replace the VFD module cooling fan:

1. Turn off and lock out unit power.
2. Remove drive cover (see Fig. 24).
3. Press together the retaining clips on the fan cover and lift.
4. Disconnect the fan cable.
5. Install the new fan be reversing Steps 2 to 4.
6. Restore power.



C08681

Fig. 21 - VFD Module Fan Replacement

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:

1. Turn off and lock out unit power.
2. Remove the drive cover.
3. Press together the retaining clips on the fan cover and lift.
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.

APPENDIX - REMOTE VFD KEYPAD REFERENCE

NOTE: This Appendix only applies when a unit with the factory-installed SAV option is equipped with the filed-installed Remote VFD Keypad (Part Number: CRDISKKIT001A00).

On 48/50 single package rooftop units and 40RU fan coils equipped with the SAV option, the supply fan speed is controlled by a 3-phase VFD. See Figs. 4 through 10 for the location of the VFD in the units covered by this supplement.

The VFD is powered during normal operation to prevent condensation from forming on the boards during the off mode and is stopped by driving the speed to 0. The units use ABB VFDs. The interface wiring for the VFDs is shown in the Fig. 16 (on page 13). Terminal designations are shown in the Terminal Designation table (see Table 12 on page 13). Configurations are shown in the VFD Parameters tables (see Tables 16 through 19 on pages 20 through 23).

VFD Operation with Remote Keypad

The VFD keypad is shown in Fig. 22. The function of SOFT KEYS 1 and 2 change depending on what is displayed on the screen. The function of SOFT KEY 1 matches the word in the lower left-hand box on the display screen. The function of SOFT KEY 2 matches the word in the lower right-hand box on the display screen. If the box is empty, then the SOFT KEY does not have a function on that specific screen. The UP and DOWN keys are used to navigate through the menus. The OFF key is used to turn off the VFD. The AUTO key is used to change control of the drive to automatic control. The HAND key is used to change control of the drive to local (hand held) control. The HELP button is used to access the help screens.

For the VFD to operate on the units covered by this document, the drive must be set in AUTO mode. The word "AUTO" will appear in the upper left hand corner of the VFD display. Press the AUTO button to set the drive in AUTO mode.

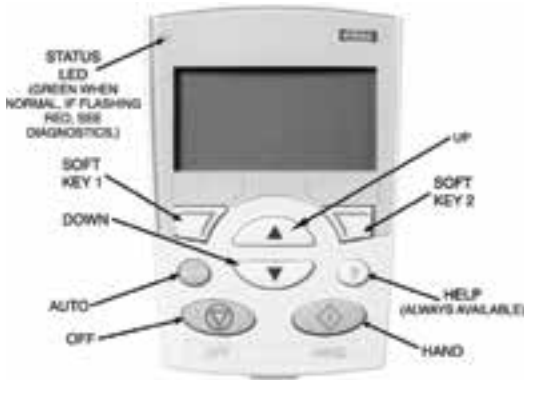


Fig. 22 - VFD Keypad

Start Up with Assistant

Initial start-up has been performed at the factory. Use of the start up assistant will override factory VFD configurations.

⚠ CAUTION

CONFIGURATION OVERRIDE HAZARD

DO NOT USE ABB OR CARRIER START-UP ASSISTANT ON THIS VFD APPLICAITON! Use of start-up assistant will override the factory VFD configurations!

Start Up by Changing Parameters Individually

Initial start-up is performed at the factory. To start up the VFD with by changing individual parameters, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.
2. Use the UP or DOWN keys to highlight PARAMETERS on the display screen and press ENTER (SOFT KEY 2).
3. Use the UP or DOWN keys to highlight the desired parameter group and press SEL (SOFT KEY 2).
4. Use the UP or DOWN keys to highlight the desired parameter and press EDIT (SOFT KEY 2).
5. Use the UP or DOWN keys to change the value of the parameter.
6. Press SAVE (SOFT KEY 2) to store the modified value. Press CANCEL (SOFT KEY 1) to keep the previous value. Any modifications that are not saved will not be changed.
7. Choose another parameter or press EXIT (SOFT KEY 1) to return to the listing of parameter groups. Continue until all the parameters have been configured and then press EXIT (SOFT KEY 1) to return to the main menu.

NOTE: The current parameter value appears above the highlight parameter. To view the default parameter value, press the UP and DOWN keys simultaneously. To restore the default factory settings, select the application macro "HVAC Default."

VFD Modes

The VFD has several different modes for configuring, operating, and diagnosing the VFD. The modes are:

1. Standard Display mode — shows drive status information and operates the drive
2. Parameters mode — edits parameter values individually
3. Start-up Assistant mode — guides the start up and configuration
4. Changed Parameters mode — shows all changed parameters
5. Drive Parameter Backup mode — stores or uploads the parameters
6. Clock Set mode — sets the time and date for the drive
7. I/O Settings mode — checks and edits the I/O settings

APPENDIX - REMOTE VFD KEYPAD REFERENCE (CONT)

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

APPENDIX - REMOTE VFD KEYPAD REFERENCE (CONT)

Table 17 – VFD Parameters — 48/50TC 16, 50TCQ 14, 48/50HC 14 and 50HCQ 12

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)
HK30WA352	ACH550–U0–012A–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–U0–012A–2	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–U0–017A–2	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–U0–024A–2	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–U0–024A–2	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–U0–06A9–4	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–U0–06A9–4	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–U0–08A8–4	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–U0–012A–4	5.0 HP 230V	HD60FL657	230	16.7	60Hz	1745	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	19.2	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA358	ACH550–U0–012A–4	5.0 HP 460V	HD60FL657	460	8.4	60Hz	1745	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	9.7	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA362	ACH550–U0–03A9–6	5.0 HP 575V	HD60FL575	575	5.1	60Hz	1725	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	5.9	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA354	ACH550–U0–06A1–6	5.0 HP 230V	HD60FK657	230	14.7	60Hz	1760	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	16.9	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA358	ACH550–U0–09A0–6	5.0 HP 460V	HD60FK657	460	6.8	60Hz	1760	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	7.8	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA362	ACH550–U0–09A0–6	5.0 HP 575V	HD60FL576	575	5.4	60Hz	1745	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	6.2	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec

APPENDIX - REMOTE VFD KEYPAD REFERENCE (CONT)

Table 18 – VFD Parameters — 48/50TC17-30, 50TCQ 17-24 and 48/50HC 17-28

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)
HK30WA352	ACH550–U0–012A–2	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–U0–017A–2	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–U0–024A–2	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–U0–024A–2	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–U0–024A–2	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–U0–024A–2	5.0 HP 230V	HD60FK657	230	14.7	60Hz	1760	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	16.9	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA358	ACH550–U0–024A–2	5.0 HP 460V	HD60FK657	460	6.8	60Hz	1760	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	7.8	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA362	ACH550–U0–031A–2	5.0 HP 575V	HD60FL576	575	5.4	60Hz	1745	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	6.2	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA354	ACH550–U0–031A–2	7.5 HP 230V	HD62FK654	230	23.5	60Hz	1760	7.5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	27.0	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA358	ACH550–U0–06A9–4	7.5 HP 460V	HD62FK654	460	11.9	60Hz	1760	7.5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	13.7	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA362	ACH550–U0–08A8–4	7.5 HP 575V	HD62FL576	575	9.0	60Hz	1750	7.5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	10.4	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA354	ACH550–U0–012A–4	5.0 HP 230V	HD60FL650	230	16.7	60Hz	1740	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	19.2	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA358	ACH550–U0–012A–4	5.0 HP 460V	HD60FL650	460	8.4	60Hz	1740	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	9.7	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA362	ACH550–U0–012A–4	5.0 HP 575V	HD60FL575	575	5.1	60Hz	1725	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	5.9	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA354	ACH550–U0–012A–4	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–U0–012A–4	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–U0–015A–4	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
HK30WA354	ACH550–U0–015A–4	7.5 HP 230V	HD62FL650	230	22.9	60Hz	1745	7.5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	26.3	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA358	ACH550–U0–06A1–6	7.5 HP 460V	HD62FL650	460	11.5	60Hz	1745	7.5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	13.2	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA362	ACH550–U0–09A0–6	7.5 HP 575V	HD62FL575	575	8.1	60Hz	1745	7.5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	9.3	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA355	ACH550–U0–09A0–6	10.0 HP 230V	HD64FK654	230	28	60Hz	1755	10	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	32.2	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA359	ACH550–U0–09A0–6	10.0 HP 460V	HD64FK654	460	12.6	60Hz	1755	10	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	14.5	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA363	ACH550–U0–09A0–6	10.0 HP 575V	HD64FL576	575	11.0	60Hz	1755	10	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	12.7	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA355	ACH550–U0–09A0–6	10.0 HP 230V	HD64FL650	230	30.8	60Hz	1745	10	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	35.4	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA359	ACH550–U0–011A–6	10.0 HP 460V	HD64FL650	460	15.4	60Hz	1745	10	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	17.7	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA363	ACH550–U0–011A–6	10.0 HP 575V	HD64FL575	575	11	60Hz	1740	10	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	12.7	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec

APPENDIX - REMOTE VFD KEYPAD REFERENCE (CONT)

Table 19 – 40RU/40RUQ Unit VFD Parameters — 40RUA 07-30, 40RUS 08-30 and 40RUQ 07-25

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)
HK30WA353	ACH550–U0–017A–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
HK30WA357	ACH550–U0–08A8–4	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
HK30WA361	ACH550–U0–06A1–6	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
HK30WA353	ACH550–U0–017A–2	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
HK30WA357	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–U0–017A–2	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–U0–08A8–4	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–U0–024A–2	5.0 HP 230V	HD60FK653	230	15.3	60Hz	1745	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	17.6	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA358	ACH550–U0–012A–4	5.0 HP 460V	HD60FK653	460	6.4	60Hz	1745	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	7.4	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA362	ACH550–U0–09A0–6	5.0 HP 575V	HD60FK575	575	5.4	60Hz	1760	5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	6.2	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA354	ACH550–U0–024A–2	7.5 HP 230V	HD62FK652	230	22.4	60Hz	1760	7.5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	25.8	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA358	ACH550–U0–012A–4	7.5 HP 460V	HD62FK652	460	9.7	60Hz	1760	7.5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	11.2	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA362	ACH550–U0–09A0–6	7.5 HP 575V	HD62FK576	575	9.0	60Hz	1750	7.5	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	10.4	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA355	ACH550–U0–031A–2	10.0 HP 230V	HD64FK654	230	30.8	60Hz	1760	10	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	35.4	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA359	ACH550–U0–015A–4	10.0 HP 460V	HD64FK654	460	15.4	60Hz	1760	10	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	17.7	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec
HK30WA363	ACH550–U0–011A–6	10.0 HP 575V	HD64FK575	575	11.0	60Hz	1755	10	DI 2,3	40Hz	60Hz	60Hz	16 FLT/ Alarm	12.7	0Hz	60Hz	4kHz	Auto	Ramp	Not Sel	30 sec	30 sec

APPENDIX - REMOTE VFD KEYPAD REFERENCE (CONT)

Standard Display Mode

Use the standard display mode to read information on the drive status and operate the drive. To reach the standard display mode, press EXIT until the LCD display shows status information as described below. (See Fig. 23.)

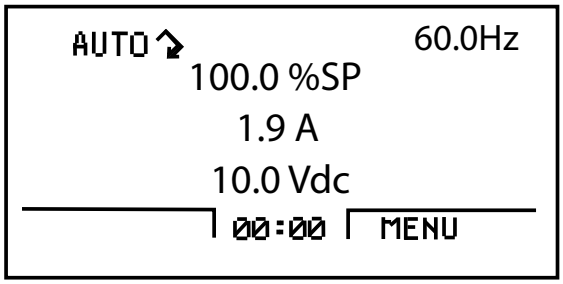


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Fig. 23 - Standard Display Example

The top line of the LCD display shows the basic status information of the drive. The HAND icon indicates that the drive control is local from the control panel. The AUTO icon indicates that the drive is in remote control mode, such as the basic I/O or field bus.

The arrow icon indicates the drive and motor rotation status. A rotating arrow (clockwise or counterclockwise) indicates that the drive is running and at set point and the shaft direction is forward or reverse. A rotating blinking arrow indicates that the drive is running but not at set point. A stationary arrow indicates that the drive is stopped. For the units covered in this manual, the correct display rotation is clockwise.

The upper right corner shows the frequency set point that the drive will maintain.

Using parameter group 34, the middle of the LCD display can be configured to display 3 parameter values. The default display shows parameters 0103 (OUTPUT FREQ) in percent speed, 0104 (CURRENT) in amperes, and 0120 (AI1) in voltage DC.

The bottom corners of the LCD display show the functions currently assigned to the two soft keys. The lower middle displays the current time (if configured to show the time).

The first time the drive is powered up, it is in the OFF mode. To switch to local hand-held control and control the drive using the control panel, press and hold the HAND button. Pressing the HAND button switches the drive to hand control while keeping the drive running. Press the AUTO button to switch to remote input control. To start the drive press the HAND or AUTO buttons, to stop the drive press the OFF button.

To adjust the speed in HAND mode, press the UP or DOWN buttons (the reference changes immediately). The reference can be modified in the local control (HAND) mode, and can be parameterized (using Group 11 reference select) to also allow modification in the remote control mode.

Parameters Mode

The Parameters mode is used to change the parameters on the drive. To change parameters, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.
2. Use the UP or DOWN keys to highlight PARAMETERS on the display screen and press ENTER (SOFT KEY 2).
3. Use the UP or DOWN keys to highlight the desired parameter group and press SEL (SOFT KEY 2).
4. Use the UP or DOWN keys to highlight the desired parameter and press EDIT (SOFT KEY 2).
5. Use the UP or DOWN keys to change the value of the parameter.
6. Press SAVE (SOFT KEY 2) to store the modified value. Press CANCEL (SOFT KEY 1) to keep the previous value. Any modifications that are not saved will not be changed.
7. Choose another parameter or press EXIT (SOFT KEY 1) to return to the listing of parameter groups. Continue until all the parameters have been configured and then press EXIT (SOFT KEY 1) to return to the main menu.

NOTE: The current parameter value appears above the highlight parameter. To view the default parameter value, press the UP and DOWN keys simultaneously. To restore the default factory settings, select the Carrier application macro.

APPENDIX - REMOTE VFD KEYPAD REFERENCE (CONT)

Changed Parameters Mode

The Changed Parameters mode is used to view and edit recently changed parameters on the drive. To view the changed parameters, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.
2. Use the UP or DOWN keys to highlight CHANGED PAR on the display screen and press ENTER (SOFT KEY 2). A list of the recently changed parameters will be displayed.
3. Use the UP or DOWN keys to highlight the desired parameter group and press EDIT (SOFT KEY 2) to change the parameter if desired.
4. Press EXIT (SOFT KEY 1) to exit the Changed Parameters mode.

Drive Parameter Backup Mode

The drive parameter back up mode is used to export the parameters from one drive to another. The parameters can be uploaded from a VFD to the removable control panel. The control panel can then be transferred to another drive and the parameters downloaded into memory.

Depending on the motor and application, there are two options available. The first option is to download all parameters. This copies both application and motor parameters to the drive from the control panel. This is recommended when using the same application for drives of the same size. This can also be used to create a backup of the parameters group for the drive.

The second option downloads only the application parameters to the drive. This is recommended when using the same application for drives of different sizes. Parameters 9905, 9906, 9907, 9908, 9909, 1605, 1607, 5201, and group 51 parameters and internal motor parameters are not copied.

Upload All Parameters

To upload and store parameters in the control panel from the VFD, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.
2. Use the UP or DOWN keys to highlight PAR BACKUP on the display screen and press ENTER (SOFT KEY 2).
3. Use the UP or DOWN keys to highlight UPLOAD TO PANEL and press SEL (SOFT KEY 2).
4. The text “Copying Parameters” will be displayed with a progress indicator. To stop the process, select ABORT (SOFT KEY 1).
5. When the upload is complete, the text “Parameter upload successful” will be displayed.
6. The display will then return to the PAR BACKUP menu. Select EXIT (SOFT KEY 1) to return to the main menu.
7. The control panel can now be disconnected from the drive.

Download All Parameters

To download all parameters from the control panel to the VFD, perform the following procedure:

1. Install the control panel with the correct parameters onto the VFD.
2. Select MENU (SOFT KEY 2). The Main menu will be displayed.
3. Use the UP or DOWN keys to highlight PAR BACKUP on the display screen and press ENTER (SOFT KEY 2).
4. Use the UP or DOWN keys to highlight DOWNLOAD TO DRIVE ALL and press SEL (SOFT KEY 2).
5. The text “Restoring Parameters” will be displayed with a progress indicator. To stop the process, select ABORT (SOFT KEY 1).
6. When the download is complete, the text “Parameter download successful” will be displayed.
7. The display will then return to the PAR BACKUP menu. Select EXIT (SOFT KEY 1) to return to the main menu.
8. The control panel can now be disconnected from the drive.

Download Application Parameters

To download application parameters only to the control panel from the VFD, perform the following procedure:

1. Install the control panel with the correct parameters onto the VFD.
2. Select MENU (SOFT KEY 2). The Main menu will be displayed.
3. Use the UP or DOWN keys to highlight PAR BACKUP on the display screen and press ENTER (SOFT KEY 2).
4. Use the UP or DOWN keys to highlight DOWNLOAD APPLICATION and press SEL (SOFT KEY 2).
5. The text “Downloading Parameters (partial)” will be displayed with a progress indicator. To stop the process, select ABORT (SOFT KEY 1).
6. When the download is complete, the text “Parameter download successful” will be displayed.
7. The display will then return to the PAR BACKUP menu. Select EXIT (SOFT KEY 1) to return to the main menu.
8. The control panel can now be disconnected from the drive.

Clock Set Mode

The clock set mode is used for setting the date and time for the internal clock of the VFD. In order to use the timer functions of the VFD control, the internal clock must be set. The date is used to determine weekdays and is visible in the fault logs.

APPENDIX - REMOTE VFD KEYPAD REFERENCE (CONT)

To set the clock, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.
2. Use the UP or DOWN keys to highlight CLOCK SET on the display screen and press ENTER (SOFT KEY 2). The clock set parameter list will be displayed.
3. Use the UP or DOWN keys to highlight CLOCK VISIBILITY and press SEL (SOFT KEY 2). This parameter is used to display or hide the clock on the screen. Use the UP or DOWN keys to change the parameter setting. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.
4. Use the UP or DOWN keys to highlight SET TIME and press SEL (SOFT KEY 2). Use the UP or DOWN keys to change the hours and minutes. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.
5. Use the UP or DOWN keys to highlight TIME FORMAT and press SEL (SOFT KEY 2). Use the UP or DOWN keys to change the parameter setting. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.
6. Use the UP or DOWN keys to highlight SET DATE and press SEL (SOFT KEY 2). Use the UP or DOWN keys to change the day, month, and year. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.
7. Use the UP or DOWN keys to highlight DATE FORMAT and press SEL (SOFT KEY 2). Use the UP or DOWN keys to change the parameter setting. Press OK (SOFT KEY 2) to save the configuration and return to the Clock Set menu.
8. Press EXIT (SOFT KEY 1) twice to return to the main menu.

I/O Settings Mode

The I/O Settings mode is used for viewing and editing the I/O settings.

To configure the I/O settings, perform the following procedure:

1. Select MENU (SOFT KEY 2). The Main menu will be displayed.
2. Use the UP or DOWN keys to highlight I/O SETTINGS on the display screen and press ENTER (SOFT KEY 2). The I/O Settings parameter list will be displayed.
3. Use the UP or DOWN keys to highlight the desired I/O setting and press SEL (SOFT KEY 2).
4. Use the UP or DOWN keys to select the parameter to view. Press OK (SOFT KEY 2).
5. Use the UP or DOWN keys to change the parameter setting. Press SAVE (SOFT KEY 2) to save the configuration. Press CANCEL (SOFT KEY 1) to keep the previous value. Any modifications that are not saved will not be changed.
6. Press EXIT (SOFT KEY 1) twice to return to the main menu.

VFD Diagnostics

The drive detects error situations and reports them using:

1. Green and red LEDs on the body of the drive (located under the keypad)
2. Status LED on the control panel
3. Control panel display
4. The Fault Word and Alarm Word parameter bits (parameters 0305 to 0309)

The form of the display depends on the severity of the error. The user can specify the severity for many errors by directing the drive to ignore the error situation, report the situation as an alarm, or report the situation as a fault.

Faults (Red LED Lit)

The VFD signals that it has detected a severe error, or fault, by:

1. Enabling the red LED on the drive (LED is either steady or flashing)
2. Setting an appropriate bit in a Fault Word parameter (0305 to 0307)
3. Overriding the control panel display with the display of a fault code
4. Stopping the motor (if it was on)
5. Sets an appropriate bit in Fault Word parameter 0305- 0307.

The fault code on the control panel display is temporary. Pressing the MENU, ENTER, UP button or DOWN buttons removes the fault message. The message reappears after a few seconds if the control panel is not touched and the fault is still active.

Alarms (Green LED Flashing)

For less severe errors, called alarms, the diagnostic display is advisory. For these situations, the drive is simply reporting that it had detected something unusual. In these situations, the drive:

1. Flashes the green LED on the drive (does not apply to alarms that arise from control panel operation errors)
2. Sets an appropriate bit in an Alarm Word parameter (0308 or 0309)
3. Overrides the control panel display with the display of an alarm code and/or name

Alarm messages disappear from the control panel display after a few seconds. The message returns periodically as long as the alarm condition exists.

APPENDIX - REMOTE VFD KEYPAD REFERENCE (CONT)

Correcting Faults

The recommended corrective action for faults is shown in the Fault Listing Table 20. The VFD can also be reset to remove the fault. If an external source for a start command is selected and is active, the VFD may start immediately after fault reset.

To reset a fault indicated by a flashing red LED, turn off the power for 5 minutes. To reset a fault indicated by a red LED (not flashing), press RESET from the control panel or turn off the power for 5 minutes. Depending on the value of parameter 1604 (FAULT RESET SELECT), digital input or serial communication could also be used to reset the drive. When the fault has been corrected, the motor can be started.

History

For reference, the last three fault codes are stored into parameters 0401, 0412, 0413. For the most recent fault (identified by parameter 0401), the drive stores additional data (in parameters 0402 through 0411) to aid in troubleshooting a problem. For example, a parameter 0404 stores the motor speed at the time of the fault. To clear the fault history (all of Group 04, Fault History parameters), follow these steps:

1. In the control panel, Parameters mode, select parameter 0401.
2. Press EDIT.
3. Press the UP and DOWN buttons simultaneously.
4. Press SAVE.

Correcting Alarms

To correct alarms, first determine if the Alarm requires any corrective action (action is not always required). Use Table 21 to find and address the root cause of the problem.

If diagnostics troubleshooting has determined that the drive is defective during the warranty period, contact ABB Automation Inc., at 1-800-435-7365, option 4, option 3. A qualified technician will review the problem with the caller and make a determination regarding how to proceed. This may involve dispatching a designated service station (DSS) representative from an authorized station, dispatching a replacement unit, or advising return for repair.

Control Panel Cleaning

Use a soft damp cloth to clean the control panel. Avoid harsh cleaners which could scratch the display window.

Battery Replacement

A battery is only used in assistant control panels that have the clock function available and enabled. The battery keeps the clock operating in memory during power interruptions. The expected life for the battery is greater than ten years. To remove the battery, use a coin to rotate the battery holder on the back of the control panel. Replace the battery with type CR2032.

APPENDIX - REMOTE VFD KEYPAD REFERENCE (CONT)

Table 20 – FAULT CODES

FAULT CODE	FAULT NAME IN PANEL	DESCRIPTION AND RECOMMENDED CORRECTIVE ACTION
1	OVERCURRENT	Output current is excessive. Check for excessive motor load, insufficient acceleration time (parameters 2202 ACCELER TIME 1, default 30 seconds), or faulty motor, motor cables or connections.
2	DC OVERVOLT	Intermediate circuit DC voltage is excessive. Check for static or transient over voltages in the input power supply, insufficient deceleration time (parameters 2203 DECELER TIME 1, default 30 seconds), or undersized brake chopper (if present).
3	DEV OVERTEMP	Drive heat sink is overheated. Temperature is at or above 115°C (239°F). Check for fan failure, obstructions in the air flow, dirt or dust coating on the heat sink, excessive ambient temperature, or excessive motor load.
4	SHORT CIRC	Fault current. Check for short–circuit in the motor cable(s) or motor or supply disturbances.
5	OVERLOAD	Inverter overload condition. The drive output current exceeds the ratings.
6	DC OVERVOLT	Intermediate circuit DC voltage is not sufficient. Check for missing phase in the input power supply, blown fuse, or under voltage on main circuit.
7	AI1 LOSS	Analog input 1 loss. Analog input value is less than AI1 FLT LIMIT (3021). Check source and connection for analog input and parameter settings for AI1 FLT LIMIT (3021) and 3001 AI<MIN FUNCTION.
8	AI2 LOSS	Analog input 2 loss. Analog input value is less than AI2 FLT LIMIT (3022). Check source and connection for analog input and parameter settings for AI2 FLT LIMIT (3022) and 3001 AI<MIN FUNCTION.
9	MOT OVERTEMP	Motor is too hot, as estimated by the drive. Check for overloaded motor. Adjust the parameters used for the estimate (3005 through 3009). Check the temperature sensors and Group 35 parameters.
10	PANEL LOSS	Panel communication is lost and either drive is in local control mode (the control panel displays LOC), or drive is in remote control mode (REM) and is parameterized to accept start/stop, direction or reference from the control panel. To correct check the communication lines and connections. Check parameter 3002 PANEL COMM ERROR, parameters in Group 10: Command Inputs and Group 11:Reference Select (if drive operation is REM).
11	ID RUN FAIL	The motor ID run was not completed successfully. Check motor connections.
12	MOTOR STALL	Motor or process stall. Motor is operating in the stall region. Check for excessive load or insufficient motor power. Check parameters 3010 through 3012.
13	RESERVED	Not used.
14	EXT FAULT 1	Digital input defined to report first external fault is active. See parameter 3003 EXTERNAL FAULT 1.
15	EXT FAULT 2	Digital input defined to report second external fault is active. See parameter 3004 EXTERNAL FAULT 2.
16	EARTH FAULT	The load on the input power system is out of balance. Check for faults in the motor or motor cable. Verify that motor cable does not exceed maximum specified length.
17	UNDERLOAD	Motor load is lower than expected. Check for disconnected load. Check parameters 3013 UNDERLOAD FUNCTION through 3015 UNDERLOAD CURVE.
18	THERM FAIL	Internal fault. The thermistor measuring the internal temperature of the drive is open or shorted. Contact Carrier.
19	OPEX LINK	Internal fault. A communication–related problem has been detected between the OMIO and OINT boards. Contact Carrier.
20	OPEX PWR	Internal fault. Low voltage condition detected on the OINT board. Contact Carrier.
21	CURR MEAS	Internal fault. Current measurement is out of range. Contact Carrier.
22	SUPPLY PHASE	Ripple voltage in the DC link is too high. Check for missing main phase or blown fuse.
23	RESERVED	Not used.
24	OVERSPEED	Motor speed is greater than 120% of the larger (in magnitude) of 2001 MINIMUM SPEED or 2002 MAXIMUM SPEED parameters. Check parameter settings for 2001 and 2002. Check adequacy of motor braking torque. Check applicability of torque control. Check brake chopper and resistor.
25	RESERVED	Not used.
26	DRIVE ID	Internal fault. Configuration block drive ID is not valid.
27	CONFIG FILE	Internal configuration file has an error. Contact Carrier.
28	SERIAL 1 ERR	Field bus communication has timed out. Check fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). Check communication settings (Group 51 or 53 as appropriate). Check for poor connections and/or noise on line.
29	EFB CON FILE	Error in reading the configuration file for the field bus adapter.
30	FORCE TRIP	Fault trip forced by the field bus. See the field bus reference literature.
31	EFB 1	Fault code reserved for the EFB protocol application. The meaning is protocol dependent.
32	EFB 2	Fault code reserved for the EFB protocol application. The meaning is protocol dependent.
33	EFB 3	Fault code reserved for the EFB protocol application. The meaning is protocol dependent.
34	MOTOR PHASE	Fault in the motor circuit. One of the motor phases is lost. Check for motor fault, motor cable fault, thermal relay fault, or internal fault.
35	OUTP WIRING	Error in power wiring suspected. Check that input power wired to drive output. Check for ground faults.
101 – 105	SYSTEM ERROR	Error internal to the drive. Contact Carrier and report the error number.

PPENDIX - REMOTE VFD KEYPAD REFERENCE (CONT)

Table 20 — FAULT CODES (cont)

FAULT CODE	FAULT NAME IN PANEL	DESCRIPTION AND RECOMMENDED CORRECTIVE ACTION
201 – 206	SYSTEM ERROR	Error internal to the drive. Contact Carrier and report the error number.
1000	PAR HZRPM	Parameter values are inconsistent. Check for any of the following: 2001 MINIMUM SPEED > 2002 MAXIMUM SPEED 2007 MINIMUM FREQ > 2008 MAXIMUM FREQ 2001 MINIMUM SPEED / 9908 MOTOR NOM SPEED is outside of the range: −128/+128 2002 MAXIMUM SPEED / 9908 MOTOR NOM SPEED is outside of the range: −128/+128 2007 MINIMUM FREQ / 9907 MOTOR NOM FREQ is outside of the range: − 128/+128 2008 MAXIMUM FREQ / 9907 MOTOR NOM FREQ is outside of the range: − 128/+128
1001	PAR PFA REFNG	Parameter values are inconsistent. Check that 2007 MINIMUM FREQ is negative, when 8123 PFA ENABLE is active.
1002	PAR PFA IOCNF	Parameter values are inconsistent. The number of programmed PFA relays does not match with Interlock configuration, when 8123 PFA ENABLE is active. Check consistency of RELAY OUTPUT parameters 1401 through 1403, and 1410 through 1412. Check 8117 NR OF AUX MOTORS, 8118 AUTOCHANGE INTERV, and 8120 INTERLOCKS.
1003	PAR AI SCALE	Parameter values are inconsistent. Check that parameter 1301 AI 1 MIN > 1302 AI 1 MAX and that parameter 1304 AI 2 MIN > 1305 AI 2 MAX.
1004	PAR AO SCALE	Parameter values are inconsistent. Check that parameter 1504 AO 1 MIN > 1505 AO 1 MAX and that parameter 1510 AO 2 MIN > 1511 AO 2 MAX.
1005	PAR PCU 2	Parameter values for power control are inconsistent: Improper motor nominal kVA or motor nominal power. Check the following parameters: 1.1 < (9906 MOTOR NOM CURR * 9905 MOTOR NOM VOLT * 1.73 / PN) < 2.6 Where: PN = 1000 * 9909 MOTOR NOM POWER (if units are kW) or PN = 746 * 9909 MOTOR NOM POWER (if units are HP, e.g., in US)
1006	PAR EXT RO	Parameter values are inconsistent. Check the extension relay module for connection and 1410 through 1412 RELAY OUTPUTS 4 through 6 have non−zero values.
1007	PAR FBUS	Parameter values are inconsistent. Check that a parameter is set for field bus control (e.g., 1001 EXT1 COMMANDS = 10 (COMM)), but 9802 COMM PROT SEL = 0.
1008	PAR PFA MODE	Parameter values are inconsistent. The 9904 MOTOR CTRL MODE must = 3 (SCALAR SPEED) when 8123 PFA ENABLE activated.
1009	PAR PCU 1	Parameter values for power control are inconsistent or improper motor nominal frequency or speed. Check for both of the following: 1 < (60 * 9907 MOTOR NOM FREQ / 9908 MOTOR NOM SPEED < 16 0.8 < 9908 MOTOR NOM SPEED / (120 * 9907 MOTOR NOM FREQ / Motor poles) < 0.992
1010	OVERRIDE/PFA CONFLICT	Override mode is enabled and PFA is activated at the same time. This cannot be done because PFA interlocks cannot be observed in the override mode.

APPENDIX - REMOTE VFD KEYPAD REFERENCE (CONT)

Table 21 – ALARM CODES

ALARM CODE	ALARM NAME IN PANEL	DESCRIPTION AND RECOMMENDED CORRECTIVE ACTION
2001	–	Reserved
2002	–	Reserved
2003	–	Reserved
2004	DIR LOCK	The change in direction being attempted is not allowed. Do not attempt to change the direction of motor rotation, or Change parameter 1003 DIRECTION to allow direction change (if reverse operation is safe).
2005	I/O COMM	Field bus communication has timed out. Check fault setup (3018 COMM FAULT FUNC and 3019 COMM FAULT TIME). Check communication settings (Group 51 or 53 as appropriate). Check for poor connections and/or noise on line.
2006	AI1 LOSS	Analog input 1 is lost, or value is less than the minimum setting. Check input source and connections. Check the parameter that sets the minimum (3021) and the parameter that sets the Alarm/Fault operation (3001).
2007	AI2 LOSS	Analog input 2 is lost, or value is less than the minimum setting. Check input source and connections. Check parameter that sets the minimum (3022) and the parameter that sets the Alarm/Fault operation (3001).
2008	PANEL LOSS	Panel communication is lost and either the VFD is in local control mode (the control panel displays HAND), or the VFD is in remote control mode (AUTO) and is parameterized to accept start/stop, direction or reference from the control panel. To correct, check the communication lines and connections, Parameter 3002 PANEL LOSS, and parameters in groups 10 COMMAND INPUTS and 11 REFERENCE SELECT (if drive operation is REM).
2009	–	Reserved
2010	MOT OVERTEMP	Motor is hot, based on either the VFD estimate or on temperature feedback. This alarm warns that a Motor Overload fault trip may be near. Check for overloaded motor. Adjust the parameters used for the estimate (3005 through 3009). Check the temperature sensors and Group 35 parameters.
2011	UNDERLOAD	Motor load is lower than expected. This alarm warns that a Motor Underload fault trip may be near. Check that the motor and drive ratings match (motor is NOT undersized for the drive). Check the settings on parameters 3013 to 3015.
2012	MOTOR STALL	Motor is operating in the stall region. This alarm warns that a Motor Stall fault trip may be near.
2013*	AUTORESET	This alarm warns that the drive is about to perform an automatic fault reset, which may start the motor. To control automatic reset, use parameter group 31 (AUTOMATIC RESET).
2014	AUTOCHANGE	This alarm warns that the PFA autochange function is active. To control PFA, use parameter group 81 (PFA) and the Pump Alternation macro.
2015	PFA INTERLOCK	This alarm warns that the PFA interlocks are active, which means that the drive cannot start any motor (when Autochange is used), or a speed regulated motor (when Autochange is not used).
2016	–	Reserved
2017*	OFF BUTTON	This alarm indicates that the OFF button has been pressed.
2018	PID SLEEP	This alarm warns that the PID sleep function is active, which means that the motor could accelerate when the PID sleep function ends. To control PID sleep, use parameters 4022 through 4026 or 4122 through 4126.
2019	ID RUN	The VFD is performing an ID run.
2020	OVERRIDE	Override mode is activated.
2021	START ENABLE 1 MISSING	This alarm warns that the Start Enable 1 signal is missing. To control Start Enable 1 function, use parameter 1608. To correct, check the digital input configuration and the communication settings.
2022	START ENABLE 2 MISSING	This alarm warns that the Start Enable 2 signal is missing. To control Start Enable 2 function, use parameter1609. To correct, check the digital input configuration and the communication settings.
2023	EMERGENCY STOP	Emergency stop is activated.

* This alarm is not indicated by a relay output, even when the relay output is configured to indicate alarm conditions, parameter 1401 RELAY OUTPUT = 5 (ALARM) or 16 (FLT/ALARM).

APPENDIX - REMOTE VFD KEYPAD REFERENCE (CONT)

Reset After Using Start-Up Assistant

⚠ CAUTION

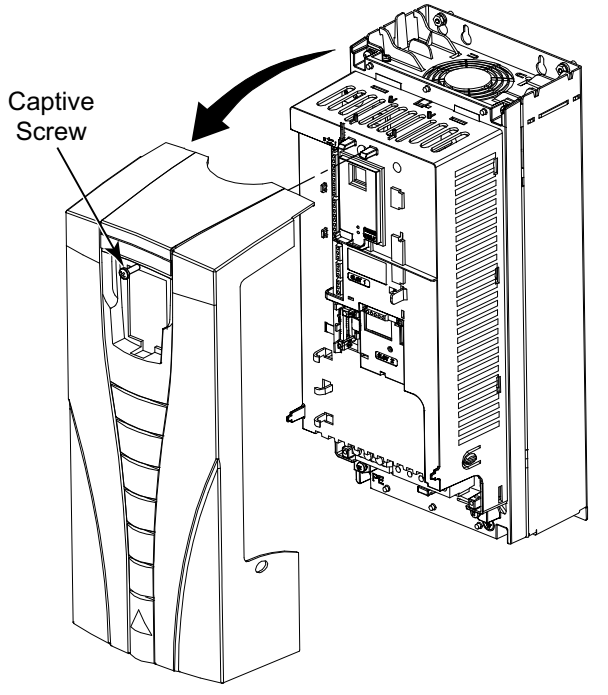
CONFIGURATION OVERRIDE HAZARD

DO NOT USE ABB OR CARRIER START-UP ASSISTANT ON THIS VFD APPLICAITON! Use of start-up assistant will override the factory VFD configurations!

The following section details how to reset the VFD after accidentally using Start-Up Assistant.

When the VFD has been incorrectly programmed by using Start-Up Assistant, the drive may be locked in an override loop because of motor *ID Run Fai*l (error code 11) and *First Start* (error code 2025).

1. Disconnect unit power. Lock-out/tag out.
2. Remove the VFD's front cover (see Fig. 24)



C12012

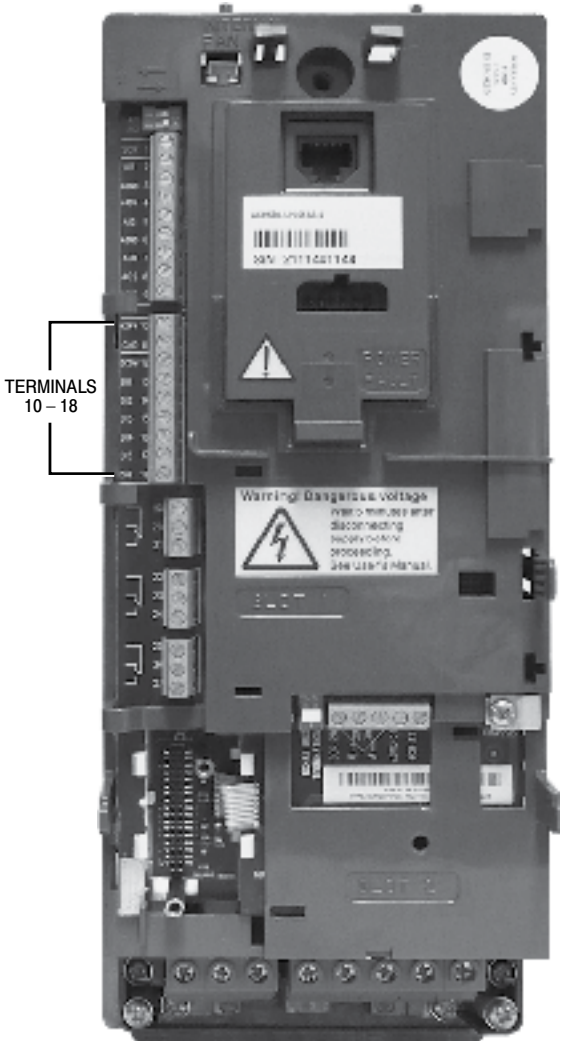
Fig. 24 - Remove VFD Front Cover

3. Disconnect the DI1 input at Terminal 13 (see Fig. 25 for location of DI1).
4. Connect the VFD Keypad accessory to the VFD (if not already connected).

NOTE: The VFD Keypad is a field-installed accessory; it is not included with the factory-installed VFD option.

5. With the wire disconnected, use the keypad to stop the loop and enter "*358*" in parameter 1704 OVERRIDE PASS CODE.
6. Go immediately to parameter 1705 OVERRIDE ENABLE and select "*Off*".
7. At this point, providing you have a clean backup of the drive, you can select "*DOWNLOAD FULL SET*" from '*PAR BACKUP*" from the Main Menu.

   If you do not have a clean backup the drive will have to be manually programmed following the instructions in this document.
8. When the correct parameters have been uploaded, disconnect power to the unit, reconnect DI1 to Terminal 13, and replace the VFD cover.
9. Reconnect power to the unit. The VFD is now commissioned from the backup file.



C13806

Fig. 25 - Location of VFD Terminal Strip

APPENDIX B
(ICM LOW AMBIENT CONTROL)

ICM325HN

Head Pressure Control with Optional Heat Pump Override

Temperature sensitive control regulates head pressure

Installation, Operation & Application Guide

For more information on our complete range of American-made products – plus wiring diagrams, troubleshooting tips and more, visit us at **www.icmcontrols.com**

Caution!

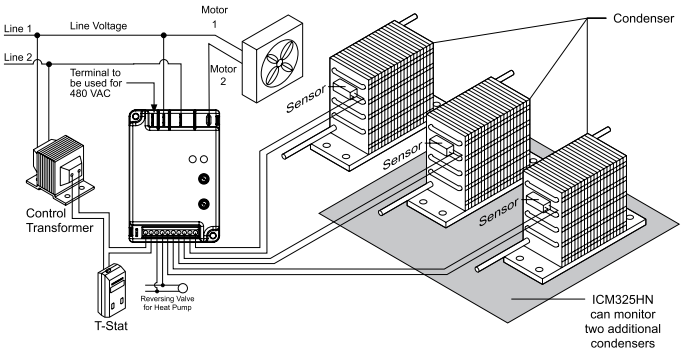
Installation of the ICM325HN shall be performed by trained technicians only. Adhere to all local and national electric codes.

Disconnect all power to the system before making any connections.

Specifications

- **Line voltage:** 120, 208, 240, and 480 VAC
- **Control voltage:** 18-30 VAC
- **Frequency:** 50-60 Hz
- **Operating temperature:** -40ºF to +176ºF (-40°C to +75°C)
- **Sensors:** 10K ohms at 77°F (25°C)
- **Heat pump override:** 24 VAC N.C. or N.O.
  - ⁂ **Note:** A maximum of three sensors can be connected to the control.
- **Weight:** 12 ounces (341 grams)
  - ⁂ **Note:** *The **ICM325HN** should be applied to motors and equipment that have been designated by their respective manufacturers as capable of being speed controlled.*
- **Mounting:**
  - – Surface mount using (4) #8 screws
  - – The **ICM325HN** should be surface mounted to a clean metal or other thermally conductive surface for maximum heat dissipation
  - – It is recommended that the **ICM325HN** be mounted away from the condenser exhaust air in order to maintain lower operating temperatures

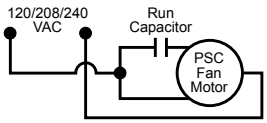
ICM325HN Typical Installation



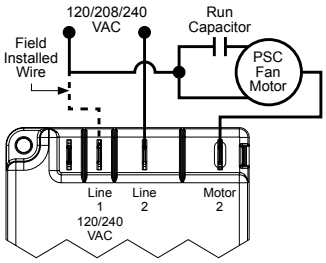
Connections for ICM325HN at 120/208/240 VAC

1. Remove power from system.
2. Field install a wire from **Line 1** wire to **Line 1** terminal.
3. Cut **Line 2** wire; affix motor side to **Motor 2** terminal and line side to **Line 2** terminal.
4. Make 24 VAC, probe and HP connections.
5. Verify wiring is correct.
6. Power up system and check operation.

Typical condenser fan



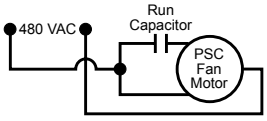
Typical condenser fan with ICM325HN installed



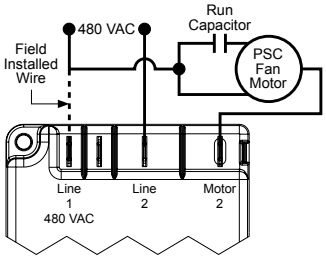
Connections for ICM325HN at 480 VAC

1. Remove power from system.
2. Field install a wire from **Line 1** wire to **Line 1** terminal.
3. Cut **Line 2** wire; affix motor side to **Motor 2** terminal and line side to **Line 2** terminal.
4. Make 24 VAC, probe and HP connections.
5. Verify wiring is correct.
6. Power up system and check operation.

Typical condenser fan



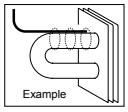
Typical condenser fan with ICM325HN installed



Connecting the Probe

1. Install the temperature probe several bends into the condenser. It can be attached to the U-bend or placed between the fins in the upper 1/3 of the condenser (see other side for more information).

   ⁂ **Note:** *The response of the system can be fine tuned by repositioning the probe. Place the probe on the condenser where it is 100°F when pressures are correct for best response.*

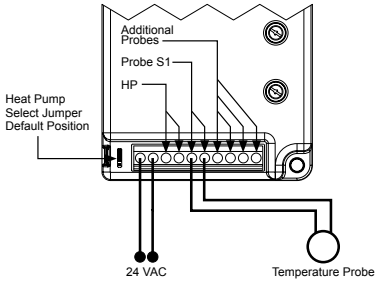


2. Connect the two wires from the sensor to the terminal block where it is marked **PROBE S1**. If additional probes are necessary for multiple refrigerant circuits, they may be attached to terminals marked **PROBE S2** and **PROBE S3**.

   ⁂ **Note:** *The control will respond to the probe that senses the highest temperature.*

Connections for Air Conditioning Only

1. **For non-heat pump applications**, the heat pump select jumper must be in the **Default** (**N.O.**) position, and the HP terminals must be left unconnected.
2. Set the **Cutout Speed** and the **Hard Start Time** to the appropriate positions for the type of motor you have (see other side).



APPENDIX C (SPACE SENSOR)

SPC RH/T Transmitter with Setpoint Control

Installation Manual

Introduction

The RH/T transmitter incorporates two sensors in one attractive wall mount enclosure for the most efficient environmental monitoring and control system. It uses a field-proven RH sensor to monitor relative humidity and a curve-matched thermistor to measure temperature. Two setpoint controls are also available for temperature and RH adjustment. The device may also include an occupancy override button and an external communication jack. Both measurements and setpoint signals are available on separate outputs as linear 4-20 mA, 0-5 or 0-10 Vdc signals.

Several configurations of the device are available with one to four outputs as required. An LCD is included for configuration and local indication of all parameters. Several operating parameters can be programmed using a keypad for specific applications including four temperature ranges and C/F display.

Before Installation

Read these instructions carefully before installing and commissioning the device. Failure to follow these instructions may result in product damage. Do not use in an explosive or hazardous environment, with combustible or flammable gases, as a safety or emergency stop device or in any other application where failure of the product could result in personal injury. Take electrostatic discharge precautions during installation and do not exceed the device ratings.

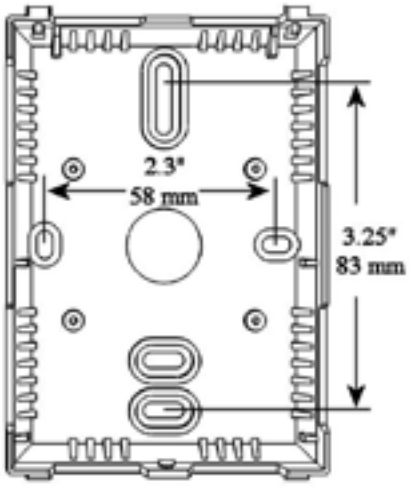
Mounting

The room type sensor installs directly on a standard electrical box and should be mounted about five feet from the floor of the area to be controlled. Do not mount the sensor near doors, opening windows, supply air diffusers or other known air disturbances.

The cover is hooked to the base at the top edge and must be removed from the bottom edge first. Use a small screwdriver to carefully pry each bottom corner if necessary. If a security screw is installed on the bottom edge, then it may have to be loosened or removed also. Tip the cover away from the base and sit it aside.

The pcb must be removed from the base to access the mounting holes. Follow usual anti-static procedures when handling the pcb and be careful not to touch or bend the sensors. The pcb is removed by pressing the tab on the enclosure base to unsnap the latch near the bottom edge, then the pcb can be lifted out of the base. Sit the pcb aside until the base is mounted on the wall.

After the base is screwed to an electrical box or the wall using the appropriate holes, pull the wires through the wiring hole in the center of the pcb and then gently reinstall it in the enclosure base. Ensure the pcb is snapped into the base securely and correctly. The mounting hole locations are shown in the following drawing.



Wiring
Deactivate the 24 Vac/dc power supply until all connections are made to the device to prevent electrical shock or equipment damage. Follow proper electrostatic discharge (ESD) handling procedures when installing the device or equipment damage may occur.

Use 22 AWG shielded wiring for all connections and do not locate the device wires in the same conduit with wiring used to supply inductive loads such as motors. Connect the cable shield to ground at the controller only. Make all connections in accordance with national and local codes.

This is a sourcing device and requires from 3 to 14 wires to implement all the features. Connect the plus dc or the ac voltage hot side to the **POWER** terminal. The power supply common is connected to the **COMMON** terminal. The device is reverse voltage protected and will not operate if connected backwards. It has a half-wave power supply so the supply common is the same as the signal common. Several devices may be connected to one power supply and the output signals all share the same common. Use caution when grounding the secondary of a transformer or when wiring multiple devices to ensure the ground point is the same on all devices and the controller.

The analog outputs are available on the **RH OUT**, **TEMP OUT**, **TEMP SET** and **RH SET** terminals. For 4-20 mA output type, all outputs operate in the Active mode and do not require a loop power supply. This means **the signal current is generated by the transmitter and must not be connected to a powered input or device damage will result.** Check the controller Analog Input to determine the proper connection before applying power. All output signals are referenced to the **COMMON** terminal. The analog output signals are typically connected directly to the Building Automation System and used as control parameters or for logging purposes.

The device is also available with field-selectable 0-5 or 0-10 Vdc voltage signal outputs which connect directly to a high impedance analog input. In either case the terminal designations are the same and the signals are referenced to **COMMON.**

The **OCC IN** terminal is a digital input that controls the OCC segment on the LCD to indicate an occupied condition. It can be connected to a 0/5V digital signal or a dry contact signal. This is usually an active low input signal and requires that the OCC IN terminal be shorted to COMMON to activate the input.

The override switch output is a dry-contact and is available on the **SWITCH +** and **SWITCH –** terminals. It is typically connected to a low-voltage digital input on the controller to indicate room occupancy or override when the button is activated.

The resistive fan speed output signal is available on the **FAN +** and **FAN –** terminals and has five positions.

The external jack is internally connected to a three-pin terminal block labeled **RING**, **MID** and **TIP** to accept a stereo phono plug for remote communication with the controller.

Start-up
Verify that the transmitter is properly wired and connections are tight. Apply power and note that the LCD will begin displaying the RH and temperature levels (if configured for both). The display normally toggles between the two values on a 2 second interval. All the output signals will also be available immediately after start-up.

LCD Display
If the device has both RH and temperature signals, then the multi-function display is factory set to display both measurement values at two second intervals. The RH will be displayed as 0 - 100 %RH for two seconds and then the temperature will be displayed as 0.0 - 35.0 °C for two seconds. This cycle will repeat constantly.

If the device is only configured for one parameter, RH or T, then only one parameter will be displayed continuously. The Setup Menu can be used to modify the displayed information. For RH and T devices, the installer can select to only display RH or temperature continuously. The device supports four temperature ranges that may also be selected in the menu. The default is 0-35 °C but this may be changed to 32-95 °C and the output signal will stay the same. Also, the temperature range may be changed to 32-122 °F or 0-50 °C and the output signal scaling will change to match the display.

Outputs (Available outputs depend on the configuration)
The RH output is scaled such that 4-20 mA (or 0-5 or 0-10 Vdc) equals 0-100 %RH and is temperature compensated over the full 0-50 °C temperature range. The temperature output is scaled such that 4-20 mA (or 0-5 or 0-10 Vdc) equals either 0-35 °C, 32-95 °F, 0-50 °C or 32-122 °F depending on which range is selected in the menu. The factory default range is 0-35 °C.

In addition, there may also be one or two setpoint output signals. These outputs are also 4-20 mA (or 0-5 or 0-10 Vdc). Scaling is determined by parameters set in the Setup Menu. If available, the temperature setpoint signal factory defaults to 22 ± 5 °C. In this case, a setpoint equal to 22 °C would cause an output signal of 12 mA or 50% of the range (4-20 mA). Each step up or down will cause a proportional change in the output to either 20 mA or 4 mA. Both the midpoint and the range can be configured in the menu. The midpoint may be changed from 18-27 °C or 65-80 °F and the range can be changed from ± 2 to ± 10 °C or ± 5 to ± 20 °F. The display and output scaling will change to match the selected range.

The following table shows the changes that would result from ± 5 ° range on the setpoint control with a midpoint of 22 °C:

	Setpoint Temperature	4-20 mA Device	0-5 Vdc Device	0-10 Vdc Device
-5	17 °C	4.0 mA	0.0 Vdc	0 Vdc
-4	18 °C	5.6 mA	0.5 Vdc	1 Vdc
-3	19 °C	7.2 mA	1.0 Vdc	2 Vdc
-2	20 °C	8.8 mA	1.5 Vdc	3 Vdc
-1	21 °C	10.4 mA	2.0 Vdc	4 Vdc
Midpoint	22 °C	12.0 mA	2.5 Vdc	5 Vdc
+1	23 °C	13.6 mA	3.0 Vdc	6 Vdc
+2	24 °C	15.2 mA	3.5 Vdc	7 Vdc
+3	25 °C	16.8 mA	4.0 Vdc	8 Vdc
+4	26 °C	18.4 mA	4.5 Vdc	9 Vdc
+5	27 °C	20.0 mA	5.0 Vdc	10 Vdc

The RH setpoint operates in a similar manner. The factory default midpoint is 45 %RH and the range is ± 10 %RH to result in a control of 35, 36, 37 .... 53, 54 and 55 %RH. The output signal is scaled the same as shown above. Again, the midpoint may be change in the menu from 20-70 %RH and the range can be either ± 5, ± 10 or ± 20 %RH.

Note that all programmed parameters and the actual setpoint values are saved in non-volatile memory so the device will remember the settings after a power-outage.

Setpoint Operation (Depends on the hardware configuration)
The device may have 0, 1 or 2 setpoint controls. If the device has no setpoint control, then the UP and DOWN buttons will not be available to the user and the device will only display RH or T or both and will only have the corresponding outputs.

If the device has a setpoint control, RH or T or both, then the unit will have two buttons labeled UP and DOWN for setpoint adjustment. During normal operation, the LCD displays either RH or T or both depending on the hardware configuration and program settings. When either the UP or DOWN buttons are pressed the display will change to setpoint mode (indicated by a flashing display). The display will show the previous setpoint setting such as 22.0 °C or 72.0 °F for temperature setpoint or 45 %RH for humidity setpoint. If no other action is taken for 5 seconds then the device will reset to normal operation. While the display is still flashing the setpoint can be modified by pressing the UP or DOWN buttons to increase or decrease the setpoint value. The LCD will update to show the new setpoint and the output signal will update accordingly. When the desired setpoint is shown on the LCD, leave the unit for 5 seconds to reset to normal operation and save the new setting. Note that the setpoint can only be set around the programmed midpoint and within the programmed range as set in the menu.

If the device has two setpoint controls, for both RH and T, then the UP and DOWN buttons have two functions. Operation is the same as described above except the device will show the main (default is temperature) setpoint first when either UP or DOWN is pressed. The main setpoint may be modified at this time by using the UP or DOWN buttons as before. To access the secondary (default is RH) setpoint, press and hold either the UP or DOWN buttons for 5 seconds and the device will enter the secondary setpoint mode. Then the second setpoint may be modified with the UP or DOWN buttons. All setpoint changes are saved on exit after 5 seconds. The main and secondary setpoints can be assigned in the menu.

Setup Menu

The menu has several items as shown below and the device cover must be removed to access the menu. To enter the menu, press and release the <MENU> key while in normal operation. This will enter the Setup Menu step 1, pressing the <MENU> key a second time advances to step 2. Each press of the <MENU> key advances the menu item. No values are changed by using the <MENU> key but the previous value is saved, so any changes made will be saved by pressing the <MENU> key. The <UP> and <DOWN> keys are used to make changes to program variables by scrolling through the available options. When a value is changed, use the <MENU> key to save it to memory and advance to the next menu item.

Setup Menu operation is explained below and the factory default values are shown. Note that some items that are not applicable to the hardware configuration are skipped in the menu so the menu may skip from item 4 to item 6 for example.

<MENU> Press and release the <MENU> key to enter the Setup Menu

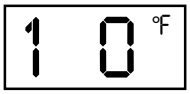
1.

C/F The temperature scale defaults to Celsius (°C), but may be changed to Fahrenheit (°F).

2.

Temperature Range

Two temperature ranges are available for both °C and °F, 0-35 °C (32-95 °F) or 50 °C (32-122 °F).

3. 

Temperature Offset

The default is 0, but can be changed from -9 to +9 °F for temperature calibration.

4.

Temperature Setpoint Midpoint

The default is 22°C, or 72°F, but can be changed to 18-27 °C, or 65-80°F.

5.

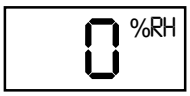
Temperature Setpoint Range

The default range is ± for 22°C and ± for 10°F, but can be changed to ± 2 to ± 10 for °C or ± 5 to ± 20 for °F.

6.

Temperature Setpoint Resolution

The default range is 1.0 °C or 1.0 °F, and can be changed to 0.5 °C or 2.0 °F.

7. 

RH Offset

The default range is 0, but can be changed from -20 to +20 %RH for humidity calibration.

8.

Display Mode

Parameter Selection. 1 = Temp. only, 2 = RH only, 3 = T + RH alternately every 2 seconds.

9.

Output Signal

The default range is 5 for 0-5Vdc or 10 for 0-10Vdc.

10.

OCC Reverse

The default OCC signal type is active low (Lo), but can be changed to active high (HI).

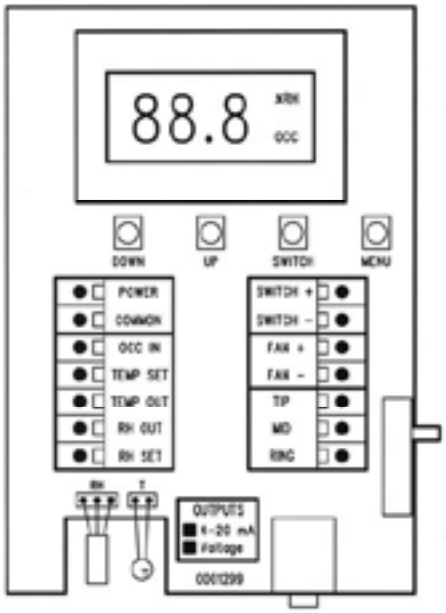
11.

OCC Reverse

The default OCC signal type is active low (Lo), but can be changed to active high (HI).

Specifications

Temperature	Sensor	10K Ohm Type 7 Curve matched thermistor
	Accuracy	±0.2 °C (±0.4 °C)
	Range	0 to 35 °C (32 to 95 °F) or 0 to 50 °C (32 to 122 °F) programmable
	Offset	±9 °F programmable
	Display Units	°C or °F programmable
	Display Resolution	0.5° < 100°, 1° > 100°
RH	Sensor	Thermoset polymer based capacitive
	Accuracy	±2 %RH
	Range	0 to 100 %RH
	Temperature Compensation	0 to 50 °C (32 to 122 °F)
	Hysteresis	±3 %RH
	Response Time	15 seconds typical
	Stability	±1.2 %RH typical @ 50 %RH in 5 years
	Offset	±20 %RH programmable
Temp Setpoint	Midpoint	18 to 27 °C or 65 to 80 °F programmable
	Range	±2 to ±10 °C or ±5 to ±20 °F of the midpoint programmable
	Resolution	0.5 or 1.0 °C and 1.0 or 2.0 °F programmable
RH Setpoint	Midpoint	20 to 70 %RH programmable
	Range	±5, ±10 or ±20 %RH of the midpoint programmable
	Resolution	1 %RH
Override	Front panel push-button available as dry-contact two-wire output N.O., 50 mA @ 12 Vdc	
Communication	3.5 mm phono jack	Connects to 3-pin terminal block (Ring, Tip, Mid)
Fan Speed Switch	Range	Off, Auto, Low, Medium, High
	Signal	0, 2, 4, 6 and 8K standard, two-wire output (other values available)
Occupied Input	Signal Type	Digital input, 0/5 Vdc or dry contact to common
	Logic	Active low or active high programmable
	Action	Causes “OCC” segment to light on LCD
LCD Display	Display Size	38.1 x 16.5 mm (1.5” w x 0.65” h)
	Digit Height	11.43 mm (0.45”)
	Symbols	°F, °C, %RH, OCC
	Backlight	Enable or disable via menu
General	Power Supply	24 Vac/dc ± 10% (non-isolated half-wave rectified)
	Consumption	20 mA + (20 mA x number of outputs) max @ 24 Vdc
	Input Voltage Effect	Negligible over specified operating range
	Protection Circuitry	Reverse voltage and MOV protected, output limited
	Output Signals	4-20 mA active (sourcing) or 0-5/0-10 Vdc (specify when ordering)
	Output Resolution	10 bit for all signals
	Output Drive Capability	550 ohm max for 4-20 mA, 10 Kohm min for voltage
	Programming and Selection	Via pushbuttons and on-screen menu
	Operating Conditions	0 to 50 °C (32 to 122 °F), 0 to 95 %RH non-condensing
	Wiring Connections	Screw terminal block (14 to 22 AWG)
	Enclosure	Wall mount, 84 x 117 x 29 mm (3.3”w x 4.6”h x 1.15”d)



Terminal	Function
POWER	From +24 Vac/dc of controller or power supply
COMMON	To GND or COMMON of controller
OCC IN	From digital output of controller
TEMP SET	Temperature setpoint to analog input of controller 4-20 mA or 0-5/0-10 Vdc
TEMP OUT	Temperature output to analog input of controller 4-20 mA or 0-5/0-10 Vdc
RH OUT	RH output to analog input of controller 4-20 mA or 0-5/0-10 Vdc
RH SET	RH setpoint to analog input of controller 4-20 mA or 0-5/0-10 Vdc
SWITCH +	Override switch + to digital input of controller
SWITCH -	Override switch - to COMMON of controller
FAN +	Fan speed switch + to analog input of controller
FAN -	Fan speed switch - to COMMON of controller
TIP	External jack TIP (tip of plug) connection
MID	External jack MID (middle of plug) connection
RING	External jack RING (base of plug) connection

APPENDIX D
(SPLIT SYSTEM PIPING REQUIREMENTS)

iAIRE SPLIT SYSTEM PIPING CHART

		iAIRE Charge		Line Size Circuit 1		Line Size Circuit 2			Add lbs/eq. foot
Model	# Comp	Circuit 1	Circuit 2	Liquid	Suction	Liquid	Suction	HGR Size	
ABB/ACC/HC36	1	9.3	N/A	3/8	3/4	N/A	N/A	5/8	0.038
ABB/ACC/HC42	1	10.2	N/A	3/8	3/4	N/A	N/A	5/8	0.038
ABB/ACC/HC48	1	12.9	N/A	3/8	3/4	N/A	N/A	5/8	0.038
ABB/ACC/HC60	1	15.4	N/A	3/8	7/8	N/A	N/A	5/8	0.045
38AZ07	1	24.5	N/A	1/2	7/8	N/A	N/A	5/8	0.057
38AZ08	1	32.6	N/A	1/2	1 1/8	N/A	N/A	7/8	0.046
38AZ12	1	34.7	N/A	1/2	1 1/8	N/A	N/A	7/8	0.067
38AZ14	1	80.5	N/A	5/8	1 3/8	N/A	N/A	7/8	0.089
38AZ16	2	74.7	N/A	5/8	1 3/8	N/A	N/A	7/8	0.063
38AD12	2	23.3	13.3	3/8	7/8	3/8	7/8	5/8	0.045
38AD14	2	40.3	23	1/2	7/8	1/2	7/8	5/8	0.045
38AD16	2	38.0	21.7	1/2	1 1/8	1/2	1 1/8	7/8	0.039
38AD25	2	33.8	18.3	1/2	1 1/8	1/2	1 1/8	7/8	0.069
38AQ07	1	31.2	N/A	1/2	7/8	N/A	N/A	5/8	0.045
38AQ08	1	36.6	N/A	1/2	1 1/8	N/A	N/A	7/8	0.039
38AQ12	1	46.9	N/A	1/2	1 1/8	N/A	N/A	7/8	0.069
38AQ16	2	36.6	20.9	1/2	1 1/8	1/2	1 1/8	7/8	0.051
38AQ25	2	47.1	20.9	1/2	1 1/8	1/2	1 1/8	7/8	0.089
38APD25	2	34.0	17	5/8	1 3/8	5/8	1 3/8	7/8	0.089
38APD30	2	38	19	5/8	1 3/8	5/8	1 3/8	7/8	0.092

Puron® Refrigerant Systems
Single–Stage and Two–Stage

Residential Piping and Long Line Guideline

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A. Safety Considerations

Only trained service technicians familiar with standard service instructions and training materials should attempt installation, service, and repair of these units. Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury, or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory--authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions included in literature and attached to the unit. Consult local building codes and National Electrical Code (NEC) for special requirements.

Recognize safety information. This is the safety-alert symbol . When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury. Understand these signal words; DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.

All equipment should be installed in accordance with accepted practices and unit Installation Instructions, and in compliance with all national and local codes. Power should be turned off when servicing or repairing electrical components. Extreme caution should be observed when troubleshooting electrical components with power on. Observe all warning notices posted on equipment and in instructions or manuals.

⚠ WARNING

EXPLOSION AND PERSONAL SAFETY HAZARD

Failure to follow this warning could result in personal injury, equipment damage or improper operation.

Refrigeration systems contain refrigerant under pressure. Puron® refrigerant (R-410A) systems operate at higher pressure than standard R-22 systems. Use only service equipment and components rated for Puron® refrigerant. Extreme caution should be observed when handling refrigerants. Wear safety glasses and gloves to prevent personal injury. During normal system operations, some components are hot and can cause burns. Rotating fan blades can cause personal injury. Appropriate safety considerations are posted throughout this manual where potentially dangerous techniques are addressed.

Refrigeration systems contain refrigerant under pressure. Extreme caution should be observed when handling refrigerants. Wear safety glasses and gloves to prevent personal injury. During normal system operations, some components are hot and can cause burns. Rotating fan blades can cause personal injury. Appropriate safety considerations are posted throughout this manual where potentially dangerous techniques are addressed.

B. Definitions

This Guideline covers **all** residential split system air conditioner and heat pump products using Puron® refrigerant **including two-stage models.**

C. Introduction

An application is considered Long Line, when the refrigerant level in the system requires the use of accessories to maintain acceptable refrigerant management for systems reliability. See Table 1 for required accessories. Defining a system as long line depends on the liquid line diameter, actual length of the tubing, and vertical separation between the indoor and outdoor units.

For Air Conditioner systems, the chart below shows when an application is considered Long Line.

AC WITH PURON® REFRIGERANT LONG LINE DESCRIPTION ft (m)
Beyond these lengths, long line accessories are required

Liquid Line Size	Units On Same Level	Outdoor Below Indoor	Outdoor Above Indoor
1/4	No accessories needed within allowed lengths	No accessories needed within allowed lengths	175 (53.3)
5/16	120 (36.6)	50 (15.2) vertical or 120 (36.6) total	120 (36.6)
3/8	80 (24.4)	35 (10.7) vertical or 80 (24.4) total	80 (24.4)

For Heat Pump systems, the chart below shows when an application is considered Long Line.

HP WITH PURON® REFRIGERANT LONG LINE DESCRIPTION ft (m)
Beyond these lengths, long line accessories are required

Liquid Line Size	Units On Same Level	Outdoor Below Indoor	Outdoor Above Indoor
3/8	80 (24.4)	20 (6.1) vertical or 80 (24.4) total	80 (24.4)

Long line applications are clearly defined in this Guideline, and must be treated differently from standard systems. A long line system requires special consideration for the following reasons:

- Additional refrigerant charge
- Refrigerant migration control
- Oil return concerns
- Capacity losses
- Metering device adjustments

Longer line sets require additional refrigerant charge that must be managed throughout the entire range of possible ambient conditions. Off-cycle refrigerant migration that results in excess refrigerant in the compressor at start up, or condensed liquid refrigerant in the suction line at start up must be avoided for compressor reliability. Follow all accessory requirements in this Guideline to control off-cycle refrigerant migration (see Table 1).

Another concern is proper line set sizing and construction to control oil return to the compressor, and minimize capacity losses. In residential applications, proper suction line sizing is critical to achieve adequate oil return, and maintain expected system performance. Oil return in heating mode is different from cooling mode thus, in some cases, heat pumps have additional line set limitations from air conditioning units. Tables 3a, 3b, 4a, and 4b in this guideline can be used to properly size suction lines. Follow all suction line sizing recommendations to ensure system performance and adequate oil return for compressor lubrication.

The third concern is refrigerant metering. Elevation changes affect pressure drop in refrigerant lines. These effects must be considered when sizing liquid lines and orifice-metering devices. Since all current products utilize a TXV for cooling mode metering, piston sizing is only a concern for heat pump heating operation. Follow piston change recommendations in this Guideline for proper heat pump heating operation (see Tables 10 & 13).

Since the last revision of this guideline, testing has been done to determine limitations for the application of 1/4 and 5/16 inch liquid lines in cooling only systems. The limiting factor when sizing liquid lines is pressure drop. Equivalent length and vertical separation both contribute to the pressure drop in a liquid line. The liquid line sizing charts in this guideline have been developed based on a TXV metering device on the indoor coil. Staying within these guidelines and charging to a minimum of 10°F (5.6°C) subcooling will ensure a column of liquid is present at the TXV. There are no capacity of efficiency changes to the system performance when staying within these guidelines.

NOTE: When an application is "Long Line" the accessories shown in Table 1 are required.

D. General Limitations

Liquid Lines - AC Only

Liquid line diameters of 1/4" and 5/16" and 3/8" are allowed for cooling only systems and limitations are provided. Using smaller liquid lines affects the maximum allowable equivalent length and when the application qualifies as long line. Elevation changes between the indoor and outdoor units also affect allowable equivalent lengths. See tables 6, 8, and 11 to properly size liquid lines.

NOTE: Using 1/4 and 5/16" liquid lines within the limits provided, result in no capacity or efficiency changes to the system.

Liquid Lines - Heat Pump

Liquid line sizing for heat pumps is currently limited to 3/8". Future updates are planned to include alternate liquid line sizing for heat pump applications. Check HVAC Partners for updates.

Suction Lines

Use Tables 3a, 3b, 4a, and 4b to properly size suction lines. Acceptable suction line sizes are are shown for each size and type system. Air conditioners and heat pumps have separate charts due to oil return needs for heat pumps in heating mode.

Table 1 - Long Line Accessory Requirements

ACCESSORY	OUTDOOR UNIT ABOVE		OUTDOOR UNIT BELOW		NO ELEVATION CHANGE	
	AC	HP	AC	HP	AC	HP
Liquid line solenoid (LLS) at outdoor	No	Yes KHALS0401LLS	No	Yes KHALS0401LLS	No	Yes KHALS0401LLS
TXV on indoor (Standard on all 13 SEER platform indoor coils and fan coils)	Yes	Yes	Yes	Yes	Yes	Yes
Crankcase heater (if not factory supplied)	Yes	Yes	Yes	Yes	Yes	Yes
Start capacitor and relay	Yes See Product Data for part number	Yes See Product Data for part number	Yes See Product Data for part number	Yes See Product Data for part number	Yes See Product Data for part number	Yes See Product Data for part number
Heating piston change	N/A	Yes see Table 13	N/A	Yes see Table 10	N/A	No
Inverted trap	N/A	N/A	Yes See Fig. 3	Yes See Fig. 3	N/A	N/A

⚠ CAUTION

COMPONENT FAILURE HAZARD

Failure to follow this caution may result in unit component failure.

For proper oil return and minimizing capacity losses, only use vapor line sizes listed in Tables 3a, 3b, 4a and 4b.

E. Interconnecting Tubing and Fitting Losses

Choosing the proper tubing diameters is critical for reliable long line applications. For proper suction line sizing, see Table 3a, 3b, 4a, and 4b These charts show all acceptable suction line diameters and related performance data based on total equivalent length. See Tables 6, 8, and 11 for the allowable liquid tubing diameters for both single-stage and two-stage.

Refrigerant tubing must be measured both in terms of actual length and equivalent length. Use actual length for limitations and refrigerant charge calculation. The maximum liquid line length will vary depending on diameter and elevation change between indoor and outdoor units. Equivalent length takes into account pressure losses from both tubing length and losses due to fittings and accessories, such as elbows, liquid line solenoid and filter drier. Losses from fittings are expressed in equivalent length, meaning the length of straight tubing that would have the same pressure loss as the fitting. See Table 2 for equivalent lengths of commonly used fittings and accessories; maximum equivalent length allowed is up to 250 ft (76.2 m) See Table 6, 8, and 11 for maximum total equivalent length.

Calculate total equivalent length by adding linear (actual) length of the tubing required and the equivalent length of all elbows and accessories used. See Tables 3a, 3b, 4a, and 4b to determine capacity loss of the system due to equivalent length losses and subtract them from the published system capacity for the particular outdoor/indoor unit combination. This data is found in the outdoor unit Product Data.

Example: A 4-ton system using 7/8 in. diameter line set has a total tubing length of 165 ft. The tubing configuration uses four standard 90° elbows and two 90° long-radius elbows. Checking Table 2, the total equivalent length is calculated as:

165 ft straight tubing + (four standard 90° elbows x 2 ft) + (two long-radius 90° elbows x 1.4 ft) = 165 ft.. + 8 ft + 2.8 ft = 175.8 ft total equivalent length.

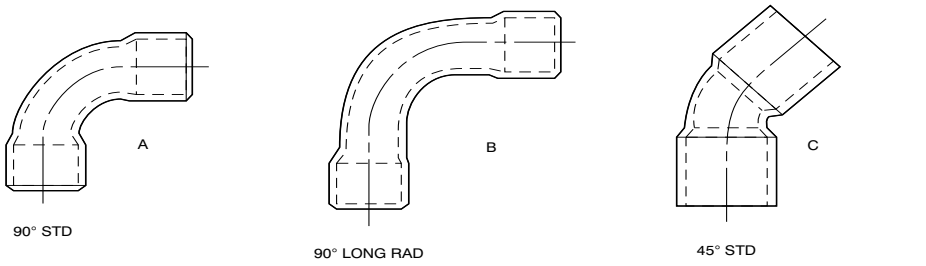

Fig. 1 – Tube Bend Losses

Table 2 - Fitting Losses in Equivalent Feet

Tube Size O.D. (In.)	Fitting– Reference Diagram in Fig. 1		
	90° Std (A)	90° Long–Rad (B)	45° Std (C)
1/2	1.2	0.8	0.6
5/8	1.6	1.0	0.8
3/4	1.8	1.2	0.9
7/8	2.0	1.4	1.0
1–1/8	2.6	1.7	1.3

Liquid Line Solenoid	12
Filter Drier	6

F. Metering Device — Long Line Cooling

In current equipment, all indoor units use a hard-shutoff TXV for metering in the cooling mode. This provides adequate refrigerant migration protection for all cooling applications.

G. Piston Sizing — Heat Pumps Only

An AccuRater™ (fixed orifice) is used for refrigerant metering in the heating mode. This fixed expansion device must be changed from the factory-supplied AccuRater™ based on indoor/outdoor vertical separation and system capacity. For horizontal applications up to 200 ft (61 m) linear length and 250 ft (76 m) total equivalent length, no heating piston change is necessary.

When sizing the heating piston for installations where the outdoor unit is below the indoor unit, use Table 10. When outdoor unit is located above indoor unit, use Table 13.

Example: The factory supplied AccuRater™ for a single-stage 3-ton heat pump is a number 57. A system is installed with 200 equivalent ft of line set. Approximately 60 ft (18.3 m) is horizontal and the outdoor unit is 140 ft (42.7 m) above the indoor unit. Table 10 shows the AccuRater™ piston change to be +6. The new piston size is 57 + 6 = 63. If a 63 is not produced, round up to the next larger available piston size.

On the same heat pump, if the outdoor unit was located 49 ft (14.9 m) below the indoor unit, Table 10 shows the piston change to be 57 - 2 = 55. If a 55 piston is not produced, round up to the next available size.

H. Liquid Line Solenoid — Long Line Heat Pump Heating

Since AccuRater™ do not provide off-cycle refrigerant migration protection in the heating mode, a liquid line solenoid is required for single-stage and two-stage heat pump long line applications. Bi-flow solenoid valves provide flow control protection only in the direction of the arrow molded into the valve. **The arrow must point toward the outdoor unit** for off-cycle refrigerant control in the heating mode. The arrow shows the direction of flow control. The solenoid should be installed within 2 ft. of the outdoor unit. The liquid line solenoid kit number for a heat pump is KHALS0401LLS.

NOTE: Equivalent length of the liquid line solenoid should be added to the total equivalent length of the tubing. See Table 2.

I. Charging Information

Use subcooling as the primary method for charging longline applications. Outdoor units are pre-charged for 15 ft (4.6 m) of 3/8 liquid line. When using different length diameter liquid lines, charge adjustments are required. See Table 5 for charge adjustments required. The charge adjustment will depend on the liquid line diameter used. See unit installation instructions for proper charging procedure.

For all long line applications, pressure drop and subcooling loss become a concern. In these applications, a **minimum of 10°F (5.6°C) of subcooling** is required for all liquid line diameters to ensure no refrigerant flashing occurs before the TXV metering device. Systems should be charged to 10° subcooling or the rating plate subcooling, whichever is greater.

The amount of factory-charge can be found on the unit rating plate or in the Product Data literature. Long line applications do not require additional oil charge.

VAPOR LINE SIZING AND COOLING CAPACITY LOSS

Acceptable vapor line diameters provide adequate oil return to the compressor while avoiding excessive capacity loss. The suction line diameters shown in Tables 3a , 3b, 4a, and 4b are acceptable for AC and HP systems with Puron refrigerant:

Table 3a – Vapor Line Sizing and Cooling Capacity Losses — Puron® Refrigerant 1-Stage Air Conditioner Applications

Unit Nominal Size (Btuh)	Maximum Liquid Line Diameters (In. OD)	Vapor Line Diameters (In. OD)	Cooling Capacity Loss (%) Total Equivalent Line Length ft. (m)								
			26–50 (7.9–15.2)	51–80 (15.5–24.4)	81–100 (24.7–30.5)	101–125 (30.8–38.1)	126–150 (38.4–45.7)	151–175 (46.0–53.3)	176–200 (53.6–61.0)	201–225 (61.3–68.6)	226–250 (68.9–76.2)
18000 1 Stage AC with Puron	3/8	1/2	1	2	3	5	6	7	8	9	11
		5/8	0	1	1	1	2	2	2	3	3
		3/4	0	0	0	0	1	1	1	1	1
24000 1 Stage AC with Puron	3/8	5/8	0	1	2	2	3	3	4	5	5
		3/4	0	0	1	1	1	1	1	2	2
		7/8	0	0	0	0	0	1	1	1	1
30000 1 Stage AC with Puron	3/8	5/8	1	2	3	3	4	5	6	7	8
		3/4	0	0	1	1	1	2	2	2	3
		7/8	0	0	0	0	1	1	1	1	1
36000 1 Stage AC with Puron	3/8	5/8	1	2	4	5	6	8	9	10	12
		3/4	0	1	1	2	2	3	3	4	4
		7/8	0	0	0	1	1	1	1	2	2
42000 1 Stage AC with Puron	3/8	3/4	0	1	2	2	3	4	4	5	6
		7/8	0	0	1	1	1	2	2	2	3
		1 1/8	0	0	0	0	0	0	0	0	0
48000 1 Stage AC with Puron	3/8	3/4	0	1	2	3	4	5	5	6	7
		7/8	0	0	1	1	2	2	2	3	3
		1 1/8	0	0	0	0	0	0	0	1	1
60000 1 Stage AC with Puron	3/8	3/4	1	2	4	5	6	7	9	10	11
		7/8	0	1	2	2	3	4	4	5	5
		1 1/8	0	0	0	1	1	1	1	1	1

Applications in this area may be long line and may have height restrictions. See pages 8, 9, and 10.

Table 3b – Vapor Line Sizing and Cooling Capacity Losses – Puron® Refrigerant 1- Stage Heat Pump Applications

Unit Nominal Size (Btuh)	Maximum Liquid Line Diameters (In. OD)	Vapor Line Diameters (In.) OD	Cooling Capacity Loss (%) Total Equivalent Line Length ft. (m)								
			Standard Application		Long Line Application Requires Accessories						
			26–50 (7.9–15.2)	51–80 (15.5–24.4)	81–100 (24.7–30.5)	101–125 (30.8–38.1)	126–150 (38.4–45.7)	151–175 (46.0–50.3)	176–200 (53.6–60.0)	201–225 (61.3–68.6)	226–250 (68.9–76.2)
18,000 1–Stage HP with Puron	3/8	1/2	1	2	3	4	6	7	8	9	10
		5/8	0	0	1	1	1	2	2	3	3
24,000 1–Stage HP with Puron	3/8	5/8	0	1	1	2	3	3	4	4	5
		3/4	0	0	0	0	1	1	1	1	1
30,000 1–Stage HP with Puron	3/8	5/8	1	2	3	3	4	5	6	7	8
		3/4	0	0	1	1	1	2	2	2	3
		7/8	0	0	0	0	1	1	1	1	1
36,000 1–Stage HP with Puron	3/8	5/8	1	2	4	5	6	7	9	10	11
		3/4	0	0	1	1	2	2	3	3	4
		7/8	0	0	0	0	1	1	1	1	2
42,000 1–Stage HP with Puron	3/8	3/4	0	1	2	2	3	4	4	5	6
		7/8	0	0	1	1	1	2	2	2	3
48,000 1–Stage HP with Puron	3/8	3/4	0	1	2	3	4	5	5	6	7
		7/8	0	0	1	1	2	2	2	3	3
60,000 1–Stage HP with Puron	3/8	3/4	1	2	4	5	6	7	9	10	11
		7/8	0	1	2	2	3	4	4	5	5
		1–1/8	0	0	0	1	1	1	1	1	1

Standard Length = 80 ft. (24.4 m) or less total equivalent length

Applications in this area are long line. Accessories are required as shown recommended on Long Line Application Guidelines

Applications in this area may have height restrictions that limit allowable total equivalent length, when outdoor unit is below indoor unit See Long Line Application Guidelines

Table 4a - Vapor Line Sizing and Cooling Capacity Losses — Puron® Refrigerant 2-Stage Air Conditioner Applications

Unit Nominal Size (Btuh)	Maximum Liquid Line Diameters (In. OD)	Vapor Line Diameters (In.) OD	Cooling Capacity Loss (%) Total Equivalent Line Length ft. (m)								
			26–50 (7.9–15.2)	51–80 (15.5–24.4)	81–100 (24.7–30.5)	101–125 (30.8–38.1)	126–150 (38.4–45.7)	151–175 (46.0–50.3)	176–200 (53.6–60.0)	201–225 (61.3–68.6)	226–250 (68.9–76.2)
24000 2–Stage Puron AC	3/8	5/8	0	1	1	2	3	3	4	4	5
		3/4	0	0	0	0	1	1	1	1	1
36000 2–Stage Puron AC	3/8	5/8	1	2	4	5	6	7	9	10	11
		3/4	0	0	1	1	2	2	3	3	4
		7/8	0	0	0	0	1	1	1	1	2
48000 2–Stage Puron AC	3/8	3/4	0	1	2	3	4	5	5	6	7
		7/8	0	0	1	1	2	2	2	3	3
60000 2–Stage Puron AC	3/8	3/4	1	2	4	5	6	7	9	10	11
		7/8	0	1	2	2	3	4	4	5	5
		1–1/8	0	0	0	1	1	1	1	1	1

Applications in this area may be long line and may have height restrictions. See pages 8, 9, and 10.

Table 4b - Vapor Line Sizing and Cooling Capacity Losses - Puron® Refrigerant 2-Stage Heat Pump Applications

Unit Nominal Size (Btuh)	Maximum Liquid Line Diameters (In. OD)	Vapor Line Diameters (In.) OD	Cooling Capacity Loss (%) Total Equivalent Line Length ft. (m)								
			Standard Application		Long Line Application Requires Accessories						
			26–50 (7.9–15.2)	51–80 (15.5–24.4)	81–100 (24.7–30.5)	101–125 (30.8–38.1)	126–150 (38.4–45.7)	151–175 (46.0–50.3)	176–200 (53.6–60.0)	201–225 (61.3–68.6)	226–250 (68.9–76.2)
24,000 2–Stage HP with Puron	3/8	5/8	0	1	1	2	3	3	4	4	5
		3/4	0	1	1	1	1	1	1	1	1
36,000 2–Stage HP with Puron	3/8	5/8	1	2	4	5	6	7	9	10	11
		3/4	0	0	1	1	2	2	3	3	4
48,000 2–Stage HP with Puron	3/8	3/4	0	1	2	3	4	5	5	6	7
		7/8	0	0	1	1	2	2	2	3	3
60,000 2–Stage HP with Puron	3/8	3/4	1	2	4	5	6	8	9	10	11
		7/8	0	1	2	2	3	4	4	5	5
		1–1/8	0	0	—	—	—	—	—	—	—

Standard Length = 80 ft. (24.4 m) or less total equivalent length

— Applications in this area are not recommended due to insufficient oil return.

Applications in this area are long line. Accessories are required as shown recommended on Long Line Application Guidelines

Applications in this area may have height restrictions that limit allowable total equivalent length, when outdoor unit is below indoor unit.

Table 5 - Refrigerant Charge Adjustments

Liquid Line Size	Puron Charge (oz/ft)
3/8	0.60 (Factory charge for lineset = 9 oz)
5/16	0.40
1/4	0.27

Units are factory-charged for 15 ft (4.6 m) of 3/8" lineset. Factory charge for 3/8 lineset is 9 oz. When using other length or diameter liquid lines, charge adjustments are required per chart above.

Charging Formula:

[(Lineset oz/ft x total length) – (factory charge for lineset)] = charge adjustment

Example 1: System has 15 ft of line set using existing ¼" liquid line. What charge adjustment is required?

Formula: (.27 oz/ft x 15ft) – (9 oz) = (-4.95) oz.

Net result is to remove 4.95 oz of refrigerant from the system

Example 2: System has 45 ft of existing 5/16" liquid line. What is the charge adjustment?

Formula: (.40 oz/ft. x 45ft) – (9 oz.) = 9 oz.

Net result is to add 9 oz of refrigerant to the system

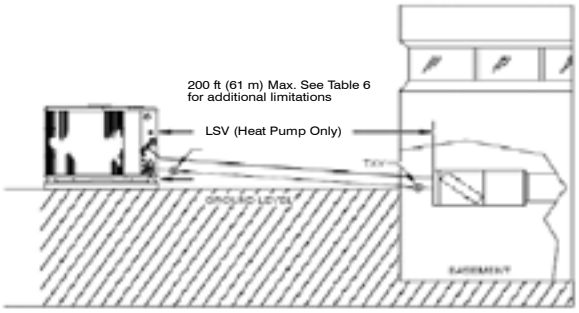

Fig. 2 – Equal-Level Outdoor/Indoor Unit

- A hard-shutoff TXV must be installed at indoor unit when application qualifies as long line. See Table 7.
- Hard Start Kit (start capacitor and relay) must be installed on outdoor unit when application qualifies as long line. See Table 7.
- A crankcase heater must be installed on compressor when the application qualifies as long line. See Table 7.
- Vapor line should slope towards indoor unit
- Maximum actual liquid line is up to 200 ft (61 m). See Table 6.
- Maximum total equivalent length is up to 250 ft (76.2 m). See Table 6.
- Heat pump only – Bi-flow liquid line solenoid must be installed within 2 ft (0.61 m) of outdoor unit with arrow pointing towards outdoor unit.
- Heat pump only – Outdoor AccuRater™ adjustment not required
- Use vapor line per Tables 3a, 3b, 4a, and 4b.
- Use liquid lines per Table 6.

Table 6 - Maximum Total Equivalent Length
Equal Level or Outdoor Unit Below Indoor

Size	System Type	Liquid Line Diameter w/ TXV	Maximum Total Equivalent Length†: Outdoor unit BELOW Indoor Vertical Separation ft (m)								
			0–5 (0–1.5)	6–10 (1.8–3.0)	11–20 (3.4–6.1)	21–30 (6.4–9.1)	31–40 (9.4–12.2)	41–50 (12.5–15.2)	51–60 (15.5–18.3)	61–70 (18.6–21.3)	71–80 (21.6–24.4)
18000	AC Only	1/4	150	150	125	100	100	75	– –	– –	– –
	AC Only	5/16	250*	250*	250*	250*	250*	250*	250*	225*	150
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
24000	AC Only	1/4	75	75	75	50	50	– –	– –	– –	– –
	AC Only	5/16	250*	250*	250*	250*	250*	225*	175	125	100
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
30000	AC Only	1/4	30	– –	– –	– –	– –	– –	– –	– –	– –
	AC Only	5/16	175	225*	200	175	125	100	75	– –	– –
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
36000	AC Only	5/16	175	150	150	100	100	100	75	– –	– –
	AC/HP	3//8	250*	250*	250*	250*	250*	250*	250*	250*	250*
42000	AC Only	5/16	125	100	100	75	75	50	– –	– –	– –
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	150
48000	AC/HP	3/8	250*	250*	250*	250*	250*	250*	230	160	– –
60000	AC/HP	3/8	250*	250*	250*	225*	190	150	110	– –	– –

*** Maximum actual length not to exceed 200 ft (61 m)**
† Total equivalent length accounts for losses due to elbows or fitting. See the Table 2 for details.
– – = outside acceptable range

Table 7 - AC / HP with Puron® Refrigerant Long Line Description ft (m)
Beyond these lengths, long line accessories are required

	AC Liquid Line Size	Units On Same Level
AC	1/4	No accessories needed within allowed lengths
	5/16	120 (36.6)
	3/8	80 (24.4)

	HP Liquid Line Size	Units On Same Level
HP	3/8	80 (24.4)

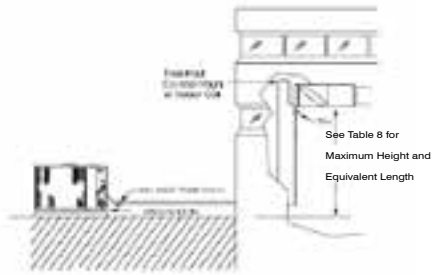

Fig. 3 – Outdoor Unit Below Indoor Unit

- Unit must be charged to 10° subcooling or nameplate subcooling, whichever is greater.
- A hard-shutoff TXV must be installed at indoor unit when application qualifies as long line. See Table 9.
- A crankcase heater must be installed on compressor when the application qualifies as long line. See Table 9.
- Hard Start Kit (start capacitor and relay) must be installed in outdoor unit when the application qualifies as long line. See Table 9.
- An inverted vapor-line trap must be installed at indoor unit. The top peak of trap must be greater than height of indoor coil.
- Maximum actual liquid line length is up to 200 ft (61 m) See Table 8 for maximum total equivalent length.
- Heat pump only – Bi-flow liquid line solenoid must be installed within 2 ft (0.61 m) of outdoor unit with arrow pointing towards outdoor unit.
- Heat pump only – Adjust outdoor piston per Table 10.
- Use vapor line per Tables 3a, 3b, 4a, and 4b.
- Use liquid lines per Table 8.

Table 8 - Maximum Total Equivalent Length†
Outdoor Unit Below Indoor Unit

Size	System Type	Liquid Line Diameter w/ TXV	Maximum Total Equivalent Length†: Outdoor unit BELOW Indoor Vertical Separation ft (m)								
			0–5 (0–1.5)	6–10 (1.8–3.0)	11–20 (3.4–6.1)	21–30 (6.4–9.1)	31–40 (9.4–12.2)	41–50 (12.5–15.2)	51–60 (15.5–18.3)	61–70 (18.6–21.3)	71–80 (21.6–24.4)
18000	AC Only	1/4	150	150	125	100	100	75	––	––	––
	AC Only	5/16	250*	250*	250*	250*	250*	250*	250*	225*	150
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
24000	AC Only	1/4	75	75	75	50	50	––	––	––	––
	AC Only	5/16	250*	250*	250*	250*	250*	225*	175	125	100
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
30000	AC Only	1/4	30	––	––	––	––	––	––	––	––
	AC Only	5/16	175	225*	200	175	125	100	75	––	––
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
36000	AC Only	5/16	175	150	150	100	100	100	75	––	––
	AC/HP	3//8	250*	250*	250*	250*	250*	250*	250*	250*	250*
42000	AC Only	5/16	125	100	100	75	75	50	––	––	––
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*	150
48000	AC/HP	3/8	250*	250*	250*	250*	250*	250*	230	160	––
60000	AC/HP	3/8	250*	250*	250*	225*	190	150	110	––	––

*** Maximum actual length not to exceed 200 ft (61 m)**
† Total equivalent length accounts for losses due to elbows or fitting. See the Table 2 for details.
–– = outside acceptable range

Table 9 - AC / HP with Puron® Refrigerant Long Line Description ft (m)
Beyond these lengths, long line accessories are required

	AC Liquid Line Size	Outdoor Below Indoor
AC	1/4	No accessories needed within allowed lengths
	5/16	50 (15.2) vertical or 120 (36.6) total
	3/8	35 (10.7) vertical or 80 (24.4) total

	HP Liquid Line Size	Outdoor Below Indoor
HP	3/8	20 (6.1) vertical or 80 (24.4) total

Table 10- Puron® Refrigerant Heat Pump Outdoor Piston Change – Outdoor Unit BELOW Indoor Unit

Btuh	Vertical Separation ft (m) – Outdoor BELOW Indoor Unit)						
	0–19 (0–5.8)	20–29 (6.1–8.8)	30–39 (9.1–11.9)	40–49 (12.2–14.9)	50–59 (15.2–18.0)	60–69 (18.3–21.0)	70–80 (21.3–24.4)
18,000	0	–1	–1	–2	–2	–2	–2
24,000	0	–1	–1	–2	–2	–3	–3
30,000	0	–1	–1	–2	–2	–3	–3
36,000	0	–1	–2	–2	–2	–3	–3
42,000	0	–1	–2	–2	–3	–3	–4
48,000	0	–1	–2	–2	–3	–3	—
60,000	0	–1	–2	–3	–3	—	—

NOTE: (—) Indicates vertical separation exceeds allowable limits.

Example 1: On a 4 ton system the outdoor unit is 60 ft (18.3 m) below the indoor unit. This is acceptable only if the total equivalent length is 230 ft (70.1 m) or less. The heating piston must be re–sized –3.

Example 2: On a 3–ton system the outdoor unit is 80 ft (24.4 m) below the indoor unit. This is acceptable up to 250 ft (76.2 m) total equivalent length. The heating piston must be re–sized –3.

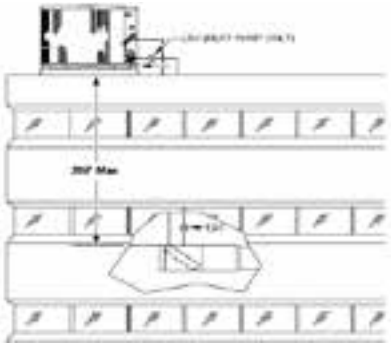

Fig. 4 – Outdoor Unit Above Indoor Unit

- A hard-shutoff TXV must be installed at indoor unit when the application qualifies as long line. See Table 12.
- A crankcase heater must be installed on compressor when the application qualifies as long line. See Table 12.
- Hard Start Kit (start capacitor and relay) must be installed in outdoor unit when the application qualifies as long line. See Table 12.
- Heat pump only – Heating piston must be changed as shown in Table 13.
- Maximum actual liquid line length is up to 200 ft (61 m). See Table 11.
- Maximum total equivalent length is up to 250 ft (61 m). See Table 11.
- Heat pump only – Bi-flow liquid line solenoid must be installed within 2 ft (0.61 m) of outdoor unit with arrow pointing towards outdoor unit.
- Use vapor line sizes per Tables 3a, 3b, 4a, and 4b.
- Use liquid lines per Table 11.
- Vapor line traps are not required.

Table 11 - Puron Refrigerant Maximum Total Equivalent Length Outdoor Unit ABOVE Indoor Unit

Size	System Type	Liquid Line Diameter	Vertical Separation ft (m) Outdoor unit ABOVE indoor unit							
			25 (7.6)	26–50 (7.9–15.2)	51–75 (15.5–22.9)	76–100 (23.2–30.5)	101–125 (30.8–38.1)	126–150 (38.4–45.7)	151–175 (46.0–53.3)	176–200 (53.6–61.0)
18000	AC Only	1/4	175	250*	250*	250*	250*	250*	250*	250*
	AC Only	5/16	250*	250*	250*	250*	250*	250*	250*	250*
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*
24000	AC Only	1/4	100	125	175	200	225*	250*	250*	250*
	AC Only	5/16	250*	250*	250*	250*	250*	250*	250*	250*
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*
30000	AC Only	1/4	30	– –	– –	– –	– –	– –	– –	– –
	AC Only	5/16	250*	250*	250*	250*	250*	250*	250*	250*
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*
36000	AC Only	5/16	225*	250*	250*	250*	250*	250*	250*	250*
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*
42000	AC Only	5/16	175	200	250*	250*	250*	250*	250*	250*
	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*
48000	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*
60000	AC/HP	3/8	250*	250*	250*	250*	250*	250*	250*	250*

Maximum Actual Length Not to Exceed 200ft (61 m)

Table 12 - AC / HP with Puron® Refrigerant Long Line Description ft (m)

Beyond these lengths, long line accessories are required

	AC Liquid Line Size	Outdoor Above Indoor
AC	1/4	175 (53.3)
	5/16	120 (36.6)
	3/8	80 (24.4)

	AC Liquid Line Size	Outdoor Above Indoor
HP	3/8	80 (24.4)

Table 13 - Heat Pump Outdoor Piston Change - Outdoor Unit ABOVE Indoor Unit

Btuh	Vertical Separation ft (m) – Outdoor Above Indoor Unit							
	20–25 (6.1–7.6)	26–50 (7.9–15.2)	51–75 (15.5–22.9)	76–100 (23.2–30.5)	101–125 (30.8–38.1)	126–150 (38.4–45.7)	151–175 (46.0–53.3)	176–200 (53.6–61.0)
18,000	+1	+1	+2	+3	+3	+4	+5	+6
24,000	+1	+1	+2	+3	+4	+5	+6	+7
30,000	+1	+2	+2	+4	+5	+6	+8	+9
36,000	+1	+2	+2	+4	+5	+6	+8	+9
42,000	+1	+2	+3	+4	+5	+7	+8	+10
48,000	+1	+2	+3	+4	+5	+7	+9	+10
60,000	+1	+2	+3	+5	+6	+8	+10	+12

J. General Requirements (Check List)

All Long Line Applications

- Hard-shutoff TXV must be installed at indoor unit.
- Hard Start Kit (start capacitor and relay) must be installed on outdoor unit.
- Crankcase heater must be installed on compressor.
- Use liquid line per Tables 6, 8, and 11.
- Use only vapor line sizes listed in Tables 3a, 3b, 4a, and 4b.
- Adjust charge per Table 5.
- Charge system to 10° subcooling or rating plate subcooling, whichever is greater.

Heat Pumps Only

- Bi-flow liquid line solenoid must be installed within 2 ft (0.61 m)of outdoor unit with arrow pointing towards outdoor unit.

Equal-level Outdoor/Indoor unit

- Outdoor unit and indoor unit must be within +/- 20 ft (6.1 m) vertical separation.
- Vapor line should slope towards indoor unit.

Heat Pumps Only

- No outdoor AccuRater™ adjustment required with less than 20 ft (6.1 m) vertical separation.

Outdoor unit BELOW indoor unit

- See Tables 7, 9, and 12 for longline thresholds.
- An inverted vapor-line trap must be installed at indoor unit. The top peak of trap must be greater than height of indoor coil. See Fig. 3.
- Vertical separation and line set equivalent length must not exceed requirements listed in Tables 6, 8, or 11.

Heat Pumps Only

- Adjust outdoor AccuRater™ per Table 10.

Outdoor unit ABOVE indoor unit

- Maximum vertical separation is 200 ft (61 m)
- Maximum actual line length is 200 ft (61 m)
- Maximum total equivalent length is 250 ft (76.2 m). See Table 11.
- Vapor line traps are not required.

Heat Pumps Only

- Adjust outdoor AccuRater™ per Table 13.

Table 14 - Common AccuRater™ - Piston Sizes Available through RCD
(Part numbers are all EA52PHxxx. The last 3 digits represent size.)

EA52PH032	063	093
035	065	096
037	067	098
038	068	101
040	070	104
042	073	106
043	076	109
046	078	110
049	080	113
052	082	116
055	084	120
057	086	125
059	088	128
061	090	

K. Air Conditioner and Heat Pump with Puron® Refrigerant — Quick Reference Guide

- Puron refrigerant operates at 50–70 percent higher pressures than R–22. Be sure that servicing equipment and replacement components are designed to operate with Puron refrigerant
- Puron refrigerant cylinders are rose colored.
- Recovery cylinder service pressure rating must be 400 psig, DOT 4BA400 or DOT BW400.
- Puron refrigerant systems should be charged with liquid refrigerant. Use a commercial type metering device in the manifold hose when charging into suction line with compressor operating
- Manifold sets should be 700 psig high side and 180 psig low side with 550 psig low–side retard.
- Use hoses with 700 psig service pressure rating.
- Leak detectors should be designed to detect HFC refrigerant.
- Puron refrigerant, as with other HFCs, is only compatible with POE oils.
- Vacuum pumps will not remove moisture from oil.
- Do not use liquid–line filter driers with rated working pressures less than 600 psig.
- Do not leave Puron suction line filter driers in line longer than 72 hours.
- Do not install a suction–line filter drier in liquid line.
- POE oils absorb moisture rapidly. Do not expose oil to atmosphere.
- POE oils may cause damage to certain plastics and roofing materials.
- Wrap all filter driers and service valves with wet cloth when brazing.
- A factory approved liquid–line filter drier is required on every unit.
- Do NOT use an R–22 TXV.
- If indoor unit is equipped with an R–22 TXV or piston metering device, it must be changed to a hard shutoff Puron TXV.
- Never open system to atmosphere while it is under a vacuum.
- When system must be opened for service, recover refrigerant, evacuate then break vacuum with dry nitrogen and replace filter driers. Evacuate to 500 microns prior to recharging.
- Do not vent Puron refrigerant into the atmosphere.
- Do not use capillary tube coils.
- Observe all **warnings**, **cautions**, and **bold** text.
- All indoor coils must be installed with a hard shutoff Puron TXV metering device.

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Catalog No: LLGP–4XA

Manufacturer reserves the right to change, at any time, specifications and designs without notice and without obligations.

Replaces: LLGP–3XA

APPLICATION TIPS

North America HVAC Systems & Service

Date: 06/16/2015 **Subject:** Long Line Guidance Light Commercial Split Systems **Dept:** RCS

Number: 38TIP-15-01 **Product Model Number(s):** 38AU (Z/D) **Author:** William Fischer

Long Line Guidance for Gemini 38AU (Z/D) Light Commercial Split Systems

The Commercial Split System Installation Instructions provide liquid and suction refrigerant line size guidance up to 100 linear feet. This Application Tip will cover line size diameters for liquid and suction lines up to 200 linear feet.

This supersedes Application Tip 38TIP-10-02 and will address linear refrigerant line lengths for round tube plate fin coils up to 200 feet with the proper refrigeration accessories (liquid line solenoid, coil, filter drier, sight glass etc.) installed in the combined system piping. In general, it is always desirable to have system line lengths as short as possible for proper refrigerant flow and system performance. However, it is recognized that applications do exist where the line lengths must be greater than 100 feet. The following units will be addressed in this application tip:

Gemini 38AUZ: Single-circuit design (uses one set of tubing)
Gemini 38AUD: Dual-circuit design (uses two separate sets of tubing)

The 38AUQ heat pumps are limited to 100 linear feet due to charging issues in the heating mode and oil return.

The most common used limit for refrigerant line length is based on the maximum allowable refrigerant charge which is 4-5 lbs of refrigerant per gross ton of capacity. When the weight of the total refrigerant charge exceeds 5 lbs per ton, the liquid line size should be reduced which will result in loss of system capacity. Capacity loss of the total capacity is shown in the charts (-2.7% example). The extended line length up to 200 linear feet is for cooling only condensing units.

General Recommendations for Selecting Tube Sizes

Liquid Line: Select the smallest tube size that permits necessary liquid lift (indoor unit ABOVE outdoor unit).
Suction Line: Select smallest tube size unless loss in capacity is unacceptable to customer.
If two line size diameters are shown, select the smallest size but consider the pressure drop, lbs/ton, and capacity reduction, if shown.

Liquid Line Vertical Elevation Difference Limits

Indoor Unit above Outdoor Unit (Lift): See tube selection table for Max Lift capabilities by tube size
Indoor Unit below Outdoor Unit: 200-ft Maximum Lift.

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R-410A EXAMPLE					
Model & Nominal Capacity Data	Linear Line Length (ft)	75 to 100 ft		100 to 125 ft	
	Equivalent Length (ft)	113 to 150 ft		150 to 188 ft	
		Line size #1	Line size #2	Line size #1	Line size #2
Model # xxxx	Liquid Line	1/2"	5/8"	1/2"	5/8"
	Liquid Line PD (F)	3.9	1.1	4.8	1.3
Total Capacity = 113 MBH	Max Lift (ft)	54	87	43	84
	Max Lift PD (F)	8.5	8.5 (Note A)	8.5	8.5 (Note B)
Sub-Cooling = 9.0F	Suction Line	1-1/8	1-3/8	1-1/8	1-3/8
	Suction PD (F) (Capac Red)	2.8 (-1.4%)	1.0	3.5 (-2.6%)	1.2
	Charge (lbs)	20.0 (Note C)	23.7 (Note C)	22.1	26.0
	#/TR	2.12	2.52	2.34	2.85

Notes:

A	Linear line length is LESS than (or equal to) 100-ft, minimum sub-cooling at TXV = 9.0 – 2.0 = 7.0 F
B	Linear line length is GREATER than 100-ft, minimum sub-cooling at TXV = 9.0 – 0.5 = 8. 5 F
C	System charge 20.0 lbs calculated for 100-ft linear line length, 1/2-in liquid and 1-3/8-in suction lines System charge 23.7 lbs calculated for 100-ft linear line length, 5/8-in liquid and 1-3/8-in suction lines

Legend:

Abbreviation	Description
TC	Total Capacity, (MBH) at 45F saturated suction, 95F outdoor air temperature
SC	Sub-cooling, degrees F (at liquid line valve)
Linear Length Line	Linear tubing length (feet)
Equivalent Length	Equivalent tubing length (feet), including effects of refrigeration specialties devices
Liquid Line	Tube size (inches) Outer Diameter
Liquid PD (F)	Liquid Line Pressure Drop, saturated temperature (degrees F)
Max Lift	Maximum liquid lift (indoor unit ABOVE outdoor unit only), at maximum permitted liquid line pressure drop Linear Length ≤ 100 ft: Minimum 2.0 F sub-cooling entering TXV (Note A) Linear Length > 100 ft: Minimum 0.5 F sub-cooling entering TXV (Note B)
Max Lift PD (F)	Pressure Drop including Maximum Liquid Lift value (degrees F)
Suction Line	Tube size (inches) Outer Diameter
Suction PD (F) (Cap Red)	Suction Line Pressure Drop, saturated temperature (degrees F) Capacity Reduction caused by suction line Pressure Drop > 2 F
Charge	Charge Quantity (lbs). Calculated for both liquid line sizes (where applicable) but otherwise only with larger suction line size – See Note C
#/TR	Charge to unit capacity ratio (lbs per ton) at 45 Sat. Suction Temp and 95F Outdoor Dry Air

General notes for pipe selection with R-22 versus Puron refrigerant on Light Commercial Split Systems

Example System Specifications	
Total Capacity (MBH)	120
Sat Condensing Temp	120
Sat Suction Temp	45
Liquid Temp	105
Condenser Coil P.D. (psi)	12

Resulting Data					
Pipe Data	R-22	R-410A	Velocity & Pressure Drop	R-22	R-410A
Mass Flow			Liquid 1/2 in		
Enthalpy, vapor (BTU/#)	108.56	121.01	Velocity (fpm)	413	478
Enthalpy, liquid (BTU/#)	40.84	53.30	Pressure Drop (psi)	14.37	15.46
Enthalpy diff (BTU/#)	67.72	67.71	Pressure Drop (deg-F)	4.6	2.8
Mass Flow Rate					
#/Hr	1772	1772	Suction 1-1/8 in		
#/min-TR	2.954	2.954	Velocity (fpm)	3115	2146
			Pressure Drop (psi)	7.57	5.32
			Pressure Drop (deg-F)	4.9	2.2

38AUZ_07 - 25 Models																	
Model & Nominal capacity	Linear Line (t	3 - 25	25 - 50		50 - 75		75 - 100		100 - 125		125 - 150		150 - 175		175 - 200		
	Equiv. Line (t	3 - 38	38 - 75		75 - 113		113 - 150		150 - 188		188 - 225		225 - 263		263 - 300		
38AUZ_07 TC 88.5, SC 5.5/9	**Liquid Line**	**3/8"**	**3/8"**	**1/2"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	
	Liquid PD (F)	2.0	4.8	0.7	1.1	0.3	1.4	0.4	1.8	0.5	2.1	0.6	2.5	0.7	2.8	0.8	
	Max Lift	18	7	34	31	39	44	57	41	57	35	54	31	50	27	50	
	Max Lift PD (F	3.5	4.8	3.5	3.5	3.5	5.0	5.0	5.0	5.0	4.3	5.0	5.0	5.8	5.0	5.0	
	Suction Line	**7/8"**	**7/8"**	**1-1/8"**	**7/8"**	**1-1/8"**	**7/8"**	**1-1/8"**	**7/8"**	**1-1/8"**	**1-1/8"**		**1-1/8"**		**1-1/8"**		
	Suction Ln PD	0.9	1.6	0.5	2.7	0.6	3.6	1.0	4.5	1.3	1.0		1.0		2.1		
	Charge	10.8	11.0	13.7	15.2	18.5	16.9	21.3	18.7	24.2	21.4	27.1	23.4	30.0	25.9	32.8	
	#/TR	1.50	2.07	2.41	2.67	3.25	2.97	3.74	3.29	4.25	3.8	4.75	4.1	5.26	4.4	5.75	

Model & Nominal capacity	Linear Line (t	3 - 25	25 - 50		50 - 75		75 - 100		100 - 125		125 - 150		150 - 175		175 - 200		
	Equiv. Line (t	3 - 38	38 - 75		75 - 113		113 - 150		150 - 188		188 - 225		225 - 263		263 - 300		
38AUZ_09 TC 91.9, SC 11.8/	**Liquid Line**	**1/2"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	
	Liquid PD (F)	0.8	1.3	0.3	1.3	0.5	2.5	0.7	3.2	0.9	3.8	1.0	4.4	1.2	5.1	1.4	
	Max Lift	25	50	50	75	75	100	100	97	97	80	80	62	121	74	119	
	Max Lift PD (F	2.7	5.4	4.5	8.1	6.7	10.8	9.0	11.2	8.9	11.2	8.9	11.2	11.2	11.2	11.2	
	Suction Line	**7/8"**	**7/8"**	**1-1/8"**	**7/8"**	**1-1/8"**	**1-1/8"**		**1-1/8"**	**1-3/8"**	**1-1/8"**	**1-3/8"**	**1-1/8"**	**1-3/8"**	**1-1/8"**	**1-3/8"**	
	Suction Ln PD	1.5	3.1	0.8	4.6	1.2	1.6		2.1	0.7	2.5	0.8	2.9	1.0	3.3	1.1	
	Charge	13.6	15.4	16.1	17.2	20.5	19.5	23.3	21.5	27.1	23.4	30.2	25.4	33.2	27.3	36.3	
	#/TR	1.28	2.02	2.11	2.25	2.68	2.55	3.05	2.80	3.54	3.06	3.95	3.32	4.34	3.57	4.75	

Model & Nominal capacity	Linear Line (t	0 - 25	25 - 50		50 - 75		75 - 100		100 - 125		125 - 150		150 - 175		175 - 200		
	Equiv. Line (t	0 - 38	38 - 75		75 - 113		113 - 150		150 - 188		188 - 225		225 - 263		263 - 300		
38AUZ_12 TC 113.1, SC 7.9	**Liquid Line**	**1/2"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**5/8"**		**5/8"**		
	Liquid PD (F)	0.9	1.9	0.5	2.0	0.8	3.0	1.0	4.7	1.3	5.7	1.6	1.8		2.1		
	Max Lift	25	40	50	28	54	34	68	22	65	11	63	59		55		
	Max Lift PD (F	2.9	5.0	4.5	5.0	5.0	6.5	6.4	6.5	6.4	6.5	6.5	6.4		6.4		
	Suction Line	**7/8"**	**7/8"**	**1-1/8"**	**1-1/8"**	**1-3/8"**	**1-1/8"**	**1-3/8"**	**1-1/8"**	**1-3/8"**	**1-1/8"**	**1-3/8"**	**1-1/8"**	**1-3/8"**	**1-1/8"**	**1-3/8"**	
	Suction Ln PD	2.4	4.8	1.2	1.8	0.8	2.4	0.9	3.1	1.1	3.7	1.3	4.3	1.5	4.9	1.7	
	Charge	15.7	17.5	19.7	19.0	23.1	21.6	26.1	23.6	29.2	25.5	32.3	34.1	35.3	30.8	38.4	
	#/TR	1.62	1.88	2.09	2.30	2.45	2.29	2.77	2.50	3.10	2.71	3.43	3.62	3.75	3.52	4.08	

Model & Nominal capacity	Linear Line (t	0 - 25	25 - 50		50 - 75		75 - 100		100 - 125		125 - 150		150 - 175		175 - 200		
	Equiv. Line (t	0 - 38	38 - 75		75 - 113		113 - 150		150 - 188		188 - 225		225 - 263		263 - 300		
38AUZ_14 TC 146.1, SC 3.9/	**Liquid Line**	**5/8"**	**5/8"**	**3/4"**	**5/8"**	**3/4"**	**5/8"**	**3/4"**	**5/8"**	**3/4"**	**5/8"**	**3/4"**	**5/8"**	**3/4"**	**3/4"**	**7/8"**	
	Liquid PD (F)	0.4	0.8	0.4	1.2	0.6	1.6	0.8	2.0	1.1	2.4	1.1	2.8	1.5	1.7	0.6	
	Max Lift	23	16	23	10	10	28	38	21	36	14	35	9	30	25	43	
	Max Lift PD (F	1.6	1.6	1.6	1.6	1.6	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	
	Suction Line	**1-1/8"**	**1-1/8"**	**1-3/8"**	**1-1/8"**	**1-3/8"**	**1-3/8"**		**1-3/8"**	**1-3/8"**	**1-3/8"**	**1-3/8"**	**1-3/8"**	**1-3/8"**	**1-3/8"**	**1-3/8"**	
	Suction Ln PD (Cap Red)	1.1	2.2	0.8	3.3 (>2.9%)	1.2	1.6		2.0	0.8	2.4 (>0.7%)	1.0	2.8 (>1.4%)	1.2	3.2 (>2.1%)	1.3	
	Charge	31.0	34.1	37.6	37.6	41.8	41.1	46.1	44.2	51.6	47.3	56.1	50.3	60.6	53.4	65.1	
	#/TR	2.62	2.88	3.09	3.09	3.44	3.38	3.73	3.64	4.24	3.88	4.61	4.14	4.98	4.39	5.32	

Model & Nominal capacity	Linear Line (t	0 - 25	25 - 50		50 - 75		75 - 100		100 - 125		125 - 150		150 - 175		175 - 200		
	Equiv. Line (t	0 - 38	38 - 75		75 - 113		113 - 150		150 - 188		188 - 225		225 - 263		263 - 300		
38AUZ_16 TC 165.7, SC 18.4/	**Liquid Line**	**5/8"**	**5/8"**		**5/8"**		**5/8"**		**5/8"**		**5/8"**		**5/8"**	**3/4"**	**5/8"**	**3/4"**	
	Liquid PD (F)	0.7	1.3		2.0		2.7		3.4		4.0		4.7	2.5	5.4	2.8	
	Max Lift	25	60		75		100		126		150		153	175	145	175	
	Max Lift PD (F	2.8	5.65		8.5		11.3		14.1		16.9		12.9	17.5	17.9	17.9	
	Suction Line	**1-3/8"**	**1-3/8"**		**1-3/8"**		**1-3/8"**		**1-3/8"**	**1-5/8"**	**1-3/8"**	**1-5/8"**	**1-3/8"**	**1-5/8"**	**1-3/8"**	**1-5/8"**	
	Suction Ln PD (Cap Red)	1.4	1.0		1.5		2.0		2.5 (>0.3%)	1.1	3 (>1.8%)	1.3	3.5 (>2.7%)	1.5	4 (>3.6%)	1.7	
	Charge	35.1	38.1		41.2		44.2		47.3	48.4	50.4	51.7	53.4	53.7	56.5	58.3	
	#/TR	2.5	3.11		3.36		3.61		3.86	3.95	4.11	4.22	4.36	5.20	4.61	5.57	

Model & Nominal capacity	Linear Line (t	0 - 25	25 - 50		50 - 75		75 - 100		100 - 125		125 - 150		150 - 175		175 - 200		
	Equiv. Line (t	0 - 38	38 - 75		75 - 113		113 - 150		150 - 188		188 - 225		225 - 263		263 - 300		
38AUZ_25 TC 233.3, SC 13.0/	**Liquid Line**	**5/8"**	**5/8"**		**5/8"**		**5/8"**		**5/8"**	**3/4"**	**5/8"**	**3/4"**	**5/8"**	**3/4"**	**5/8"**	**3/4"**	
	Liquid PD (F)	1.1	2.1		3.2		4.3		5.4	2.8	6.4	3.3	7.5	3.9	8.6	4.4	
	Max Lift	25	50		50		50		65	18	71	108	53	182	48	35	
	Max Lift PD (F	3.2	6.4		9.6		12.5		12.5	12.5	12.4	12.5	12.5	12.5	12.5	12.5	
	Suction Line	**1-3/8"**	**1-3/8"**		**1-3/8"**	**1-5/8"**	**1-3/8"**	**1-5/8"**	**1-3/8"**	**1-5/8"**	**1-5/8"**	**2-1/8"**	**1-5/8"**	**2-1/8"**	**1-5/8"**	**2-1/8"**	
	Suction Ln PD (Cap Red)	0.8	1.6		2.4 (>0.8%)	1.0	3.3 (>2.2%)	1.4	4 (>3.6%)	1.7	2.0	0.4	2.4 (>0.7%)	0.5	2.7 (>1.2%)	0.6	
	Charge	31.1	34.1		37.2	37.9	40.2	41.1	43.3	50.7	41.7	56.5	51.0	63.6	54.3	69.7	
	#/TR	2.52	2.77		3.02	3.07	3.26	3.34	3.51	4.11	3.87	4.75	4.13	5.16	4.40	5.57	

LEGEND	
TC	Total Capacity, MBH (at 45 S suction, 95 F outdoor air temp)
SC	Sub-cooling, degrees F (at liquid line valve)
Liquid PD (F)	Liquid Line Pressure Drop, saturated temperature, degrees F
Max Lift	Maximum liquid lift (indoor unit ABOVE outdoor unit only), at maximum permitted liquid line pressure drop. See notes, page 2
Max Lift PD (F)	Pressure Drop including Maximum Liquid Lift value
Suction PD (F)	Suction Line Pressure Drop, saturated temperature, degrees F
(Cap Red)	Capacity Reduction caused by suction line PD GT 2 F
#/TR	Charge to unit capacity ratio, lbs per ton (at 45 SST/95 ODA)

38AUD_12 - 25 Models, 2 Sets required															
Model & Nominal capacity	Linear Line (ft)	0 - 25	25 - 50	50 - 75	75 - 100		100 - 125		125 - 150		150 - 175		175 - 200	
	Equiv. Line (ft)	0 - 38	38 - 75	75 - 113	113 - 150		150 - 188		188 - 225		225 - 263		263 - 300	
38AUD_12 TC 55.9 Each, SC 12.3F	**Liquid Line**	**3/8"**	**3/8"**	**3/8"**	**3/8"**	**1/2"**	**3/8"**	**1/2"**	**3/8"**	**1/2"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**
	Liquid PD (F)	1.4	2.7	5.5	5.5	0.9	6.9	1.1	8.2	1.4	1.6	0.5	1.8	0.5
	Max Lift	25	50	75	62	100	96	125	49	100	100	164	128	164
	Max Lift PD (F)	3.4	6.8	10.2	12.1	5.0	12.1	11.2	12.1	12.1	12.1	12.1	12.1	12.1
	Suction Line	**3/4"**	**7/8"**	**7/8"**	**7/8"**	**1-1/8"**	**7/8"**	**1-1/8"**	**1-1/8"**		**1-1/8"**		**1-1/8"**	
	Suction Ln PD(F) (Cap Red)	1.4	1.2	1.8	2.5 (-0.8%)	0.8	3.1 (-1.5%)	0.9	1.1		1.3		1.5	
	Charge	5.0	10.0	9.0	12.1	15.7	13.1	17.7	14.3	19.6	21.5	29.2	23.5	31.8
	#/TR	0.73	0.81	0.89	0.97	1.27	1.05	1.42	1.28	1.58	1.74	2.21	1.89	2.59

Model & Nominal capacity	Linear Line (ft)	0 - 25	25 - 50	50 - 75		75 - 100		100 - 125		125 - 150		150 - 175		175 - 200	
	Equiv. Line (ft)	0 - 38	38 - 75	75 - 113		113 - 150		150 - 188		188 - 225		225 - 263		263 - 300	
38AUD_14 TC 63.8 Each, SC 14.2F	**Liquid Line**	**3/8"**	**3/8"**	**3/8"**		**3/8"**	**1/2"**	**3/8"**	**1/2"**	**1/2"**		**1/2"**	**5/8"**	**1/2"**	**5/8"**
	Liquid PD (F)	2.1	4.1	6.2		6.2	1.5	10.0	1.0	2.2		2.5	0.7	2.9	0.8
	Max Lift	128	50	75		69	155	42	125	149		140	153	135	182
	Max Lift PD (F)	4.0	8.1	12.1		13.6	9.4	13.6	11.7	13.6		13.6	13.6	13.6	13.6
	Suction Line	**7/8"**	**7/8"**	**7/8"**	**1-1/8"**	**1-1/8"**		**1-1/8"**		**1-1/8"**		**1-1/8"**		**1-1/8"**	
	Suction Ln PD(F) (Cap Red)	1.0	1.9	2.9 (-1.5%)	0.8	1.1		1.4		1.9		1.9		2.2 (-0.1%)	0.7
	Charge	17.0	18.0	19.0	19.5	20.6	23.7	21.8	25.7	27.6		29.5	36.2	31.5	39.9
	#/TR	1.36	1.44	1.52	1.56	1.65	1.90	1.74	2.06	2.21		2.36	2.89	2.52	3.12

Model & Nominal capacity	Linear Line (ft)	0 - 25	25 - 50		50 - 75		75 - 100		100 - 125		125 - 150		150 - 175		175 - 200	
	Equiv. Line (ft)	0 - 38	38 - 75		75 - 113		113 - 153		150 - 188		188 - 225		225 - 263		263 - 300	
38AUD_16 TC 32.3 Each, SC 15.1F	**Liquid Line**	**3/8"**	**3/8"**		**3/8"**	**1/2"**	**1/2"**		**1/2"**		**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**
	Liquid PD (F)	3.4	6.9		10.3	1.9	2.6		3.2		3.9	1.0	4.5	1.2	5.1	1.4
	Max Lift	25	50		32	75	144		125		127	150	121	159	112	157
	Max Lift PD(F)	5.5	11.1		13.8	8.2	10.9		13.7		14.5	13.6	14.5	14.5	14.5	14.5
	Suction Line	**7/8"**	**7/8"**	**1-1/8"**	**1-1/8"**		**1-1/8"**		**1-1/8"**	**1-3/8"**	**1-1/8"**	**1-3/8"**	**1-1/8"**	**1-3/8"**	**1-1/8"**	
	Suction Ln PD(F) (Cap Red)	1.5	3.1 (-1.9%)	0.8	1.2		1.5		2 (-0.1%)	0.7	2.5 (-0.8%)	0.8	2.9 (-1.5%)	1.0	3.3 (-2.2%)	1.1
	Charge	17.0	18.0	18.3	19.5	21.8	23.7		25.7	28.6	27.6	34.4	29.5	37.4	31.5	40.5
	#/TR	1.35	1.43	1.46	1.55	1.73	1.89		2.04	2.11	2.19	2.72	2.35	2.97	2.50	3.22

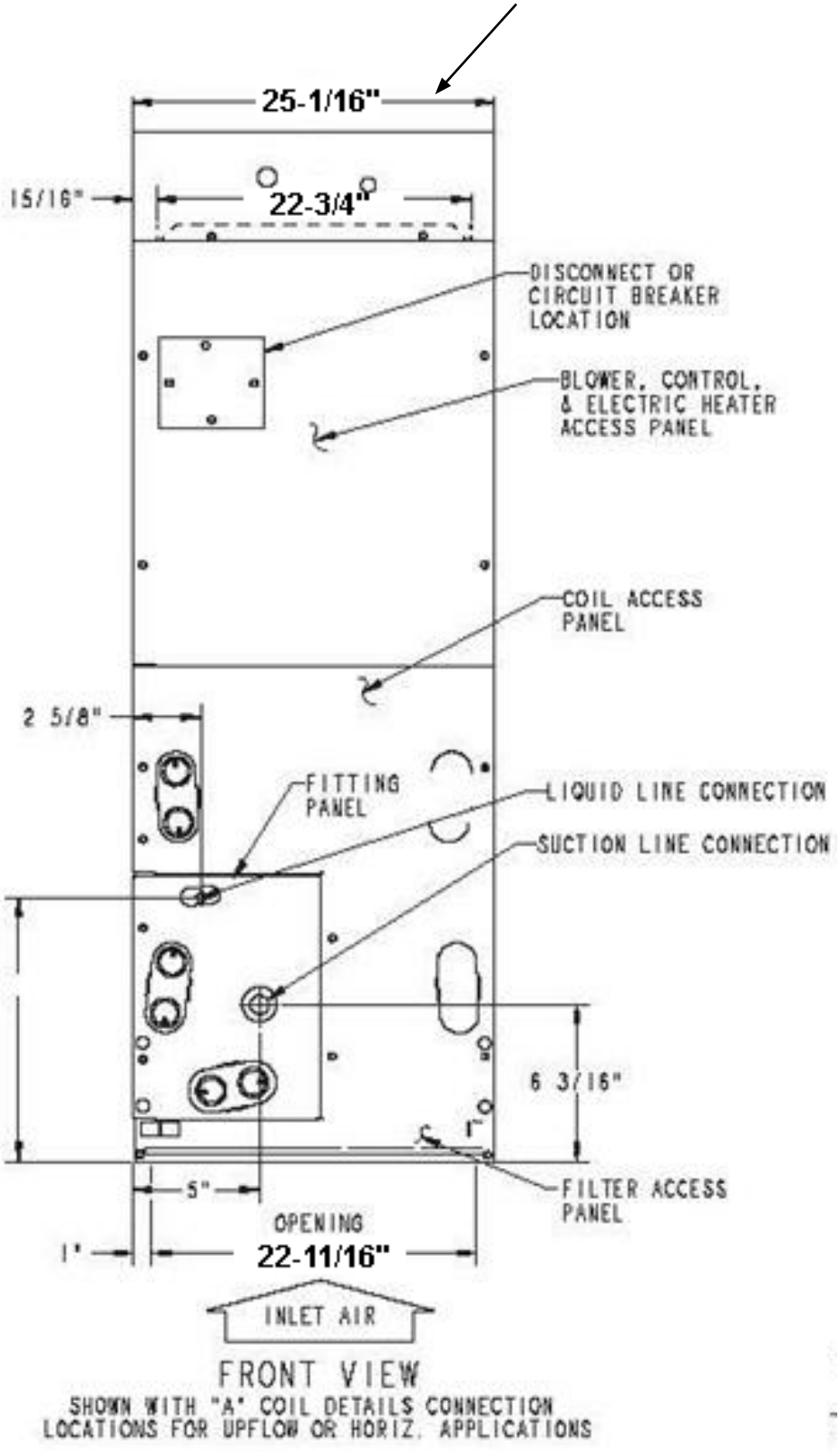
Model & Nominal capacity	Linear Line (ft)	0 - 25	25 - 50		50 - 75		75 - 100		100 - 125		125 - 150		150 - 175		175 - 200	
	Equiv. Line (ft)	0 - 38	38 - 75		75 - 113		113 - 150		150 - 188		188 - 225		225 - 263		263 - 300	
38AUD_25 TC 121.2 Each, SC 16.6F	**Liquid Line**	**3/8"**	**1/2"**		**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**1/2"**	**5/8"**	**5/8"**		**5/8"**	**3/4"**
	Liquid PD (F)	5.6	2.2		3.3	0.9	4.3	1.2	5.4	1.5	6.5	1.6	2.1		2.4	1.3
	Max Lift	25	50		64	75	70	138	55	104	42	130	97		92	107
	Max Lift PD(F)	7.7	6.3		9.5	7.1	10.9	9.4	9.3	13.0	10.0	10.0	10.0		9.9	10.9
	Suction Line	**1-1/8"**	**1-1/8"**		**1-1/8"**	**1-3/8"**	**1-1/8"**	**1-3/8"**	**1-1/8"**	**1-3/8"**	**1-3/8"**		**1-3/8"**		**1-3/8"**	
	Suction Line PD (F) (Cap Red)	0.7	1.3		2.0	0.7	2.7 (-1.2%)	1.0	3.4 (-2.4%)	1.2	1.4		1.7		1.9	
	Charge	15.2	17.9		19.8	23.2	23.7	29.2	23.7	29.3	28.7	32.4	35.4		36.5	40.5
	#/TR	1.20	1.41		1.56	1.83	1.72	2.07	1.67	2.31	2.11	2.56	2.80		3.34	3.83

Note: Where two line sizes are shown but only one set of data exists, the value is the same for both line sizes.

LEGEND	
TC	Total Capacity, MBH (at 45 S suction, 95 F outdoor air temp)
SC	Sub-cooling, degrees F (at liquid line valve)
Liquid PD (F)	Liquid Line Pressure Drop, saturated temperature, degrees F
Max Lift	Maximum liquid lift (indoor unit ABOVE outdoor unit only), at maximum permitted liquid line pressure drop. See notes, page 2
Max Lift PD (F)	Pressure Drop including Maximum Liquid Lift value
Suction PD (F)	Suction Line Pressure Drop, saturated temperature, degrees F
(Cap Red)	Capacity Reduction caused by suction line PD GT 2 F
#/TR	Charge to unit capacity ratio, lbs per ton (at 45 SST/95 ODA)

APPENDIX E
(SPLIT SYSTEM DAT SENSOR INSTALLATION)

Sensor and wire bundle is on top of unit



On iAIRE Split Systems, the DAT sensor is not pre-installed in the unit. The DAT sensor needs to be installed in the contractor installed duct work. Once the unit (and heater if applicable) is installed, this sensor should be installed downstream of the discharge of the unit (and heater if applicable).

APPENDIX F (MODULATING GAS VALVE)

CONNECTIONS

Step 1: Remove factory gas valve and install modulating valve.
Step 2: Reinstall factory gas valve before modulating valve (note: modulating valve should be in-between factory (valve and the manifold).

Step 3: Remove 2 screws holding cover.

Step 4: Connect switched OFF 24V (AC/DC) power source to terminals 3 and 4 (see Figure 2, page 2).

Step 5: Set DIP switches to match available control signal (see Table 3, page 2).

Step 6: Connect switched OFF control signal to terminals 1 and 2. Observe polarity.
Note that the return, or signal ground, must be connected to terminal 2 (see Figure 2, page 2).

Step 7: Switch power and control signal ON.

Step 8: Set valve (see "Valve Setting" in section below).

Step 9: Replace cover.

VALVE SETTING

The EXA STAR modulating valve series has two (2) buttons and a communication LED for the user interface. The buttons are used to set the valve for high and low fire settings (see Figure 4).

Apply differential pressure gauge on gas manifold. Use port located on the burner manafold to adjust the high and low fire pressure. Refer to the unit's name plate for high gas value (should be between 2-5 in-wc).

1. High Fire Setting (LED will be solid red)
2. Low Fire Setting (LED will be blinking red)
3. Operating Mode (LED will be OFF)

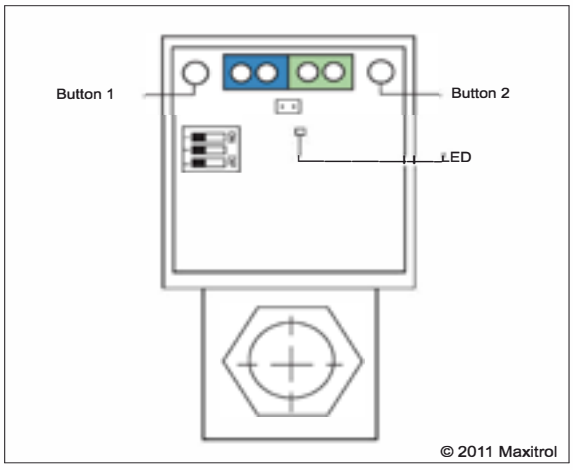


Figure 4: EXA STAR Modulating Valve Series Adjustment Controls

MAXITROL

Maxitrol Company
23555 Telegraph Rd., P.O. Box 2230
Southfield, MI 48037-2230 U.S.A.
EXA_MS_EN_11.2011

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HIGH FIRE SETTING - BUTTON #1

To enter the high fire setting mode, press and hold button #1 until the LED lights solid red. Release. The valve is now in the high fire setting mode. Buttons #1 and #2 are used to set desired high fire setting.

Press or hold Button #1 to increase gas flow. Each button press equates to the minimum available step size and will increase flow slowly. Holding the button down auto steps and eliminates the need to repeatedly press the button. Use this feature to rapidly increase the flow.

Press or hold Button #2 to decrease gas flow. Each button press equates to the minimum available step size and will decrease flow slowly. Holding the button down auto steps and eliminates the need to repeatedly press the button. Use this feature to rapidly decrease the flow.

To save the high fire setting, simultaneously hold Buttons #1 and #2 until the LED turns OFF.

NOTE: Controls left in any setting mode will default to the current settings and return to normal operating mode after 5 minutes of inactivity.

SET UP FOR CARRIER UNITS WITH GAS HEAT

2 stage Carrier gas units on high fire should be set at 3.5" gas pressure.

This should be done with:

- W1 & W2 on
- Mod gas at 100%

To set the low fire on the Carrier units, the gas pressure should be approximately 0.6" of gas pressure.

This should be done with:

- W1 on, W2 off
- Mod gas at 0%

At this low setting, make sure that the unit has a good flame on the 1st stage burner. If not, slightly raise the gas pressure until you see a good flame.

Once you have completed this set up, the unit will modulate between the lowest and the highest pressure settings as the modulating heat tries to maintain the discharge air temperature.

LOW FIRE SETTING - BUTTON #2

To enter into the low fire setting mode, press and hold button #2 until the LED light blinks red. Release. The valve is now in the low fire setting mode. Buttons #1 and #2 are used to set the desired low fire setting.

Press or hold Button #2 to decrease gas flow. Each button press equates to the minimum available step size and will decrease flow slowly. Holding the button down auto steps and eliminates the need to repeatedly press the button. Use this feature to rapidly decrease the flow.

Press or hold Button #1 to increase gas flow. Each button press equates to the minimum available step size and will increase flow slowly. Holding the button down auto steps and eliminates the need to repeatedly press the button. Use this feature to rapidly increase the flow.

To save the low fire setting, simultaneously hold Buttons #1 and #2 until the blinking LED turns OFF.

NOTE: Controls left in any setting mode will default to the current settings and return to normal operating mode after 5 minutes of inactivity.

MAXITROL

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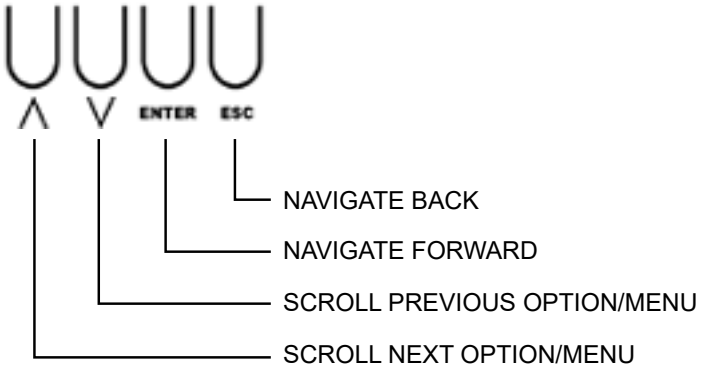
NAVIGATING ON AN iAIRE CONTROLLER



POWER ON THE CONTROLLER AND THE FIRST MENU IS **STATUS MENU**. TO NAVIGATE THROUGH THE OPTIONS, PRESS THE **UP ARROW** KEY. PRESS **ENTER** TO MAKE CHANGES IN ANY SUB MENU. TO GO BACK TO THE MAIN STATUS MENU, PRESS THE **ESC** BUTTON.

MENU SCREENS BEGIN ON THE FOLLOWING PAGE.

STATUS MENU

OPERATING STATUS

W1 0-1
DAT 60 - 120
HEAT % 0 - 100%

MOD HEAT WAIT STATUS

RANGE: **DEFAULT:**
000s - 030s **030s**

TEST MODE MENU

MOD HEAT TEST

RANGE: **DEFAULT:**
0 - 100% **000%**

SETPOINTS MENU

HEAT SETPOINT

RANGE: 60 F_120 F
DEFAULT: 95 F

CONFIGURATION MENU

CONTROLLER MODE CONFIGURATION

OPTION: DAT MODE
RANGE: N/A
DEFAULT: [enabled]
NOTE: Discharge Air Temp Controlled.

OPTION: SPACE MODE
RANGE: N/A
DEFAULT: [disabled]
NOTE: 0-10vdc Space Sensor Controlled.

GAS / ELECTRIC CONFIGURATION

RANGE: GAS_ELECTRIC
DEFAULT: ELECTRIC

MODULATED HEAT GAIN

RANGE: -20 _ 20
DEFAULT: 04
NOTE: % Modulating heat signal = (((Act temp - setpoint temp)+ Mod Heat Offset)/Moulated Heat Gain) * Mod Heat Multiplier.

MOD HEAT OFFSET

RANGE: -10_10
DEFAULT: 01
NOTE: % Modulating reheat signal = (((Act. Temp - Setpoint Temp) + Reheat Offset) / Reheat Gain) * Reheat Multiplier.

MOD HEAT MULTIPLIER

RANGE: 0.1_1
DEFAULT: 01

GAS HEAT MIN

RANGE: 000%_100%
DEFAULT: 000%

GSA HEAT MAX

RANGE: 000%_100%
DEFAULT: 100%

MOD HEAT WAIT TIME

RANGE: 000S_300S
DEFAULT: 030S

LOAD DEFAULTS

Note: If "Check SP" displayed, load defaults

ROOM TEMP TYPE

OPTION: GreyStone
RANGE: N/A
DEFAULT: [enabled]
NOTE: Allows user to select what type of space sensor is being used.

OPTION: User Defined
RANGE: N/A
DEFAULT: [disabled]
NOTE: Allows user to create custom curve to utilize their own space sensor. Signal is 0-10V.

OPTION: Tongdy 32F-122F
RANGE: N/A
DEFAULT: [disabled]
NOTE:

OPTION: Tongdy 32F-140F
RANGE: N/A
DEFAULT: [disabled]
NOTE:

ROOM TEMP LOW

RANGE: -040 _ 080
DEFAULT: 032

ROOM TEMP HIGH

RANGE: 000 _ 140
DEFAULT: 095

ROOM SETPOINT SOURCE

OPTION: I/O
RANGE: 60 F_90 F
DEFAULT: [enabled]
NOTE: When this is enabled, unit is getting room setpoint temperature for iAIRE provided space sensor.

OPTION: Remotely
RANGE: BAS Controlled
DEFAULT: [disabled]
NOTE: When this is enabled, unit is getting room setpoint temperature from BAS system.

OPTION: User Interface
RANGE: 60 F_90 F
DEFAULT: [enabled]
NOTE: When this is enabled, unit is getting room setpoint temperature from iAIRE controller in unit.

ROOM SETPOINT LOW

RANGE: 050 _ 082
DEFAULT: 062

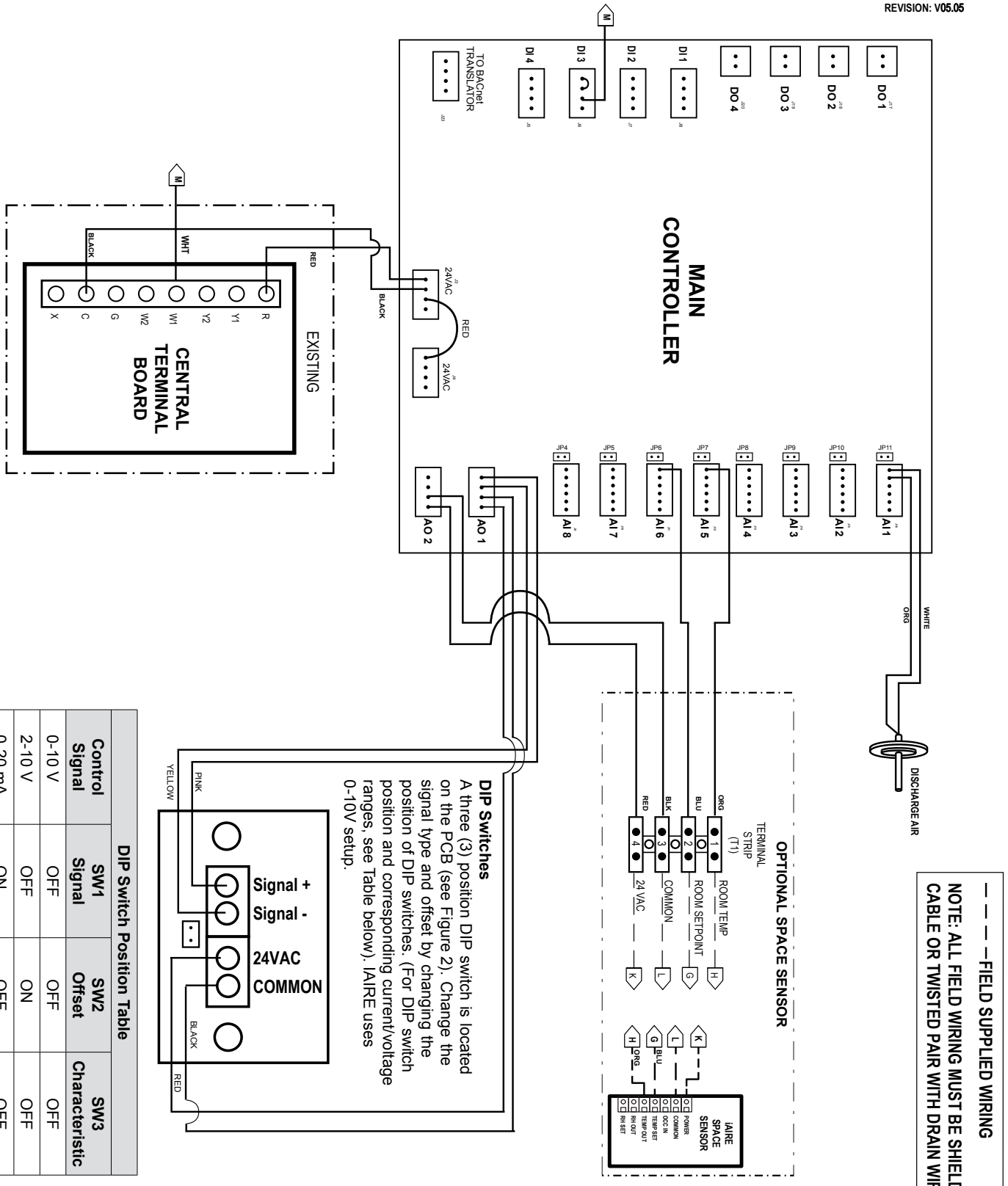
ROOM SETPOINT HIGH

RANGE: 062 _ 130
DEFAULT: 082

MOD HEAT INSTALLATION WIRING (Gas Only)

SCH-0001-I

REVISION: V05.05



DIP Switches

A three (3) position DIP switch is located on the PCB (see Figure 2). Change the signal type and offset by changing the position of DIP switches. (For DIP switch position and corresponding current/voltage ranges, see Table below). IAIRE uses 0-10V setup.

DIP Switch Position Table

Control Signal	SW1 Signal	SW2 Offset	SW3 Characteristic
0-10 V	OFF	OFF	OFF
2-10 V	OFF	ON	OFF
0-20 mA	ON	OFF	OFF
4-20 mA	ON	ON	OFF

– – – –FIELD SUPPLIED WIRING

NOTE: ALL FIELD WIRING MUST BE SHIELDED CABLE OR TWISTED PAIR WITH DRAIN WIRE

Mod Gas Heat Install I/O/M manual

PD 02/04/2022 - v 1.31
PN IOM-0011

APPENDIX G (SMOKE SENSOR)

AIR PRODUCTS AND CONTROLS

You in Control

AIR PRODUCTS AND CONTROLS INC.
INSTALLATION AND MAINTENANCE INSTRUCTIONS
FOR SL-2000 SERIES DUCT SMOKE DETECTORS

SL-2000-N 4-Wire, Ionization Type
SL-2000-P 4-Wire, Photoelectric Type

PRODUCT OVERVIEW

PRODUCT APPLICATION

SL-2000 Series duct smoke detectors provide early detection of smoke and products of combustion present in air moving through an HVAC duct supply, return, or both in commercial, industrial, and residential applications. These devices are designed to prevent the recirculation of smoke in areas by the air handling system's fans and blowers. Complete systems may be shut down in the event of smoke detection.

⚠ **NOTE:** *For the correct installation of a duct smoke unit, please refer to the NFPA 72 (National Fire Alarm Code), NFPA 90A (Standard for Installation of Air Conditioning and Ventilation Systems),NFPA 92A (Recommended Practice for Smoke Control Systems.), NFPA 5000 (Building Construction and Safety Code), IMC (International Mechanical Code), and IFC (International Fire Code).*

This detector is not intended for open area protection nor should it be used for early warning detection or replace a regular fire detection system.

PRODUCT DESCRIPTION

The SL-2000 Series smoke detector is fitted with a mounting base that will accept an ionization smoke detector head model 55000-225APO or photoelectric smoke detector head model 55000-328APO. The duct unit supports two sets of form "C" alarm contacts, one form "A" alarm contact and one form "C" trouble contact. The trouble contact supervises the presence of the input power, removal of the detector cover and the removal of the smoke detector head.

⚠ **This detector is equipped with a cover removal switch that instantly provides a trouble condition upon removal of the clear cover. For all testing and inspection with the cover removed, the cover removal switch (designated as SW1 on PCB) must be manually depressed to simulate standard "pilot" operation. THE TROUBLE CONTACTS (TERMINALS 4, 15, 5) ARE SHOWN IN THE NON-ENERGIZED CONDITION.**

The trouble contacts **will not** operate in the event of a smoke alarm. The SL-2000 Series duct detector will operate from various input voltage sources; namely 24VAC, 24VDC, 115VAC and 230VAC.

SAMPLING TUBES

The operating principle of a duct detector is based on the Venturi effect. Two tubes extend into the HVAC duct. Air flowing through the duct is forced into the air intake (inlet) tube via the air intake holes, (facing the airflow) and passes over the detector head. The air will be drawn out via the exhaust tube back into the HVAC duct. (A 7" exhaust tube is provided in the installation kit.) When the concentration of smoke particles suspended in the air stream reach the alarm threshold of the detector head, the unit will go into alarm.

The duct smoke detector units are designed to operate in duct widths from 6" to 10' wide with an air velocity between 100 to 4,000 feet per minute. To verify correct installation, the pressure differential between the sampling (high side) and exhaust (low side) tubes should be measured using a Magnehelic pressure gauge or equivalent. An acceptable reading is between 0.01 and 1.2 inches of water.

To minimize the impact of air turbulence and stratification on performance, a duct smoke detector should be located as far as possible downstream from any obstruction (i.e. deflector plates, elbows, dampers, etc.). In all situations, confirmation of velocity and pressure differential within specifications is required.

REMOTE ACCESSORIES

Audible and visual alarm indicators, remote status indicators, and remote reset/test switches can be accommodated by the SL-2000 Series duct units by connecting to DC voltage output terminals as described on Page 4. These terminals are not supervised and the voltage/current will only be present when the detector unit is in alarm. The remote pilot (green) LED will be permanently illuminated when connected to the output terminals as long as input power and detector head are present.

SL-2000 AT-A-GLANCE

MODEL NUMBER:
SL-2000-N 4-Wire Ionization Duct Smoke Detector
SL-2000-P 4-Wire Photoelectric Duct Smoke Detector

DETECTOR HEAD MODEL NUMBER:
Ionization Detector Head: **55000-225APO**
Photoelectric Detector Head: **55000-328APO**

POWER	STANDBY CURRENT		ALARM CURRENT	
		WITH ACCESSORIES		WITH ACCESSORIES
24VAC	55.0mA	95.0mA	190.0mA	280.0mA
24VDC	14.0mA	32.0mA	68.0mA	165.0mA
115VAC	22.0mA	25.0mA	32.0mA	50mA
230VAC	14.0mA	14.0mA	18.0mA	30.0mA

RELAY CONTACT RATINGS:

Alarm contacts:	2 Sets form "C" rated at 10A @ 115VAC resistive 1 form "A" rated at 2A
Trouble contacts:	1 Set form "C" rated at 10A @ 115VAC resistive
Air velocity:	100 to 4,000ft/min.
Ambient temperature:	SL-2000-N: 32°F to 158°F (0°C to 70°C) SL-2000-P: 32°F to 140°F (0°C to 60°C)
Humidity:	10% to 85% RH Non-Condensing/Non-Freezing
Material:	Gray plastic back box with clear plastic cover (Makrolon 94V-0)
Dimensions:	13½" L X 4½" W X 2¼" D
Max. net wt.:	3½ lbs.
Radioactive element:	SL-2000-N (Ionization) - Americium 241, 0.9 micro curie.

Do not expose to corrosive atmospheres.

U.S. Patents 6,741,181; 7,204,522; 6.124.795

MECHANICAL INSTALLATION

LOCATION PREREQUISITES

This guideline contains general information on duct smoke detector installation, but does not preclude the NFPA and/or ICC documents listed. Air Products and Controls assumes no responsibility for improperly installed duct detectors. To determine the correct installation position for an SL-2000 Series duct smoke detector, the following factors must be considered.

1) A uniform non-turbulent (laminar) airflow between 100 ft/min. to 4,000 ft/min. must be present in the HVAC duct. To determine duct velocities, examine the engineering specifications that define the expected velocities or use an Alnor model 6000AP velocity meter (or equivalent).

2) To minimize the impact of air turbulence and stratification on performance, a duct smoke detector should be located as far as possible downstream from any obstruction (i.e. deflector plates, elbows, dampers, etc.). In all situations, confirmation of velocity and pressure differential within specifications is required.

The pressure differential between the input sampling (high pressure) tube and exhaust (low pressure) tube for the SL-2000 Series smoke duct detector should be greater than 0.01 inches of water and less than 1.2 inches of water.

3) Identify a code compliant location (supply or return side, or both) for the installation of the duct unit that will permit easy access for viewing and serviceability.

4) When installing on the return side, install duct units prior to the air being exhausted from the building or diluted with outside "fresh" air.

5) When installing duct smoke units downstream of filters, fires occurring in the filters will be detected, but if the filters become blocked, insufficient air flow through the duct unit will prevent the correct operation of the duct detector. Duct units installed in the supply air side may monitor upstream equipment and/or filters.

6) Where possible, install duct detectors upstream of air humidifiers and downstream of dehumidifiers.

7) To prevent false alarms, the duct detector should not be mounted in areas of extreme high or low temperatures, in areas where high humidity exists, or in areas where the duct may contain gases or excessive dust.

SAMPLING TUBE ASSEMBLY

The SL-2000 Series duct smoke detectors employ a specially notched sampling tube, which must be ordered separately in one of four standard lengths.

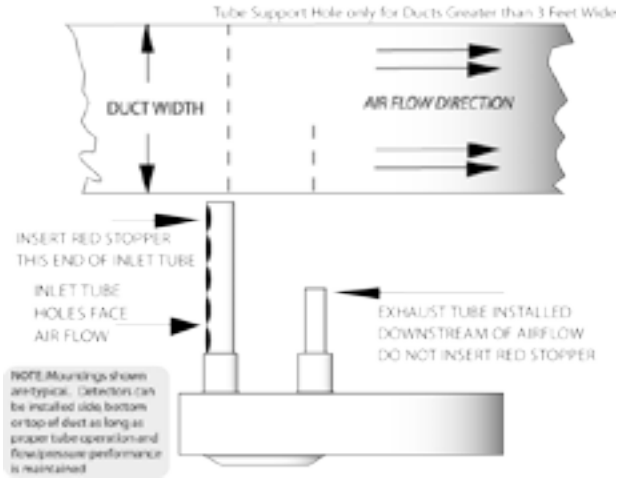
STN-1.0	For duct widths of 6" TO 1.0'
STN-2.5	For duct widths of 1.0' TO 3.0'
STN-5.0	For duct widths of 3.0' TO 5.0'
STN-10.0	For duct widths of 5.0' TO 10.0'

Standard sampling tubes are steel tubes with air intake holes drilled the entire length of the tube. These tubes can be cut to length and must span at least 80% the width of the duct. Sampling tubes over 3.0' must be supported on the opposite side of the duct. To ensure the correct operation of the sensing tube, the red end cap (red stopper in installation kit) must be inserted in the end of the air intake sampling tube. For custom duct widths, always use the next longest standard size and cut down to the exact requirement.

"NO-TOOLS" TUBE INSTALLATION

The SL-2000 Series duct smoke detector provides a unique, patented mechanism for installation and/or removal of the sampling and exhaust tubes from either the front or rear of the detector housing.

Once the airflow direction has been determined, insert the inlet and exhaust tubes into the duct smoke detector. If the cover is in place, the tubes may be inserted into the back of the detector via the key-slots provided. Simply push the tube into place against the spring loaded retainer, and turn into the correct position, allowing the key to "lock" the tube in the desired orientation. For front side installation, simply rotate the tube retainer until the tube may be inserted and oriented properly. Once the tube is installed, rotate the retainer back into place to lock down the tube. Ensure air intake sampling tube is positioned so that the inlet holes are directly facing the airflow.



DUCT PREPARATION

Remove mounting template from the installation kit. Remove paper backing from the mounting template and affix it to the duct at the desired location. Using the template as a guide, drill (2) mounting holes, 3/32" (2.5mm) for the #12 X ½ " sheet metal screws packaged in the installation kit. Drill or punch (2) 1¼" (32mm) holes for inlet sampling and exhaust tubes, using the template as a guide. Clean all holes.

MOUNTING

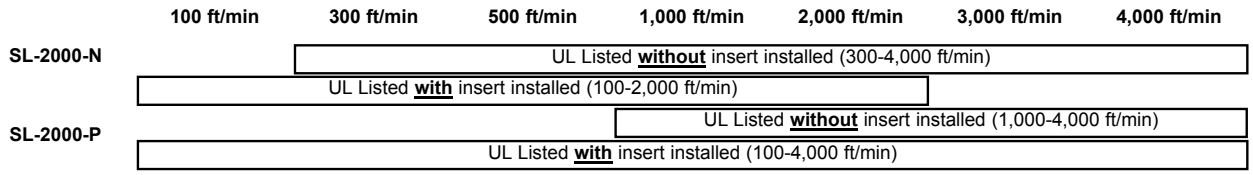
After securing the sampling and exhaust tubes to the duct smoke unit, (or initially placing the tubes through the 1¼" holes drilled or punched in the HVAC duct to accept the inlet sampling and exhaust tubes and then attaching them to the duct unit), hold the duct unit assembly in position and use (2) # 12 X ½" sheet metal screws (packaged in the installation kit) to secure the duct smoke detector to the HVAC duct sheet metal.

AIR SAMPLING VERIFICATION

To ensure correct operation of the duct unit use a Magnehelic differential pressure gauge, Dwyer 2000 or 4000 Series (or equivalent) to determine the differential pressure between the inlet (high side) and exhaust (low side) tubes. The differential pressure between the two tubes should be greater than 0.01 inches of water and less than 1.2 inches of water.

AIR SAMPLING VERIFICATION (CONT'D)

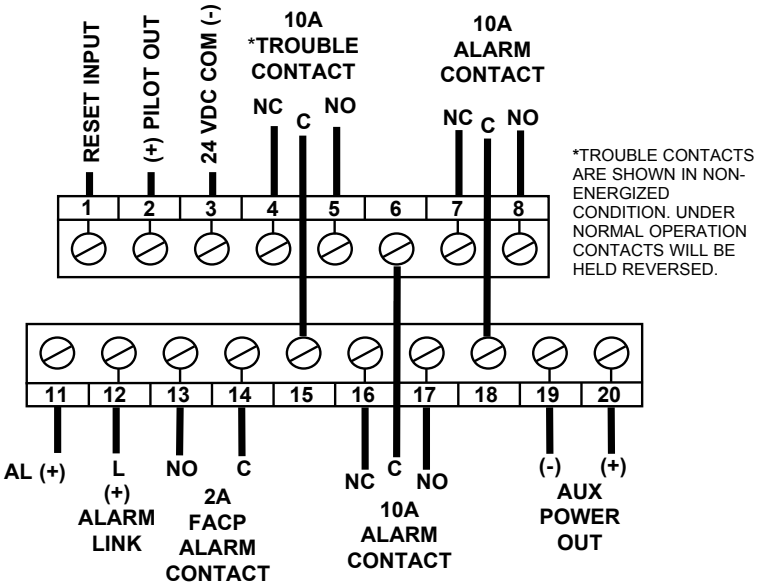
This duct smoke detector is shipped with a velocity adapter insert, either factory installed (SL-2000-P), or found in the installation kit (SL-2000-N). When installed, this adapter will allow the duct detector to operate at extremely low air velocities. To install the adapter, simply insert it into the slots provided inside the detector housing so that the adapter fits snugly over the smoke detector head. Unless your system is consistently operating in the slower velocity range (where the adapter is specifically required, SL-2000-N), we recommend that the adapter not be inserted. If you experience false alarms at higher velocities with the adapter in place, the adapter should be removed. Please use the following chart for guidance on when the velocity adapter should be used. For reference, the speeds indicated are intended to represent the velocity of air within the duct under normal operational conditions.



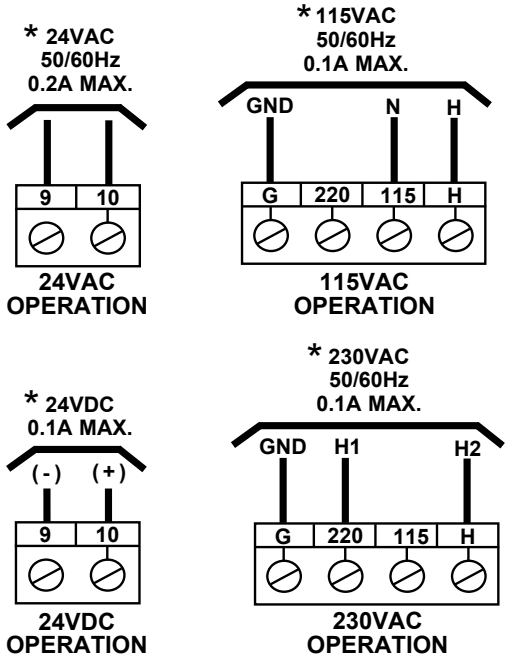
ELECTRICAL INSTALLATION

TERMINAL AND POWER CONNECTIONS

Prior to connecting input power to the duct unit, determine the correct input voltage/ current availability and ensure it is connected to the correct terminals.



*TROUBLE CONTACTS ARE SHOWN IN NON-ENERGIZED CONDITION. UNDER NORMAL OPERATION CONTACTS WILL BE HELD REVERSED.



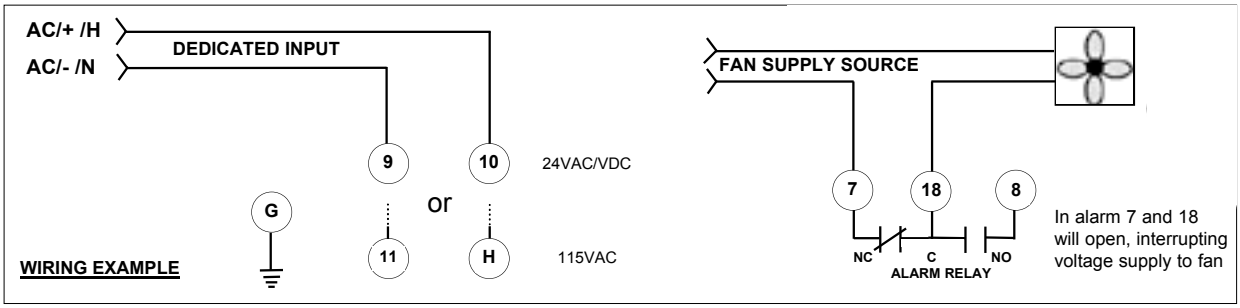
* NOTE: Choose only one source of operating voltage

WIRING

⚠ **CAUTION**: Do not use looped wire under terminals. Break wire run to provide for proper supervision of connections.

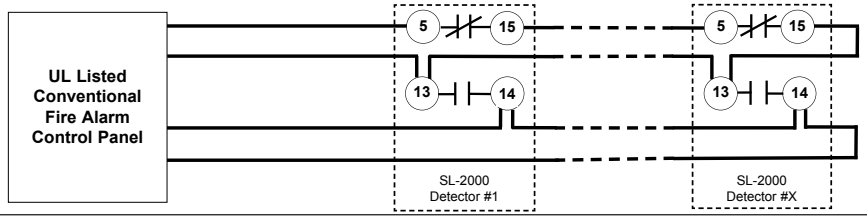
With detector head removed, connect one of the appropriate dedicated power sources to the applicable terminals (see above). Replace detector head and depress the cover removal switch (SW1) and the unit will be energized. The green pilot LED will be illuminated, and when pressing the test/reset button (SW2), the red alarm LED will be illuminated. This test confirms the correct basic operation of the duct smoke unit, excluding the detector head (see functional testing).

In the event of a fire alarm, certain equipment may be required to be shut down. For example, shut down may be achieved by interrupting the fan supply source to that particular piece of equipment when wired as indicated on Page 4.

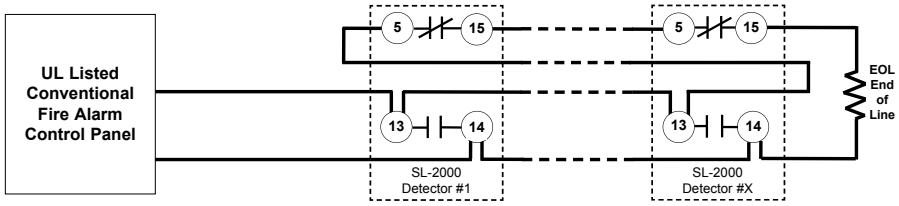


FIRE ALARM CONTROL PANEL WIRING

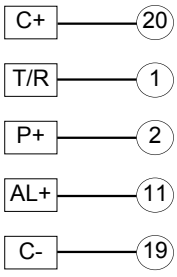
SAMPLE CONTROL PANEL WIRING - STYLE "D" / CLASS "A" IDC (Supervised - A fault condition will not inhibit an alarm response)



SAMPLE CONTROL PANEL WIRING - STYLE "B" / CLASS "B" IDC (Supervised - A fault condition will not inhibit an alarm response)



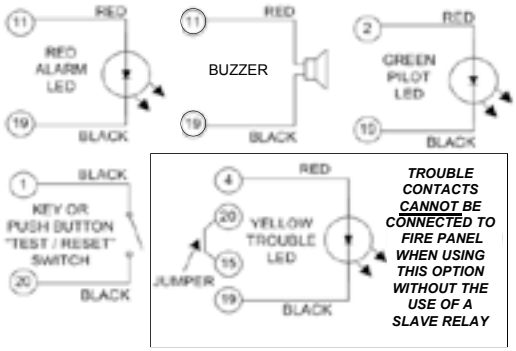
MSR REMOTE ACCESSORY WIRING



CONNECTIONS SHOWN FOR ALL POSSIBLE TERMINAL STYLE CONFIGURATIONS.

CONNECT ONLY THOSE TERMINALS AVAILABLE ON THE MSR REMOTE ACCESSORY CONTROL ASSEMBLY.

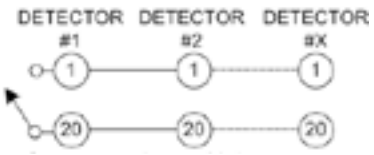
MS REMOTE ACCESSORY WIRING



INTERCONNECTION WIRING FOR COMMON FUNCTIONS

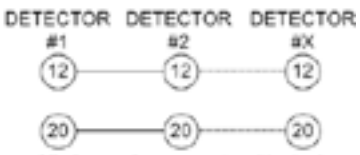
⚠ **NOTE:** A common power supply must be used for all interconnected detectors.

Common Test/Reset



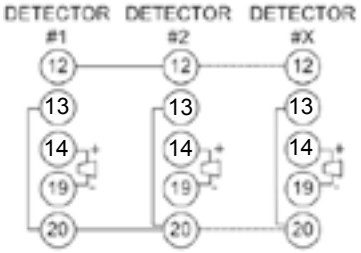
30 detectors max.
(Use normally open test/reset switch)

Common Alarm Shutdown



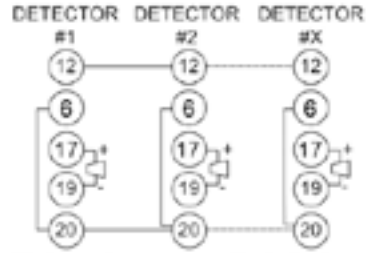
All alarm relays operate with single alarm. 30 detectors max.

Adding Individual Horn/Strobes



All alarm relays operate with single alarm. Individual horn/strobe units operate on alarmed detector only. 30 detectors max.

Adding Common Alarm Horn/Strobes



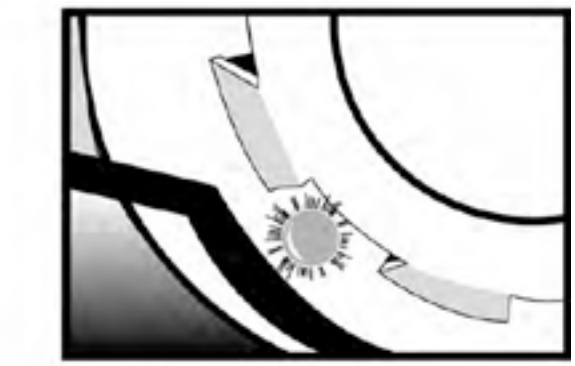
All alarm relays operate with single alarm. All horn/strobe units operate on any single alarm. 30 detectors max.

TESTING AND MAINTENANCE PROCEDURES

OPERATIONAL TESTING

To determine the correct operation of the SL-2000 Series duct smoke detector, ensure input power is connected and the green pilot LED is illuminated.

The LED on the detector head of both the ionization and photoelectric models will flash while the unit is in standby mode. The LED on the smoke detector head will be permanently illuminated when smoke is detected and the head is in alarm.



Above: The LED will be permanently illuminated when the unit is in alarm.

With the air handling unit shut down (not connected), and the clear cover removed, press and hold the test/reset button and the cover removal switch on the SL-2000. The red alarm LED on the circuit board will be illuminated and the alarm relay outputs will change state. Using a multimeter set to OHMS (or continuity buzzer function on the meter) place the meter probes on the following terminals, and ensure the contacts are closed (continuity) (8-18) and (6-17). When releasing the test/reset button these contacts will open.

The trouble contacts (4,15,5) on the SL-2000 detector will not change state in the event of a fire alarm, operational, or functional testing. The trouble contacts can be tested by either releasing the cover removal switch, or depressing the cover removal switch after rotating the smoke detector head counter-clockwise and removing the detector head. This action will extinguish the green pilot LED and cause the trouble contacts to change state, (4-15) will be closed (continuity) and (5-15) will be open circuit. Replacing the detector head and rotating it clockwise until it locks, will cause the green pilot LED to be illuminated and the unit will be operational, terminals (4-15) will be an open circuit and (5-15) will be closed (continuity).

FUNCTIONAL TESTING

Once operational testing is concluded the unit requires functional testing to determine the correct operation of the detector head.

MAGNET TESTING: Place the magnet provided with the installation kit on top of the housing between the raised sections above the detector head (as indicated by the arrows on the unit cover). Allow at least five seconds for alarm initiation. Remove magnet and reset detector.

SMOKE TESTING: Using smoke test canister with testing nozzle (available from Air Products and Controls Inc. part number TG-2000), insert the test gas nozzle into the test port on the unit cover. Press can against cover to release gas into the chamber.

⚠ **CAUTION: DO NOT SPRAY GAS FOR MORE THAN ½ SECOND. OVERUSE OF TEST GAS FACILITY MAY RESULT IN DETECTOR CONTAMINATION.**

After 15 to 20 seconds the detector head will go into alarm, illuminating the detector head LED and causing the duct unit functions to operate, alarm relays will change state, and the alarm related remote accessories, if attached, will function.

If no test gas is available to conduct functional testing, remove cover and, while holding down the cover removal switch, blow smoke from a cotton wick or punk directly at the head to cause an alarm. The alarm indicator should illuminate within one minute.

Should additional testing also be required for simulated fire conditions, smoke bombs placed in the duct may not be suited for the particular detector head (photoelectric or ionization) selected and installed. Consult the smoke bomb data for proper use and compatibility with detector type.

The S65A ionization detector head (55000-225APO) utilizes a radioactive source as its means of detection and will detect smoke particles of between .1 and 1 micron in size.

The S65A photoelectric detector head (55000-328APO) operates on the principle of light scatter and will detect smoke particles of between 1 and 10 microns in size.

When purchasing smoke bombs for additional required functional testing, ensure smoke particle sizes comply with the criteria as described above.

NOTE: In situations that require a duct smoke detector to be held in an alarm condition for an extended period of time, the magnet test or smoke test methods should be used to ensure the detector is locked into alarm.

MAINTENANCE

Each installation location must be assessed on its own merits. If the protected area is of a very dirty nature then the SL-2000 Duct unit(s) will have to be checked and cleaned on a quarterly basis or when cleaning is required.

As a guideline the smoke detector head should be cleaned every six months or as required. The best methods of cleaning are to vacuum the detector head thoroughly or to blow the detector head out using clean, dry compressed air.

Do not use chemicals or non-conforming air to clean the detector head housing as this could contaminate the detector head and damage the casing.

Sensing tubes must be inspected and cleaned in accordance with the schedule as determined above, to allow the free flow of air through both inlet and exhaust tubes.

Consult your local code and AHJ requirements for required maintenance schedules.

AIR PRODUCTS AND CONTROLS INC.
25 Corporate Drive Auburn Hills, MI 48326 USA
Telephone: (248) 332-3900 www.ap-c.com

AVAILABLE ACCESSORIES FOR USE WITH SL-2000 SERIES DUCT SMOKE DETECTORS

MSR- SERIES REMOTE ACCESSORIES

X* = Replace X* with W for White Cover Plate; R for Red Plate; S for Stainless Steel Plate

MSR-100 Series Features Visual Indicators: Alarm, Pilot, Trouble • Buzzer: Programmable for Alarm and Trouble Buzzer Silence: Visual Notification and Ringback • Detector Test/Reset: Key Operated • LED/Buzzer Test: Push-Button Operated

MSR-100R/X*	White Face Plate
MSR-100RS/X*/C	White Face Plate; Strobe with Clear Lens
MSR-100RS/X*/O	White Face Plate; Strobe with Opaque Lens

MSR-50RM Series Features Magnet Test, Pushbutton Reset, Visual Pilot, Trouble, Alarm LED

MSR-50RM/X*	Remote Indicator/Control Assembly w/ (color) Single Gang Cover Plate
MSR-50RMS Series Features MSR-50RM with Strobe and Double Gang Plate	
MSR-50RMS/X*/C	Remote Indicator/Control Assembly w/ Strobe Assembly (Clear Lens)
MSR-50RMS/X*/O	Remote Indicator/Control Assembly w/ Strobe Assembly (Opaque Lens)

MSR-50RK Series Feature Key Test & Reset with Visual Pilot, Trouble, Alarm LED

MSR-50RK/X*	Remote Indicator/Control Assembly w/ (color) Single Gang Cover Plate
MSR-50RKS Series Features MSR-50RK with Strobe and Double Gang Plate	
MSR-50RKS/X*/C	Remote Indicator/Control Assembly w/ Strobe Assembly (Clear Lens)
MSR-50RKS/X*/O	Remote Indicator/Control Assembly w/ Strobe Assy (Opaque Lens)

MSR-50SA Series Features plug-in combination Strobe (Visual) and Sounder (Audible)

MSR-50SA/X*/C	Module, Clear Lens with (color) Double Gang Cover Plate
MSR-50SA/X*/O	Module, Opaque Lens with (color) Double Gang Cover Plate

MS- and SHP- SERIES REMOTE ACCESSORIES

MS-RA	Remote Alarm
MS-RA/R	Remote Alarm, push button Test/Reset Switch
MS-RA/P/R	Remote Alarm, Pilot, push-button Test/Reset Switch
MS-KA/R	Remote Alarm, key-operated Test/Switch
MS-KA/P/R	Remote Alarm, Pilot, key-operated Test/Reset Switch
MS-RA/P	Remote Alarm, Pilot
MS-RH	Remote Alarm Horn
MS-RH/KA/P/R	Remote Alarm, Pilot, Horn, key-operated Test/Reset Switch
MS-RH/P/A	Remote Alarm, Pilot, Horn
MS-RH/KA/P/A/T	Remote Alarm, Trouble, Pilot, Horn, key-operated Test/Reset Switch
MS-RA/P/T	Remote Pilot, Trouble
MS-RA/FT/P	Remote Pilot, Trouble, push-button Test/Reset Switch
MS-KA/P/R/T	Remote Pilot, Trouble, key-operated Test/Reset Switch
MS-RD	Remote Alarm
MS-F/T	Remote Trouble
SHP24-1575R	Horn/Strobe, red housing, clear cover
SHP24-1575O	Horn/Strobe, white housing, opaque cover
SHP24-1575W	Horn/Strobe, white housing, clear cover

SMOKE TEST GAS

TG-2000	Solo Aerosol Test Gas with Nozzle for Test Port

NOTCHED SAMPLING TUBES

STN-1.0	For duct widths of 6" to 1.0'	STN-2.5	For duct widths of 1.0' to 3.0'
STN-5.0	For duct widths of 3.0' to 5.0'	STN-10.0	For duct widths of 5.0' to 10.0'

REPLACEMENT SMOKE DETECTOR HEADS

55000-225APO	S65A Ionization Detector Replacement Head
55000-328APO	S65A Photoelectric Detector Replacement Head

POWER SUPPLIES

T-PB 202-1	24VAC @ 4.0A Class I Power Supply
T-PB 202-0	24VAC @ 4.0A Class I Power Supply
T-PB 303-1	24VAC @ 3.0A Class II Power Supply
T-PB 303-0	24VAC @ 3.0A Class II Power Supply

SL-2000 SERIES DUCT SMOKE DETECTORS

INSTALLATION AND MAINTENANCE INSTRUCTIONS

SL-2000-N Ionization Type, 4-Wire Duct Smoke Detector
SL-2000-P Photoelectric Type, 4-Wire Duct Smoke Detector

ANSI APPROVED / UL LISTED to the 268A Standard
for Smoke Detectors for Duct Application:
UROX, UROX7, File No S2829

CSFM LISTED: 3240-1004:105 • MEA ACCEPTED: 73-92-E VOL 27

NOTICE: The information contained in this document is the most current available at the time of shipment of accompanying product, and is subject to change without notice. Future references should always be made to the most current revision of this document. The information contained in all this document should be considered before installing or using the product. Any example applications shown are subject to the most current enforced local/national codes, standards, approvals, certifications, and/or the authority having jurisdiction. All of these resources, as well as the specific manufacturer of any shown or mentioned related equipment, should be consulted prior to any implementation. For further information or assistance concerning this product, contact Air Products and Controls Inc. Air Products and Controls Inc. reserves the right to change any and all documentation without notice.
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FOR TECHNICAL SUPPORT CALL 888-332-2241 OR 248-332-3900

APPENDIX H (24/7 TIMER)

ENFORCER®

SA-027HQ

365-Day Annual Timer

Manual

- Two N.O. or N.C. Form C relays, 10A@14VDC
- Each relay can be programmed for 50 events, for a total of 100 individual programmable events
- 10 Programmable holidays
- The 100 programmable events can be set weekly, daily, or hourly, over the course of an entire year
- Password protection can be turned ON or OFF
- One egress input per relay (2 total)

SECO-LARM® SLI

ENFORCER 365-Day Annual Timer

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Warranty 12

Introduction:

The ENFORCER SA-027HQ Annual Timer can be programmed to operate two relays 24 hours a day, over the course of an entire year. These relays can be used to control devices in many applications such as security, access control, lighting, and environmental control. The two Form C relays can each be programmed to operate in shunt or momentary mode for up to 50 unique events. Each event can be programmed on a weekly or daily schedule. Block programming allows events to be repeated on consecutive days. 10 Programmable holidays disable the timer for a single day, or for the same day every year.

Features:

- Two N.O. or N.C. Form C relays 10A@14VDC.
- Each relay can be programmed for 50 events, for a total of 100 individual programmable events.
- The 100 programmable events can be set weekly, daily, or hourly, over the course of an entire year.
- Password protection can be turned ON or OFF.
- One egress input per relay (2 total).
- Block programming allows events to be repeated on consecutive days.
- First-person-in function interrupts the normal operation of the annual timer.
- Event outputs can be programmed disable, ON, OFF, shunt, or momentary (1~99 seconds).
- 10 Programmable holidays.
- Can be programmed for password protection.
- Tandem mode allows both relays to operate simultaneously.
- EEPROM Memory for safe data protection in case of power failure.
- Built-in clock backup battery.
- Built-in backup battery charger for external backup battery use.
- Compensates for leap years.
- Can be set for Standard or Daylight Saving Time.
- Alphanumeric backlit LCD display for easy programming.

ENFORCER 365-Day Annual Timer

Specifications:

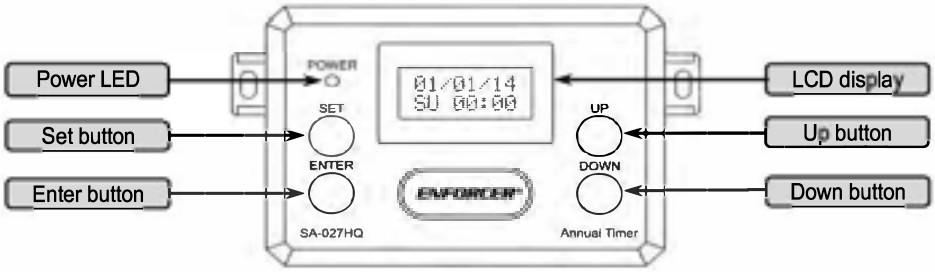
Input voltage		12~24 VDC/VAC
Number of relays		2
Relay rating		10A@14VDC
Current draw		100mA
Number of prog. events		50 for each relay, 100 total
Blue LED	ON	Power is ON
	OFF	Power is OFF
Number of prog. holidays		10
Battery charging current		90mA
Security code		4-digits, numeric, ON/OFF

Parts List:

1x 365-Day Timer
1x Manual
2x Screws
2x Back-up battery wires

Overview:

SA-027HQ Annual Timer



Installation:

1. Find a location for the SA-027HQ where the LCD display is easily seen and the buttons can be pressed. Mark that location.
2. Open the case and connect the wires.
3. Connect a 12/24 VDC/VAC power supply to the power input terminals marked (+) and (-).
4. Connect the battery backup to the backup battery input terminals marked (+) and (-).
   NOTE: For the best backup battery charging results, the power input should not be lower than 17VDC or 12VAC.
5. Remove the paper battery protector from the onboard clock backup battery.
   NOTE: The paper protector prevents the battery from being drained during product shipment. If the protector is not removed, the onboard clock backup battery will fail to function.
6. Connect the devices that are being controlled to the outputs of one or two relays.
   NOTE: If using a DC-powered electric/electromagnetic lock, connect a 1N4004 diode in parallel with the power supply and as close to the lock as possible. This absorbs possible interference and prevents operation of the lock from damaging the timer. Not required for AC-powered locks.
7. Close the case and mount the unit.

Function Buttons

The SA-027HQ has 4 function buttons that control the programming features.

Table 1: Function Buttons

SET	Enters the main menu, backs out of a submenu
ENTER	Enters a submenu, accepts the current value above the cursor
UP	Changes the menu selection or the value above the cursor
DOWN	Changes the menu selection or the value above the cursor

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Relay Options:

1. Press the UP or DOWN button while the main screen is on to show the relay status screen.
   a. Press and hold the UP button for 3 seconds to toggle relay 1.
   b. Press and hold the DOWN button for 3 seconds to toggle relay 2.
2. See Table 2 below for different event modes available under Event programming

Table 2: Event Modes

Disable	Disables the event (factory default)
ON	Turns the relay ON
OFF	Turns the relay OFF
Pulse	Activates the relay for 1~99 secs.

Programming Key:

BK	Block Coding	HOL	Holiday
ON	Relay will switch on	MO	Monday
OFF	Relay will switch off	TU	Tuesday
DIS	Relay will be disabled	WE	Wednesday
PL	Relay will pulse for a # of seconds	TH	Thursday
DS	Daylight Saving Time*	FR	Friday
ST	Standard Time	SA	Saturday
R1	Relay 1	SU	Sunday
R2	Relay 2		

For an explanation of Daylight Saving Time, please see page 8.

Programming Notes:

A convenient feature of the SA-027HQ Annual Timer is the ability to program it before installation. The EEPROM memory stores and protects programming instructions.
Programming the SA-027HQ is easier and faster if you know exactly how you want to use the Annual Timer, as well as functions it will perform.

1. Following the programming instructions in order will make installation easier.
2. Determine which relays will operate the devices that are being controlled.
3. Determine if two relays will be used in tandem.
4. Determine if Daylight Saving Time or Standard Time will be used. For a full explanation, see Setting Block Programming and Time Settings on page 8.
5. Using a separate piece of paper, write down the following:
   a. The days to be block coded. For example: Monday through Friday or Sunday and Monday.
   b. All the events you want to program, as well as their duration (up to 50 per relay).
   c. Any holidays you wish to program to override the programmed events (up to 10).
6. Decide whether you will use a password or not, and what the password will be. For password operation, see page 9.
7. To reset the password, see Password Reset on page 9.

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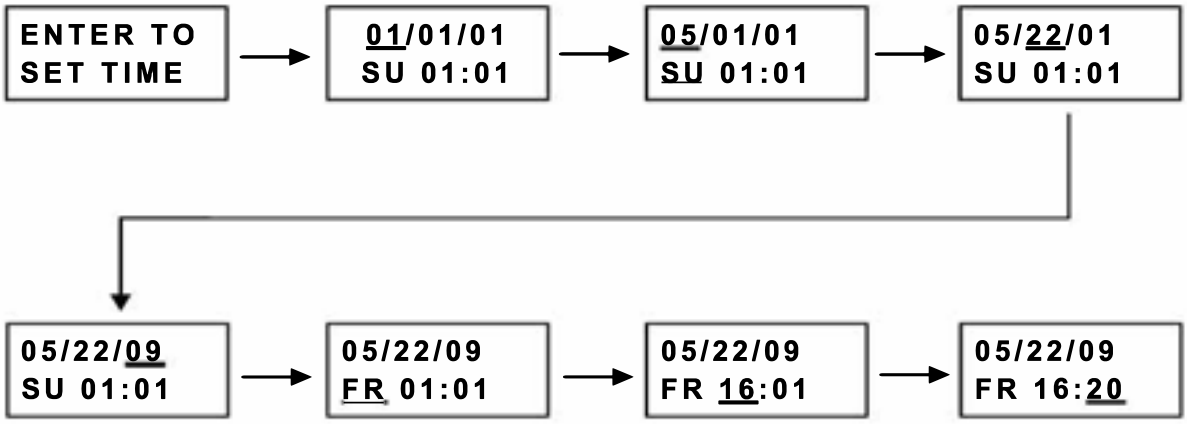
Setting the Time and Date:

1. To set the time and date, press the SET button on the SA-027HQ until “ENTER TO SET TIME" appears on-screen. Press the ENTER button to confirm the programming selection.



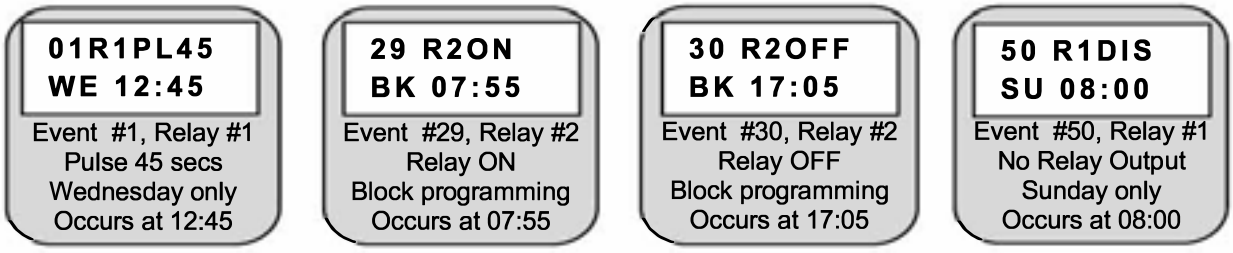
2. Press the UP or DOWN button to enter the correct month, date, and year.
3. Press the UP or DOWN button to enter the correct day of the week, hour, and minute.
4. Press the ENTER button to confirm a selection, or press the SET button to go back to the previous selection.

NOTE: Time is shown using the 24-hour format. For example, 5:30 AM is shown as 05:30, while 5:30 PM is shown as 17:30.

Programming Events:

1. To set events, press the SET button on the SA-027HQ until “ENTER TO SET EVNT” appears on-screen. Press the ENTER button to confirm the programming selection.

2. Press the UP or DOWN button to enter the event number, the relay number and how the relay will operate, and the day and time the event is scheduled. Refer to Programming Key on page 4.
3. Below are some examples of how each event can be programmed:



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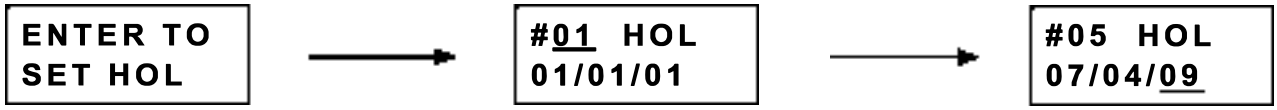
Programming Holidays:

1. To set holidays for suspending normal operation of the timer, press the SET button on the SA-027HQ until "ENTER TO SET HOL" appears on screen. Press the ENTER button to confirm the programming selection.



2. Press the UP and DOWN buttons to enter the holiday number and the date the timer will suspend normal operation. Press the ENTER button to confirm the programming selection.
3. To set a holiday for suspending normal operation of the timer every year, set the year to XX.

Note: Please be aware that most holidays occur on different days of the week in different years. For example, if New Year's Day occurs on Sunday, January 1st, a workplace will be typically closed on Monday, January 2nd. Note this when programming a holiday with the XX option.

Clearing the Memory:

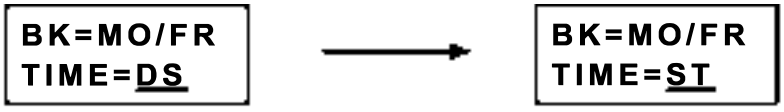
1. To clear the memory, press the SET button on the SA-027HQ until "ENTER TO CLR MEMO" appears on-screen. Press the ENTER button to confirm the programming selection.

2. Using the function buttons, press the ENTER button to confirm you want to clear the memory.
3. Using the function buttons, press the UP button to clear the memory.

Setting Block Programming and Time Settings:

1. To set block events, press the SET button on the SA-027HQ until "ENTER TO SET BK" appears on screen.

2. Pressing the ENTER button will confirm the programming selection.
3. Using the function buttons, press UP or DOWN to enter in the first day of consecutive days you want an event to repeat, press the ENTER button to confirm the programming selection.
4. Using the function buttons, press UP or DOWN to enter in the last day of consecutive days you want an event to repeat. Press the ENTER button to confirm the programming selection.
5. Using the function buttons, press UP or DOWN to switch between Daylight Saving Time (DS) or Standard Time (ST) format. For more information see the note below.



Note: The SA-027HQ follows U.S. Daylight Saving Time (DST) standards. DST begins at 2:00 a.m. local time (add one hour) on the 2nd Sunday of March and switches back to Standard Time at 2:00 a.m. local time (subtract one hour) on the 1st Sunday in November.

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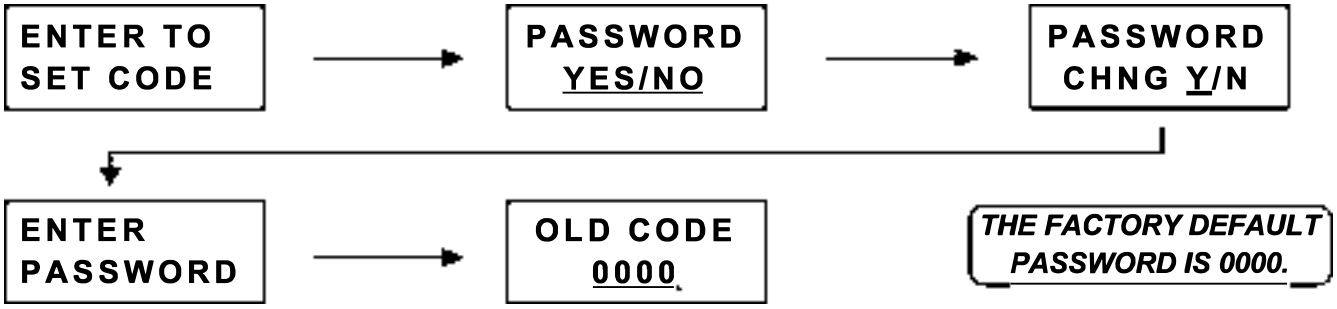
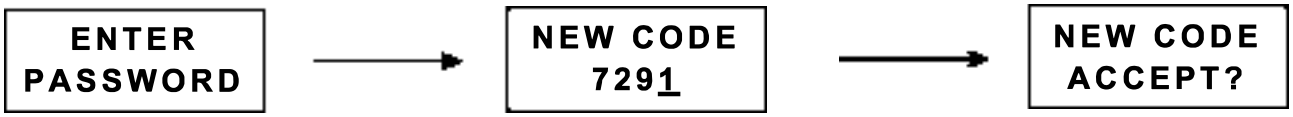
Programming Password:

1. To set the password, press the SET button on the SA-027HQ until “ENTER TO SET CODE” appears on-screen. Press the ENTER button to confirm the programming selection.



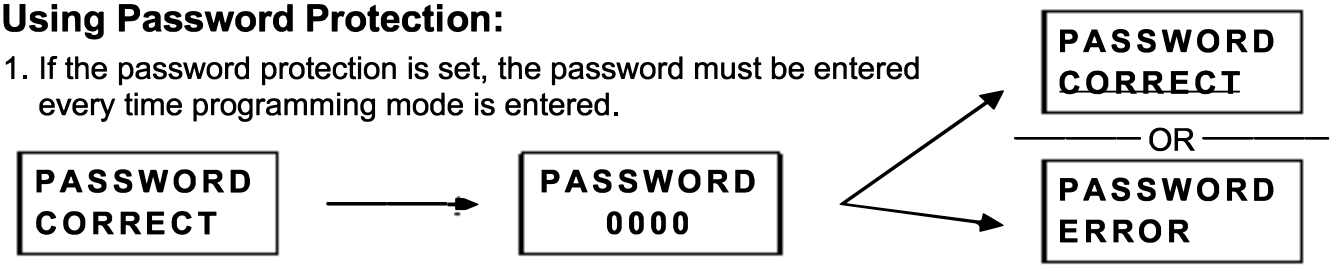
2. Using the UP and DOWN buttons, select “YES” or “NO”. Press the “ENTER” button to confirm the selection. A confirmation screen will appear. Select “Y” to set the password or “N” to go back.
3. Using the UP and DOWN buttons, enter in the password you are changing.



4. If the password is correct, use the UP and DOWN buttons to set a new password.
5. After entering the new password, press the ENTER button to accept the new password.

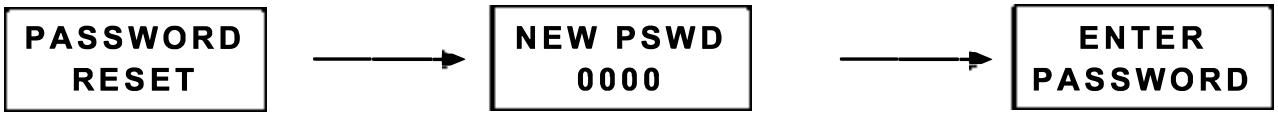
Using Password Protection:

1. If the password protection is set, the password must be entered every time programming mode is entered.



Password Reset:

1. Disconnect power from the SA-027HQ. If installed, remove the back-up batteries.
2. Within 30 seconds after power is reconnected, press all four function buttons (UP, DOWN, SET, and ENTER) at the same time for approximately 5 seconds. **If the buttons are not pressed within 30 seconds, then the SA-027HQ will be unable to reset the password.**
3. After the four function buttons are pressed for 5 seconds, “PASSWORD RESET” will appear for 1 second, followed by “NEW PSWD 0000” for 1 second, and then “ENTER PASSWORD”.



4. The password has now been restored to the factory default setting 0000.
5. Within 1 min. after “ENTER PASSWORD” is displayed, enter the new password. If no password is entered, the SA-027HQ will exit password programming mode automatically.
6. No other programming changes have been reset, only the password.
7. For added security, it is recommended to change the password immediately.

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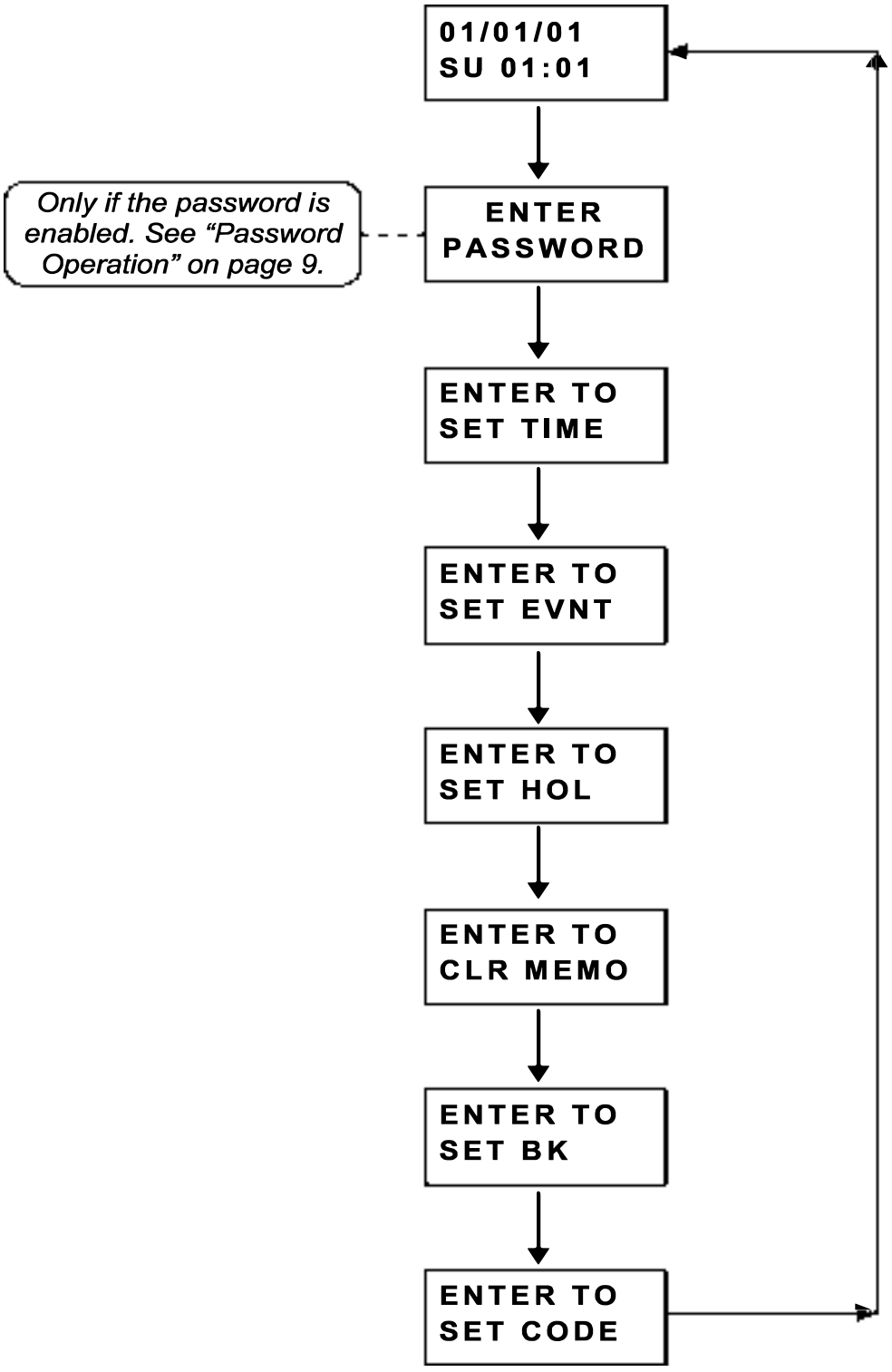
Programming Menu Flowchart:



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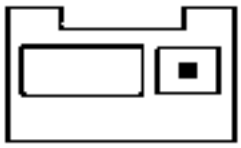
Using 2 Relays in Tandem:

The SA-027HQ can be configured so that both relays operate at the same time.

By setting the jumper to the "ON" position, the timer will output on both relays whenever an event is programmed for either Relay #1 or Relay #2 (factory default is set to OFF).

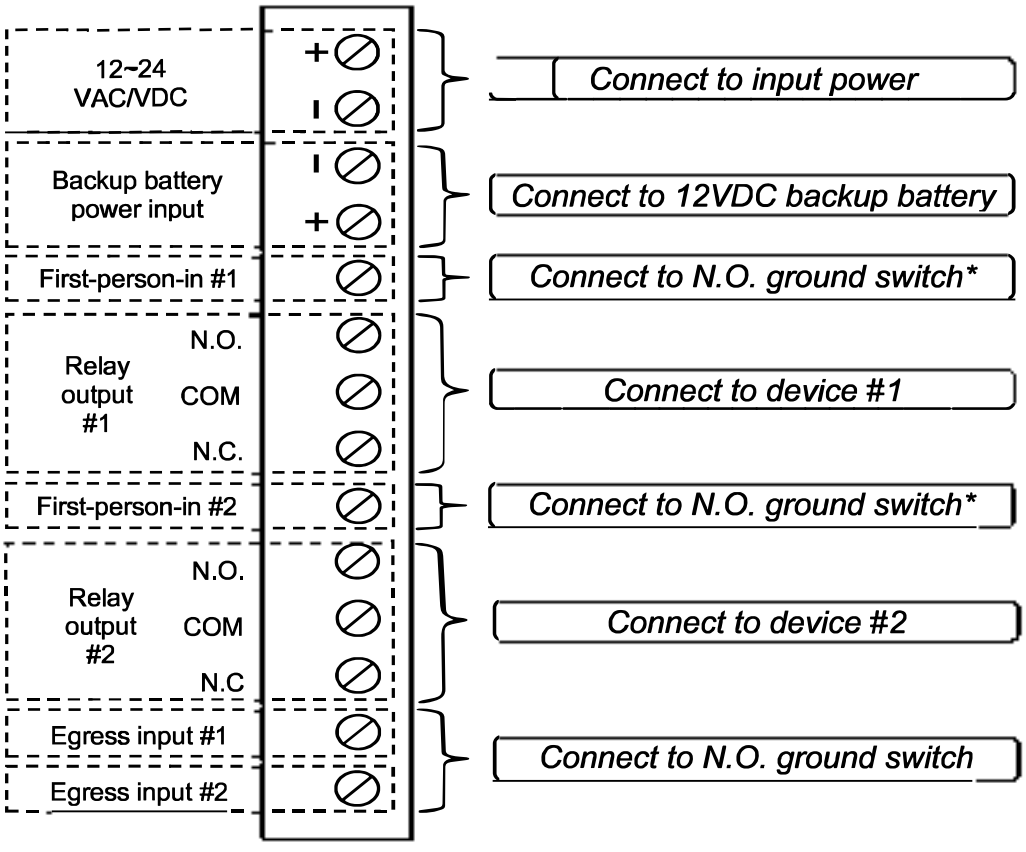
Tandem Jumper marked JP01:



	ON	OFF
JP01	Tandem output	No tandem output

Wiring Diagram:

IMPORTANT: When connecting to a backup battery, the input voltage needs to be 17~24VDC or 12~24VAC ONLY. An unregulated 12VDC adapter (ST-1212-U0.5A) is acceptable.



* When the optional N.O. switch is activated, the first-person-in function suspends the operation of the SA-027HQ annual timer. If a relay is turned on before the first-person-in feature is activated, the relay will remain on until the first-person-in feature is deactivated. Once deactivated by turning the switch off, the timer will turn on the last programmed function prior to the first-person-in activation.

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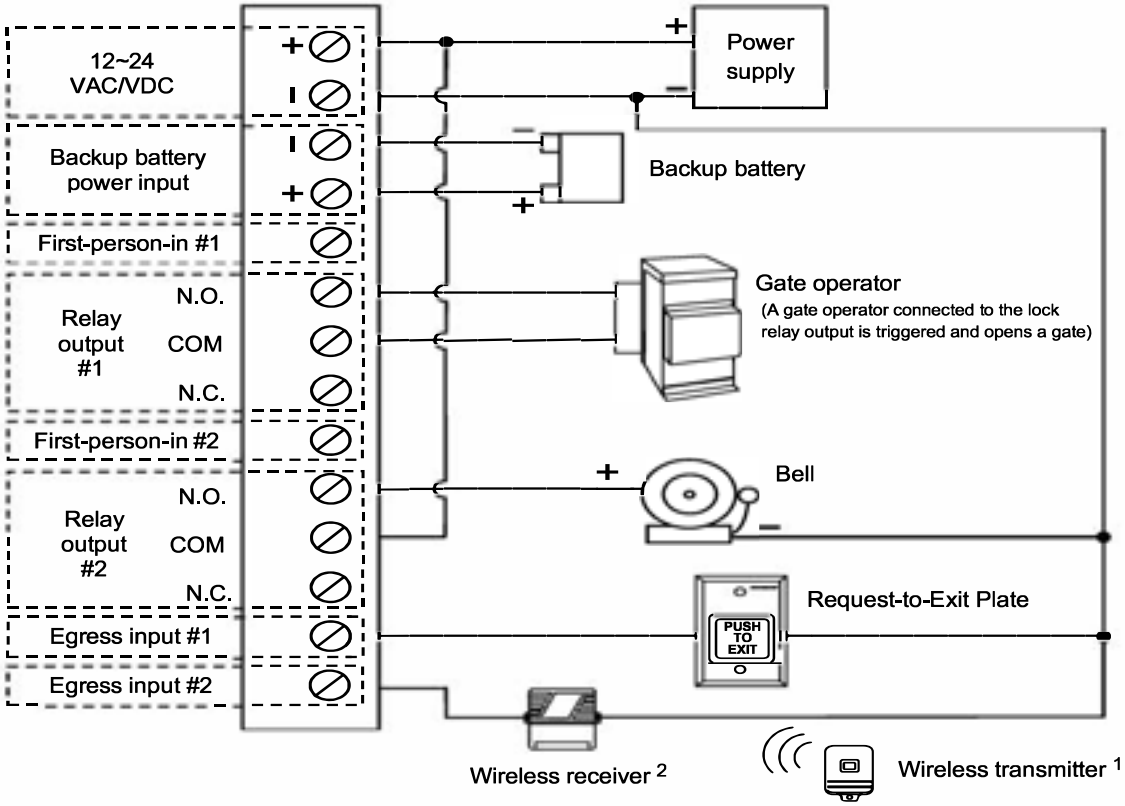
Sample Application:



[1] A wireless initiate device, such as the SK-919TD1S-UP, is triggered.

[2] A wireless receiver, such as the SK-910RBQ receives the signal. The receiver's common terminal is connected to a positive voltage and the normally closed terminal is connected to the SA-025EQ's initiate input.

WARRANTY This SECO-LARM product is warranted against defects in material and workmanship while used in normal service for a period of one (1) year from the date of sale to the original consumer customer. SECO-LARM's obligation is limited to the repair or replacement of any defective part if the unit is returned, transportation prepaid, to SECO-LARM. This Warranty is void if damage is caused by or attributed to acts of God, physical or electrical misuse or abuse, neglect, repair, or alteration, improper or abnormal usage, or faulty installation, or if for any other reason SECO-LARM determines that such equipment is not operating properly as a result of causes other than defects in material and workmanship. The sole obligation of SECO-LARM, and the purchaser's exclusive remedy, shall be limited to replacement or repair only, at SECO-LARM's option. In no event shall SECO-LARM be liable for any special, collateral, incidental, or consequential personal or property damages of any kind to the purchaser or anyone else.

NOTICE: The information and specifications printed in this manual are current at the time of publication. However, the SECO-LARM policy is one of continual development and improvement. For this reason, SECO-LARM reserves the right to change specifications without notice. SECO-LARM is also not responsible for misprints or typographical errors. Copyright © 2014 SECO-LARM U.S.A., Inc. All rights reserved. This material may not be reproduced or copied, in whole or in part, without the written permission of SECO-LARM.

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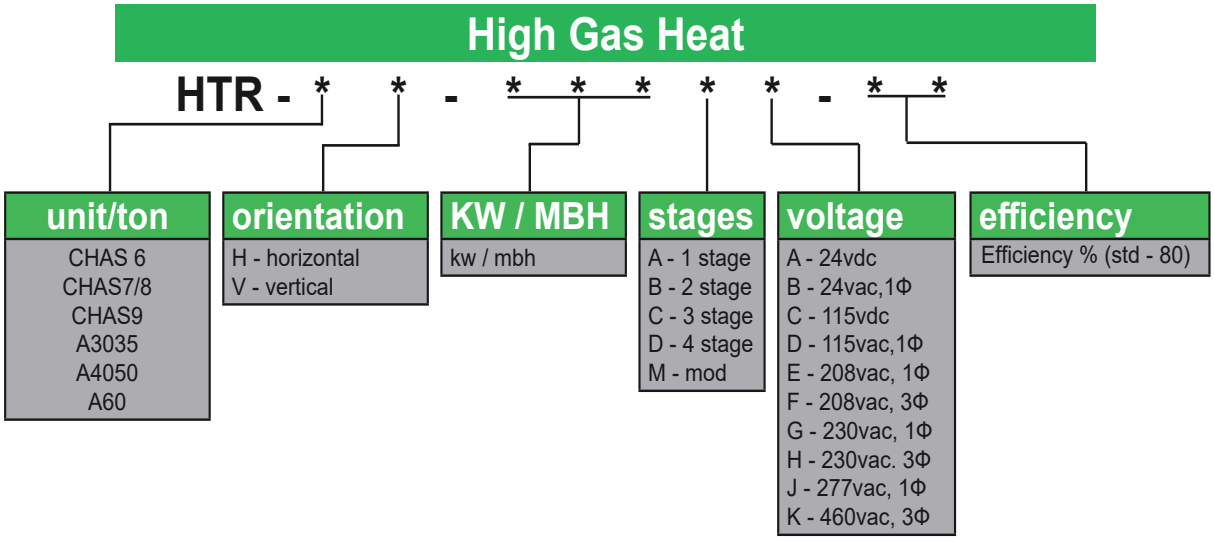
E-mail: info@seco-larm.com

PITSW1
MiSA-027HQ_1402.docx
Order Part# 763-180%

APPENDIX J (HIGH HEAT BOX)

HIGH HEAT BOX DESCRIPTION

iAIRE's High Heat Box rooftop packages are designed to supply air flow in vertical or horizontal duct configuration, and to fit on pre-installed curbs. They offer total low cost of ownership by providing 80% efficient gas heaters, ranging from *400,000 BTUH* to *1,000,000 BTUH* input, and a temperature rise up to 100 F, with low installed costs, low maintenance costs, and high reliability.



⚠ WARNING:

FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury, death or property damage.

Be sure to read and understand the installation, operation and service instructions in this manual.

Improper installation, adjustment, alteration, service or maintenance can cause serious injury, death or property damage.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance
- Do not touch any electrical switch; do not use any phone in your building
- Leave the building immediately
- Immediately call your gas supplier from a phone remote from the building. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

Installation must be performed by a qualified installer, service agency or gas supplier.

GENERAL INSTRUCTIONS

An iAIRE's operation is a function of the options and control packages that the iAIRE unit is equipped with.

RECEIVING / INSPECTION

Check part # of iAIRE unit to ensure it is what was ordered. Verify voltage/phases match.

At the time of delivery the iAIRE unit should be visually inspected for possible damage. If any damage is found it should be reported immediately to the last courier company, preferably in writing. iAIRE recommends leaving the iAIRE unit in its shipping packaging until the time of installation.

Standard Operating and Safety Controls

When working on iAIRE or other HVAC units observe precautions in the literature, tags and labels attached to the units, and any other safety precautions that may apply.

Follow all local, national and industry electrical codes when installing these units and accessories.

Primary safety control
Direct spark ignition with flame supervision and 100% safety shut-off, multiple ignition trials on call for heat, pre-purge and post-purge and auto reset on lockout after one (1) hour. Diagnostic LED.
Primary control and gas control circuit is low voltage – 24 VAC. Transformer is mounted on each control panel.

Combustion air pressure switch
Monitor induced draft fan operation and blocked vent shut-off.

Manual reset type rollout switch(es)
Shut-off gas in event of flame rollout.

Automatic reset high limit switch
Cycles burners on & off on temperature in low airflow conditions.

Combination gas control
Redundant gas valves, pressure regulation and manual shut-off. Controls are listed to ANSI Standard Z21.85.

ROOFTOP INSTALLATION

Verify the unit is the correct part # and voltage.

Check the HHB weight listed in this packet to determine if building structure reinforcements are required.

See the lifting and rigging section of this packet for instructions on setting the HHB.

RIGGING / LIFTING

Rig and place the HVAC unit per the instructions provided by the HVAC manufacturer (for mated applications only)

Inspect the HHB unit for transportation damage. File any claim with the transportation company.

The HHB unit weight is included in this packet. Check the lifting devices for capacity constraints.

Control Systems

SN - On/Off Operation
Single Stage operation at rated maximum input and single speed induced draft fan. Single stage thermostat or controller located in conditioned space. Heater cycles on and off to maintain space temperature.

TN - Two-Stage Operation
High / Low fire operation with two-stage gas valve and single speed induced draft fan. Two stage thermostat or controller located in conditioned space. Heater operates at 100% or 55% of maximum input depending on thermostat position.

TS - Two-stage Operation
High / Low fire operation with two speed induced draft fan control. Programmed Low fire start cycle. Operates at low fire for 90 seconds after initial call for heat, then high or low fire depending on thermostat position. During normal operation at high fire operation (100%) system operates with high speed ID Fan or low fire operation (55%) with low speed ID fan for improved operating efficiency during low fire operation. Two stage thermostat or controller located in conditioned space.

Electrical Supply

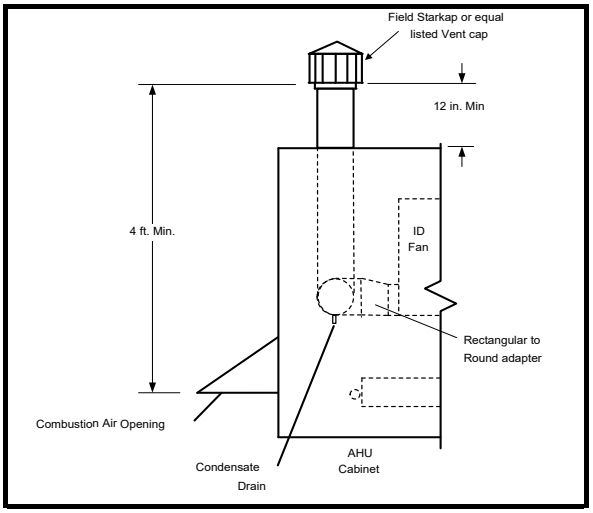
The furnace control system requires both line voltage and low voltage circuits with correct polarity, and clean neutral and ground. Line voltage readings between L1 and Neutral as well as L1 and Ground should be within +/- 3 volts.

Venting

All duct furnaces must be connected to a venting system to convey flue gases outside of the heating unit and the heated space and away from combustion air inlet.

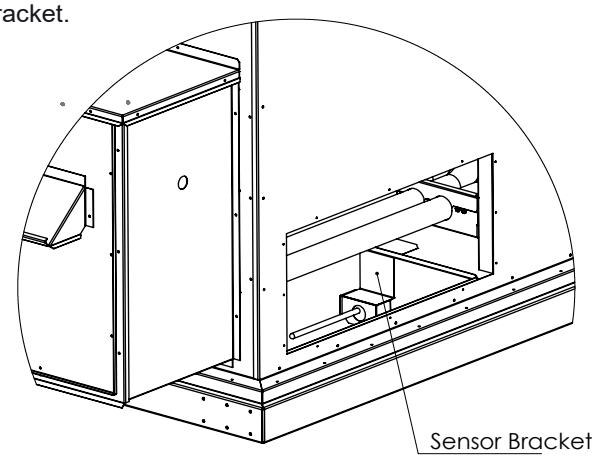
The air handling unit will be provided with a vent duct to exhaust flue gases outside of the unit.

All joints in the vent connectors inside the vestibule must be sealed to prevent leakage of flue gases in the vestibule area and into the combustion air supplied to the burners.



How to Install DAT Sensor & Sensor Bracket

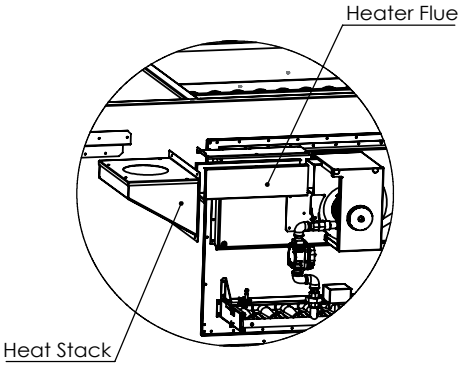
1. Remove access panels (Horz supply opening) to reach heater compartment.
2. Place Sensor Bracket 10" from the edge of access panel under direct air-flow stream.
3. Screw bracket properly in position.
4. Attach Sensor-53 in designated opening on the bracket.



How to install Flue

Attach Flue assembly over the opening of the Induced Draft Fan, and make sure it is locked in place. Place the Heat Stack over the Flue opening, and attach it to the control box.

NOTE: Heat Stack/Flue assembly might have to be disassembled to access fliter compartment in some units.



Control Box (Enclosure)

Access panels or doors to the vestibule area are sized and located to provide easy access for adjustment, servicing and maintenance of gas and electrical controls.

Install control panel (withen Nema 3R Enclosure) on non-heated surface and in an area with good ventilation air flow, away from heat sources and especially vent piping.

Do not mount electrical control panels where water may accumulate, especially on the vestibule base.

Installation

Verify the following before placing the equipment into service:

1. Electrical supply matches the voltage marked on the furnace module Rating Plate.
2. Gas supply provided matches the Gas Type marked on the furnace module Rating Plate.
3. Furnace module is installed in orientation marked on vestibule. Orientation is specific to airflow direction through the heating section of the unit.
4. There is an adequate supply of fresh air for the combustion and ventilation process. **Combustion air openings in the cabinet should be sized to provide 1 sq. in of free area per 4000 Btuh of input.**

WARNING !

The presence of chlorine vapors in the combustion air supplied to gas-fired heaters presents a substantial corrosion hazard.

5. **A properly designed vent system is connected to the furnace module unit** to convey the products of combustion (flue gases) outside the building. For outdoor applications be sure the flue gases are directed away from any combustion air inlets.
6. Furnace module is installed in a **non-combustible duct or cabinet on the positive pressure side of the circulating air blower.**
7. An **air flow proving switch** is installed and wired to prove operation of the system circulating air blower.
8. An auxiliary **Manual Reset Limit** is installed to shut-off furnace module in the event of low airflow conditions due to filter blockage, coil blockage and or damper failure.
9. A drain tube is installed for **disposal of condensate**, if the furnace module is equipped with modulating controls or is located downstream of cooling system.
10. Equipment access panels and doors are sized and located to provide easy access for servicing, adjustment and maintenance of the furnace installed.

WARNING !

Gas-fired furnaces are not designed for use in hazardous atmospheres containing flammable vapors or combustible dust, in atmospheres containing chlorinated or halogenated hydrocarbons, or in applications with airborne substances containing silicone.

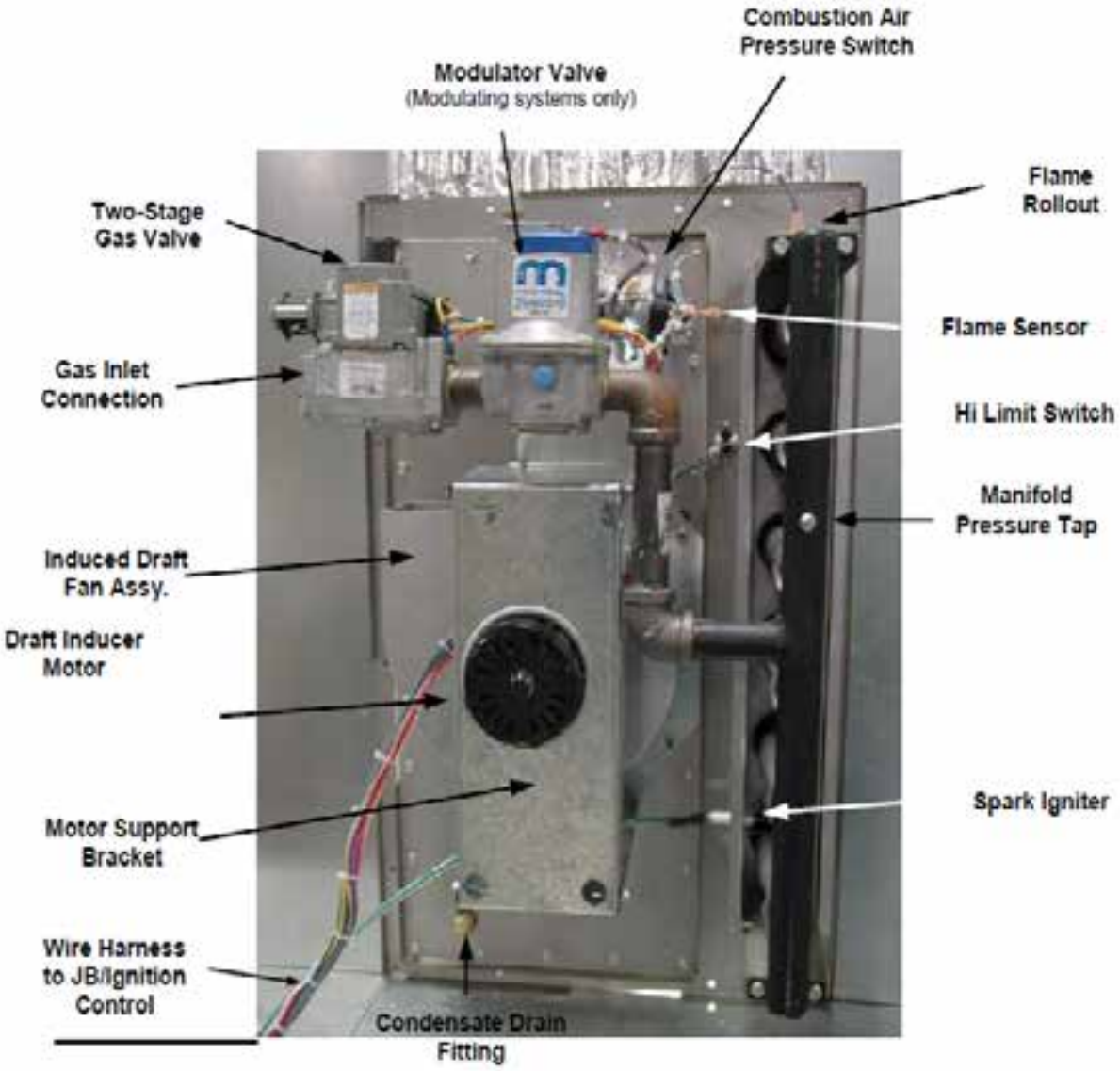
WARNING !

This furnace is not listed or suitable for drying or process applications. Use in such applications voids any warranty and manufacturer disclaims any responsibility for the duct furnace and /or application.

Operating & Safety Instructions

1. This furnace module does not have a pilot. It is equipped with a direct spark ignition device that automatically lights the gas burner. DO NOT try to light burners by hand.
2. BEFORE OPERATING, leak test all gas piping up to heater gas valve. Smell around the unit area for gas. DO NOT attempt to place heater in operation until source of gas leak is identified and corrected.
3. Use only hand force to push and turn the gas control knob to the “ON” position. NEVER use tools. If knob does not operate by hand, replace gas valve prior to staring the unit. Forcing or attempting to repair the gas valve may result in fire or explosion.

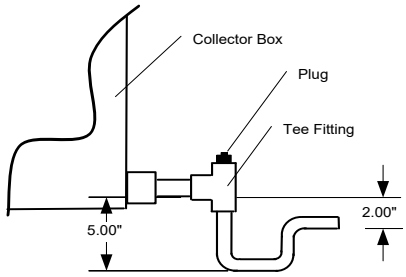
Figure - Furnace Component Identification



Condensate Drains

Heating units located downstream of a refrigeration system or a cooling coil will typically experience condensation during operation of the air conditioning. Heat exchanger surfaces may be cooled below the dew point temperature of the moist ambient air inside the heat exchanger resulting in condensation of water vapor in the heat exchanger and flue collector(s). This condensate is not harmful to the heat exchanger provided it is drained continuously. **A ¼" NPT condensate drain connection** is provided in the flue box for duct furnaces with vertical or horizontal top mounted burner tray, to remove condensate from heat exchanger. **Condensate drain lines must be connected.** Condensate drain lines should have corrosion resistance at least equal to that of 304 SS.

Heat exchangers are under negative pressure and a P-trap should be provided as shown in figure below. The use of a “Tee” fitting allows for cleaning the trap. Use plug in cleanout opening.



In furnace modules with bottom mounted horizontal burner, condensate will drain from the open end of the tubes. A condensate collection pan which attaches to the burner assembly is available as an option.

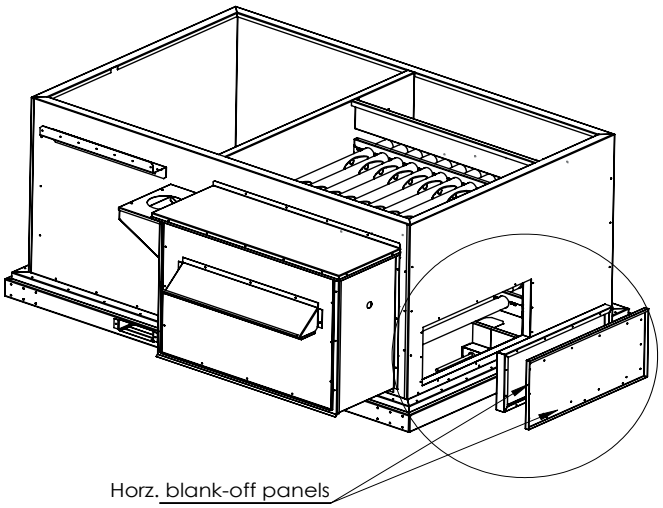
Additionally, condensation may form on surfaces such as the furnace vestibule panel (header plate) in contact with the conditioned air. Depending on operating conditions, condensate may collect in the lower vestibule pan. Provisions should be made to drain and remove this condensate as well, if such operating conditions exist.

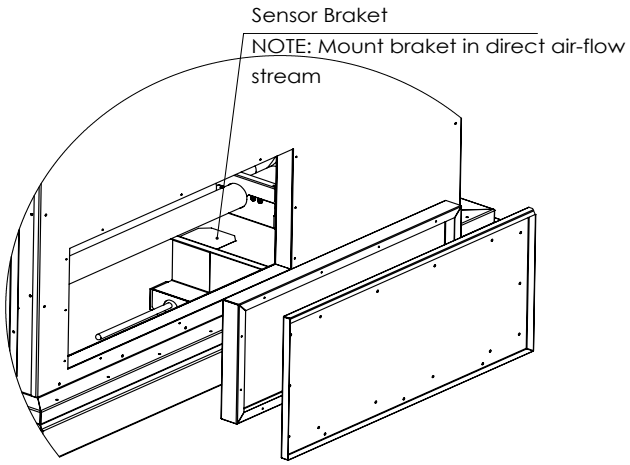
Typically, condensation does not occur in mid-efficiency furnaces during heating operation. However, in applications with modulating controls or with 100% make-up air, some condensation may occur in the heating cycle. In these applications, connection of the drain line is required to prevent condensate buildup and possible heat exchanger damage. **Flue gas condensate is corrosive and may result in shortened heat exchanger life.** Use corrosion resistant metal tubing. Copper tubing is not suitable for flue gas condensate.

Disposal of condensate is subject to local codes and ordinances. Some municipalities require that the acidic condensate produced be neutralized before being discharged into the sanitary sewer. A condensate neutralizer kit is available. When neutralizer kits are provided they should be installed where they are readily accessible for inspection and maintenance

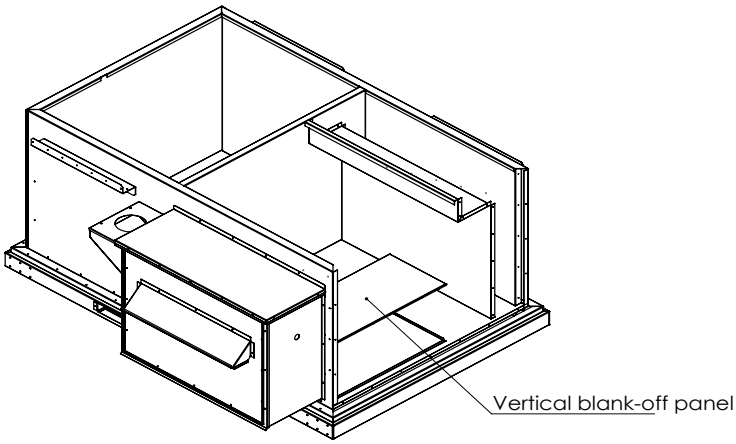
Air Flow Configuration

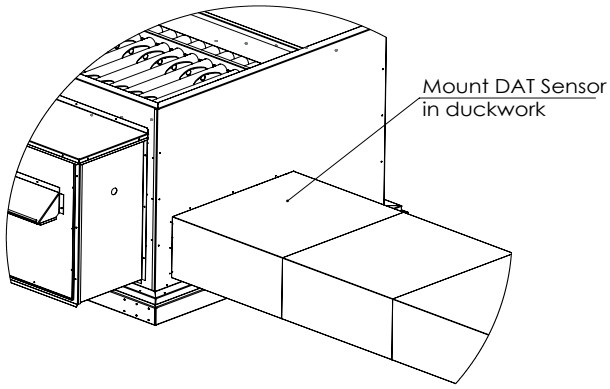
Vertical - supply units should include a *Sensor 53*, a sensor bracket, and two blank off panels for horizontal supply opening.





Horizontal - supply units should include a 15ft liquid pipe conduit, fittings for the conduit, a Nema 3R Enclosure box, a DAT Sensor, and a blank off panel for vertical supply openings must be installed.





Nema 3R Enclosure Box

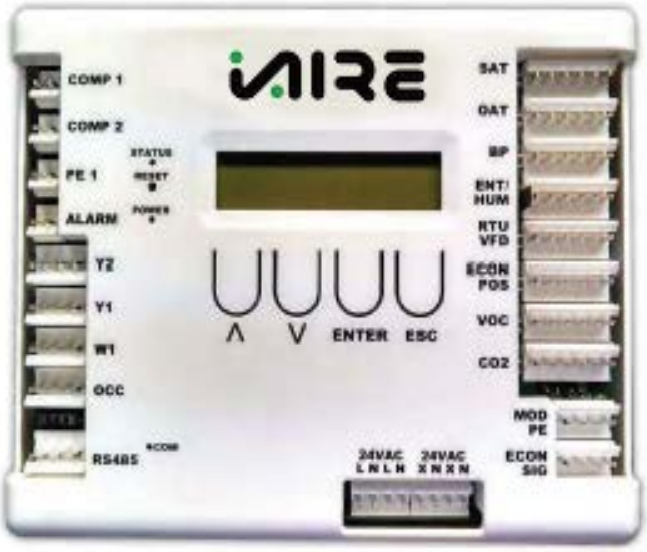
NAVIGATING ON AN iAIRE CONTROLLER

NAVIGATE BACK

NAVIGATE FORWARD

SCROLL PREVIOUS OPTION/MENU

SCROLL NEXT OPTION/MENU



POWER ON THE CONTROLLER AND THE FIRST MENU IS **STATUS MENU**. TO NAVIGATE THROUGH THE OPTIONS, PRESS THE **UP ARROW** KEY. PRESS **ENTER** TO MAKE CHANGES IN ANY SUB MENU. TO GO BACK TO THE MAIN STATUS MENU, PRESS THE **ESC** BUTTON.

MENU SCREENS BEGIN ON THE FOLLOWING PAGE.

STATUS MENU

HUM DAT GAS%

RANGE:
0_58.44F 01%

HUM 0-100%
DAT 44-90
GAS 0-100%

Timer:
030S

W1 DAT HEAT%

RANGE:
0_58.44F 00%

W1 0-1
DAT 44-90
HEAT 0-100%

Timer:
030S

TEST MODE MENU

VFD SPEED TEST

RANGE:
0_100%

DEFAULT:
065%

NOTE: VFD speed changes modulating gas heat. This is what will be used to test modulating gas heat.

HOT GAS TEST

RANGE:
0_100%

DEFAULT:
000

NOTE: This is not used for modulating gas heat.

SETPOINTS MENU

HEAT SETPOINT

RANGE: 60 F_90 F
DEFAULT: 75 F

DAT SETPOINT

RANGE: 000 F_100 F
DEFAULT: 070 F

NOTE: (DAT MODE ONLY) Temperature unit is trying to control to when in Discharge air mode (DAT).

CONFIGURATION MENU

MOD GAIN

RANGE: -20_20
DEFAULT: 03

NOTE: % Modulating reheat signal = (((Act temp - setpoint temp)+ Reheat Offset)/Reheat Gain) * Reheat Multiplier.

MOD OFFSET

RANGE: -10_10
DEFAULT: 01

NOTE: % Modulating reheat signal = (((Act temp - setpoint temp)+ Reheat Offset)/Reheat Gain) * Reheat Multiplier.

MOD MULTIPLYER

RANGE: 0.1_1
DEFAULT: 01

GAS HEAT MIN

RANGE: 00%_100%
DEFAULT: 00%

GAS HEAT MAX

RANGE: 00%_100%
DEFAULT: 100%

MOD HEAT WAIT

RANGE: 000S_300S
DEFAULT: 100%

REHEAT GAIN

RANGE: -20_20
DEFAULT: 01

NOTE: This is not used for modulating gas heat.

REHEAT MULTIPLIER

RANGE: 0.1_1
DEFAULT: 0.8

NOTE: This is not used for modulating gas heat.

REHEAT MIN

RANGE: 01%_100%
DEFAULT: 01%

NOTE: This is not used for modulating gas heat.

REHEAT MAX

RANGE: 01%_100%
DEFAULT: 75%

NOTE: This is not used for modulating gas heat.

REHEAT OFFSET

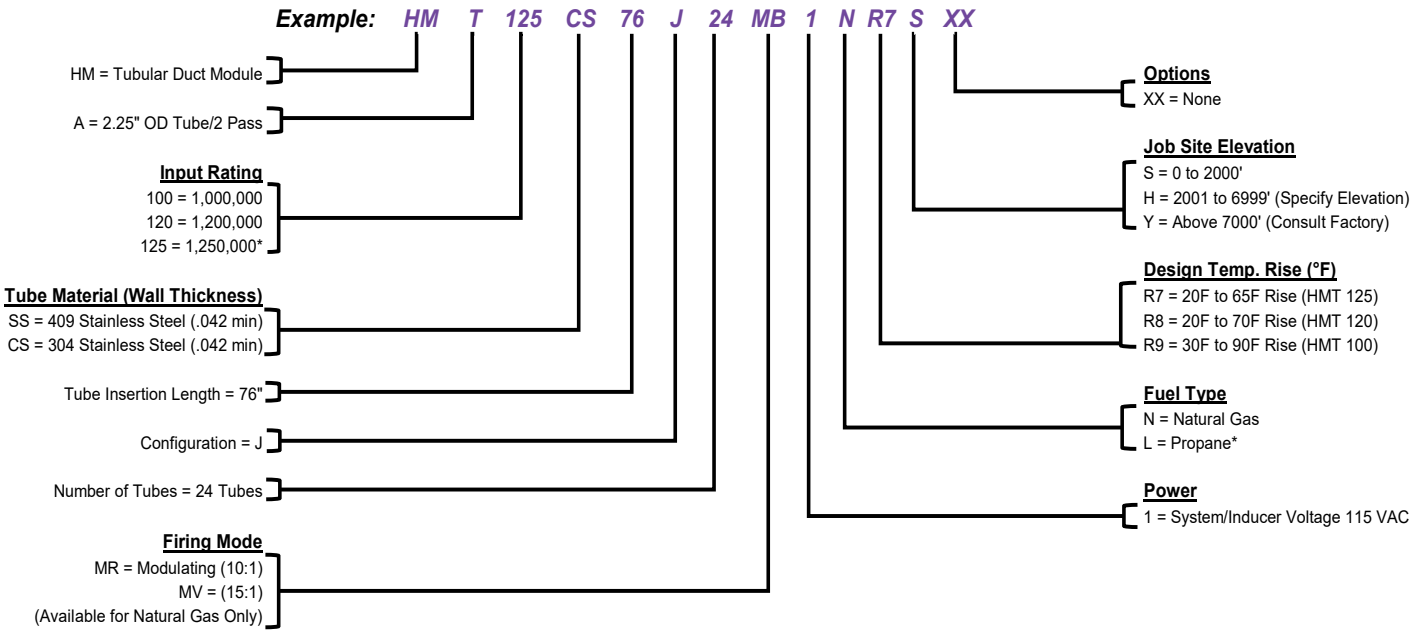
RANGE: -10_10
DEFAULT: 01

NOTE: This is not used for modulating gas heat.

Setpoint	Standard Exchangers					High High Heat Exchangers	
Control Type	**SPACE**	**DAT**	**ERV SPACE**	**ERV DAT**		**SPACE**	**DAT**
Heat 1 On Delay	060s	060s	TBD	000s		0	0
Heat 1 Off Delay	005s	005s	TBD	000s		0	0
Heat 2 On Delay	005s	005s	TBD	150s		200	200
Heat 2 Off Delay	000s	000s	TBD	000s		0	0
Heat 1 On Offset	EXACT	EXACT	TBD	+04		1	2
Heat 1 Off Offset	+04	+04	TBD	+06		5	5
Heat 2 On Offset	-02	-02	TBD	-06		-5	-8
Heat 2 Off Offset	+02	+02	TBD	+02		EXACT	-3
# of Heat Stages	1	1	TBD	2		2	2
Mod Heat Config	Gas 1	Gas 1	TBD	Gas 2		Gas 2	Gas 2
Config Heat Type	Mod Heat	Mod Heat	TBD	Mod Heat		Mod Heat	Mod Heat
Mod Heat Min	0	0	TBD	0		0	0
Mod Heat Max	100	100	TBD	100		100	100
Mod Heat Gain	4	4	TBD	4		4	4
Mod Heat Offset	0	0	TBD	0		0	0
Mod Heat Multiplier	1	1	TBD	1		1	1
Min Heat %	0%	0%	TBD	0%		0%	0%
Max Heat %	100%	100%	TBD	100%		100%	100%
DAT Max	110F	110F	TBD	90F		98F	98F
Wait Time	030s	030s	TBD	000s		010s	000s

HIGH HEAT BOX MANUAL - APPENDIX A (Heatco. Model Number Identification)

Heater Model Number Identification



HIGH HEAT BOX MANUAL - APPENDIX B (Heatco. Application Guide)

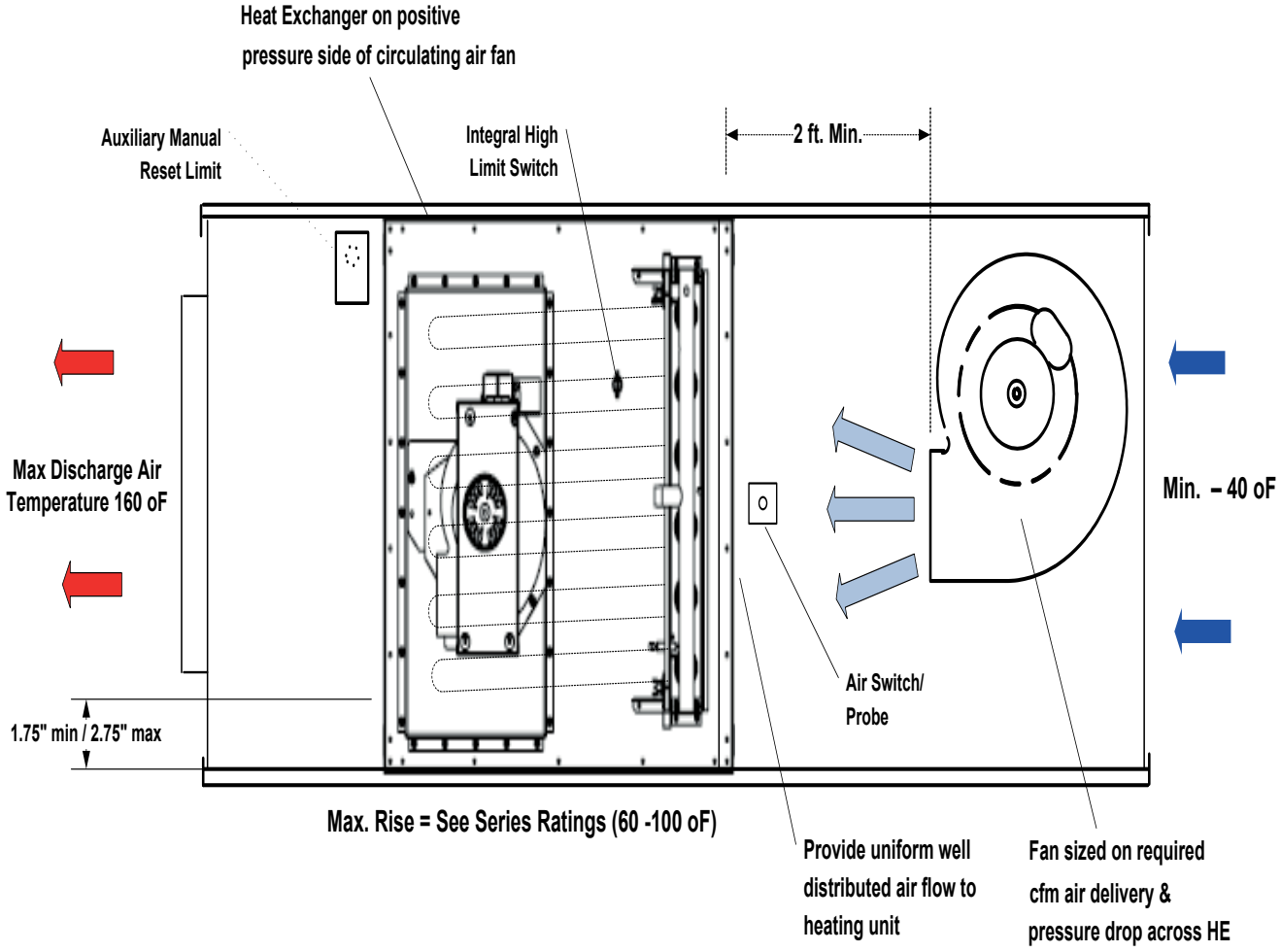
Application Guide

HVAC Equipment Design

With HM / HD Series Duct Furnaces

ANSI Z83.8 (2009) - CSA 2.6M (2009) – Gas-Fired Duct Furnace

Typical HD/HM Make-Up Air Application

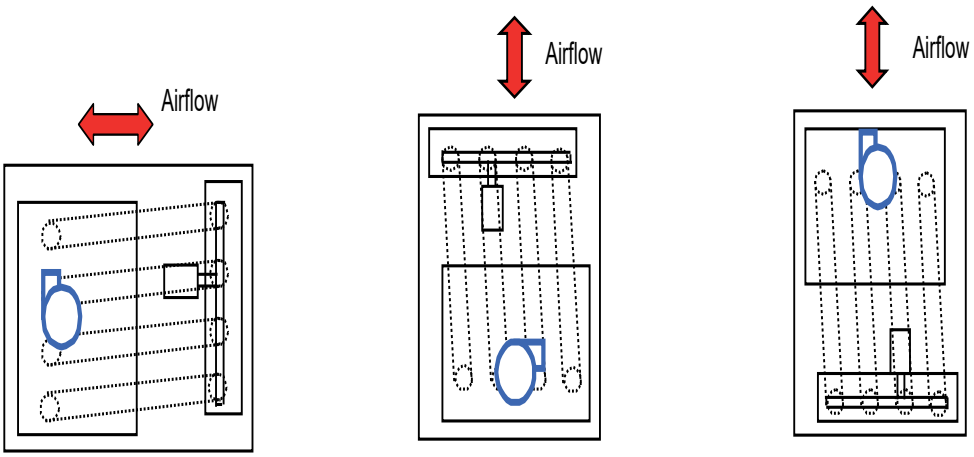


HM Series heat exchangers typically employ an integral restriction form (dimple) in the heat exchanger tubes. Marking is provided on the heater indicating the proper mounting orientation

Heater configurations are available for any airflow scheme, to provide the proper orientation of the dimple form to allow drainage of condensate.

Airflow Configurations

Airflow direction across heat exchanger affects maximum temperature rise @ 80% efficiency.



Preferred airflow direction provides for highest temperature rise @ rated efficiency

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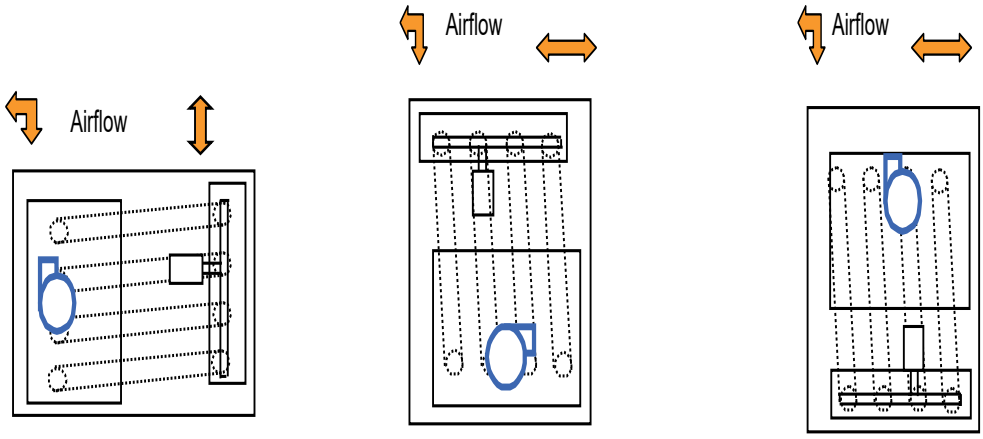


Airflow direction results in reduced maximum temperature rise @ rated efficiency. Maximum rise for these configurations is 60 ^{o}F.

Cabinet Design & Airflow

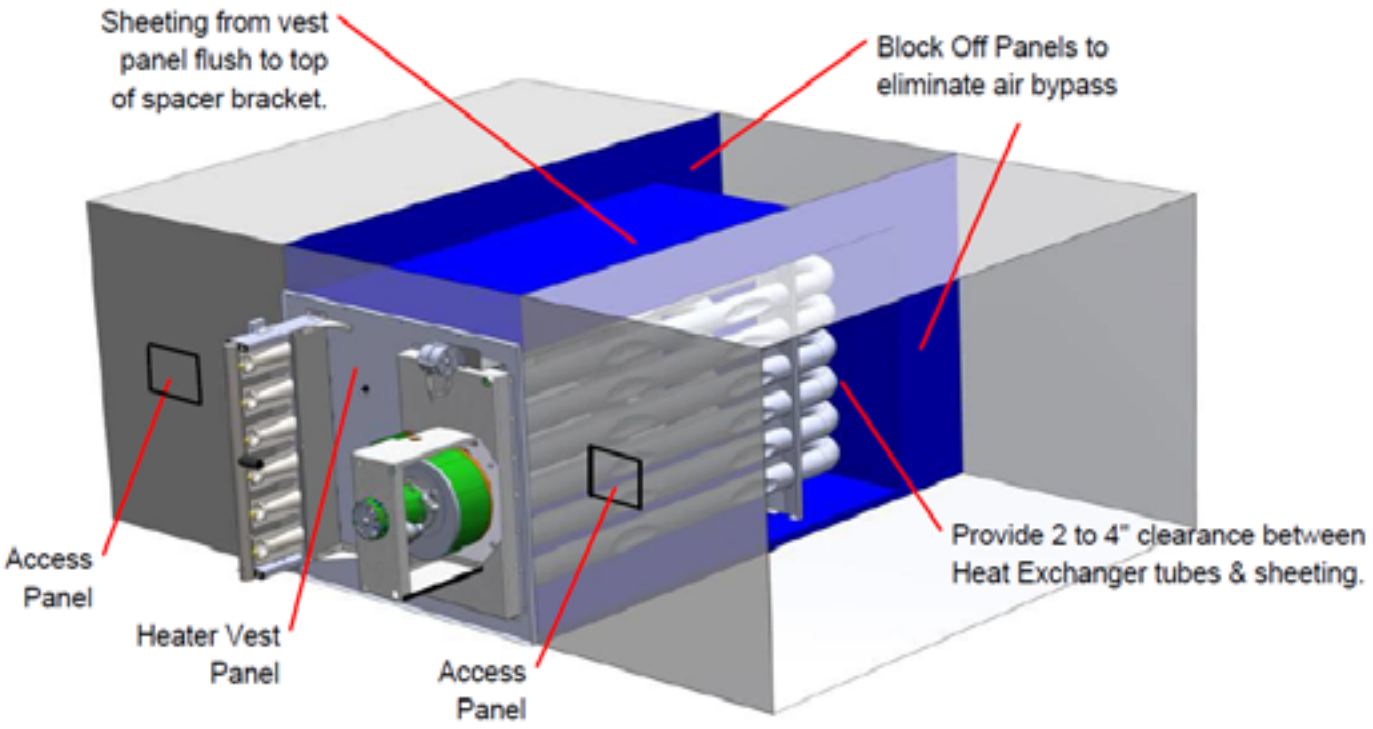
Duct furnace **MUST BE INSTALLED IN A NON-COMBUSTIBLE duct on the positive pressure side of the circulating air fan or blower.**

Duct furnace can be installed in products for Indoor or Outdoor Installation and downstream from refrigeration or cooling systems.

Poor Air distribution results in reduced performance and shortened heat exchanger life.

Heat exchanger must be properly sheeted to direct airflow over tubes and eliminate by-pass air for optimum performance.

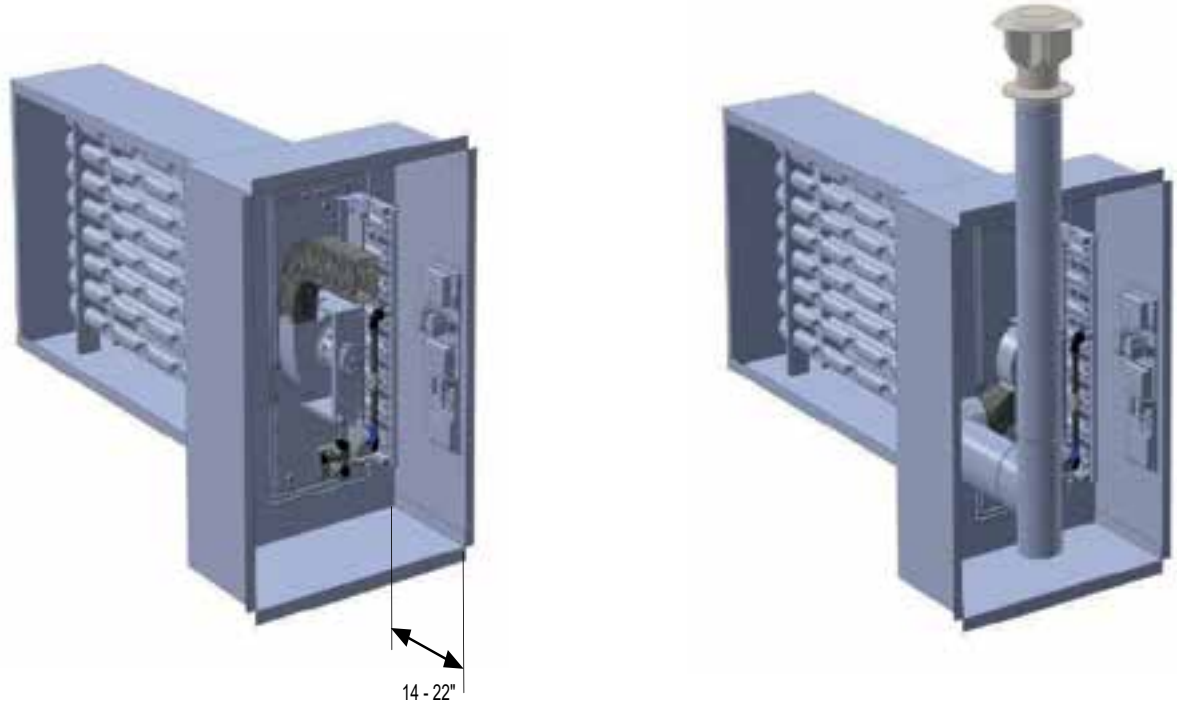
If air tunnel opening is larger than heater profile, provide panels to block by-pass air and direct all airflow over heat exchanger.



Provide removable access panels in cabinet immediately upstream. and downstream of duct furnace to allow for inspection of the heat exchanger

Vestibule / Enclosure

Provide an enclosed vestibule area to house and protect gas controls, burner assemblies, induced draft fans and electrical controls. Depending on furnace model and control system, the vestibule depth required will be 14 to 22 inches.



Access panels or doors to the vestibule area should be sized and located to provide easy access for adjustment, servicing and maintenance of gas and electrical controls.

Electrical control panels for HM and HD Series furnaces are shipped loose for customer mounting and connection.

Install control panel on non-heated surface and in an area with good ventilation air flow, away from heat sources and especially vent piping.

Do not mount electrical control panels where water may accumulate, especially on the vestibule base.

Combustion Air Supply

Provisions must be included to provide an ample supply of air to the vestibule area to provide ventilation and a supply of combustion air for the gas burners.

Combustion process requires approximately 15 cu. ft. of air for every cu. ft. of gas burned

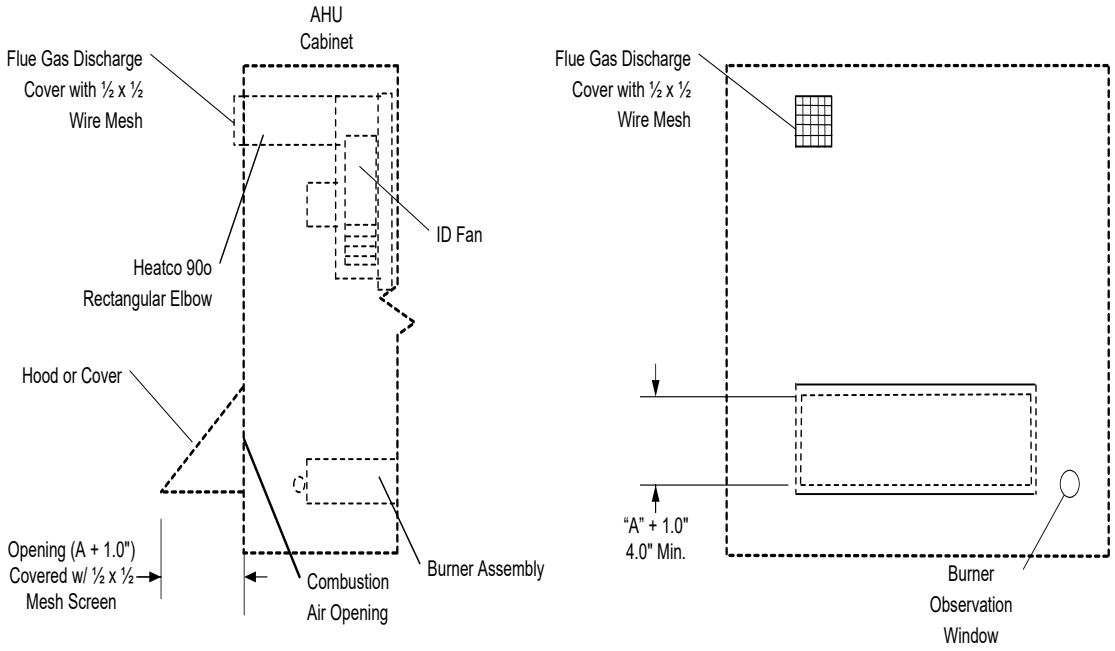
Openings for combustion air must be provided in a panel or door (except separated combustion systems) with direct access to the vestibule area where the burners and draft inducer are located.

Provide Combustion air openings in the cabinet sized to provide one (1) square inch of free area per every 4000 Btuh of heater maximum input rating.

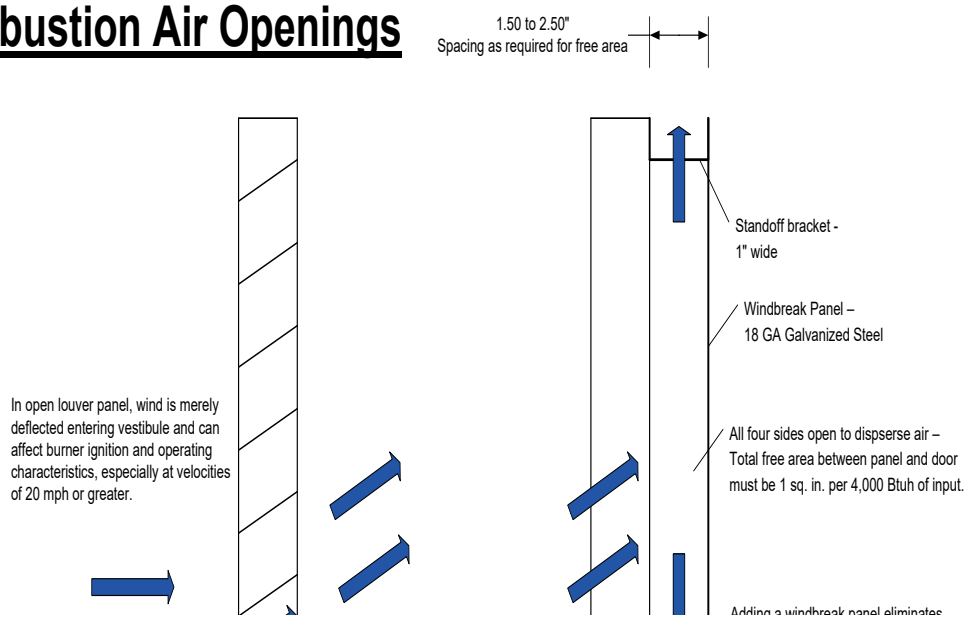
Louvered openings may restrict free area up to 50%. If louvers are employed be sure the overall opening size is sufficient.

Locate combustion air openings to minimize the possibility of flue gas recirculation into combustion air supply.

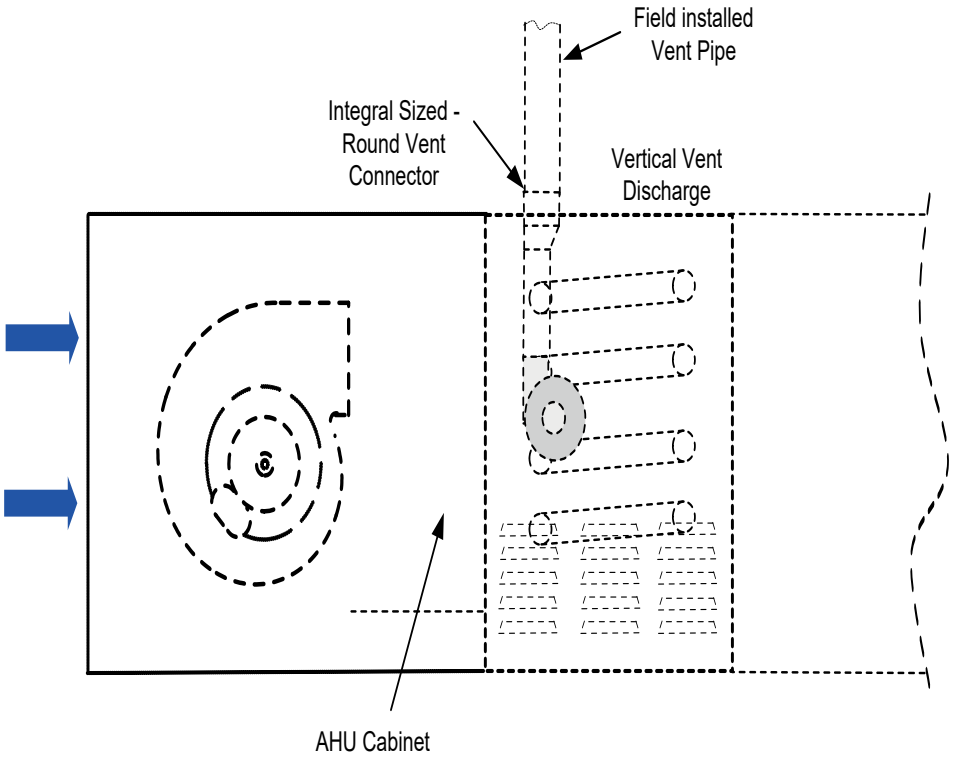
Combustion Air Hood / Rectangular Opening



Louvered Combustion Air Openings



For Indoor Category I or III installations, unit manufacturer must provide a point of connection for installation of vent pipe to the outdoors. This connection should be suitable for connection to round vent pipe.



For indoor applications where rectangular fittings or ducts are used to exit cabinet, transition to round vent pipe immediately after exiting cabinet.

Round vent pipe must be sized in accordance with Table based on the input rating of the duct furnace (air heater).

Table – Round Vent Pipe Sizing

Input Rating (Btuh)	Input Rating (W)	Vent Pipe Dia.
75,000 – 149,999	21,980 – 43,958	5 in. (126 mm)
150,000 – 400,000	43,960 – 117,228	6 in. (152 mm)
401,000 – 600,000	117,229 – 175,842	7 in. (178mm)

Fan Location & Circulating Airflow

Locate circulating air fan to provide uniform, well distributed air flow over the heat exchanger.

Circulating air fan should be located at least 24" from the heating section.

The use of a diffuser or directional baffles may be necessary to provide well distributed air flow over the heat exchanger.

Filters and filter racks should be located at least 36" from heating section.

To insure proper fan sizing, determine pressure drop through gas heat section, based on design temperature rise and required airflow.

A Circulating Airflow Proving Switch should be provided as part of the installation to insure proper airflow over the heat exchanger. This switch prevents operations of burners if airflow is below minimum threshold.

Heater Condensation

Indirect fired gas heaters will generate some condensate during modulating burner operation or when operated with a high percentage of outside air due to reduced flue gas temperature or colder heat exchanger surface temperatures.

Flue gas condensate is corrosive, and operating heater in a continuous condensing mode, or accumulation of condensate, can lead to premature heat exchanger failure

For heaters located downstream of the cooling system, condensation in heat exchanger is likely during cooling operation. Even though this condensate is typically benign, damage can result from accumulation.

Therefore, steps must be taken to manage the disposal of condensate.

A ¼" NPT condensate drain connection is provided in the flue box for furnaces with vertical or horizontal top mounted burner tray.

Condensate Disposal

Condensate drain lines must be connected if heating unit is equipped with modulating controls or if it is located downstream of cooling section.

Condensate drain lines should be corrosion resistant. If Metal tubing is used, it must have corrosion resistance at least equal to that of 304 SS. Copper tubing is not suitable for flue gas condensate.

For furnaces with bottom mounted horizontal burner trays, condensate will drain from the open end of the heat exchanger tubes. A condensate collection pan should be installed at the base of the vest panel or cabinet vestibule.

Consult local plumbing codes regarding disposal of flue gas condensate as it will be a slightly acidic.

Gas Supply and Piping

Installation of piping must conform with ANSI Z223.1 (NFPA 54) National Fuel Gas Code. In Canada, installation must be in accordance with CAN/CGA –B149.1 for Natural gas and B149.2 for propane units.

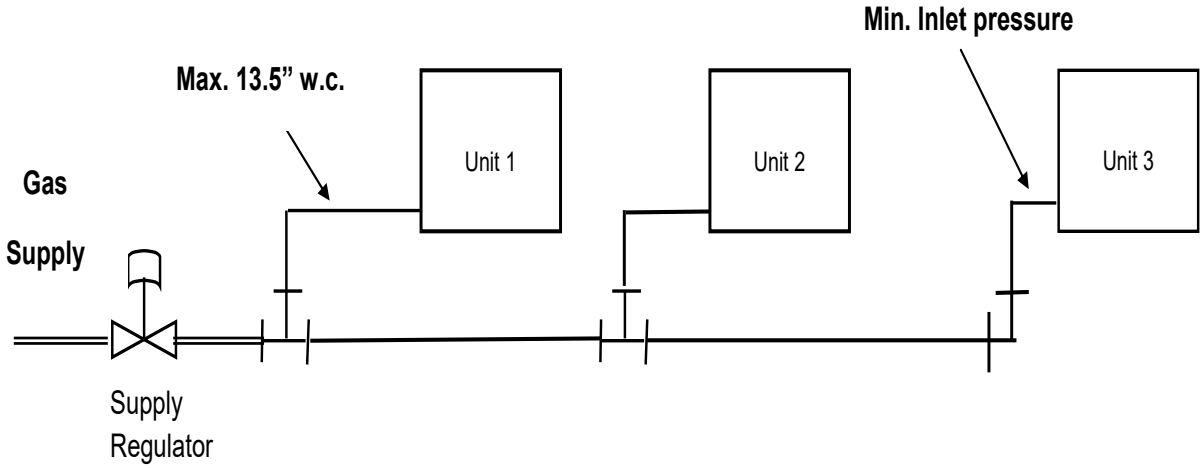
Use a pipe sealant **resistant to LP gases** on **g**as supply connections to heater.

Properly support gas valve with back-up wrench, during supply pipe installation to prevent loosening valve or damage to burner assembly or manifold.

Gas piping must be sized for the total Btu input of all units (heaters) serviced by a single supply.

The individual heat module inlet gas supply pipe connection size is ¾" NPT for gas inputs up to 400,000 Btuh and 1" NPT for gas inputs between 401,000 and 600,000 Btuh for all control systems.

For multiple heater installations, be sure that gas regulators servicing more than one heater have the proper pipe and internal orifice size for the total input of all heating units serviced by the regulator.



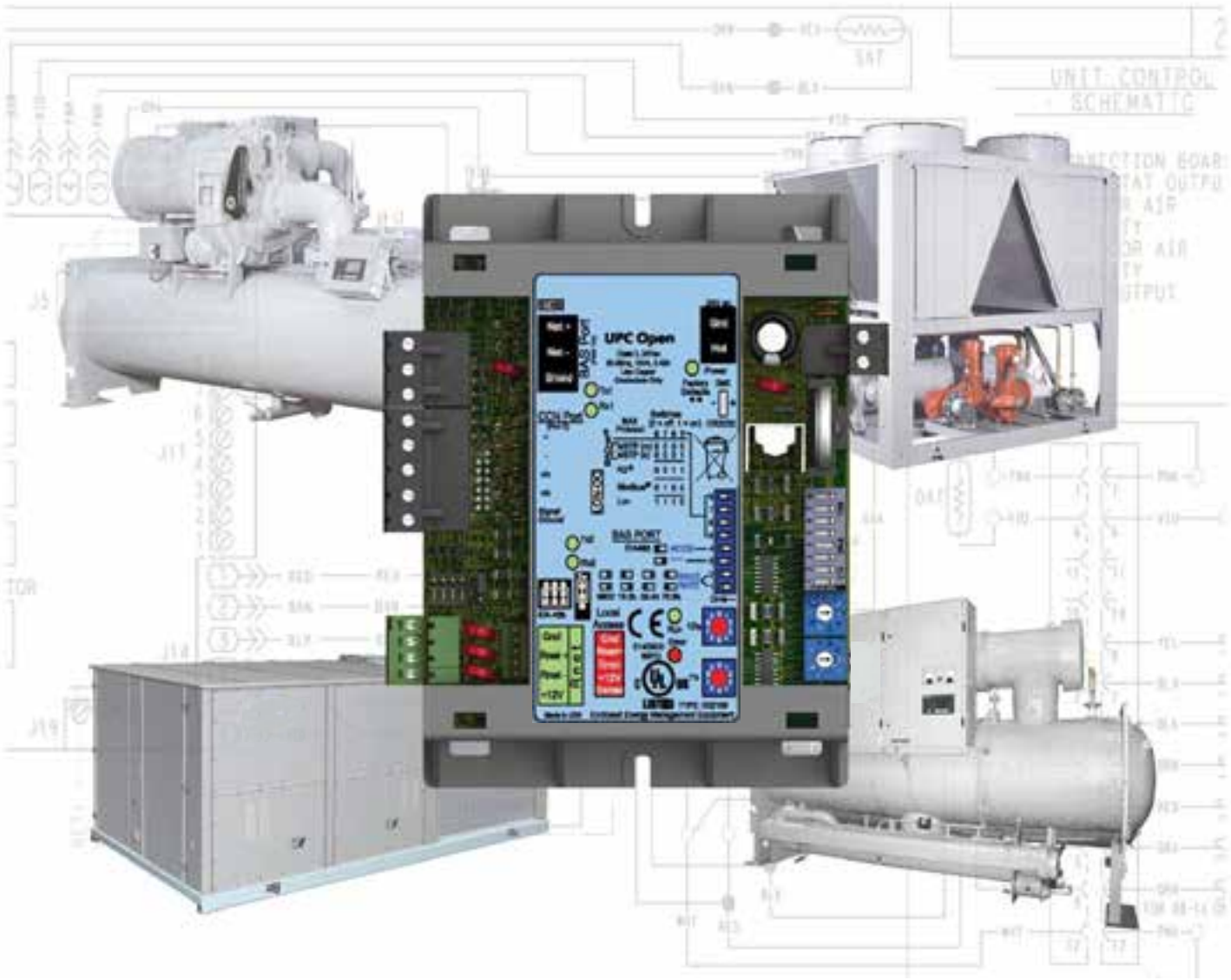
Individual duct furnace modules require a **minimum** inlet gas pressure as shown below.

	Natural Gas	Propane Gas
Minimum (50,000 to 400,000 Btuh models)	**5.0" w.c.**	**11.0" w.c.**
Minimum (401,000 and higher Btuh models)	**6.0" w.c.**	**12.0" w.c.**
Maximum Inlet	**13.5" w.c.**	**13.5" w.c.**

APPENDIX K (UPC BACNET INSTALLATION)

UPC Open

Installation and Integration Guide



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Introduction

What is the UPC Open?

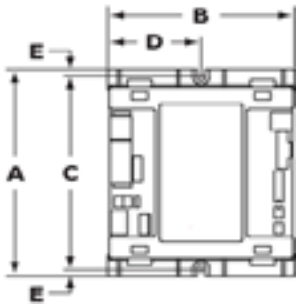
The UPC Open (Universal Protocol Card) is a general purpose protocol converter. The UPC Open can convert proprietary equipment data into open protocol data, enabling a stand-alone, single piece of equipment to reside on a BACnet network, where it can be monitored or controlled by a Building Automation System (BAS).

NOTE A future release of the UPC Open will support installation on a Modbus, N2, or LonWorks network.

Specifications

Driver	DRV_UPC
Maximum number of control programs	2
Maximum number of BACnet objects*	1050
* Depends on available memory	Total available memory for application is 551244 bytes. Obtain available memory information by viewing a module status report after the control program is loaded.
Power	24 Vac ±10%, 50–60 Hz 10 VA power consumption (16 VA with BAC*view* attached) 26 Vdc (25 V min, 30 V max) Single Class 2 source only, 100 VA or less We highly recommend using a dedicated transformer to power the UPC Open.
BAS port (Port 1a)	3-pin port supports EIA-485 2-wire communications. Protocols supported (DIP switch selectable): ○ BACnet MS/TP ○ Modbus (RTU) (future) ○ Johnson N2 (future) This port must be configured as a BAS port. **NOTE** Port 1a *or* LON-OC port can be used, but not both.
LON-OC port	14-pin communication port supports the LonWorks Option Card (future)
CCN port (Port 2)	5-pin port supports EIA-485 3-wire connection to a single CCN controller
Rnet port	For SPT sensors and a BAC*view*[6] in any of the following combinations, wired in a daisy-chain configuration: • 1 SPT Plus or SPT Pro • 1–4 SPT Standards • 1–4 SPT Standards, and 1 SPT Plus or SPT Pro Any of the above combinations, plus a BAC*view*[6], but no more than 6 devices total
Local Access port	For system start-up and controller troubleshooting, use a PC with Virtual BACview, Field Assistant, or BACview6 (115.2 kbps)
Battery	10-year Lithium CR2032 battery provides a minimum of 10,000 hours of data retention during power outages
Protection	Built-in surge and transient protection circuitry - internal solid state Polyswitches on the incoming power and network connections.
Real time clock	Battery-backed real time clock keeps track of time in the event of a power failure
Status indicators	LED's indicate status of communications, running, errors, and power.

Environmental operating range	-22 to 150°F (-30 to 66°C), 0 to 90% relative humidity, non-condensing
Storage temperature range	-24 to 140°F (-30 to 60°C), 0 to 90% relative humidity, non-condensing
Physical	Rugged GE C2950HF Cycoloy plastic



Overall dimensions	A: B:	5-3/16 in. (13.2 cm) 4-1/8 in. (10.5 cm)
Mounting hole dimensions	C: D: E:	4-7/8 in. (12.4 cm) 2-1/20 in. (5.2 cm) 3/16 in. (.5 cm)
Panel depth	2 in. (5.1 cm)	
Weight	.44 lbs (.2 kg)	
BACnet support	Conforms to the Advanced Application Controller (B-AAC) Standard Device Profile as defined in ANSI/ASHRAE Standard 135-2004 (BACnet) Annex L	
Listed by	UL-916, (Canadian Std C22.2 No. 205-M1983), CE, FCC Part 15-Subpart B-Class A	

Installation

To install the UPC Open:

1 *Mount the controller* (page 4).

2 *Wire the controller for power.* (page 5)

3 *Set the controller's address.* (page 5)

4 *Configure the BAS port for BACnet MS/TP.* (page 6)

5 *Wire the controller to the MS/TP network.* (page 7)

6 *Wire the controller to the CCN network.* (page 8)

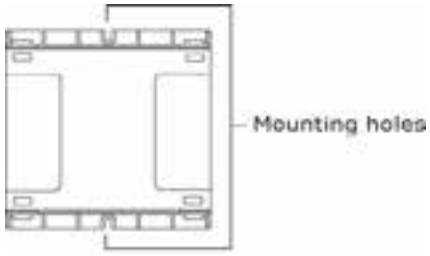
To mount the UPC Open

⚠ Warning!

When you handle the UPC Open:

- Do not contaminate the printed circuit board with fingerprints, moisture, or any foreign material.
- Do not touch components or leads.
- Handle the board by its edges.
- Isolate from high voltage or electrostatic discharge.
- Ensure that you are properly grounded.

Screw the UPC Open into an enclosed panel using the mounting slots on the coverplate. Leave about 2 in. (5 cm) on each side of the controller for wiring. Mounting hole dimensions 4.8 in. (12.2 cm) between mounting slot center lines.



Wiring the UPC Open for power

⚠ Caution!

The UPC Open is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present. The UPC Open is a half wave device. Half wave and full wave devices **cannot** share power. Examples of a full wave device are a CVC or ICVC in an applied chiller.

Controllers can share a power supply as long as you:

- Maintain the same polarity
- Use the power supply only for Open controllers

To wire for power

1. Remove power from the power supply.
2. Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **Hot**.
3. Connect the transformer wires to the screw terminal connector.

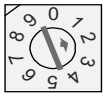
   NOTE If using a grounded transformer, connect the ungrounded lead to the **Hot** terminal to avoid damaging the transformer.
4. Apply power to the power supply.
5. Measure the voltage at the UPC Open's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
6. Insert the screw terminal connector into the UPC Open's power terminals.
7. Verify that the **Power** LED is on and the **Run** LED is blinking.

To address the UPC Open

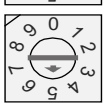
You must give the UPC Open a MAC address that is unique on the MS/TP network. You can address the UPC Open before or after you wire it for power

1. If the UPC Open has been wired for power, pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **Hot**. The controller reads the address each time you apply power to it.
2. Using the rotary switches, set the controller's address. Set the **Tens** (**10's**) switch to the tens digit of the address, and set the **Ones** (**1's**) switch to the ones digit.

   EXAMPLE If the controller's address is 25, point the arrow on the **Tens** (**10's**) switch to 2 and the arrow on the **Ones** (**1's**) switch to 5.

   10's

   1's

   CAUTION The factory default setting is **00** and must be changed to successfully install your UPC Open.

BACnet Device Instance Address

The UPC Open also has a BACnet Device Instance address. This Device Instance MUST be unique for the complete BACnet system in which the UPC Open is installed. The Device Instance is auto-generated by default and is derived by adding the MAC address to the end of the Network Number. The Network Number of a new UPC Open is 16101A. Thus, a controller with a MAC address of 20 results in a Device Instance of 16101 + 20, which is a Device Instance of 1610120. Also, using i-Vu Tools or BACView, you can configure a specific address for the Device Instance.

Configuring the BAS Port for BACnet MS/TP

Use the same baud rate and communication settings for all controllers on the network segment. The UPC Open is fixed at 8 data bits, No Parity, and 1 Stop bit for this protocol's communications.

1. If the UPC Open has been wired for power, pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **Hot**. The controller reads the DIP Switches and jumpers each time you apply power to it.
2. Leave **DS7** and **DS8** in the OFF position. These switches are not applicable to MS/TP.
3. Set the BAS Port DIP Switches **DS4** through **DS6** for BACnet MS/TP. See table and example below.

Protocol DIP switch settings for MS/TP

DS8	DS7	DS6	DS5	DS4	DS3
Off	Off	Off	Off	On	Off

NOTE DIP Switch **DS3** is not used in i-Vu Open Control Systems.

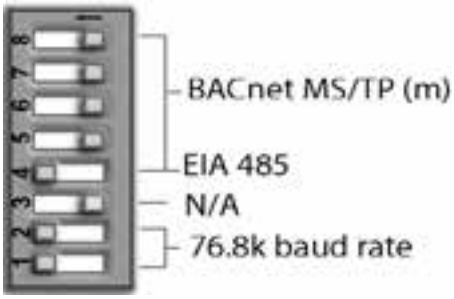
4. Set the BAS Port DIP Switches **DS1** and **DS2** for the appropriate communications speed of the MS/TP network (9600, 19.2k, 38.4k, or 76.8k bps).

Baud Selection Table

Baud Rate	DS2	DS1
9,600	Off	Off
19,200	On	Off
38,400	Off	On
76,800	On	On

5. Verify that the EIA-485 jumpers below the CCN Port are set to EIA-485 and 2W.

The following example shows the BAS Port DIP Switches set for 76.8k, and MS/TP.

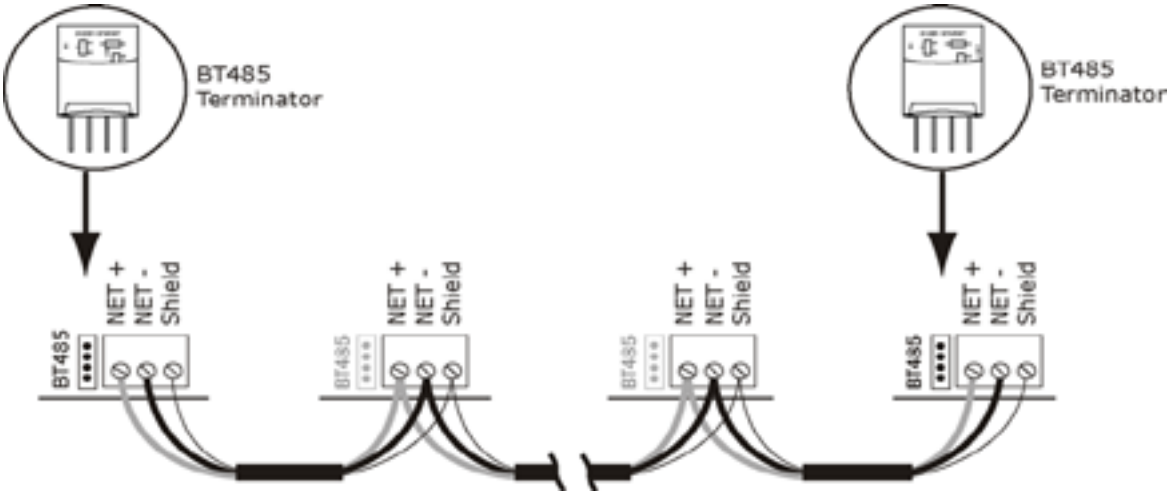


Wiring the UPC Open to the MS/TP network

The UPC Open communicates using BACnet on an MS/TP network segment communications at 9600 bps, 19.2 kbps, 38.4 kbps, or 76.8 kbps.

Wire the controllers on an MS/TP network segment in a daisy-chain configuration.

Install a BT485 on the first and last controller on a network segment to add bias and prevent signal distortions due to echoing.



See the *MS/TP Networking and Wiring Installation Guide* for more details.

Wiring specifications

Cable:	22 AWG or 24 AWG, low-capacitance, twisted, stranded, shielded copper wire
Maximum length:	2000 feet (610 meters)

To wire the UPC Open to the BAS network

1 Pull the screw terminal connector from the controller's **BAS Port**.

2 Check the communications wiring for shorts and grounds.

3 Connect the communications wiring to the BAS port's screw terminals labeled **Net +**, **Net -**, and **Shield**.

NOTE Use the same polarity throughout the network segment.

4 Insert the power screw terminal connector into the UPC Open's power terminals if they are not currently connected.

5 Verify communication with the network by viewing a module status report.

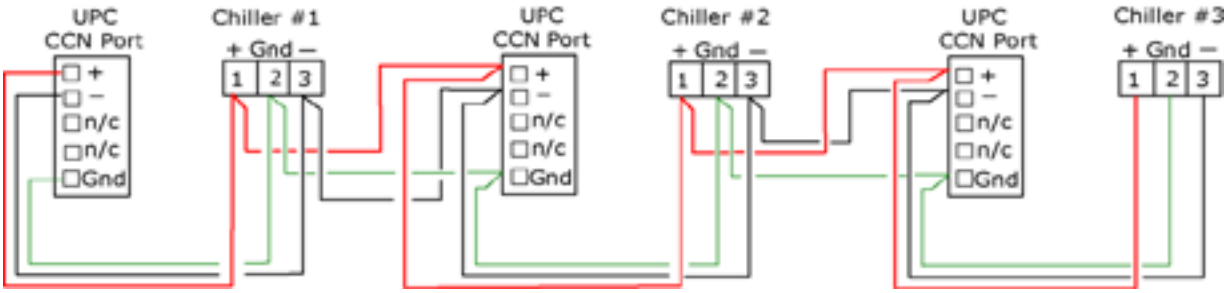
Wiring the UPC Open to the CCN network

The UPC Open's CCN Port communicates using EIA RS-485 and supports 9600 bps. Future versions will support baud rates of 19.2 and 38.4 kbps.

NOTES

- The UPC Open is intended to be wired directly to one piece of equipment.
  NOTE The exception is a Multiple Chiller Application, which consists of two or three chillers configured for Lead/Lag, with a potential third chiller as a standby chiller. In this application, wire the CCN network between the UPC Open and chillers in a daisy-chain configuration. All other applications have one network segment between the UPC Open and the interfaced equipment.
- Refer to the *CCN Installation and Start-up Guide* for more details on wiring the CCN bus.

Multiple chiller application only (Lead/Lag, and, possibly, a standby chiller)



Single unit application

Wiring specifications for CCN

Cable:	20 AWG, general purpose, 3-conductor, foil shielded copper wire
Maximum length:	1000 feet (305 meters)

To wire the CCN equipment to the UPC Open

1. Pull the screw terminal connector from the UPC Open's **CCN Port**.
2. Check the communications wiring for shorts and grounds.
3. Connect the communications wiring to the CCN Port's screw terminals labeled **Net +**, **Net -**, and **Shield**.

   NOTE Maintain the same polarity.
4. Insert the power screw terminal connector into the UPC Open's CCN Port's terminals.
5. Verify the LED lights **TX2** and **RX2** are flashing to indicate the UPC Open is communicating on the CCN Port.

   NOTE If the CCN target address differs from what the UPC Open is configured for (default 0, 1), then only the transmit LED flashes about 1 time per second.

Select or create a custom control program and graphic for the UPC Open

The field-installed UPC Open does not come from the factory with a control program or graphic. You must load a control program and graphic as part of the installation/commissioning of the UPC Open. You can select a control program and graphic from ApplicationBuilder that has all the configurations that are currently available on a factory-installed UPC Open. You can also create a custom control program using Snap. See the Snap Help files for details.

Consider the following before creating your program in Snap:

- Is the equipment already available in ApplicationBuilder?
- Which points from the equipment are to be mapped in the UPC Open?
- The type of microblock does each point require?
- Do you need to create custom **Property** pages for the equipment?
- Are there any special microblocks you may need, such as **Communication Device**, **Schedule**, **Alarms**?

To create your control program in Snap, you must:

- Obtain your CCN points list from the equipment or CCN database.
- Know what points need to be mapped in the control program to the equipment.
- Load a separate control program if Airside Linkage is needed and the UPC Open is used on a rooftop unit. An Airside Linkage equipment file can be selected in ApplicationBuilder.

After creating your control program, save and download it to the controller. If desired, create a custom graphic using ViewBuilder. See ViewBuilder Help files for details.

Local access to the UPC Open

You can use the following items as a local user interface to an Open controller. These items let you access the controller information, read sensor values, and test the controller.

NOTE At the present time, Field Assistant is the required local access user interface for UPC Open start-up, commissioning, operation, and troubleshooting. The 3 versions of BACview only provide rudimentary driver information.

Connect...	To the controller's...	For...
BACview6 Handheld keypad/display unit	Local Access port	Temporary user interface for driver parameter access
Virtual BACview software running on a laptop	Local Access port*	Temporary user interface for driver parameter access
BACview6 keypad/display unit	Rnet port	Permanent user interface for driver parameter access
Field Assistant	Local Access port*	Temporary user interface for start-up, commissioning, troubleshooting, etc..

* Requires a USB Link (USB-L)

These are accessory items that do not come with the controller.

See the *BACview Installation and User Guide* for instructions on connecting and using the BACview display.

Start-up

To start up the UPC Open, use one of the following interfaces. They allow you to access and configure controller information, read sensor values, and test the controller.

This interface...	Provides a...
i-Vu Open software	Permanent interface
Field Assistant software - runs on a laptop connected to controller's Local Access port [1]	Temporary interface

[1] Requires a USB Link (USB-L).

Configuring the UPC Open's properties

To start up the UPC Open, set the following properties:

Navigation: i-Vu / Field Assistant: **Properties** > **Equipment** > **Status**
BACview: **CCN**

Point Name/Description	Default/Range
Element Comm Stat - The UPC Open's current status of communication to the CCN equipment. Click the **Element Comm Stat** microblock link to change the CCN equipment target address - bus and element number. **NOTE** If more than one UPC Open is connected to a CCN bus for a Multiple Chiller Application, you must change the CCN controller's address in this object's **Summary** tab.	D: 0, 1 R: Bus: 0.1 - 239 Element: 1 - 239

Navigation: i-Vu / Field Assistant: **Driver Properties** > **Communications** > **CCN**

Point Name/Description	Default/Range
CCN Address - Configuration of the UPC Open's CCN element number.	D: 0, 200 R: 1 - 239

NOTES

If the UPC Open is used in a Multiple Chiller Application, then you must change the address of the chillers and the CCN address of all the UPC Open controllers to ensure they are all unique. In this application, the maximum number of UPC Open controllers allowed on the CCN bus is **3**.

- **CCN Alarm Acknowledger** – The UPC Open defaults as the **CCN Acknowledger**. In a Multiple Chiller Application, you must configure only one of the UPC Open controllers as the **CCN Acknowledger**.
- **CCN Time Broadcaster** – The UPC Open can be a **CCN Time Broadcaster.** In a Multiple Chiller Application, you must configure only one of the UPC Open controllers as the **CCN Time Broadcaster**.

- In chiller applications, verify the chiller is configured in CCN mode. If the chiller is not in CCN mode, then the UPC Open is not able to force points or write to the chiller. Refer to the specific chiller's documentation for information on how to setup the chiller to be in CCN mode.

Troubleshooting

If you have problems mounting, wiring, or addressing the UPC Open, contact iAIRE Technical Support.

The UPC Open LED's

The LED's indicate if the controller is speaking to the devices on the network. The LED's should reflect communication traffic based on the baud rate set. The higher the baud rate the more solid the LED's become.

LEDs	Status
Power	Lights when power is being supplied to the controller. **NOTE** The UPC Open is protected by internal solid state Polyswitches on the incoming power and network connections. These Polyswitches are not replaceable, but they will reset themselves if the condition that caused the fault returns to normal.
Rx	Lights when the controller receives data from the network segment; there is an Rx LED for Ports 1 and 2.
Tx	Lights when the controller transits data from the network segment; there is an Rx LED for Ports 1 and 2.
Run	Lights based on controller health.
Error	Lights based on controller health.

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is...
1 flash per second	1 flash per second, alternating with the **Run** LED	The controller files are archiving. Archive is complete when **Error** LED stops flashing.
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with **Run** LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	On	Two or more devices on this network have the same MS/TP network address
2 flashes per second	1 flash per second	The controller is alone on the network

If Run LED shows...	And Error LED shows...	Status is...
2 flashes per second	On	Exec halted after frequent system errors, due to: • Controller halted • Program memory corrupted • Address conflicts - duplicate MS/TP MAC addresses • One or more programs stopped
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with **Run** LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with **Run** LED	Brownout
On	On	Failure. Try the following solutions: • Turn the UPC Open off, then on. • Download memory to the UPC Open. • Replace the UPC Open.

Serial number

If you need the UPC Open's serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (modstat) from your user interface

Replacing the UPC Open's battery

The UPC Open's 10-year Lithium CR2032 battery provides a minimum of 10,000 hours of data retention during power outages.

CAUTION Power must be **ON** to the UPC Open when replacing the battery, or your date, time, and trend data will be lost.

1 Remove the battery from the controller, making note of the battery's polarity.

2 Insert the new battery, matching the battery's polarity with the polarity indicated on the UPC Open.

Appendix A: Single Point Linkage and Device Address Binding

Single Point Linkage

The UPC Open receives data from other Open controllers when they are installed as part of an Open system. The data transfer may take the form of Single Point Linkage (SPL), which is automatic, or Device Address Binding, which you must configure.

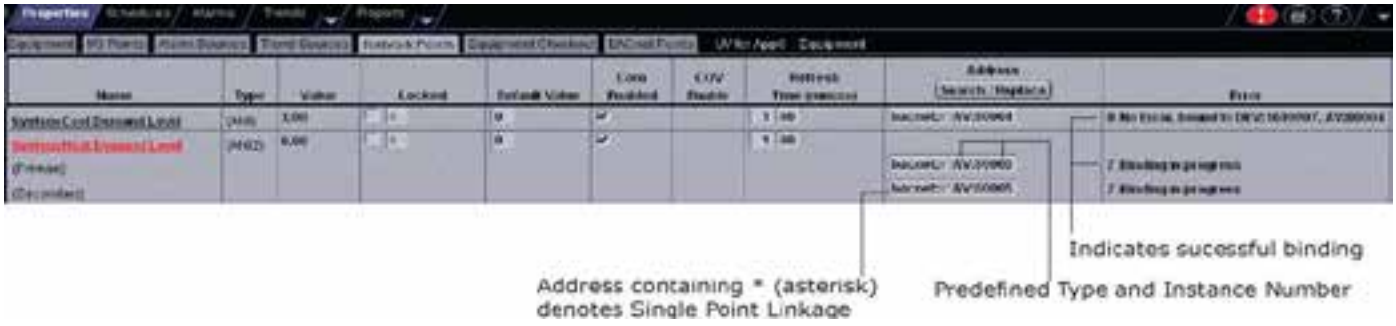
Currently, the UPC Open implements Single Point Linkage (SPL) for 3 variables:

- **System Cool Demand Level**
- **System Heat Demand Level**
- **System Outside Air Temperature**

Network Points for which SPL has been implemented are displayed in i-Vu and Field Assistant on the **Properties** page > **Network Points** tab.

The following example involves outside air temperature. **System Heat & Cool Demand Level** behaves similarly, except that their usage involves a specific application loaded on a Universal Controller Open. See *UC Open Installation Guide* for additional information. In either case, note that the BACnet type and instance numbers specified in the **Address** field of these variables have been predefined.

Network variables for which SPL is used are easily identified on the **Properties** page > **Network Points** tab. The asterisk in the BACnet address invokes the SPL function. These addresses cause the controller to issue a BACnet “who has” command for this variable. The controller binds to the closest of the first 5 devices from which it receives a valid response.

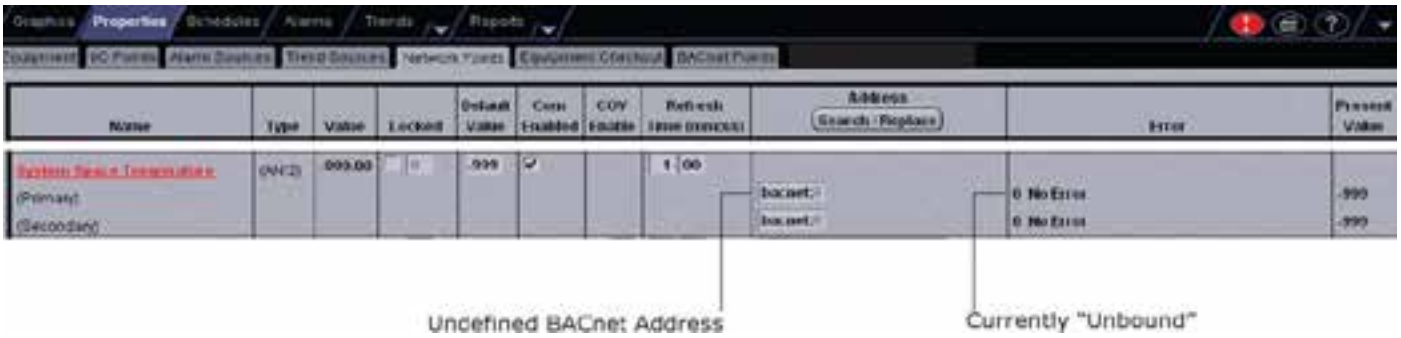


Device Address Binding

As described previously, **Device Address Binding** allows the UPC Open to receive data from other Open controllers when they are connected by a network. You must configure this method.

Currently, the UPC Open allows **Device Address Binding** (DAB) only for **System Space Temperature**.

You can implement DAB on network points with an undefined BACnet address, displayed in i-Vu and Field Assistant on the **Properties** page > **Network Points** tab. See example below.



Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance

WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

BACnet® is a registered trademark of ASHRAE. ASHRAE does not endorse, approve or test products for compliance with ASHRAE standards. Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of the BACnet manufacturers Association (BMA). BTL® is a registered trademark of the BMA.

APPENDIX L (BACNET TROUBLESHOOTING GUIDE)

BACNet Troubleshooting Guide

1. Is the UPC connected to the BMS front end?
    a. If not, make sure that the polarity is correct between the UPC and the iAIRE board and the UPC and the BMS front end
    b. Ensure that user settings on the UPC are correct
        i. Baud rate
        ii. Communication type
        iii. Address
    c. Check to see if BMS front end is a Metasys system. If it is, then iAIRE needs a special driver in the UPC to communicate to Metasys (Metasys has a proprietary call when trying to connect and the UPC thinks it is not BACNet)
2. If the BMS front end can see the UPC, but none of the points are changing?
    a. Make sure the iAIRE board has been switched in the Misc Configuration menu to BAS Config enabled. If this point is not switched, the unit will run in stand-alone mode and the UPC will not push points to the UPC.
3. If the unit runs fine in stand alone mode and when you put the unit into BAS Config enabled and the unit starts not working
    a. If the unit has a UPC that was not programmed before Feb 2019, the UPC uses the default points in the UPC. The UPC is the master controller in the system. This will cause the UPC to utilize its default points. Since these are probably not what the start-up technician put into the unit to make it work correctly, there are 2 options to fix this:
        i. Have the controls tech change any read/write point to the values the start-up technician used to make the machine run correctly
        ii. Get the newest program for the UPC. iAIRE worked with ALC to have the UPC program go and grab the default values in our control board to eliminate this issue.
4. If it is some other issue than described above, we will need to get ALC to help us with their technical support