Copeland Scroll® Outdoor Condensing Unit
Installation and reference manual

Copeland Scroll®

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Copeland Scroll® Outdoor Condensing Unit

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Introduction

Copeland Scroll® outdoor condensing units provide the many benefits of scroll compressor technology, coupled with advanced diagnostic controls, to ensure reliable performance and operation in foodservice applications. Electronics are used extensively in its protection and diagnostic features. These features are controlled by an electronic integrated control board. The control board provides base control functions related to temperature controller, defrost, evaporator fan control, compressor protection e.g. current overload, phase reversal, liquid/vapor injection control, self diagnostics and warnings. These error codes can be seen by an LED display for easy and rapid troubleshooting and maintenance.

A complete product offering for medium and low temperature HFC-404A units is being offered in single and three phase 208/230 volts. The -002 and -012 BOM product is approved for operation in ambients from 120°F to -10°F. The -022 BOM is featured with the required components to operate in colder climates. See **Figure 1** for details. For applications outside these guidelines, please contact Application Engineering.

Nomenclature/Features

See **Figure 1** (page 6).

Understanding Actual vs. Standard Airflow

To choose the proper coil for your application, the density of the incoming air needs to be known to calculate the actual capacity and performance of the system.

A coil's required capacity can be calculated using the thermodynamic equation

Q = M x Delta hr

  Q = Heat transfer to or from the air (Btuh)

  M = Mass flow rate of air (lb/hr)

  Delta h = Difference between the entering and leaving air enthalpy or total heat (Btu/lb)

The mass flow rate is equal to the density of air times the face area of the coil times the velocity of the air at the coil or face velocity.

M = P x A x V

P = Density (lb/ cubic ft.)

A = Face area of coil (square ft.) ~ Fin height x fin length

V = Air Velocity (ft./min.)

For temperature conversions $(A1) = \frac{530}{T+460}$

Temperature Conversion Factors

Temp (degrees F)	Factor A1	Temp (degrees F)	Factor A1
0	1.15	60	1.02
10	1.13	70	1.00
20	1.10	80	.98
30	1.08	90	.96
40	1.06	100	.95
50	1.04	110	.93

Altitude Conversion Factors (A2)

Alt.- Ft.	Factor- A2	Alt.- Ft	Factor- A2
0	1.00	3000	.895
500	.982	4000	.864
1000	.965	5000	.832
1500	.947	6000	.802
2000	.930	7000	.771
2500	.912	8000	.743

SCFM= CFM X A1 X A2

Note: all calculations and ratings are based on standard air at 70°F dry bulb temp and 29.92 Hg atmospheric pressure (sea level). These tables convert non standard cfm to standard cfm.

Performance Data

See **Tables 1** and **2** (page 10).

Electrical / Physical Data

See **Table 3** (page 11).

Generator Requirements

In situations or locations were an electrical power generator could be applied in the event of a power outage, the Copeland Scroll® outdoor condensing unit will operate providing the generator will provide a supply voltage range of 180-260 VAC along with a frequency of 47-63 Hz. The electronics control along with the power board will function properly providing the range of operating limits is in compliance!

Physical Dimensions

See **Figure 2** (page 7).

Installation / Piping Instructions

See **Figure 2** for overall dimensions of the units. It is recommended that a clearance of 8 inches from the

wall (or the next unit) be maintained from the unit's left and rear panel whereas a clearance of 20 inches is to be maintained from the unit's right, top and front panels. Both service access and airflow have been considered in making these recommendations. Where multiple units are to be installed in the same location, careful consideration for proper clearance needs to be given to each individual unit.

Ideally, the unit should be mounted level on a solid concrete slab with rubber strips between unit feet and concrete. However, these units have been designed for mounting on suitable brackets for wall mounting. In this case it is equally important that the spatial guidelines given above are followed, and additional consideration needs to be given for possible air recycling if units are stacked above and below each other. In general terms, air by-pass around each condenser and between each unit should be avoided at all times.

Pipe sizing should not only be of sufficient size to ensure optimum performance and good oil return, but it also needs to take into account the full capacity range through which this particular unit will need to operate. Follow the ASHRAE guidelines for proper piping practices.

Condensing Unit Operational Control

The Digital Control electronic control board controls the operation of the condensing unit. Whenever there is a control input asking to start or stop the condensing unit, the control board will execute a set of pre-programmed procedures to do so. It also monitors the compressor operating parameters, so as to protect the system from unsafe operating parameters. See **Figure 3** (page 8).

For example, when the low temperature unit experiences an extreme temperature day, the control board decides to switch from vapor-injection-optimization to discharge gas temperature control to allow the compressor to run safely and pass the extreme weather hours.

Control Features

The base control function is for the following standard features. See **Figure 3** for additional input options and output options of the control board.

Fresh Start Program

This Fresh Start Program is a bump start procedure that will energize and start the compressor for 3 seconds and then will be followed by a 20 second off cycle time. This will occur for 3 cycles, and then continuous power will be supplied to the compressor for normal operation.

The Fresh Start Program will be executed on initial start up or any time power is reapplied when the ambient

temperature is lower than 95°F. In addition, the Fresh Start Program will be executed for any start when the unit has been cycled off for more than an hour when the ambient temperature is lower than 95°F.

Stop Program

When the unit is satisfied, or there is any error which requires the unit to be shut down, the controller will execute a Stop Program. The compressor and the condenser fans will cycle off and the injection valves will close.

For low temperature units only, when the unit is satisfied the EXV will start closing immediately, but the compressor will delay 5 seconds before shut down to prevent reverse rotation of the compressor.

Automatic Liquid Injection (Medium temperature units only)

Automatic Liquid Injection ensures that the scroll compressor operates within a safe temperature limit. This unit employs a patented liquid injection system which injects a saturated refrigerant into the suction line at the compressor. Activation of the liquid injection valve is in response to a thermistor which is attached to the compressor discharge line. A signal is sent to the stepper motor of the injection valve, opening the valve in response to increasing discharge temperatures and injecting saturated refrigerant to reduce the discharge temperature.

Compressor Phase Reversal

Compressor Phase Reversal senses for the correct phase sequence on three phase applications. Reset is automatic once the correct phase sequence is sensed. An error message will be shown on the diagnostic LED.

Loss of Phase Protection

If three phase supply is incorrectly connected to the contactor terminals, or if a missing phase is sensed, an error message will be shown on the diagnostic LED. Reset is automatic once the correct phasing is sensed.

Motor Current Overload

- All scroll compressors used in these condensing units have an internal inherit motor protector.
- The Copeland Scroll Outdoor Condensing Unit is also equipped with two current sensors (CT1, CT2) to monitor the electrical current of the condensing unit. If the condensing unit current exceeds a pre-defined current limit, the controller will take the following actions:
  - □ Stop the compressor for 3 minutes

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□ LED signal will display an Over Current Error for 3 minutes

□ After a 3 minute delay the compressor will go through a normal start

□ The system will lock out after 6 over current trips within an hour

For this function to operate, two of the power leads are routed through the current sensing coils (CT1, CT2), prior to the contactor, from the factory. See **Figure 3.**

Non-Adjustable High Pressure Control

This pressure sensing device is a nonadjustable, low voltage pressure switch that will open at 435psig and reset at 348psig in the event of high discharge pressure. Its signal is monitored by the control board.

• In the event of a high pressure trip, the unit will stop and then restart after a 3-minute delay.

• After 6 successive HP cut-outs within 1 hour, the unit will lock-out.

• The lockout feature can be reset by disconnecting the power source and then cycling power to the unit.

Adjustable Low Pressure Switch

An adjustable low pressure switch is provided as standard equipment on both the medium and low temperature condensing units. This control can be used for a pump-down cycle if so desired. See **Table 8, Low Pressure Control Settings** (page 13). No error message will be shown for this adjustable control.

Liquid Floodback Protection

• Liquid refrigerant entering the compressor during the run cycle, in excessive quantities, can damage the compressor by diluting the lubricant, as well as excessive stress on several components in the compressor. Proper control of liquid refrigerant within the system is an application issue and is beyond control of this controller. However, the controller can perform checks and alert the user that liquid refrigerant floodback may be occurring and immediate field service is required. This is only a warning signal and will not terminate the operation of the unit. See **Tables 6** and **6a** (page 13).

• Liquid Floodback Protection is acquired by monitoring the compressor discharge temperature. When the discharge line temperature falls below a specified point, low suction line superheat may be the cause.

Crankcase Heater

The crankcase heater is wired through a normally closed

contact of the compressor contactor which is energized whenever the compressor cycles off.

Condenser Fan Speed Control

The Condenser Fan Speed Control will vary the speed of the condenser fan motor for head pressure control under low ambient conditions. There are two thermistor type sensors that are connected to the control board. These sensors monitor the condenser mid coil temperatures and ambient air temperatures to control the fan speed.

Enhanced Vapor Injection (EVI) Control (Low temperature units only)

The EVI system improves low temperature operational efficiency and provides a reliable low temperature envelope. It is used to optimize performance and to prevent the scroll set from overheating. This is done by controlling the discharge line temperature (DLT) and vapor injection superheat (VISH).

Enhanced vapor injection is accomplished by utilizing a subcooling circuit. A heat exchanger is used to subcool the liquid refrigerant before it enters the evaporator. As a result of the subcooling done by the heat exchanger, refrigerant will also be evaporated. This evaporated refrigerant is then injected into the mid compression cycle of the scroll compressor for overheat temperature control.

There are two thermistors sensing the discharge line temperature, one is located at the discharge line of the compressor and the second one is placed at the inlet of the condenser coil. In order to have a higher temperature resolution, the discharge line thermistor and condenser coil inlet sensor cooperate to sense a temperature range from 50°F to 329°F. The discharge line thermistor has a sensing range from 163°F to 329°F and the condenser coil will sense temperature from 50°F to 176°F. The EVI system will keep the discharge line temperature below 230°F to ensure the safety of the compressor.

It is important to insulate the system liquid line from the condensing unit to the evaporator. The recommended insulation thickness is a minimum of ½ inch. Also the lower liquid temperature can increase the evaporator expansion valve capacities. Please follow the valve manufactures recommended liquid temperature correction factors for proper selection of the evaporator expansion valve.

Electronic Expansion Value (EXV)

The Electronic Expansion Value (EXV) is a key part of the EVI system. It will regulate vapor injection flow to optimize the performance of system and cool the scroll set. Every second, the control chip will collect the

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thermistors reading and do a four second averaging. The EXV opening will be changed every 20 seconds and the variation is calculated by different ways based on different purposes.

TXV selection

For EVI, Emerson recommends a balanced port TXV because it offers a wider operating range for floating liquid temperatures.

See **Table 7** (page 14) for specifics regarding balanced port sizing recommendations. Applied with the low temp units it is recommended that a balanced port expansion valve be used along with a complete review of the the distributor & nozzle (orifice) that is supplied with the Evaporator coil being matched with the applicable condensing unit. Typically nozzles are selected for standard TXV sizing using 100°F liquid, with the XJAL those typical selections could be grossly oversized. See **Table 7** for the liquid correction safety factors when selecting those components.

Other Inputs to the Control Board

Customer Supplied Control (Thermostat)

The control board will accept a normal 220 volt AC input ON/OFF signal such as the switching action of a normal commercial thermostat and relay. If the system is controlled by low pressure control for a multiple evaporator system and/or pump down system, the control board will accept the signal directly from the control. See **Wiring Diagrams**, pages 21-24, for proper installation.

Other Outputs from the Control Board

Defrost Control Board

The defrost control board is a basic time initiated module which is standard on the low temperature units and is an add on feature for the medium temperature units. The defrost control board can control either off-cycle or electric defrost.

The defrost control board will control the liquid line solenoid valve. When defrost is initiated the liquid line solenoid valve will close and the unit will go into a pumpdown cycle. When the suction pressure equals the setting of the low pressure control, the compressor will cycle off. After the defrost time has expired, the liquid line solenoid valve opens and then the low pressure control will allow the compressor to restart.

Due to heater amperage loads, electric defrost requires an additional relay or contactor to energize the defrost heater.

The defrost cycle can be executed either automatically or manually. There are two rotary dip switches by which the user can set up the defrost cycle, see **Figure 4**. One rotary dipswitch sets the defrost duration (SW1) and the second rotary dipswitch sets the time interval between defrost cycles (SW2). For automatic defrost set SW1 and SW2 as desired. See **Table 4** (page 11) for time settings. The defrost control board also incorporates a manual defrost button that enables a manual defrost as an override to the rotary switch setting the defrost interval. Upon the completion of a manual defrost, the system will reset to the refrigeration cycle with the same procedures as automatic defrost and then the automatic defrost timer will reset.

For setting manual defrost only set SW1 as desired and set SW2 to "0". Whenever the manual defrost button is pressed, one defrost cycle will be executed and the duration of defrost will be determined by the setting of the rotary dipswitch SW1.

Note: There is no method to terminate a defrost cycle without resetting the control board.

Table 4 lists rotary dip switch settings for the Defrost Control Board.

An ON/OFF output connection is provided on the control board (JP10) for direct connection of a customer supplied contactor coil/relay when the defrost option is used. Terminals are male spade type. Coil voltage rating should be 220VAC and current ratings, 30VA (hold) and 330VA (inrush). See **Figure 6** (page 9).

For customers using their existing defrost timer, remove the defrost cable connecting the defrost control board to the unit control board. Also on the unit control board change the mode setting dip-switch bit 2 to ON and proceed to standard defrost wiring. See **Table 5** (page 12)

Evaporator Fan Control

An ON/OFF output connection is also provided on the control board (JP9) for direct connection of a customer supplied contactor coil controlling the evaporator fans. Terminals are the male spade type. Coil voltage rating is to be 220VAC and a maximum power rating of 30VA (hold) and 330VA (inrush). See **Figure 6**.

Diagnostic Display Board

Each condensing unit is supplied with a diagnostic display board, see **Figure 5** (page 13)**.** A two character display will make up the diagnostic/error code. The first character will display the unit status as shown in **Table 6**. The second character will display the error/warning

code as shown in **Table 6a**. See **Figure 5** for a detailed view of the diagnostics board assembly.

The Main Board Connector terminal will accept the cable connecting the display board to the main control board.

The Reset Button will reset the diagnostic display board only. The Message Recall Button will display the last error signal received by the display board. See **Figure 5.**

Family X-Line

J = R404A

A = Air-Cooled

M = Medium Temp
L = Low temp

Z = Scroll

CFV = 208/230V-1ph-60Hz
TFC = 208/230V-3ph-60Hz

0 = UL Listed Product

X J A M - 0 2 0 Z - T F C - 0 0 2

1.5 to 6.0 = Nominal Hp

Model Variation
0 Base Unit
1 Communication/ Defrost Module
2 Low Ambient / On Board Defrost Relays

BOM	XJAM -002	XJAL -002	XJAM -012	XJAL -012	XJAM -022	XJAL -022
Features Fan Motor	Variable	Variable	Variable	Variable	Variable	Variable
Head Pressure Control	VS	VS	VS	VS	VS	VS
Hood	X	X	X	X	X	X
Service Valves	Brass	Brass	Brass	Brass	Brass	Brass
Receiver	X	X	X	X	X	X
Liquid Shut Off	X	X	X	X	X	X
Moisture Indicator	X	X	X	X	X	X
Filter Dryer	X	X	X	X	X	X
Fixed HP	X	X	X	X	X	X
Adjustable LP	X	X	X	X	X	X
CCH	X	X	X	X	X	X
Diagnostics	X	X	X	X	X	X
Accumulator		X		X		X
Oil Seperator		X		X		X
Defrost timer		X	X	X		
One Way Communication			X	X	X	X
3 Minute Anti-Short Cycling	X	X	X	X	X	X
20 Second Anti-Short Cycling Option			X	X	X	X
Defrost timer w/ Relays					X	X
Heated Insulated Receiver					X	X
Low Pressure Bypass Time Delay					X	X
Diagnostics Over Current	X	X	X	X	X	X
Incorrect Phase Rotation	X	X	X	X	X	X
Liquid Flood-Back Prediction	X	X	X	X	X	X
"Fresh" Start Logic	X	X	X	X	X	X
"Smart" CCH	X	X	X	X	X	X
Compressor Overheating	X	X	X	X	X	X
Compressor Short Cycle	X	X	X	X	X	X
Fault Code History	X	X	X	X	X	X
Remote Alarming	X	X	X	X	X	X

Figure 1 – Nomenclature and Features

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END ELEVATION & ELEVATION VIEWS - SINGLE FAN UNIT

END ELEVATION & ELEVATION VIEWS - DUAL FAN UNIT

XJAM/XJAL ALL MODELS

BOTTOM VIEW - ALL MODELS
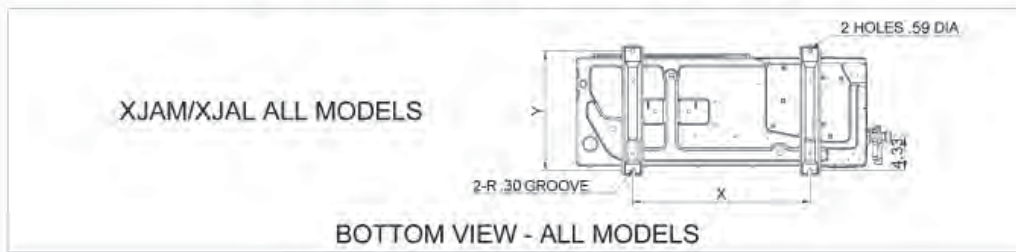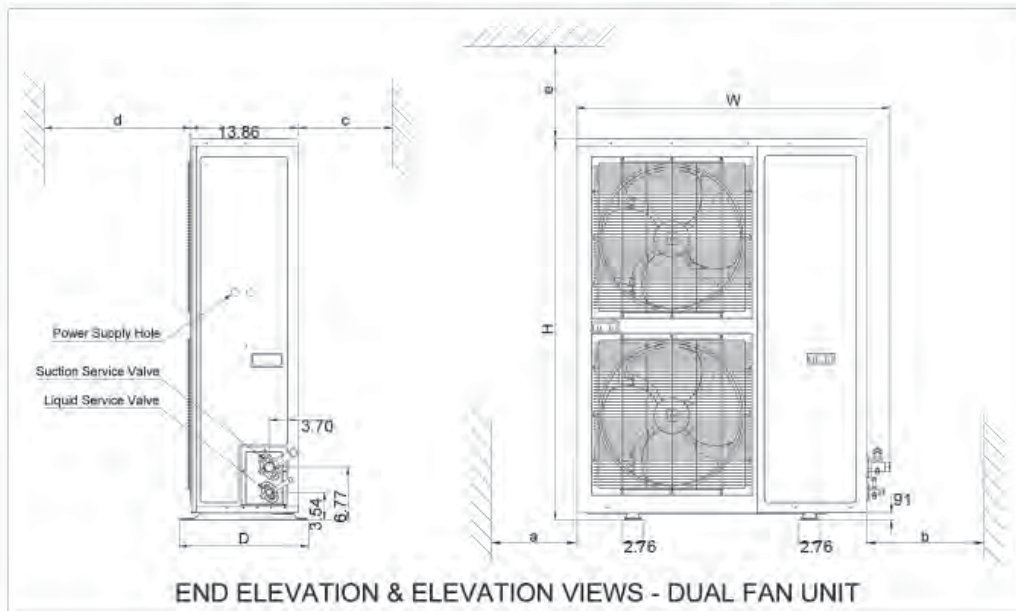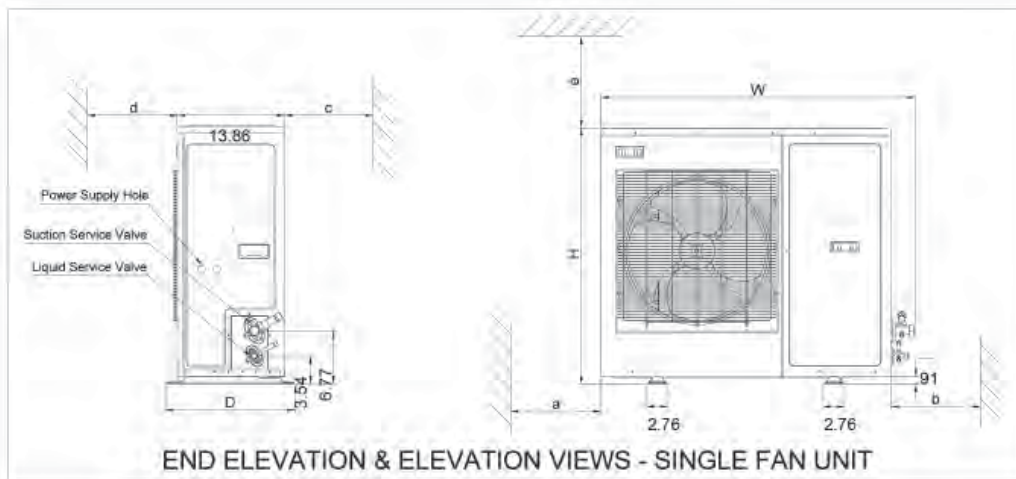
PHYSICAL DATA											
MODEL	WIDTH	HEIGHT	DEPTH	MTG. CENTERS		CONN. SIZE		INSTALLATION CLEARANCES				
	W	H	D	X	Y	Suction	Liquid	a	b	c	d	e
SINGLE FAN UNIT	40.51"	33.07"	16.69"	22.84"	15.28"	3/4"	1/2"	12"	20"	8"	20"	20"
DUAL FAN UNIT	40.51"	48.90"	16.69"	22.84"	15.28"	7/8"	1/2"	12"	20"	8"	20"	20"

Figure 2 – Physical and Installation Requirements

Compressor Current Sensing
(Hi/Lo) Setting Dip-Switch

3-Phase Power
Supply Input

3-Phase Detect
Module

Current Transformers

MCU

Temperature Sensors

Compressor Type
Setting Rotary-Switch

High Pressure
Switch Connector

Short Cycle
Protection Option
*See Note

Defrost Module
Connector

EXV Driver

Diagnosis Module
Connector

Switch Mode
Power Supply

1-Phase Power
Supply Input

High Voltage
Outputs

Mode Setting
Dip-Switch

Figure 3 – Power Board / Control Board

* Note: Short Cycle Protection Option

a) Factory Jumper Installed Three Minute Time Delay
b) Remove Jumper Twenty Second Time Delay

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Manual Defrost Button

Defrost Duration Switch SW1

Defrost Duration Switch SW2

2 Digit LED display

Reset Button

Message Recall Button

Remote Manual Defrost Button Connector

Main Board Connector
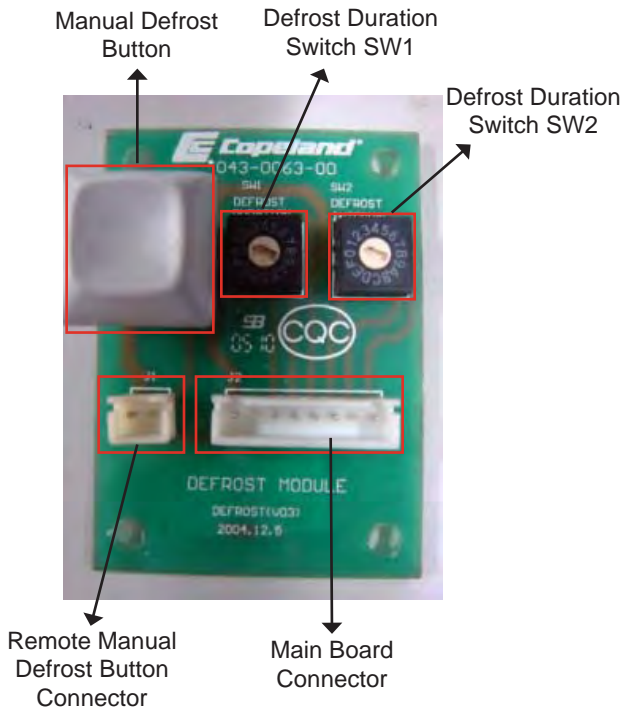
Figure 4
Defrost Control Module

Main Board Connector
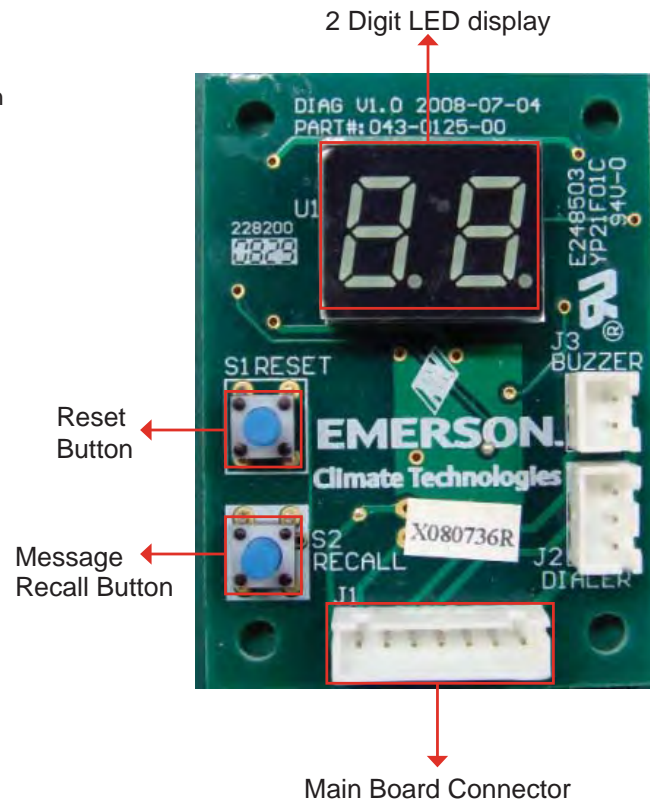
Figure 5
Diagnostics Module

Emerson-Supplied Defrost Module Requirements Utilized on Bom's -002/-012

Defrost Wiring

Emerson Provided

To JP10

Wired By User

TERMINAL BLOCK

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |

K1

Wired By User

L1   K1   Defrost Heater   L2

S1   K1

Thermostat   Liquid Line Solenoid Valve

K1: Double Pole Relay/Contactor

Note: Emerson defrost module (PN#043-0063-00) is used as the defrost timer.
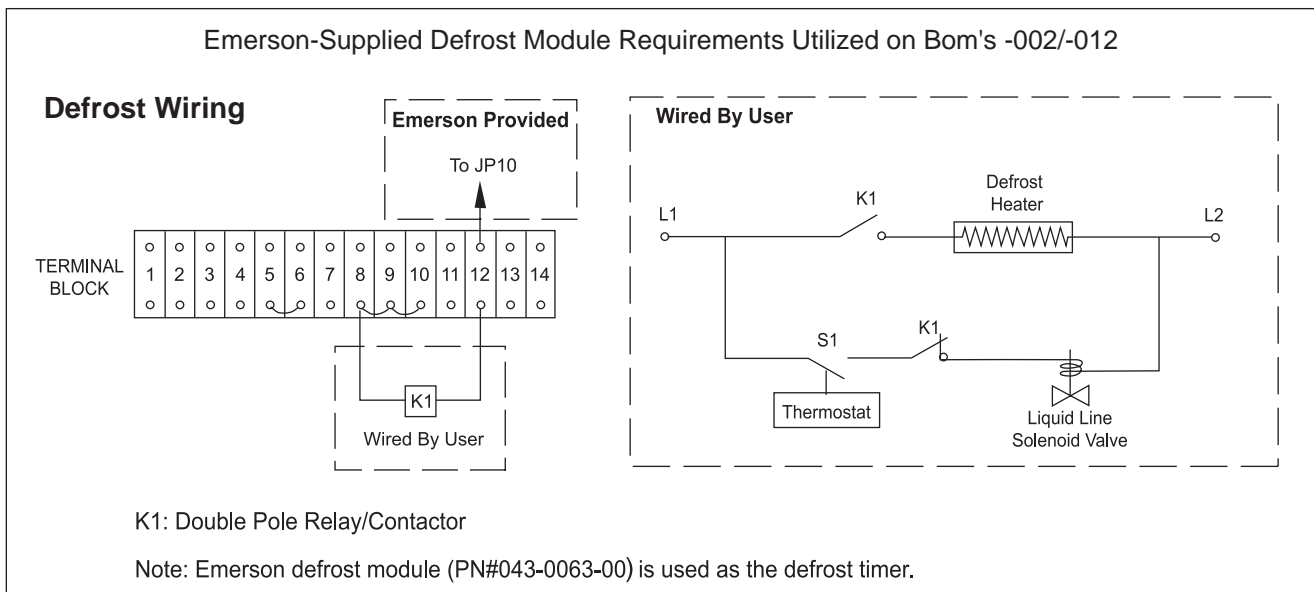
Figure 6
Emerson Supplied Defrost

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Table 1
Medium Temp Performance Criteria

H.P.	Medium Temperature Model Number	Btu/hr @ +25°F Sat. Suction Temp / 90°F Ambient	Btu/hr @ +25°F Sat. Suction Temp / 100°F Ambient	Refrigerant/ Oil Type
1.5	XJAM-015Z-CFV	14600	13600	R404A / POE
2	XJAM-020Z-CFV	19600	17900	R404A / POE
2	XJAM-020Z-TFC	19600	17900	R404A / POE
3	XJAM-030Z-CFV	28500	25900	R404A / POE
3	XJAM-030Z-TFC	28500	25900	R404A / POE
4	XJAM-040Z-CFV	38600	35300	R404A / POE
4	XJAM-040Z-TFC	38600	35300	R404A / POE
5	XJAM-050Z-CFV	47100	43800	R404A / POE
5	XJAM-050Z-TFC	47100	43800	R404A / POE
6	XJAM-060Z-TFC	54600	50200	R404A / POE

Table 2
Low Temp Performance Criteria

H.P.	Low Temperature Model Number	Btu/hr @ +25°F Sat. Suction Temp / 90°F Ambient	Btu/hr @ -10°F Sat. Suction Temp / 100°F Ambient	Refrigerant/ Oil Type
2	XJAL-020Z-CFV	13100	12700	R404A / POE
2	XJAL-020Z-TFC	13100	12700	R404A / POE
3	XJAL-030Z- TFC	17200	16400	R404A / POE
3	XJAL-035Z- CFV	19700	18100	R404A / POE
4	XJAL-040Z-CFV	24700	23700	R404A / POE
4	XJAL-040Z-TFC	24700	23700	R404A / POE
5	XJAL-050Z-CFV	27600	25700	R404A / POE
5	XJAL-050Z-TFC	27600	25700	R404A / POE
6	XJAL-060Z-TFC	34700	32700	R404A / POE

Table 3
Mechanical /Electrical Specifications

Unit Model	Compressor	H.P.	Dimensions (in)			Connection Lines		# of Fans	Min Circuit Ampacity/ Max Fuse (Amps)		Pump Down Capacity (lbs)	Unit Weight (lbs)	dba *
			L	W	H	Suction	Liquid		208/230V 1ph-60hz	208/230V 3ph-60hz			
XJAM-015Z	ZB11KCE	1.5	16.7	40.5	33	3/4 "	1/2 "	1	12.3 / 20	N/A	7.5	180	55
XJAM-020Z	ZX15KCE	2	16.7	40.5	33	3/4 "	1/2 "	1	18.7 / 30	11.1 / 15	7.5	182	55
XJAM-030Z	ZX21KCE	3	16.7	40.5	33	3/4 "	1/2 "	1	24.3 / 40	14.7 / 25	7.5	194	55
XJAM-040Z	ZX30KCE	4	16.7	40.5	49	7/8 "	1/2 "	2	32.1 / 50	19.7 / 30	11	250	56
XJAM-050Z	ZX38KCE	5	16.7	40.5	49	7/8 "	1/2 "	2	36.6 / 60	29.0 / 50	11	258	56
XJAM-060Z	ZX45KCE	6	16.7	40.5	49	7/8 "	1/2 "	2	N/A	28.1 / 45	11	270	56
XJAL-020Z	ZXI06KCE	2	16.7	40.5	33	3/4 "	1/2 "	1	19.4 / 30	14.7 / 25	7.5	188	50
XJAL-030Z	ZXI09KCE	3	16.7	40.5	33	3/4 "	1/2 "	1	N/A	15.4 / 25	7.5	192	50
XJAL-035Z	ZXI11KCE	3.5	16.7	40.5	33	7/8 "	1/2 "	1	30.7 / 50	N/A	7.5	213	50
XJAL-040Z	ZXI14KCE	4	16.7	40.5	49	7/8 "	1/2 "	2	36.1 / 60	24.5 / 40	11	251	58
XJAL-050Z	ZXI15KCE	5	16.7	40.5	49	7/8 "	1/2 "	2	N/A	26.1 / 45	11	267	58
XJAL-050Z	ZXI16KCE	5	16.7	40.5	49	7/8 "	1/2 "	2	40.4 / 70	N/A	11	287	58
XJAL-060Z	ZXI18KCE	6	16.7	40.5	49	7/8 "	1/2 "	2	N/A	30.7 / 50	11	291	58

Assume Each Fan @ .75 Amps

*Estimated sound pressure values are 10 feet from the unit at 25F evap for MT and -10 evap for LT at 90 ambient. A sound reduction of up to 3 dBA will occur in ambient temperatures below 70F. This data is typical of "free field" conditions for horizontal air cooled condensing units and may vary depending on the condensing unit installation. There are many factors that affect the sound reading of a condensing unit such as unit mounting, reflecting walls, background noise and operating condition.

Table 4
Emerson Supplied Defrost Set Points

Switch 1	Defrost duration (minutes)	Switch 2	Time interval between defrost
0	No defrost (manual defrost only)	0	No defrost (manual defrost only)
1	5 minutes	1	1 hour
2	10 minutes	2	2 hours
3	15 minutes	3	3 hours
4	20 minutes	4	4 hours
5	25 minutes	5	5 hours
6	30 minutes	6	6 hours
7	35 minutes	7	7 hours

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Table 5
Main Control Board Setting For XJAM

Model Name**	Rotary Switch	2bit Dip-Switch	3bit Dip-Switch
Control Board Default Setting	0	ON/ON	Bit 1: To set evaporator fan control mode - "ON": Evaporator fan will be ON all the time no matter whether compressor is ON/OFF or defrosting Bit 2: To set defrost mode - "OFF": Using Emerson defrost module - "ON": Using customer defrost module Bit 3: Not used yet.
ZB11KCE-PFV	A	ON/ON	
ZX15KCE-TF5	1	ON/ON	
ZX15KCE-PFV	2	ON/ON	
ZX21KCE-TF5	3	ON/ON	
ZX21KCE-PFV	4	OFF/OFF	
ZX30KCE-TF5	5	ON/ON	
ZX30KCE-PFV	6	OFF/OFF	
ZX38KCE-TF5	7	OFF/OFF	
ZX38KCE-PFV	8	OFF/OFF	
ZX45KCE-TF5	9	OFF/OFF	

Main Control Board Setting For XJAL

Model Name**	Rotary Switch	2bit Dip-Switch	3bit Dip-Switch
Control Board Default Setting	0	ON/ON	Bit 1: To set evaporator fan control mode - "OFF": Evaporator Fan On/Off Logic Same As Compressor - "ON": Evaporator fan will be ON all the time no mater whether compressor is ON/OFF or defrosting Bit 2: To set defrost mode - "OFF": Using Emerson defrost module - "ON": Using customer defrost module Bit 3: Not used yet.
ZXI06KCE-TF5	1	ON/ON	
ZXI06KCE-PFV	2	ON/ON	
ZXI09KCE-TF5	3	ON/ON	
ZXI11KCE-PFV	4	OFF/OFF	
ZXI14KCE-TF5	5	OFF/OFF	
ZXI14KCE-PFV	6	ON/ON	
ZXI15KCE-TF5	7	OFF/OFF	
ZXI16KCE-PFV	8	OFF/OFF	
ZXI18KCE-TF5	9	OFF/OFF	

** Please set the switches to the correct position according to compressor model.

Table 6 – Diagnostics Module Display

Display	Status
LED1 - Unit Status	
0	Idle (Stop When Reach To Set-point)
1	Run
2	About To Start [1]
3	Defrost
4	Unit Trip
5	Unit Lockout

Table 6a – Diagnostics Module Display

Display	Error/Warning
LED2 - Error/Warning Code	
0	No error/warnings
1	Compressor Phase Error (Wrong Phase Sequence/Loss Of Phase)
2	Compressor Inside Internal Motor Protector Trip
3	Compressor Over Current
4	Discharge Gas Overheat (High Discharge Temperature)
5	Compressor High Pressure Cut Out
6	Not Used
7	DLT Thermistors Failure
8	Ambient Temperature Sensor Failure
9	Mid-coil Temperature Sensor Failure
A	PHE Vapor In Temperature Sensor Failure or over range [2]
C	PHE Vapor Out Temperature Sensor Failure or over range [2]
E	System Liquid Flood Back Warning

Note: [1] This signal is for Fresh Start, Normal Start Program and any start request delay.
[2] PHE Vapor In/Out Temperature Sensor is not applicable in XJAM condensing unit (MT units).

All error/warning messages are priority-ranked from highest to lowest.

If unit is initially powered on, the diagnosis module will show signal similar to the below example:

Diagnostics Module Start Up Information

Delay   Firmware   Unit Revision   Stator

88 (1second) -> 02 (3 seconds) -> -F (3 seconds) -> 00

02 = Software Version No.

-F = Unit Identification Code

    → "F"- With OD Fan Speed Control; "-" = W/O OD Fan Speed Control
    → "L"- LT; "-" = MT

00 = Power On   *Lockout feature can be reset by disconnecting the unit power source and then reconnection of the unit power source.

Table 7
Refrigerant Liquid Temperature Valve Capacity Multiplier Correction Factors

	Refrigerant Liquid Temperature °F														
	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140
R-12 Correction Factor	1.60	1.54	1.48	1.42	1.36	1.30	1.24	1.18	1.12	1.06	1.00	0.94	0.88	0.82	0.75
R-134a Correction Factor	1.70	1.63	1.56	1.49	1.42	1.36	1.29	1.21	1.14	1.07	1.00	0.93	0.85	0.78	0.71
R-22 Correction Factor	1.56	1.51	1.45	1.40	1.34	1.29	1.23	1.17	1.12	1.06	1.00	0.94	0.88	0.82	0.76
R-404A/R-507 Correction Factor	2.00	1.90	1.80	1.70	1.60	1.50	1.40	1.30	1.20	1.10	1.00	0.90	0.80	0.70	0.50

These factors include corrections for liquid refrigerant density and net refrigerating effect and are based on an average evaporator temperature of 0°F. However, they may be used for any evaporator temperature from - 40°F to + 40°F since the variation in the actual Factors across this range is insignificant.

Table 8
Low Pressure Control Settings for XJAM/L Units

Application	Control	R404A/R507
XJAL (Low Temp)	Low	0 PSIG Min
XJAM (Medium Temp)	Low	17.0 psig Min

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Table 9 – System Diagnostic Information

Note:
* Reference Figure 3, Page 8 for Control Board Three Minute Time Delay functionality

Fault Type	Trip to Set Point	Code Char. 1	Code Char. 2	Control Board Actions	Auto Resets	Possible Error and Solution
Reverse Phase/Loss of phase (3 phase only)	Incorrect Voltage sequence	5	1	-Stop the unit -Display the incorrect phase -Display waiting to restart on diagnostic -*Check the phase sequence after 3 minutes	Auto Start	-Check Voltage sequence of the control board whether it is same as the compressor; -Change the voltage sequence at circular break
Fresh Start	Occurs on: -initial unit start, -When power is reset <95°F ambient Compressor is cycled off > than 1 hour < than 95° F ambient	2	0	-Compressor runs 3 sec and stops 20 sec -After 3 cycles, compressor runs continuously -Display fresh start on diagnostic	Auto Start	-Nothing is wrong, just wait until compressor runs continuously.
High Pressure Trip	-Contact open at 435 psig ±22psig -Contact Close at 348 psig ±22psig	5	5	-Stop the Unit -Display HP trip on diagnostic -Display waiting to restart on diagnostic - *Auto start the unit after 3 minutes -Lockout unit if 6 trips in less than 12 hours -Display HP lockout on diagnostic	5 Auto Starts in 1 Hour	-Check whether HP cutout functions properly or is connected to control board; -Check whether condenser fan can run; -Check liquid line solenoid valve, liquid service valve, make sure they are open;
Discharge Gas Overheat	Discharge Temperatures over 270°F	4 2 5	4 4 4	-Stop the Unit -Display DLT trip on diagnostic -Display waiting to restart on diagnostc -*Auto start the unit after 3 minutes -Lockout unit if 6 trips in less than 12 hour -Display DLT overheat lockout on diagnostic	5 Auto Starts in 1 hour	-Check liquid line sight glass -Check the injection feature for proper operation

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Table 9 Continued

Fault Type	Trip to Set Point	Code Char. 1	Code Char. 2	Control Board Actions	Auto Resets	Possible Error and Solution
Over Current	Set based on Compressor	5	2	-Stop the Unit -Display over current trip on diagnostic -Display waiting to restart on diagnostic -*Auto start the unit after 3 minutes -Lockout unit if 6 trips in less than 12 hour -Display over current lockout on diagnostic	Auto Start	-Check rotarty switch, make sure it is on the right position according to the unit model; -Check oil level through compressor sight glass (Low temp unit only); -Check accumulator (Low temp unit only), inlet should connect to return gas service valve.
Electrical Failure	Compressor intends to start but current transformers sense no current	5	2	-Display compressor protector trip on diagnostic -Auto Start When protector resets	Auto Start	-Check whether contact is pull-in? If not, check wiring of contact coil; -Check wiring, make sure compressor is connected to contactor, and is powered; -Compressor motor thermal protector trips, wait until it resets.
Compressor Rapid Cycling	*Minimum 3 minutes off time between starts	2	0	-*Delay compressor start, if minimum off time is less than 3 min -Display about to turn on diagnostic	Auto Start	-Compressor start signal is active when unit stops; the only thing needed to do is wait until the unit starts
Ambient Temperature Sensor Failure (See **Table 10**)	Ambient sensor reads < -22°F or >145°F	1	8	-Display ambient temp sensors failure on diagnostic -Continue to run the unit on default mode.	Run	-check whether actual ambient temperature is out of range; -Check whether ambient sensor is OK and connected to control board.
Condensor Mid-Coil Sensor Failure (See **Table 10**)	Mid-coil sensor reads < -22°F or >145°F	1	9	-Display mid-coil temp sensors failure on diagnostic -Continue to run the unit on default mode.	Run	-check whether actual mid-coil temperature is out of range; -Check whether mid-coil sensor is OK and connected to control board.

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Table 9 Continued

Fault Type	Trip to Set Point	Code Char. 1	Code Char. 2	Control Board Actions	Auto Resets	Possible Error and Solution
Discharge Line And Coil in Temp Sensors Failure (See **Table 10**)	-Actual DLT>320°F ~DLT Sensor Fails and actual DLT> 176°F -Both coil-in and DLT sensors fail (short circuit)	2

1

5 | 7

7

7 | (Only in XJAL) -Stop the unit -Display DLT sensor failure on the diagnostic -Display waiting to restart on diagnostic -*Auto start the unit after 3 minutes -Lockout unit if 6 trips in less than 1 hour -Display DLT sensor failure lockout on diagnostic | 5 Auto Starts in 1 hour | -Check liquid line sight glass -Check whether the DLT sensor is connected to the control board; -Check whether DLT sensor is OK -Check whether Coil in sensor is OK |
				(only in XJAM) -Display DLT sensor failure on diagnostic -Continue to run the unit on default mode	Run	
	-Coil Sensor fails (open) and actual DLT is <163°F			(Both XJAL and XJAM) -Display DLT sensor failure on diagnostic -Continue to run the unit on default mode	Run	-Check whether the sensors are connected to control board; -Check whether Coil in sensor is OK. -Check for liquid floodback
PHE vapor in sensor failure (Only in XJAL CDU) (See **Table 10**)	-Vapor in sensor reads <3.2°F or >163°F -Ambient temp reads >50°F	1	A	-Display sensor error on diagnostics -Continue to run unit on default mode	Run	-Check whether actual temperature is out of range; -Check whether the sensor is connected to the control board -Check whether the sensor is mounted at the right position; -Check whether the sensor is in trhe heat isolation material; -Check whether the sensor has failed
PHE vapor out sensor failure (Only in XJAL CDU) (See **Table 10**)	-Vapor out sensor reads <3.2°F or >163°F -Ambient temp reads >50°F	1	C	-Display sensor error on diagnostics -Continue to run unit on default mode	Run	-Check whether actual temperature is out of range; -Check whether the sensor is connected to the control board -Check whether the sensor is mounted at the right position; -Check whether the sensor is in trhe heat isolation material; -Check whether the sensor has failed

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Sensor information

In the event there is fault code referencing a possible issue with any one of the four unit control temperature sensors, see **Table 10** to assess the fault code condition. If the resistance of the sensor in question does not compare to the information provide in the table for the applicable sensor, then that sensor will need replaced.

Table 10 – Sensor Information

DLT			Coil-in			Amb/Mid-Coil			VIT/VOT		
Temp (F)	Temp (C)	R (kohm)	Temp (F)	Temp (C)	R (kohm)	Temp (F)	Temp (C)	R (kohm)	Temp (F)	Temp (C)	R (kohm)
140	60	22.99	50	10	207.6	-22	-30	121.9	5	-15	56.48
142	61	22.13	52	11	197.2	-20	-29	115.5	7	-14	53.78
144	62	21.31	54	12	187.5	-18	-28	109.5	9	-13	51.24
145	63	20.51	55	13	178.4	-17	-27	103.9	10	-12	48.84
147	64	19.78	57	14	169.7	-15	-26	98.54	12	-11	46.56
149	65	19.06	59	15	161.5	-13	-25	93.52	14	-10	44.4
151	66	18.36	61	16	153.7	-11	-24	88.78	16	-9	42.36
153	67	17.7	63	17	146.4	-9	-23	84.32	18	-8	40.42
154	68	17.06	64	18	139.4	-8	-22	80.1	19	-7	38.58
156	69	16.45	66	19	132.8	-6	-21	76.12	21	-6	36.84
158	70	15.87	68	20	126.6	-4	-20	72.38	23	-5	35.08
160	71	15.31	70	21	120.6	-2	-19	68.82	25	-4	33.62
162	72	14.78	72	22	115.1	0	-18	65.48	27	-3	32.12
163	73	14.26	73	23	109.8	1	-17	62.3	28	-2	30.7
165	74	13.77	75	24	104.7	3	-16	59.3	30	-1	29.36
167	75	13.29	77	25	100	5	-15	56.48	32	0	28.08
169	76	12.83	79	26	95.47	7	-14	53.78	34	1	26.86
171	77	12.39	81	27	91.19	9	-13	51.24	36	2	25.7
172	78	11.97	82	28	87.1	10	-12	48.84	37	3	24.6
174	79	11.57	84	29	83.24	12	-11	46.56	39	4	23.56
176	80	11.18	86	30	79.55	14	-10	44.4	41	5	22.46
178	81	10.8	88	31	76.05	16	-9	42.36	43	6	21.6
180	82	10.44	90	32	72.73	18	-8	40.42	45	7	20.7
181	83	10.1	91	33	35.12	19	-7	38.58	46	8	19.84
183	84	9.761	93	34	66.56	21	-6	36.84	48	9	19.02
185	85	9.443	95	35	63.7	23	-5	35.08	50	10	18.24
187	86	9.135	97	36	60.98	25	-4	33.62	52	11	17.49
189	87	8.836	99	37	58.4	27	-3	32.12	54	12	16.78
190	88	8.55	100	38	55.92	28	-2	30.7	55	13	16.11
192	89	8.275	102	39	53.59	30	-1	29.36	57	14	15.46
194	90	8.01	104	40	51.34	32	0	28.08	59	15	14.84
196	91	7.754	106	41	49.21	34	1	26.86	61	16	14.25
198	92	7.508	108	42	47.18	36	2	25.7	63	17	13.69
199	93	7.272	109	43	45.25	37	3	24.6	64	18	13.15
201	94	7.044	111	44	43.39	39	4	23.56	66	19	12.64

Table 10 Continued

DLT			Coil-in			Amb/Mid-Coil			VIT/VOT		
Temp (F)	Temp (C)	R (kohm)	Temp (F)	Temp (C)	R (kohm)	Temp (F)	Temp (C)	R (kohm)	Temp (F)	Temp (C)	R (kohm)
203	95	6.823	113	45	41.64	41	5	22.46	68	20	12.15
205	96	6.612	115	46	39.95	43	6	21.6	70	21	11.68
207	97	6.406	117	47	38.36	45	7	20.7	72	22	11.23
208	98	6.209	118	48	36.82	46	8	19.84	73	23	10.8
210	99	6.019	120	49	35.36	48	9	19.02	75	24	10.39
212	100	5.834	122	50	33.96	50	10	18.24	77	25	10
214	101	5.658	124	51	32.62	52	11	17.49	79	26	9.624
216	102	5.487	126	52	31.35	54	12	16.78	81	27	9.266
217	103	5.321	127	53	30.14	55	13	16.11	82	28	8.922
219	104	5.164	129	54	28.97	57	14	15.46	84	29	8.592
221	105	5.01	131	55	27.86	59	15	14.84	86	30	8.276
223	106	4.862	133	56	26.8	61	16	14.25	88	31	7.974
225	107	4.717	135	57	25.78	63	17	13.69	90	32	7.686
226	108	4.578	136	58	24.81	64	18	13.15	91	33	7.408
228	109	4.445	138	59	23.87	66	19	12.64	93	34	7.142
230	110	4.316	140	60	22.99	68	20	12.15	95	35	6.886
232	111	4.192	142	61	22.13	70	21	11.68	97	36	6.642
234	112	4.07	144	62	21.31	72	22	11.23	99	37	6.408
235	113	3.954	145	63	20.51	73	23	10.8	100	38	6.182
237	114	3.841	147	64	19.78	75	24	10.39	102	39	5.966
239	115	3.733	149	65	19.06	77	25	10	104	40	5.76
241	116	3.626	151	66	18.36	79	26	9.624	106	41	5.56
243	117	3.524	153	67	17.7	81	27	9.266	108	42	5.368
244	118	3.427	154	68	17.06	82	28	8.922	109	43	5.186
246	119	3.331	156	69	16.45	84	29	8.592	111	44	5.008
248	120	3.239	158	70	15.87	86	30	8.276	113	45	4.84
250	121	3.149	160	71	15.31	88	31	7.974	115	46	4.676
252	122	3.062	162	72	14.78	90	32	7.686	117	47	4.52
253	123	2.978	163	73	14.26	91	33	7.408	118	48	4.37
255	124	2.897	165	74	13.77	93	34	7.142	120	49	4.224
257	125	2.819	167	75	13.29	95	35	6.886	122	50	4.086
259	126	2.742	169	76	12.83	97	36	6.642	124	51	3.952
261	127	2.668	171	77	12.39	99	37	6.408	126	52	3.822
262	128	2.598	172	78	11.97	100	38	6.182	127	53	3.698
264	129	2.529	174	79	11.57	102	39	5.966	129	54	3.58
266	130	2.462	176	80	11.18	104	40	5.76	131	55	3.464
268	131	2.396				106	41	5.56	133	56	3.354
270	132	2.333				108	42	5.368	135	57	3.246
271	133	2.272				109	43	5.186	136	58	3.144

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AE5-1377 R2

Table 10 Continued

DLT				Amb/Mid-Coil				VIT/VOT		
Temp (F)	Temp (C)	R (kohm)		Temp (F)	Temp (C)	R (kohm)		Temp (F)	Temp (C)	R (kohm)
273	134	2.213		111	44	5.008		138	59	3.046
275	135	2.156		113	45	4.84		140	60	2.95
277	136	2.101		115	46	4.676		142	61	2.858
279	137	2.047		117	47	4.52		144	62	2.77
280	138	1.994		118	48	4.37		145	63	2.684
282	139	1.944		120	49	4.224		147	64	2.602
284	140	1.894		122	50	4.086		149	65	2.522
286	141	1.847		124	51	3.952		151	66	2.446
288	142	1.801		126	52	3.822		153	67	2.372
289	143	1.756		127	53	3.698		154	68	2.302
291	144	1.712		129	54	3.58		156	69	2.232
293	145	1.669		131	55	3.464		158	70	2.166
295	146	1.628		133	56	3.354		160	71	2.102
297	147	1.588		135	57	3.246		162	72	2.04
298	148	1.549		136	58	3.144		163	73	1.98
300	149	1.512		138	59	3.046				
302	150	1.474		140	60	2.95				

XJAM/XJAL Single Fan CFV-002 and -012 Models

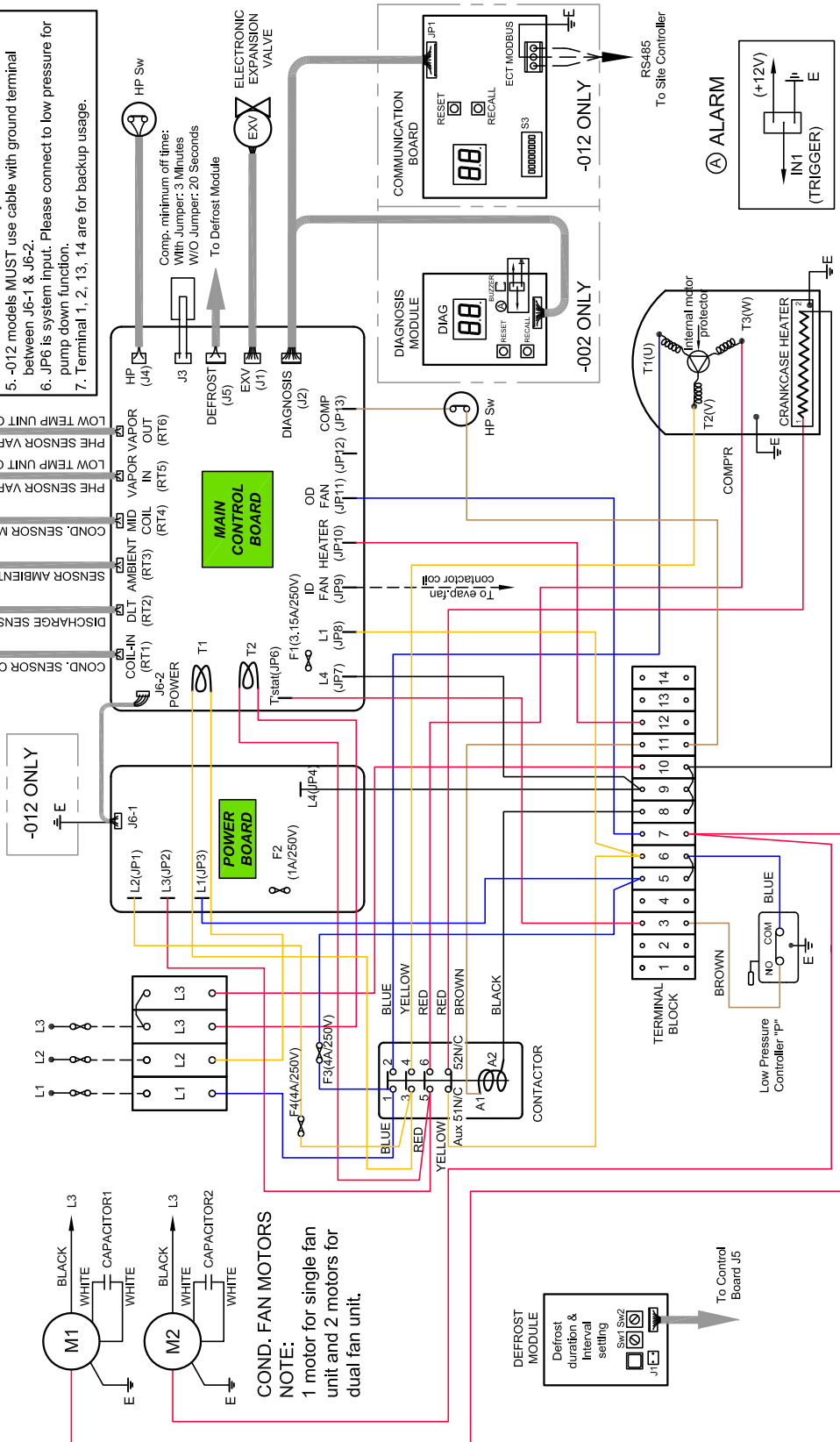## ATTENTION: Unit MUST be grounded!

Notes:
1. Dashed line " ----- " is wired by installer.
2. "L4" and Earth "E" wirings are not shown in harnesses for clarity.
3. Diagnosis module only exists in -002 models, Communication board only exists in -012 models.
4. -012 models MUST use cable with ground terminal between J6-1 & J6-2.
5. JP6 is system input. Please connect to low pressure for pump down function.
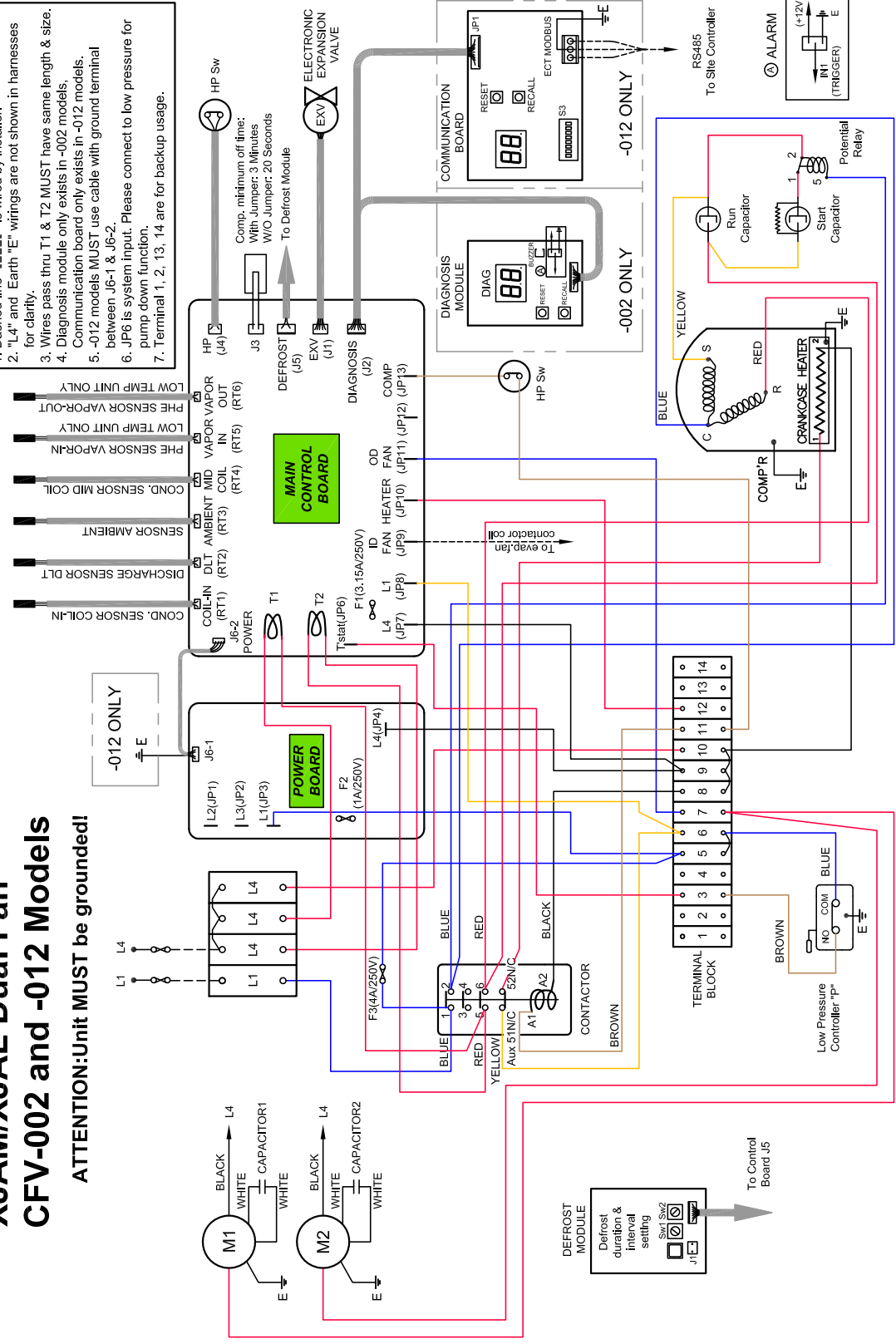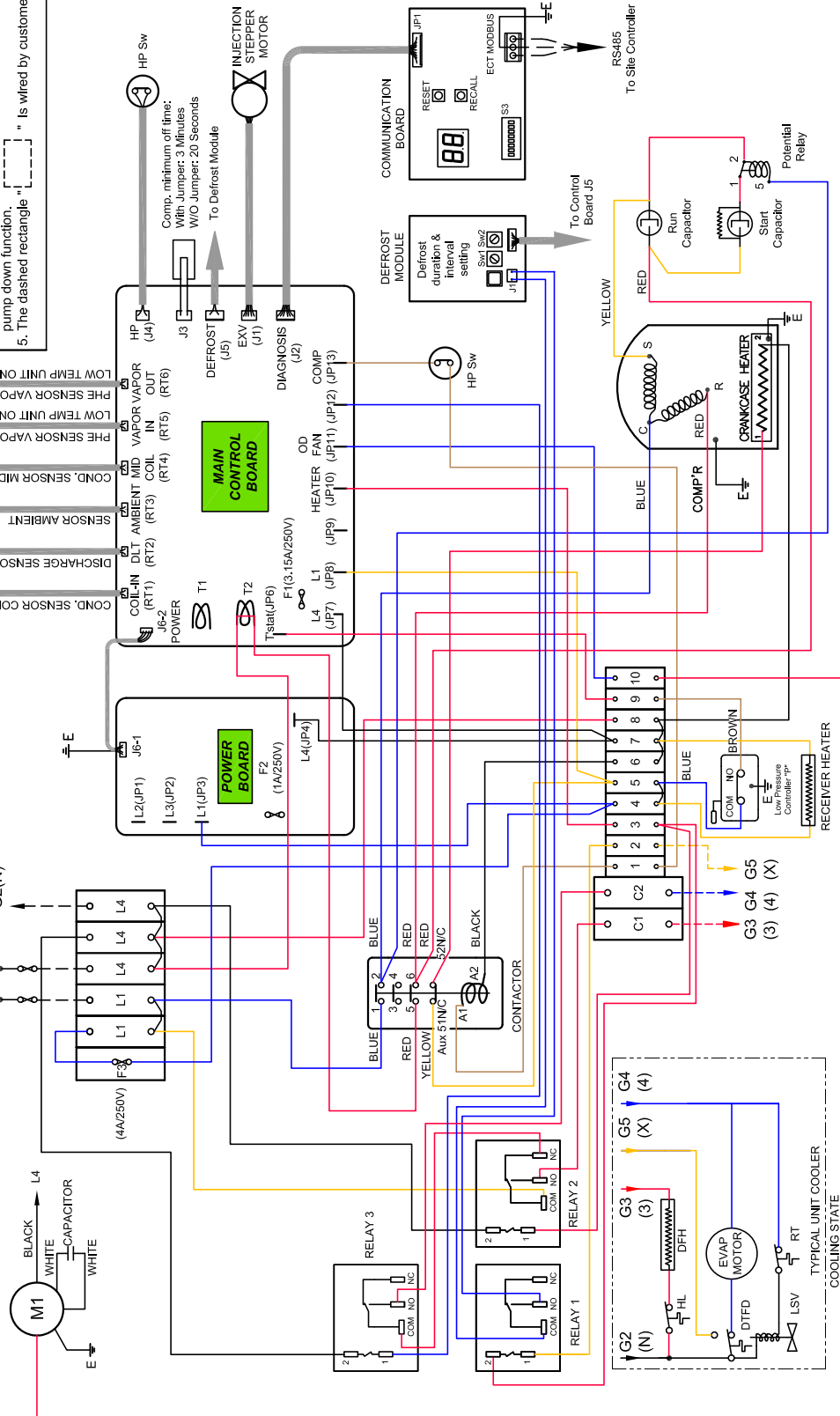6. Terminal 1, 2, 13, 14 are for backup usage.

HP Sw

ELECTRONIC EXPANSION VALVE

Comp. minimum off time:
With Jumper: 3 Minutes
W/O Jumper: 20 Seconds
To Defrost Module

COMMUNICATION BOARD
RESET   RECALL   ECT MODBUS
S3
-012 ONLY

RS485 To Site Controller

ALARM   (+12V)   E   IN1 (TRIGGER)

DIAGNOSIS MODULE
DIAG   BUZZER
RESET   RECALL
-002 ONLY

Potential Relay
Run Capacitor   Start Capacitor

YELLOW   RED

BLUE   RED

S   R   C

CRANKCASE HEATER

COMP'R   E

HP Sw

MAIN CONTROL BOARD

HP (J4)   J3   DEFROST (J5)   EXV (J1)   DIAGNOSIS (J2)
COMP (JP13)
OD FAN (JP12)
FAN (JP11)
HEATER (JP10)
FAN (JP9)
L1 (JP8)
L4 (JP7)

COIL-IN (RT1)   DLT (RT2)   AMBIENT (RT3)   MID COIL (RT4)   VAPOR IN (RT5)   VAPOR OUT (RT6)

COND. SENSOR COIL-IN
DISCHARGE SENSOR DLT
SENSOR AMBIENT
COND. SENSOR MID COIL   PHE SENSOR VAPOR-IN   LOW TEMP UNIT ONLY
PHE SENSOR VAPOR-OUT   LOW TEMP UNIT ONLY

J6-2 POWER   T1   T2   Tstat(JP6)   F1(3.15A/250V)   ID
To evap fan contactor coil

-012 ONLY   E

J6-1   POWER BOARD   L4(JP4)
L2(JP1)   L3(JP2)   L1(JP3)   F2 (1A/250V)

TERMINAL BLOCK
1 2 3 4 5 6 7 8 9 10 11 12 13 14

L1 L4   L4   L4   L1 L4

BLUE   RED   RED   BLACK

F3(4A/250V)
BLUE   1 2 3 4 5 6   52N/C   A2   A1
RED   YELLOW   Aux 51N/C
CONTACTOR   BROWN

BLUE   NO   COM
BROWN   E
Low Pressure Controller "P"

M1   BLACK   L4   WHITE   CAPACITOR   WHITE   E

DEFROST MODULE
Defrost duration & interval setting
Sw1 Sw2
J1
To Control Board J5

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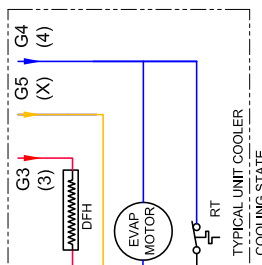# XJAM/XJAL Single and Dual Fan
TFC-002 and -012 Models

ATTENTION:Unit MUST be grounded!

NOTES:
1. Dashed line "_ _ _" is wired by installer.
2. Earth "E" wirings are not shown in harnesses for clarity.
3. "L4" shown on Power Supply Board & Main Control Board connect to Hotline "L3".
4. Diagnosis module only exists in -002 models, Communication board only exists in -012 models.
5. -012 models MUST use cable with ground terminal between J6-1 & J6-2.
6. JP6 is system input. Please connect to low pressure for pump down function.
7. Terminal 1, 2, 13, 14 are for backup usage.

HP Sw

ELECTRONIC EXPANSION VALVE

EXV

Comp. minimum off time:
With Jumper: 3 Minutes
W/O Jumper: 20 Seconds
To Defrost Module

COMMUNICATION BOARD

JP1

RESET   RECALL
ECT MODBUS
S3

-012 ONLY

RS485
To Site Controller

(+12V)   E
IN1
(TRIGGER)

ALARM

DIAGNOSIS MODULE
DIAG
BUZZER
RESET   RECALL

-002 ONLY

HP Sw

Internal motor protector
T1(U)   T3(W)
T2(V)
COMPR
CRANKCASE HEATER
E
E

MAIN CONTROL BOARD

HP (J4)
DEFROST (J5)
EXV (J1)
DIAGNOSIS (J2)

LOW TEMP UNIT ONLY
PHE SENSOR VAPOR-OUT   VAPOR OUT (RT6)
LOW TEMP UNIT ONLY
PHE SENSOR VAPOR-IN   VAPOR IN (RT5)
COND. SENSOR MID COIL   MID COIL (RT4)
SENSOR AMBIENT   AMBIENT (RT3)
DISCHARGE SENSOR DLT   DLT (RT2)
COND. SENSOR COIL-IN   COIL-IN (RT1)

COMP (JP13)
OD FAN (JP12)
FAN (JP11)
HEATER (JP10)
To evap.fan contactor coil
ID FAN (JP9)
L1 (JP8)
L4 (JP7)
F1(3.15A/250V)
Tstat(JP6)

J6-2 POWER
T1   T2

-012 ONLY   E

J6-1

POWER BOARD
F2 (1A/250V)
L2(JP1)   L3(JP2)   L1(JP3)
L4(JP4)

TERMINAL BLOCK
1 2 3 4 5 6 7 8 9 10 11 12 13 14

BLUE
BROWN
NO   COM
Low Pressure Controller "P"
E

L1 L2 L3
L1 L2 L3
L3

BLUE
YELLOW
RED
RED
BROWN
BLACK

F4(4A/250V)
F3(4A/250V)

BLUE
RED
YELLOW

1 2
3 4
5 6
Aux 51N/C 52N/C
A1   A2
CONTACTOR

COND. FAN MOTORS
NOTE:
1 motor for single fan unit and 2 motors for dual fan unit.

M1
BLACK   L3
WHITE   CAPACITOR1
WHITE
E

M2
BLACK   L3
WHITE   CAPACITOR2
WHITE
E

DEFROST MODULE
Defrost duration & Interval setting
Sw1 Sw2
J1

To Control Board J5

Application Engineering

Copeland®
brand products

EMERSON
Climate Technologies

B U L L E T I N

AE5-1377 R2

XJAM/XJAL Dual Fan
CFV-002 and -012 Models
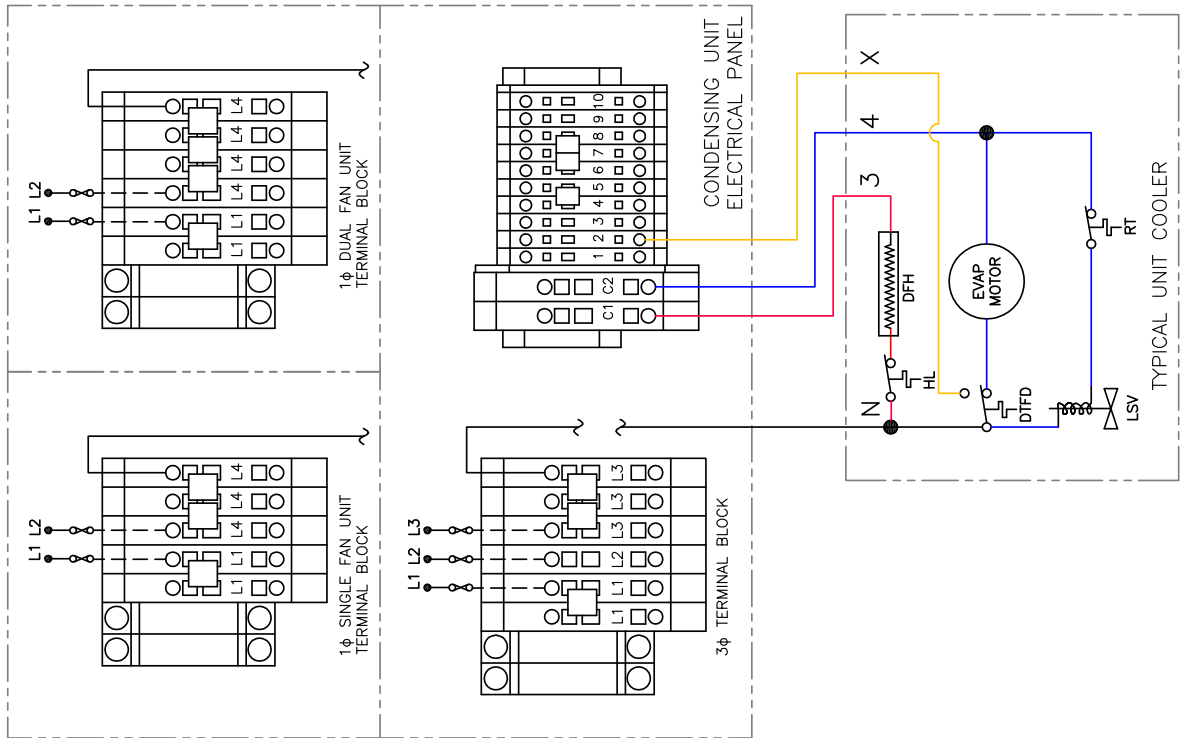### ATTENTION:Unit MUST be grounded!

Notes:
1. Dashed line " _ _ _ _ " is wired by installer.
2. "L4" and Earth "E" wirings are not shown in harnesses for clarity.
3. Wires pass thru T1 & T2 MUST have same length & size.
4. Diagnosis module only exists in -002 models, Communication board only exists in -012 models.
5. -012 models MUST use cable with ground terminal between J6-1 & J6-2.
6. JP6 is system input. Please connect to low pressure for pump down function.
7. Terminal 1, 2, 13, 14 are for backup usage.

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Application Engineering

B U L L E T I N

AE5-1377 R2

EMERSON
Climate Technologies

Copeland
brand products

XJAM/XJAL Single Fan CFV-022 Models

ATTENTION:Unit MUST be grounded!

NOTES:
1. Dashed line "– –" denotes wiring by installer.
2. Earth "E" wirings are not shown in harnesses for clarity.
3. MUST use cable with ground terminal between J6-1 & J6-2.
4. JP6 is system input. Please connect to low pressure for pump down function.
5. The dashed rectangle " ⌐ _ ┐ " Is wired by customer

HP Sw

INJECTION STEPPER MOTOR

COMMUNICATION BOARD
RESET RECALL S3
ECT MODBUS
JP1
E
RS485 To Site Controller

Comp. minimum off time:
With Jumper: 3 Minutes
W/O Jumper: 20 Seconds

To Defrost Module

DEFROST MODULE
Defrost duration & interval setting
Sw1 Sw2
J11

To Control Board J5

Potential Relay
1 2
5 1
Run Capacitor
Start Capacitor
RED
YELLOW

MAIN CONTROL BOARD

HP (J4)
J3
DEFROST (J5)
EXV (J1)
DIAGNOSIS (J2)
COMP (JP3)
OD FAN (JP11) (JP12)
HEATER (JP10)
(JP9)
L1 (JP8)
L4 (JP7)
F1(3.15A/250V)
Tstat(JP6)

HP Sw

COMP'R
S
C
R
RED
RED
BLUE
CRANKCASE HEATER
E

PHE SENSOR VAPOR-OUT   LOW TEMP UNIT ONLY
PHE SENSOR VAPOR-IN   LOW TEMP UNIT ONLY
COND. SENSOR MID COIL
SENSOR AMBIENT
DISCHARGE SENSOR DLT
COND. SENSOR COIL-IN

VAPOR OUT (RT6)
VAPOR IN (RT5)
MID COIL (RT4)
AMBIENT (RT3)
DLT (RT2)
COIL-IN (RT1)
J6-2 POWER
T1
T2

POWER BOARD
L2(JP1)
L3(JP2)
L1(JP3)
F2 (1A/250V)
L4(JP4)

J6-1
E

G2(N)
L4 L4
L4 L4
L1 L4
L1 L1
L1
(4A/250V) F3

BLUE
RED RED RED
52N/C
BLACK
1 2
3 4
5 6
Aux 51N/C
A2
A1
CONTACTOR
BLUE
YELLOW

BROWN
BLUE
COM NO
E
Low Pressure Controller "P"
RECEIVER HEATER

10 9 8 7 6 5 4 3 2 1
C2 C1

G5 (X)
G4 (4)
G3 (3)

M1
BLACK
WHITE
CAPACITOR
WHITE
L4
E

RELAY 3
COM NO NC
RELAY 1
COM NO NC
RELAY 2
COM NO NC

G4 (4)
G5 (X)
G3 (3)
DFH
HL
G2 (N)
DTFD
LSV
EVAP MOTOR
RT
TYPICAL UNIT COOLER
COOLING STATE

XJAM/XJAL Single And Dual Fan TFC-022 Models

ATTENTION:Unit MUST be grounded!

NOTES:
1. Dashed line "_ _ _" denotes wiring by installer.
2. Earth "E" wirings are not shown in harnesses for clarity.
3. "L4" shown on Power Supply Board & Main Control Board connect to Hotline "L3".
4. MUST use cable with ground terminal between J6-1 & J6-2.
5. JP6 is system input. Please connect to low pressure for pump down function.
6. The dashed rectangle "_ _ _" is wired by customer

HP Sw

INJECTION STEPPER MOTOR

Comp. minimum off time:
With Jumper: 3 Minutes
W/O Jumper: 20 Seconds

To Defrost Module

COMMUNICATION BOARD
JP1
RESET   RECALL
ECT MODBUS
S3
RS485 To Site Controller

DEFROST MODULE
Defrost duration & interval setting
Sw1 Sw2
To Control Board J5

MAIN CONTROL BOARD

HP (J4)
DEFROST (J5)
EXV (J1)
DIAGNOSIS (J2)
COMP (JP13)
OD FAN (JP12) (JP11)
HEATER (JP10)
(JP9)
L1 (JP8)
L4 (JP7)
F1(3.15A/250V)
Tstat(JP6)

HP Sw

LOW TEMP UNIT ONLY — PHE SENSOR VAPOR-OUT — VAPOR OUT (RT6)
LOW TEMP UNIT ONLY — PHE SENSOR VAPOR-IN — VAPOR IN (RT5)
COND. SENSOR MID COIL — AMBIENT MID COIL (RT4)
SENSOR AMBIENT — AMBIENT (RT3)
DISCHARGE SENSOR DLT — DLT (RT2)
COND. SENSOR COIL-IN — COIL-IN (RT1)
J6-2 POWER
T1   T2

T1(U)   T3(W)
internal motor protector
T2(V)
CRANKCASE HEATER
COMPR
E
COMP

POWER BOARD
F2 (1A/250V)
J6-1
L2(JP1) L3(JP2) L1(JP3)
L4(JP4)

BROWN
BLUE
COM NO
Low Pressure Controller "P"
RECEIVER HEATER

G2(N)

L3 L3 L3
L2 L2
L1 L1 L1
F4
F3

BLUE YELLOW RED RED BLACK
52NC BROWN
A2 A1
1 2 3 4 5 6
Aux 51NC
CONTACTOR

BLUE
YELLOW RED
YELLOW

C1   C2

G5 (X)
G4 (4)
G3 (3)

COND. FAN MOTORS
NOTE:
1 motor for single fan unit and 2 motors for dual fan unit.

M1
BLACK WHITE CAPACITOR1 WHITE L3
M2
BLACK WHITE CAPACITOR2 WHITE L3
(4A/250V)

RELAY 3
RELAY 2
RELAY 1
COM NO NC

TYPICAL UNIT COOLER
COOLING STATE
G4 (4)
G5 (X)
G3 (3)
DFH
EVAP MOTOR
RT
DTFD
HL
LSV
G2 (N)
DTFD

XJAM/XJAL Dual Fan
CFV-022 Models

ATTENTION:Unit MUST be grounded!

NOTES:
1. Dashed line "_ _ _ _" denotes wiring by installer.
2. Earth "E" wirings are not shown in harnesses for clarity.
3. Wires pass thru T1 & T2 must have same length & size.
4. MUST use cable with ground terminal between J6-1 & J6-2.
5. JP6 is system input. Please connect to low pressure for pump down function.
6. The dashed rectangle "⌐ ¬" is wired by customer

Application Engineering

Copeland
brand products

EMERSON
Climate Technologies

B U L L E T I N

AE5-1377 R2
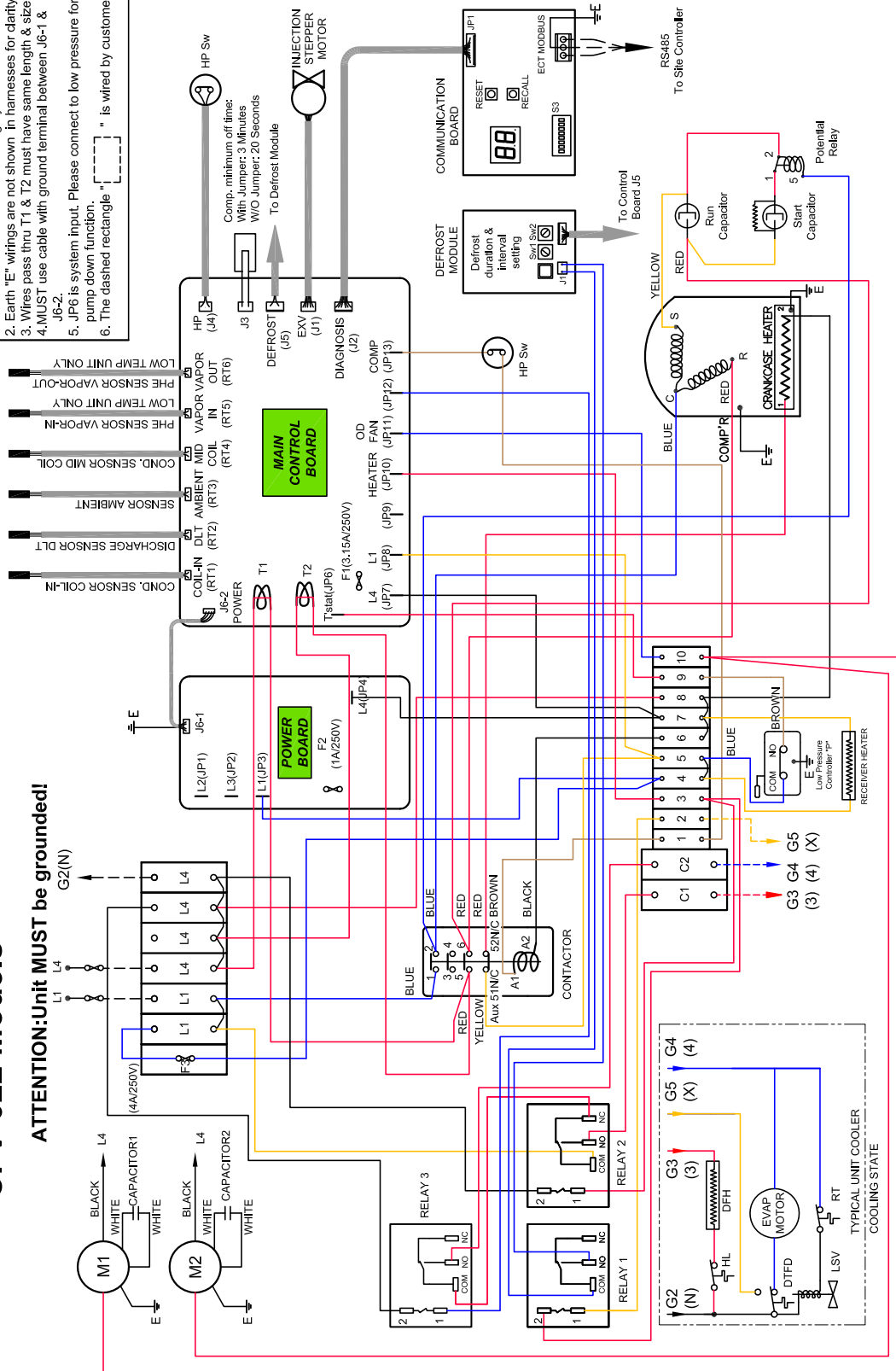
052-2596-00
2011-09-16

Defrost Wiring

DEFROST WIRING
ALL WIRES SHOWN ARE FIELD INSTALLED

LEGEND:

DFH........DEFROST HEATER
DTFD......DEFROST TERMINATION/FAN DELAY
HL...........HEATER LIMIT
LSV..........LIQUID SOLENOID VALVE
RT............ROOM THERMOSTAT

TERMINAL BLOCK CONNECTIONS:
2............DEFROST TERMINATION (L2) INPUT
C1...........HEATER LINE VOLTAGE (L1) OUTPUT
C2............FAN LINE VOLTAGE (L1) OUTPUT
L4............LINE VOLTAGE (L2) OUTPUT

1φ DUAL FAN UNIT TERMINAL BLOCK

1φ SINGLE FAN UNIT TERMINAL BLOCK

3φ TERMINAL BLOCK

CONDENSING UNIT ELECTRICAL PANEL

TYPICAL UNIT COOLER

EVAP MOTOR

DFH

Installation Instructions: XJ Scroll Condenser to E2

Overview

Copeland XJ Scroll Condenser Units are used for walk-in cooler and freezer applications. All units integrate the many benefits of scroll compressor technology, fan speed control, and Copeland PerformanceAlert™ diagnostic controls.

E2 communicates with the Copeland XJ Scroll Condenser One-way Communication Board via the RS485 MODBUS network. The E2 is used to receive alarm and notice status from the XJ Scroll condensers via the One-way Communication board. If the XJ Scroll condenser does not have a One-way Communication Board, one must be installed for E2 alarm and notice receiving. The E2 then provides the ability to assign delays and priorities to alarms or notices, but the alarms and notices can be logged in the E2.

Maximum Number of XJ Scroll units per E2:

E2 Model/Series	100	300	400
RX	4	8	16
CX	4	8	16

Table 1 - E2 Models

Network Wiring and Configuration

XJ Scroll Condensers connect to the E2 with the One-Way Communication Board using RS485 MODBUS.
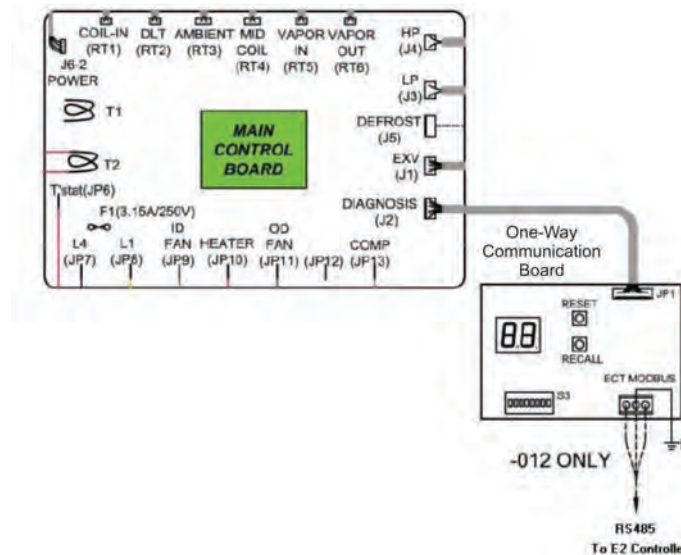
Figure 1 - XJ Scroll Connected to a One-Way Communication Board

Connect the XJ Scroll to the MODBUS network as shown in *Figure 2*. Connect the network cable to the three-terminal connector on the E2 COM port that has been configured as MODBUS port (COM 2, 4, or 6).

When the E2 is at one end of the daisy chain, terminate the E2 with all three jumpers in the terminated (UP) position.
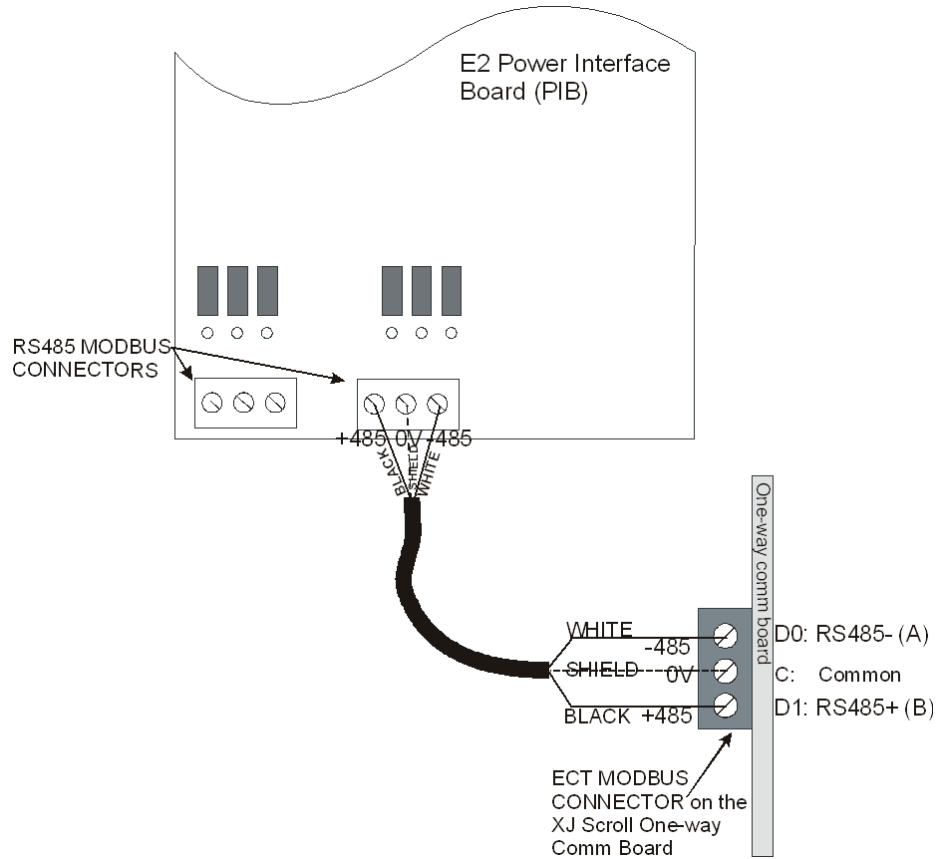
Figure 2 - E2 Modbus Connected to the One-Way Communication Board

XJ Scroll One-Way Communication Board Configuration

XJ Scroll address is determined using dip switches on the One-Way Communication Board. Switch numbers 1 to 6 set the slave address. Switch number 7 will set the Baud rate and switch number 8 will set the parity. The range of allowable addresses is 1 through 63. Refer to *Table 2* for settings.

Make sure that you are setting the same parity and baud rate as that in E2.

Please note the Termination JP3 Jumper is just used for the devices **at beginning or end of the chain** – any devices in the middle of the chain do not need it.

JP3 Termination Jumper ON = Add 150 Ohm resistor between A and B
JP3 Termination Jumper Off = Remove 150 Ohm resistor between A and B
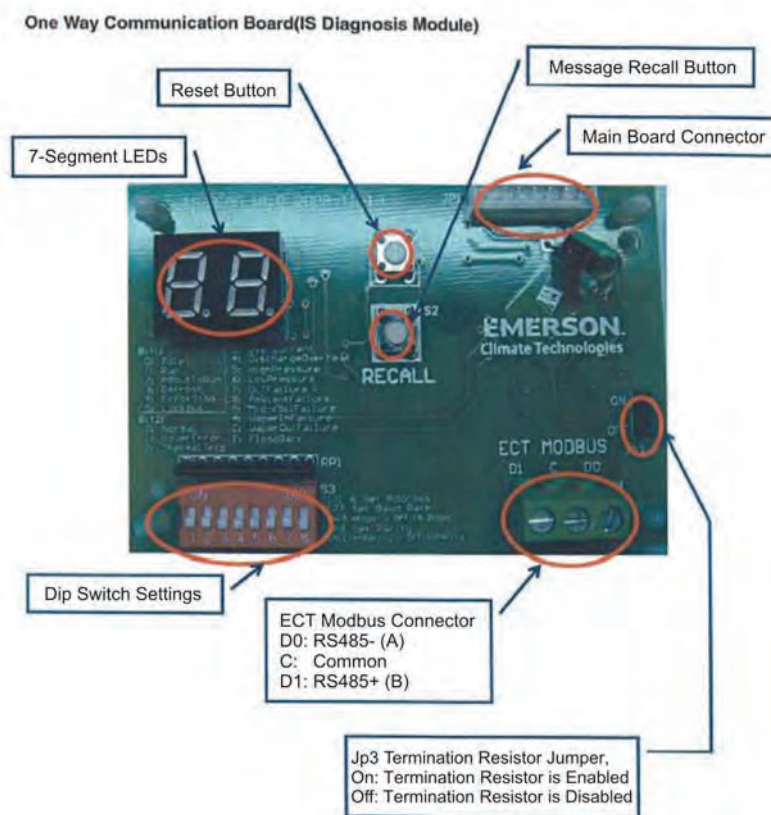
Figure 3 - XJ Scroll One-Way Communication Board

Dip Switch Address Settings

					•No.1~6: Set Slave Address •No.7: Set Baud Rate •No.8: Set Parity			
1	2	3	4	5	6	7	8	
Set Address								Address
OFF	OFF	OFF	OFF	OFF	ON	-	-	Address=1
OFF	OFF	OFF	OFF	ON	OFF	-	-	Address=2
OFF	OFF	OFF	OFF	ON	ON	-	-	Address=3
OFF	OFF	OFF	ON	OFF	OFF	-	-	Address=4
OFF	OFF	OFF	ON	OFF	ON	-	-	Address=5
OFF	OFF	OFF	ON	ON	OFF	-	-	Address=6
OFF	OFF	OFF	ON	ON	ON	-	-	Address=7
OFF	OFF	ON	OFF	OFF	OFF	-	-	Address=8
OFF	OFF	ON	OFF	OFF	ON	-	-	Address=9
OFF	OFF	ON	OFF	ON	OFF	-	-	Address=10
OFF	OFF	ON	OFF	ON	ON	-	-	Address=11
OFF	OFF	ON	ON	OFF	OFF	-	-	Address=12
OFF	OFF	ON	ON	OFF	ON	-	-	Address=13
OFF	OFF	ON	ON	ON	OFF	-	-	Address=14
OFF	OFF	ON	ON	ON	ON	-	-	Address=15
OFF	ON	OFF	OFF	OFF	OFF	-	-	Address=16
OFF	ON	OFF	OFF	OFF	ON	-	-	Address=17
ON	ON	OFF	OFF	OFF	ON	-	-	Address=18
OFF	ON	OFF	OFF	ON	ON	-	-	Address=19
OFF	ON	OFF	ON	OFF	OFF	-	-	Address=20
OFF	ON	OFF	ON	OFF	ON	-	-	Address=21
OFF	ON	OFF	ON	ON	OFF	-	-	Address=22
OFF	ON	OFF	ON	ON	ON	-	-	Address=23
OFF	ON	ON	OFF	OFF	OFF	-	-	Address=24
OFF	ON	ON	OFF	OFF	ON	-	-	Address=25
OFF	ON	ON	OFF	ON	OFF	-	-	Address=26

Table 2 - Address Settings

Installation Instructions: XJ Scroll Condenser to E2

			ON DIP 1 2 3 4 5 6 7 8			•No.1~6: Set Slave Address •No.7: Set Baud Rate •No.8: Set Parity		
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
OFF	ON	ON	OFF	ON	ON	-	-	Address=27
OFF	ON	ON	ON	OFF	OFF	-	-	Address=28
OFF	ON	ON	ON	OFF	ON	-	-	Address=29
OFF	ON	ON	ON	ON	OFF	-	-	Address=30
OFF	ON	ON	ON	ON	ON	-	-	Address=31
ON	OFF	OFF	OFF	OFF	OFF	-	-	Address=32
ON	OFF	OFF	OFF	OFF	ON	-	-	Address=33
ON	OFF	OFF	OFF	ON	OFF	-	-	Address=34
ON	OFF	OFF	OFF	ON	ON	-	-	Address=35
ON	OFF	OFF	ON	OFF	OFF	-	-	Address=36
ON	OFF	OFF	ON	OFF	ON	-	-	Address=37
ON	OFF	OFF	ON	ON	OFF	-	-	Address=38
ON	OFF	OFF	ON	ON	ON	-	-	Address=39
ON	OFF	ON	OFF	OFF	OFF	-	-	Address=40
ON	OFF	ON	OFF	OFF	ON	-	-	Address=41
ON	OFF	ON	OFF	ON	OFF	-	-	Address=42
ON	OFF	ON	OFF	ON	ON	-	-	Address=43
ON	OFF	ON	ON	OFF	OFF	-	-	Address=44
ON	OFF	ON	ON	OFF	ON	-	-	Address=45
ON	OFF	ON	ON	ON	OFF	-	-	Address=46
ON	OFF	ON	ON	ON	ON	-	-	Address=47
ON	ON	OFF	OFF	OFF	OFF	-	-	Address=48
ON	ON	OFF	OFF	OFF	ON	-	-	Address=49
ON	ON	OFF	OFF	ON	OFF	-	-	Address=50
ON	ON	OFF	OFF	ON	ON	-	-	Address=51
ON	ON	OFF	ON	OFF	OFF	-	-	Address=52
ON	ON	OFF	ON	OFF	ON	-	-	Address=53
ON	ON	OFF	ON	ON	OFF	-	-	Address=54
ON	ON	OFF	ON	ON	ON	-	-	Address=55

Table 2 - Address Settings

Installation Instructions: XJ Scroll Condenser to E2

1	2	3	4	5	6	7	8	
ON	ON	ON	OFF	OFF	OFF	-	-	Address=56
ON	ON	ON	OFF	OFF	ON	-	-	Address=57
ON	ON	ON	OFF	ON	OFF	-	-	Address=58
ON	ON	ON	OFF	ON	ON	-	-	Address=59
ON	ON	ON	ON	OFF	OFF	-	-	Address=60
ON	ON	ON	ON	OFF	ON	-	-	Address=61
ON	ON	ON	ON	ON	OFF	-	-	Address=62
ON	ON	ON	ON	ON	ON	-	-	Address=63
Set Baud Rate								Baud Rate
-	-	-	-	-	-	ON	-	9.6Kbps
-	-	-	-	-	-	OFF	-	19.2Kbps
Set Parity								Parity
-	-	-	-	-	-	-	ON	Even Parity
-	-	-	-	-	-	-	OFF	No Parity

Top note:
- No.1~6: Set Slave Address
- No.7: Set Baud Rate
- No.8: Set Parity

Table 2 - Address Settings

Network Connection to E2

Connecting an XJ Scroll Condenser to an E2 unit requires the E2 to be version 2.84 or above. Contact Retail Solutions for upgrade information if the controller is a version before 2.84.

An E2 has up to three COM ports that can be assigned for XJ Scroll board communication (COM2, an RS485 port on the E2 power interface board, and COM4 and COM6, which are external RS485 cards). COM ports can only be used for one function; in other words, if COM2 is set up as the I/O network, you cannot connect XJ Scroll boards to COM2. If COM2 is not used for XJ Scroll boards, ensure your E2 is equipped with an RS485 COM Card *(P/N 637-4890)* and configured in E2 General Services ([Menu] [7] [3] [1] or press [Alt]+[M], **Serial** tab) to enable COM4.

Connect the network cable to the three-terminal connector on the COM port that has been configured as XJ Scroll.

When the E2 is at one end of the daisy chain, terminate the E2 with all three jumpers in the terminated (UP) position.

E2 PIB COM PORT ASSOCIATIONS
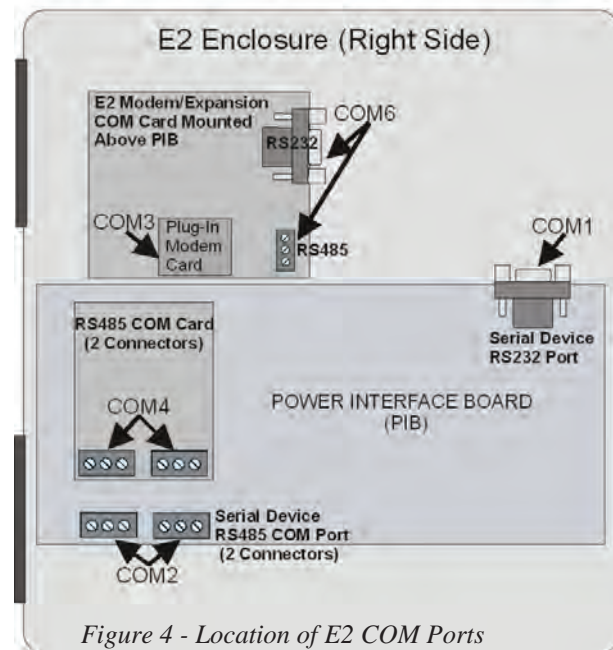
Figure 4 - Location of E2 COM Ports

E2 Setup of XJ Scroll Condensers

Set Up Network Ports

Before communicating to an XJ Scroll, the port on the E2 that has the cable connected to the XJ Scroll Condenser must be configured to use the XJ Scroll Condenser.

1. Log in to the E2 with Level 4 access.
2. Press [Menu] followed by [7] [3] [1] - **General Controller Info**.
3. Press [Ctrl]+[3] to open the **Serial** tab of the General Controller Info setup screens:
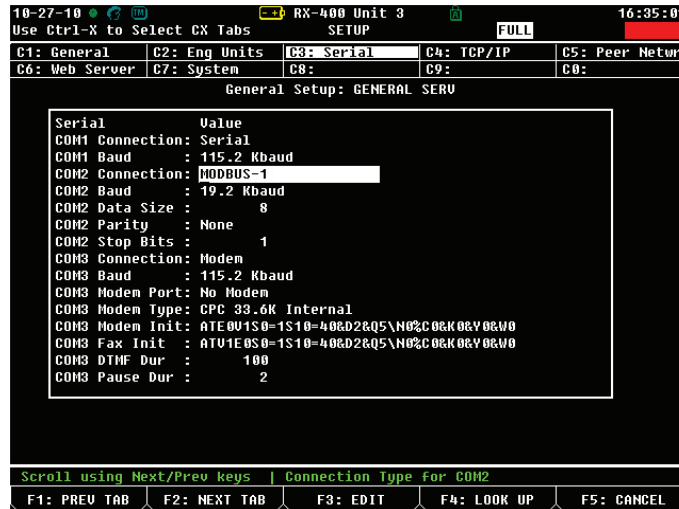
Figure 5 - Serial Communications Manager Screen

4. This screen will have a "Connection" field for all COM ports on the E2. Highlight the COM port connection field that will be used for MODBUS, and press `F4` - **LOOK UP**. From the list of network types, select **MODBUS** (**1-3**).

5. Four fields will become visible underneath the COM port connection field, which pertain to the way the device communicates:

   •**Baud -** Default setting is **19.2k**. The baud rate setting should be set to match the baud rate dip switch settings of all XJ Scroll devices. Refer to *Table 2*. (All devices connected to the same COM port should be set to the same baud rate.)

   •**Data Size -** Leave this field at the default value (**8**).

   •**Parity -** Leave this field at the default value (**None**). The parity settings should be set to match the parity dip switch settings of all XJ Scroll devices. Refer to Table 2.

   •**Stop Bits -** Leave this field at the default value (**1**).

6. Press ⬭ to save changes and exit.

Add and Connect XJ Scroll

To enable communications between E2 and the XJ Scroll, the devices must be added and addressed in E2.

1. Log in to the E2 with Level 4 access.
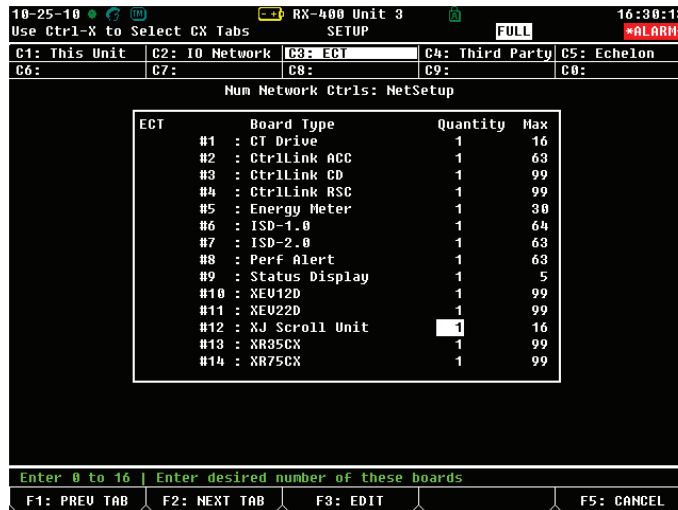2. Press [Menu] [7] [7] [2] - **Connected I/O Boards and Controllers**.

Figure 6 - Connected I/O Screen

3. In the Connected I/O screen, under the **ECT** tab, Enter the number of XJ Scroll devices in the **XJ Scroll Unit** number field.
4. Press [↩] to return to the Network Setup menu, then select [1] - **Network Summary**.
5. Locate the XJ Scroll units you added to the network list (press [Page Up] and [Page Down] to scroll through the list). The default name for an XJ Scroll begins with a two-letter designator of the model type (**XJ** for XJ Scroll).
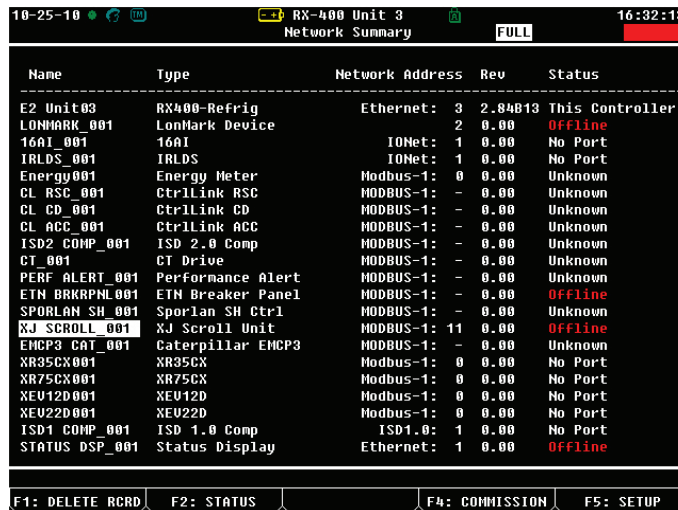
Figure 7 - Network Summary Screen

6. By default, each XJ Scroll's board number in the network list is indicated by a - (dash). To set the address and begin communication, press F4 to Commission. (If you have more than one MODBUS network, specify to which network you want the device to belong.) A screen will open that will allow you set the address:
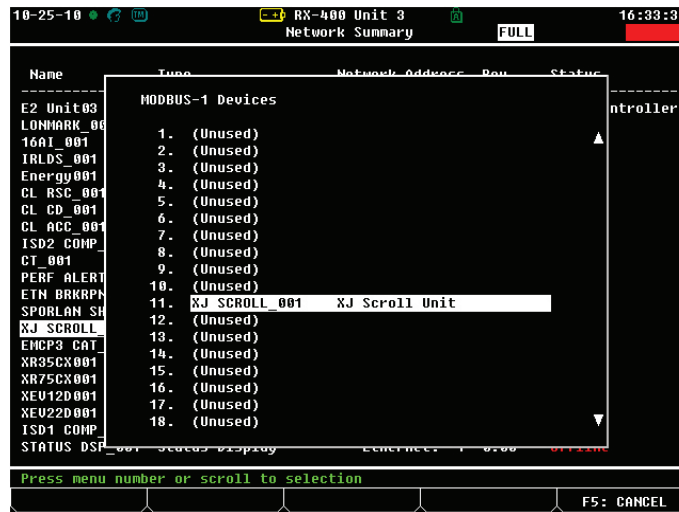

Figure 8 - Set Address of the XJ Scroll

7. In the list of MODBUS devices, choose the address number corresponding to the XJ Scroll One-way Communication Board address dip switch setting, and press Enter to select it. If a network ID has already been selected, its name will be shown next to the network ID in this list. If the network ID you are trying to assign has already been used, you must set the network ID dip switch on this device to a different number that is not being used.

8. Repeat *Steps 5* and *6* until each XJ Scroll device has been commissioned.

9. When finished, press 🔀 to return to the Network Setup menu, then press 1 - **Network Summary**. Locate the XJ Scrolls you set up, and look at each device's status in the **Status** field. You will see one of the following messages:

   •*Online* - The XJ Scroll is communicating normally.

   •*Offline* - The XJ Scroll is not communicating, has not been commissioned, is not functional, or is not powered up. Verify the XJ Scroll is powered up, wired correctly, and has the proper network address, baud rate, and parity.

   •*Unknown* - The XJ Scroll is not communicating or has not been commissioned. Verify the XJ Scroll is powered up, wired correctly, and has the proper network address, baud rate, and parity.

   •*No Port* - No port is set up in the E2 Serial Configuration Manager to be a MODBUS port.

   •*Wrong FW Rev* - This message is likely caused by the XJ Scroll having a firmware version older than the minimum revision required by E2 for communication. Replace the XJ Scroll One-way Communication Board with one that has the latest version of firmware on it.

Wiring Types

Retail Solutions specifies Belden #8641 shielded twisted pair cables for use as RS485 Bus wiring (or Belden #82761 and Belden #88761 for plenum installations).

If the recommended cable is not available in your area, be sure the wiring meets or exceeds the following specs:

Shielded?	Yes
Conductor Type	Twisted Pair
Gauge	18 - 24 AWG
Capacitance between signal wires	31 pF/ft or less (9.45 m) or less
Capacitance between signal and shield	59 pF/ft or less (17.98 m) or less
Maximum Length	4000 ft/18 to 22 AWG (1219.2 m) 2500 ft/24 AWG (762 m)
Nominal Impedance	120Ω±50Ω

Table 3 - Cable Specs

Appendix

Main Control Board Setting For XJAM CDU (Software Version 300-0043-06 V1.0)

Model Name	Rotary Switch	2bit Dip-Switch	3bit Dip-Switch
Control Board Default Setting	0	ON/ON	Bit 1: To set evaporator fan control mode - "OFF": Evaporator Fan On/Off Logic Same As Compressor - "ON": Evaporator fan will be ON all the time no mater whether compressor is ON/OFF or defrosting Bit 2: To set defrost mode - "OFF": Using Emerson defrost module - "ON": Using customer defrost module Bit 3: Not used yet.
ZX15KCE-TF5	1	ON/ON	
ZX15KCE-PFV	2	ON/ON	
ZX21KCE-TF5	3	ON/ON	
ZX21KCE-PFV	4	OFF/OFF	
ZX30KCE-TF5	5	ON/ON	
ZX30KCE-PFV	6	OFF/OFF	
ZX38KCE-TF5	7	OFF/OFF	
ZX38KCE-PFV	8	OFF/OFF	
ZX45KCE-TF5	9	OFF/OFF	

Table 4 - Settings for XJAM CDU

Main Control Board Setting For XJAL CDU (Software Version 300-0043-05 V1.0)

Model Name	Rotary Switch	2bit Dip-Switch	3bit Dip-Switch
Control Board Default Setting	0	ON/ON	Bit 1: To set evaporator fan control mode - "OFF": Evaporator Fan On/Off Logic Same As Compressor - "ON": Evaporator fan will be ON all the time no mater whether compressor is ON/OFF or defrosting Bit 2: To set defrost mode - "OFF": Using Emerson defrost module - "ON": Using customer defrost module Bit 3: Not used yet.
ZXI06KCE-TF5	1	ON/ON	
ZXI06KCE-PFV	2	ON/ON	
ZXI09KCE-TF5	3	ON/ON	
ZXI11KCE-PFV	4	OFF/OFF	
ZXI14KCE-TF5	5	OFF/OFF	
ZXI14KCE-PFV	6	ON/ON	
ZXI15KCE-TF5	7	OFF/OFF	
ZXI16KCE-PFV	8	OFF/OFF	
ZXI18KCE-TF5	9	OFF/OFF	

Table 5 - Settings for XJAL CDU

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