Application Engineering

CoreSense Diagnostic Modules for Copeland Scroll Refrigeration Compressors

BULLETIN NO: AE8-1424 R4

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COPELAND

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Safety

Important Safety Information

Those involved in the design, manufacture, and installation of a system, system purchasers, and service personnel may need to be aware of hazards and precautions discussed in this section and throughout this document. OEMs integrating the compressor into a system should ensure that their own employees follow this bulletin and provide any necessary safety information to those involved in manufacturing, installing, purchasing, and servicing the system.

Responsibilities, Qualifications and Training

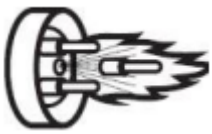
• OEMs are responsible for system design, selection of appropriate components, integration of this component into the system, and testing the system. OEMs must ensure that staff involved in these activities are competent and qualified.

• OEMs are also responsible for ensuring that all product, service, and cautionary labels remain visible or are appropriately added in a conspicuous location on the system to ensure they are clear to any personnel involved in the installation, commissioning, troubleshooting or maintenance of this equipment.

• Only qualified and authorized HVAC or refrigeration personnel are permitted to install, commission, troubleshoot and maintain this equipment. Electrical connections must be made by qualified electrical personnel.

• Observe all applicable standards and codes for installing, servicing, and maintaining electrical and refrigeration equipment.

Terminal Venting and Other Pressurized System Hazards



If a compressor's electrical terminal pin loses its seal, pressurized oil, refrigerant, and debris may spray out. This is called "terminal venting".

The ejected debris, oil, and refrigerant can injure people or damage property. The oil and refrigerant spray can be ignited by electrical arcing at the terminal or any nearby ignition source, producing flames that may project a significant distance from the compressor. The distance depends on the pressure and the amount of refrigerant and oil mixture in the system. The flames can cause serious or fatal burns and ignite nearby materials.

Each compressor has a terminal cover or molded plug that covers electrical connections. The cover or plug helps to protect against electric shock and the risks of terminal venting. If terminal venting occurs, the cover or plug helps contain the spray of refrigerant and oil and reduces the risk of ignition. If ignition occurs, the plug or cover helps contain the flames. However, neither the terminal cover nor the molded plug can completely eliminate the risk of venting, ignition, or electric shock.

See copeland.com/terminal-venting for more details about terminal venting. Additionally, a compressor's refrigerant lines keep refrigerant and oil under pressure. When removing or recharging refrigerant from this component during service, this can pose a pressurized fluid hazard.

Flammable Refrigerant Hazards

If flammable refrigerant is released from a system, an explosive concentration can be present in the air near the system. If there is an ignition source nearby, a release of flammable refrigerant can result in a fire or explosion. While systems using flammable refrigerant are designed to mitigate the risk of ignition if the refrigerant is released, fire and explosion can still occur.

See copeland.com/flammable-refrigerants for more information on flammable refrigerant safety.

Electrical Hazards

Until a system is de-energized, and capacitors have been discharged, the system presents a risk of electric shock.

Hot Surface and Fire Hazards

While the system is energized, and for some time after it is deenergized, the compressor may be hot. Touching the compressor before it has cooled can result in severe burns. When brazing system components during service, the flames can cause severe burns and ignite nearby combustible materials.

Lifting Hazards

Certain system components may be very heavy. Improperly lifting system components or the compressor can result in serious personal injury. Use proper lifting techniques when moving.

POE Oil Hazards

This equipment contains polyol ester (POE) oils. Certain polymers (e.g., PVC/CPVC and polycarbonate) can be harmed if they come into contact with POE oils. If POE oil contacts bare skin, it may cause an allergic skin reaction.

Precautions

• Always wear personal protective equipment (gloves, eye protection, etc.).

• Keep a fire extinguisher at the jobsite at all times.

• Keep clear of the compressor when power is applied.

- IMMEDIATELY GET AWAY **if you hear unusual sounds in the compressor. They can indicate that terminal pin ejection may be imminent. This may sound like electrical arcing (sizzling, sputtering or popping). However, terminal venting may still occur even if you do not hear any unusual sounds.**

• Never reset a breaker or replace a blown fuse without performing appropriate electrical testing

- **A tripped breaker or blown fuse may indicate an electrical fault in the compressor. Energizing a compressor with an electrical fault can cause terminal venting. Perform checks to rule out an electrical fault.**

• Disconnect power and use lock-out/tag-out procedures before servicing.

- Before removing the terminal cover or molded plug, check that ALL electrical power is disconnected from the unit. Make sure that all power legs are open. (Note: The system may have more than one power supply.)

- Discharge capacitors for a minimum of two minutes

- Always use control of hazardous energy (lock-out/tag-out) procedures to ensure that power is not reconnected while the unit is being serviced.

• Allow time for the compressor to cool before servicing.

- Ensure that materials and wiring do not touch high temperature areas of the compressor.

• Keep all non-essential personnel away from the compressor during service.

• For A3 refrigerants (R290) remove refrigerant from both the high and low sides of the compressor. Use a recovery machine and cylinder designed for flammable refrigerants. Do not use standard recovery machines because they contain sources of ignition such as switches, high- and low-pressure controls and relays. Only vent the R290 refrigerant into the atmosphere if the system is in a well-ventilated area.

• Never use a torch to remove the compressor. Only tubing cutters should be used for both A2L and A3 refrigerants.

• Use an appropriate lifting device to install or remove the compressor.

• Never install a system and leave it unattended when it has no charge, a holding charge, or with the service valves closed without electrically locking out the system.

• Always wear appropriate safety glasses and gloves when brazing or unbrazing system components.

• Charge the system with only approved refrigerants and refrigeration oils.

• Keep POE oils away from certain polymers (e.g., PVC/CPVC and polycarbonate) and any other surface or material that might be harmed by POE oils. Proper protective equipment (gloves, eye protection, etc.) must be used when handling POE lubricant. Handle POE oil with care. Refer to the Safety Data Sheet (SDS) for further details.

• Before energizing the system:

1. Securely fasten the protective terminal cover or molded plug to the compressor, and

2. Check that the compressor is properly grounded per the applicable system and compressor requirements.

Signal Word Definitions

The signal word explained below are used throughout the document to indicate safety messages.

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

CoreSense Diagnostics Module Introduction

Introduction

The CoreSense Diagnostics module for Copeland Scroll refrigeration compressors (referred to as “the CoreSense module” in this document) is a breakthrough innovation for monitoring and protecting the compressor as well as alerting the contractor to refrigeration system faults. It also can perform digital unloading, liquid injection control, and can detect the cause of system related issues by monitoring the discharge line temperature and current.

A flashing LED indicator communicates the alert code and guides the service technician more quickly and accurately to the root cause of a problem. The CoreSense module is factory installed in the electrical box of all 7.0 - 17 HP Scroll Family ZB*K5 & ZF*K5 refrigeration compressors. It is also offered as a panel mount for an aftermarket solution from Copeland Distribution Services for the 2.0 – 7.5HP Family (ZB*KA/C/Q & ZF*K4/KVE) compressors. Refer to Pg. 42 for charts with model number identification. The CoreSense modules offered on the different compressor families are not interchangeable due to different current operating ranges of the compressors.

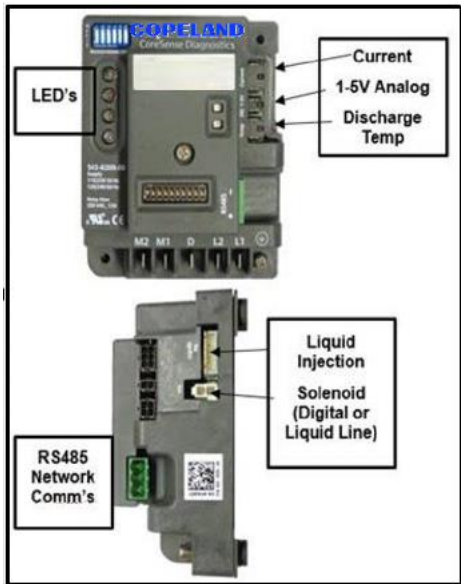


Figure 1 – CoreSense Diagnostics Module

CoreSense Diagnostics Module Overview

Current Signal Input

This connector is where the current transducer (CT) is plugged into the CoreSense module. In **Figure 1**, this input is labeled ‘Current’. For 7.0 – 17 HP models, the minimum compressor running current is 3 Amps, and for the 2.0 – 7.5HP compressors, it is 1 Amp. This input is used to tell the CoreSense module the running state of the compressor. Compressor protective alert codes, injection, and modulation control will only be active when the current transducer is plugged in and current is sensed through the CT.

1-5V Analog Input

1-5V analog input supplied from a separate device, controller, etc. for digital modulation. This would utilize the input labeled ‘DIG 1-5V’. A separate demand input is not required if this input is used. Digital modulation can also be performed via communication and would eliminate the need for a separate 1-5 V analog input.

Discharge Temperature Input

In **Figure 1**, the discharge temperature thermistor input is labeled ‘Temp’. CoreSense can utilize both discharge line temperature probes and top cap probes for various compressor applications. When the probe is plugged into the thermistor input, the CoreSense module identifies the probe type (line or top cap) based on pin locations. Refer to **Table 6** and **Table 7** for specific probe part numbers. Please note that only a top cap temperature probe can be used for low temp models using liquid injection. If a line probe is used, an error code will occur.

Digital Modulation and RS485 Network Communication

Digital modulation commands are communicated via RS485 network communications to the CoreSense module. If you are controlling through network

communications, 1-5V and demand inputs are not used for this configuration.

Unloading capacities for the compressors are as follows:

ZBD*KC/Q & ZFD*K4/KVE
2.0 -7.0 HP Copeland Scroll: 10 to 100%

ZBD*K5 & ZFD*K5
7.0 -17 HP Low Temp Refrigeration K5 Scroll: 30 to 100%
7.0-17 HP Med Temp Refrigeration K5 Scroll: 10 to 100%

Liquid Injection Output

The CoreSense module can also provide liquid injection for Low Temp Scroll compressors. This connector is a 12VDC output to a stepper motor that drives the EXV that is plumbed to the compressor. In **Figure 1,** this output is labeled 'LIQUID INJ'.

Please note that the EXV for the compressor families are not interchangeable due to different orifice sizes.

ZB*KA/C/Q & ZF*K4/KVE
2.0 -7.0 HP Copeland Scroll: 1.3 mm EXV

ZB*K5 & ZF*K5
7.0-17 HP Refrigeration K5 Scroll: 1.8 mm EXV

Refer to **Table 6** for EXV, stepper motor, and extension cable part numbers.

Solenoid Output

The solenoid output labeled 'SOL' on the CoreSense module can be used for either digital capacity control or liquid line solenoid control. For digital compressors (ZFD/ZBD), Copeland recommends using this output for digital capacity control vs. liquid line solenoid control. For digital low temperature, compressors using liquid injection (ZFD*K5 or K4), use a current sense relay for the liquid line solenoid control.

a) **Digital Solenoid**
This is a 110VAC/220VAC solenoid output (labeled 'SOL') which is used to control the digital operation.

b) **Liquid Line Solenoid**
For fixed capacity compressors, the liquid line solenoid can also be controlled by the CoreSense module, by using the 'SOL' output. This eliminates the need for a separate relay to control the liquid line solenoid supplying the liquid injection EXV. Use the connector supplied in the kit to attach the solenoid wires to the CoreSense.

NOTE: Refer Table 7 for kit details and extension cables for remote mount models.

CoreSense Module LED Overview

LED Overview

The CoreSense module has four LED's, green, yellow, red, and blue, that are on the face of the module. These LED's will flash compressor codes or stay solid depending upon the code that is being annunciated by the CoreSense module.

The CoreSense module can shut down the compressor if an abnormal condition is detected. This is performed by opening M1-M2 relay on the CoreSense which is wired in series with the compressor contactor coil. For a list of protective alerts and features, see **Figure 11**.

There are different categories of flashing codes that the CoreSense Module can annunciate - (Green) normal operation, (Yellow) tripped condition, (Red) lockout, and (Blue) demand error codes and unloading status.

The CoreSense module will trip the compressor "off" when any of the following severe alert conditions (Codes 1, 2, 4, 6, 7 or 9) are detected. Refer to **Table 3** for Fault Code Identification. Alert code 7, reverse phase detection, is the only severe alert code that defaults to a lockout and cannot be configured. A trip condition is when the CoreSense pilot circuit relay interrupts the contactor which results in stopping the compressor motor. A trip condition will automatically allow the compressor to run once the trip condition is satisfied and a protective off time has elapsed.

A lockout event results in the CoreSense module shutting down the compressor and not allowing it to restart until the situation is corrected and the module is manually reset. A manual reset is done by cycling power to the module. Other codes can be configured to lockout, these codes include high discharge temperature, locked rotor and phase loss. **See Table 3** for more information on the default number of consecutive trips before a lockout. These default values can be configured through the E2 or PCIF.

Table 3 indicates how to read the LED's codes. If an alert code is present, the CoreSense module will continue to annunciate the code until the condition is cleared or module power is cycled.

Green LED:

SOLID: Normal compressor operation
FLASHING: Alert codes that do NOT have a protective shutdown associated with them.

Yellow LED:

FLASHING: Alerts of an abnormal system condition via alert codes.
SOLID: Demand is present, but no current is detected. All protective shutdowns will auto reset once tripped condition is satisfied and a protective off time has elapsed.

Red LED:

FLASHING: Indicates the CoreSense module is locked out on the flashing alert code. Manual power cycle reset is required to clear the lockout and restart the compressor

Blue LED:

FLASHING: Indicates demand error codes.
SOLID BLUE LIGHT: Indicates digital unloader is energized. This time varies based on capacity request (2-20 seconds).

For an explanation of each code and troubleshooting tips, refer to **Table 4** at the end of this document.

CoreSense Diagnostics Part Number & Compressor Applications

There are two different Scroll CoreSense module part numbers, one for the 7.0-17HP K5 and one for the 2.0 -7.5 HP compressor families. This is due to the difference in the compressor operating current ranges. It is important to select the correct part number per the compressor family to avoid nuisance trips.

2.0 -7.5 HP Scrolls (ZB*KA/C/Q & ZF*K4/KVE) CoreSense P/N 543-0223-00 (Panel Mounted)

The CoreSense module is not accurate below 1 Amp. If the current drawn by the compressor during operation falls below 1 Amp, the module may indicate a nuisance trip.

7.5-15 HP Scrolls (ZB*K5 & ZF*K5) CoreSense P/N 543-0209-00 (T-Box Mounted)

The CoreSense module is not accurate below 3 Amps. If the current drawn by the compressor during operation falls below 3 Amps, the module may indicate a nuisance trip.

NOTE: In low current applications, it is applicable for both modules to loop the power leads through the current sensor twice. This will double the current value the CoreSense module reads and eliminate the low current nuisance trip.

Product Specifications

Specifications

Operating Temp: -40° to 150°F (-40° to 65°C)
Storage Temp: -40° to 175°F (-40° to 80°C) Power Supply Range: 85-265VAC, 50-60 Hz
CoreSense Compressor Amperage Detection Range:

ZB*KA/C/Q & ZF*K4/KVE
1-76 Amps 2 - 7.5HP Copeland Scroll Applications

ZB*K5 & ZF*K5
3-200 Amps 7.5 - 15HP K5 Applications

Maximum continuous contactor coil current is 2A with a max inrush current of 20A.
The CoreSense module connections are ¼ in male terminals.

CoreSense Module Mounting

2.0 -7.5 HP Scrolls (ZB*KA/C/Q & ZF*K4/KVE

CoreSense is offered as a **panel mounted** solution for the **2-7.5 HP Copeland Scroll compressors**. These kits are offered through Copeland Distribution Services. See Kits and Accessories Section, for kit number information. **Figure 2** shows the panel mounted solution for a refrigeration application. It should be noted that the module is not IP rated and requires an electrical enclosure for protection from the elements. Care should be taken to place the module in a location where it will not get wet.

Figure 2 – Panel Mount CoreSense Module 2.0 – 7.5HP Copeland Scroll Compressors

7.5-15 HP Scrolls (ZB*K5 & ZF*K5)

The CoreSense module will come pre-mounted inside the compressor terminal box from the factory. The module is mounted so all LEDs are in front of the light pipes in the terminal covers so codes are visible when the terminal box cover is installed. The CoreSense module is installed inside the terminal box with a torque of 8-inch pounds. See **Figure 3.**

Figure 3 – Terminal Box Mount CoreSense Diagnostics

Network DIP Switch Configuration

Figure 4 shows the two DIP switch panels. The brown DIP switch panel has 10 positions and is located near the center of the CoreSense module. The blue DIP switch panel has 6 positions and is in the upper left corner of the CoreSense module.

Figure 4 – CoreSense Diagnostics DIP Switches

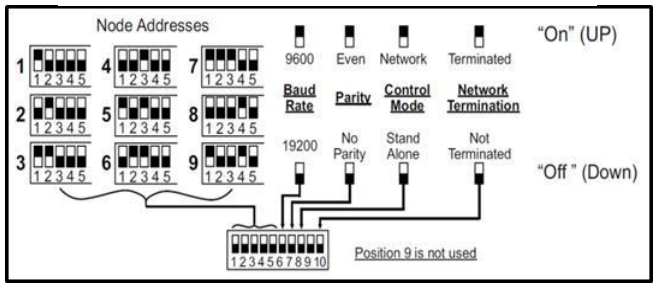


Figure 5 - CoreSense Diagnostics DIP Switches

Figure 6 – Brown 10 Position

Switches 1-5

Switches 1 through 5 are used for setting the node address for each CoreSense module. The CoreSense module uses a binary addressing for switches 1-5. The unique combination of these switches will define the node address 1 -31. Use **Table 1** as a reference to setting node addresses.

Table 1 - Node Address DIP Switch Configurations

Node Address	1	2	3	4	5
#1	On	Off	Off	Off	Off
#2	Off	On	Off	Off	Off
#3	On	On	Off	Off	Off
#4	Off	Off	On	Off	Off
#5	On	Off	On	Off	Off
#6	Off	On	On	Off	Off
#7	On	On	On	Off	Off
#8	Off	Off	Off	On	Off
#9	On	Off	Off	On	Off
#10	Off	On	Off	On	Off
#11	On	On	Off	On	Off
#12	Off	Off	On	On	Off
#13	On	Off	On	On	Off
#14	Off	On	On	On	Off
#15	On	On	On	On	Off
#16	Off	Off	Off	Off	On
#17	On	Off	Off	Off	On
#18	Off	On	Off	Off	On
#19	On	On	Off	Off	On
#20	Off	Off	On	Off	On
#21	On	Off	On	Off	On
#22	Off	On	On	Off	On
#23	On	On	On	Off	On
#24	Off	Off	Off	On	On
#25	On	Off	Off	On	On
#26	Off	On	Off	On	On
#27	On	On	Off	On	On
#28	Off	Off	On	On	On
#29	On	Off	On	On	On
#30	Off	On	On	On	On
#31	On	On	On	On	On

NOTE: Each connected CoreSense Diagnostics device must have its own unique node address.

Switch 6

CoreSense Diagnostics Modbus communication baud rate setting is configurable to either 19200 or 9600 through DIP switch 6 on the 10-position dip switch.

ON = 9600
OFF = 19200 (Default)

The baud rate for each of the CoreSense devices should be set to match the rack controller. To determine the baud rate in the E2, follow these steps:

- From the main menu select 7 (System Configuration)
- Press 3 (System Information)
- Press 1 (General Controller Info)
- Access the Serial Communications Tab by pressing CTRL + 3
- Use the Page Down button or scroll down to view the settings for COM4.

Switch 7

CoreSense Diagnostics Modbus communication parity is user configurable (even or no parity) through DIP switch number 7

ON = even parity
OFF = no parity (default)

The parity setting must match the parity setting of the rack controller.

Switch 8

Switch 8 is used to set the module to be in network mode or standalone.

ON = Network Mode
OFF = Standalone (Default)

Network mode will generate a communications error if the rack controller fails to communicate with the device. For standalone mode, no communications are expected so the communication error is blocked. The CoreSense Diagnostics module can communicate with a rack controller using Modbus protocol. The communication cable is wired from the rack controller to the first compressor. Additional compressors are wired in a daisy chained configuration. A shielded, twisted pair cable such as Belden #8761 (22 AWG) should be used for the communication wiring. Passing the communications wire through the grommet in the plastic housing will help reduce abrasion to the wiring. Appropriate strain relief is recommended.

Modules using a communications network must be commissioned as part of the E2 rack controller setup. The commissioning process uploads compressor asset information (model and serial number) into the rack controller for future reference. Once the commissioning process is completed, the controller will supervise and communicate with the module unless the node is deleted. Refer to AE-1383 section titled Modbus® Communication to CoreSense Diagnostics for K5.

Compressors or an E2 manual for more details on commissioning the scrolls with a Copeland Retail Solutions E2 rack controller.

NOTE: For digital capacity using an E2 controller, an enhanced suction group must be enabled.

More information: The E2 jumpers on the Network Interface Board should be set for “terminated”.

NOTE: The RS485 is polarity sensitive. “+” wires must connect to other “+” terminals, and “-” wires must connect to other “-” terminals. The shield wire is connected to the center terminal, or “0 volt” position.

Figure 7 – CoreSense Modbus Connections

* These guidelines are based on E2 firmware version

3.0 and are subject to change. Contact your Copeland representative or refer to the operation manual for more details on configuring an E2 module.

Switch 9

The Copeland Scroll compressor model numbers include the nominal capacity at the standard 60 Hertz “ARI” rating conditions with R-404A refrigerant. Switch 9 is NOT used.

Switch 10

The Copeland Scroll compressor model numbers include the nominal capacity at the standard 60 Hertz “ARI” rating conditions with R-404A refrigerant.

Compressor DIP Switch Configuration

Figure 8 – Blue 6 Position

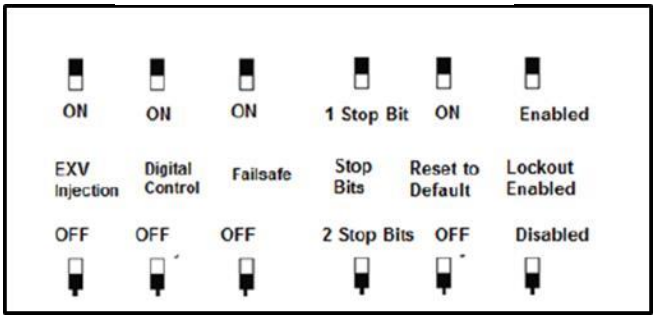


Figure 9 – CoreSense Compressor DIP Switch Settings

Switch 1

Switch 1 is used to enable liquid injection EXV control. The ‘on’ position enables the EXV control via the CoreSense module.

Switch 2

Switch 2 is used to enable digital capacity control. The ‘on’ position enables digital capacity control via the CoreSense Module.

ZB*KC & ZF*K4/KVE& ZB*K5
10 -100 % Capacity for 2.0 – 7.5 HP & Medium Temp K5

ZF*K5
30 -100% Capacity for Low Temp K5

Switch 3

Switch 3 is used for failsafe mode. The ‘on’ position will allow the compressor to run at full load if communications between the CoreSense module and the rack controller is lost. If in the ‘off’ position, the compressor turns off if communication is lost between the two devices.

Switch 4

Switch 4 affects standard Modbus®. For applications using IPRO or XWeb (Dixell) 'non-standard Modbus turn switch 4 ‘on’. For Standard Copeland Modbus, the DIP switch orientation doesn't matter. For all other standard Modbus, DIP switch 4 should be in the ‘off’ position.

CoreSense Diagnostics Modbus communication stop bits is user configurable to either be 1 or 2 stop bit.

DIP switch number 4 on the main DIP switch board is used to configure stop bit.

ON = 1 stop bits
OFF = 2 stop bits (Default)

Switch 5

Switch 5 is used to return module to factory defaults. By resetting the module all configurations and module history will be erased. To reset, switch 5 must transition from 'off' to 'on' within 5 seconds of module power up.

Switch 6

Switch 6 is used to enable/disable lockouts. The 'on' position will enable lockouts for the following codes: high discharge temperature, missing phase, and locked rotor. Reverse phase is automatically a lockout and cannot be configured. If this switch is 'on' each of these lockouts can be individually configured to a specific number of trips before a lockout. This is done over communications or via the PCIF Software (available Copeland/OPI site).

CoreSense Diagnostics Wiring

Current Transducer (P/N 543-0159-00)

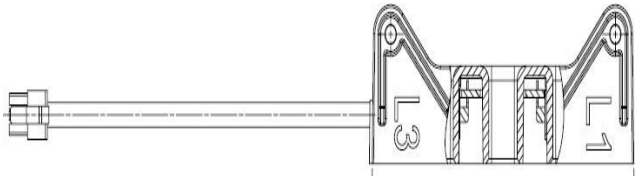


Figure 10

A current transducer (CT) is used in conjunction with the CoreSense module to detect the running state of the compressor. The compressor power wires T1, T2, and T3 must be routed from the contactor through the CT L1, L2, and L3, respectively, to detect the running state of the compressor. It is important that the compressor power wires are routed in respect to the markings on the current transducer. For 7.0 – 28 HP compressors, the CT is mounted in the terminal box. For 2.0 – 7.0 HP applications, the CT is mounted in the panel near the CoreSense module. If needed for 2.0 – 7.0 HP applications, an extension cable is available.

NOTE: Only the compressor lead wires should be placed through the CT module. If the compressor lead wires do not match the L1, L2, and L3 Current Transducer holes, the compressor current measurement will be incorrect.

110-230VAC CoreSense Module Power Wiring

The CoreSense module requires 110-230VAC power between to the L1 and L2 terminals on the module. The module should remain powered through all states of compressor on/off operation. Refer to wiring schematic examples shown in the following section.

Module Wiring Diagrams

There are 3 basic applications that require specific wiring schematics and DIP switch configurations.

1. Fixed Capacity using the Demand Input (Figure 11)
2. Digital Compressors using Analog Input for the modulation (Figure 12)
3. Digital or Non-Digital compressors using control via communications (Figure 13)

It should be noted that CoreSense modules with p/n 543-0209-00 and 543-0223-00 have a normally open M1-M2 relay and that will only close when the demand is present. This eliminates the need for a cycling device to be supplied externally from the module. On a detected tripped or lockout condition, the CoreSense module will de-energize the M1-M2 relay to stop the motor from running.

1. Fixed Capacity Using Demand Input

Figure 11 shows the wiring diagram for a fixed capacity compressor using a demand signal. The demand signal must be supplied from a control relay and wired to the "D" terminal of the module. It is preferred the demand wired upstream of any other device in the pilot circuit.

Note: Referring to **Figure 11**, the Blue DIP Switch #2 is "OFF" for fixed capacity.

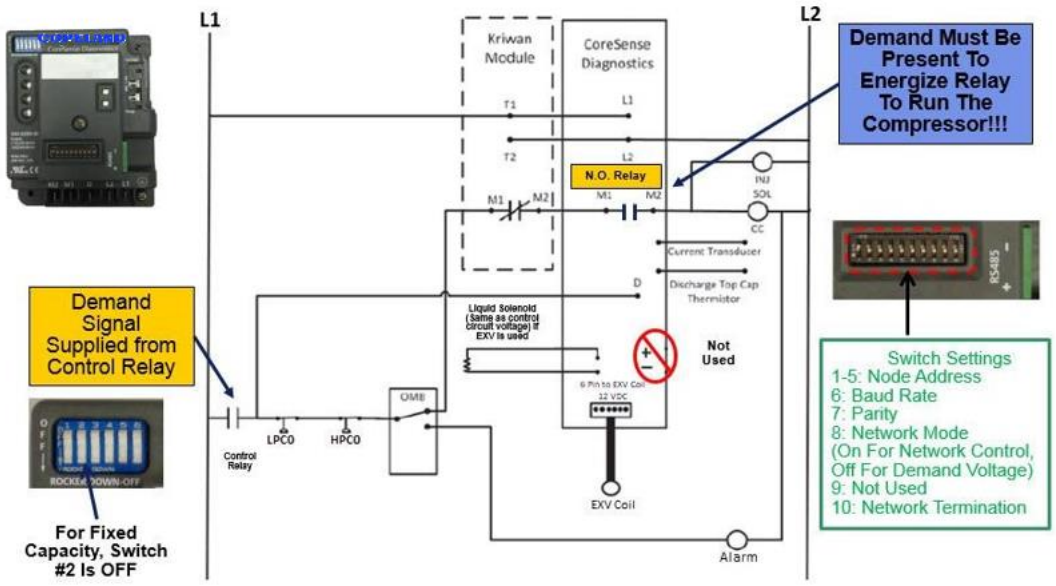


Figure 11 - Fixed Capacity Using Demand Input

2. Digital Compressor Using Analog Input for Modulation

Figure 12 shows the wiring for Digital Compressors using analog input for the modulation. The network dip switch #8 must be in the “off” position for the digital control when using a 1-5V analog input. A demand wire is not required to be run to the “d” terminal. The 1- 5V analog signal for the digital will close the module relay from normally open to closed when the compressor is called to run.

Note: Referring to **Figure 6,** Brown DIP Switch #8 is “OFF” for Digital Operation with Analog Input. Also, referring to Figure 8, Blue DIP Switch #2 is “ON” for Digital Operation.

3. Digital and Non-Digital Compressors Using Control via Communications

Figure 13 shows the wiring diagram for a digital or non-digital application using an E2 controller. Demand is supplied via communications and a wire is not required to be run to the “d” terminal. The communications must be hooked up to the E2, and the module brown dip switch #8 must be “on” and the blue dip switch #2 must be “on” for the digital control to work. There is no 1-5V analog input used to control the digital in this arrangement because digital control is provided via the E2. This is the easiest way of wiring for digital control if an E2 is present.

Note: Referring to **Figure 6**, Brown DIP Switch #8 is “ON” for Digital Operation via Communications. Also, referring to Figure 8, Blue DIP Switch #2 is “ON” for Fixed Capacity

For E2 commissioning please refer to the following instructions.

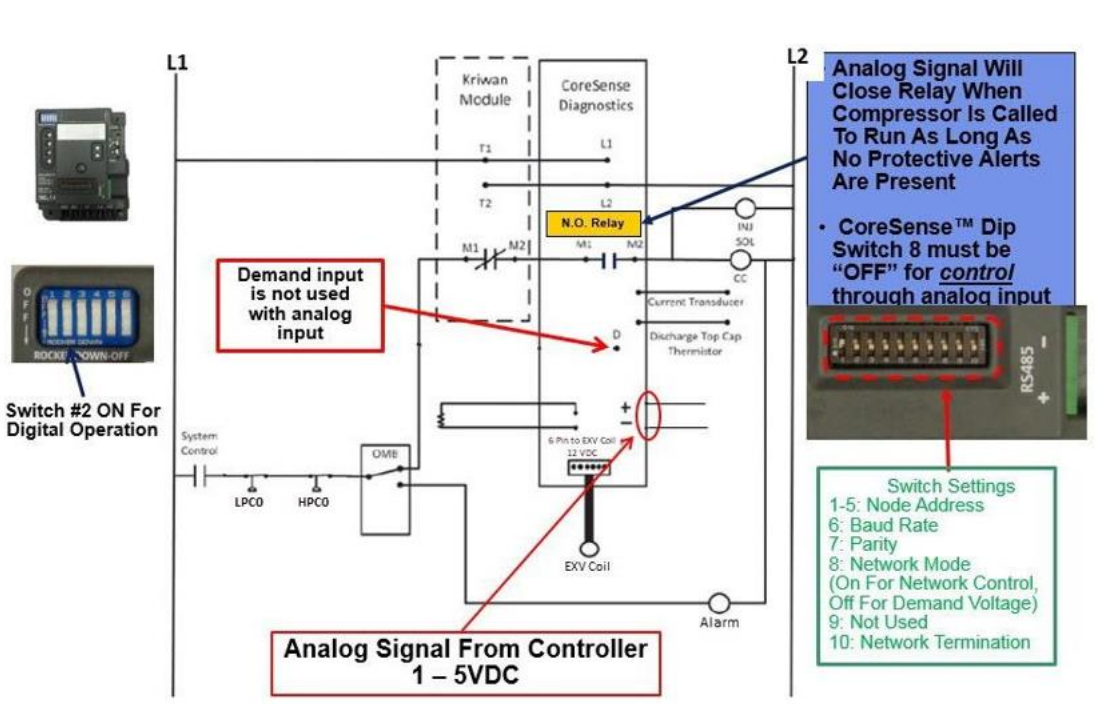


Figure 12 - Digital Compressors Using Analog Input for Modulation

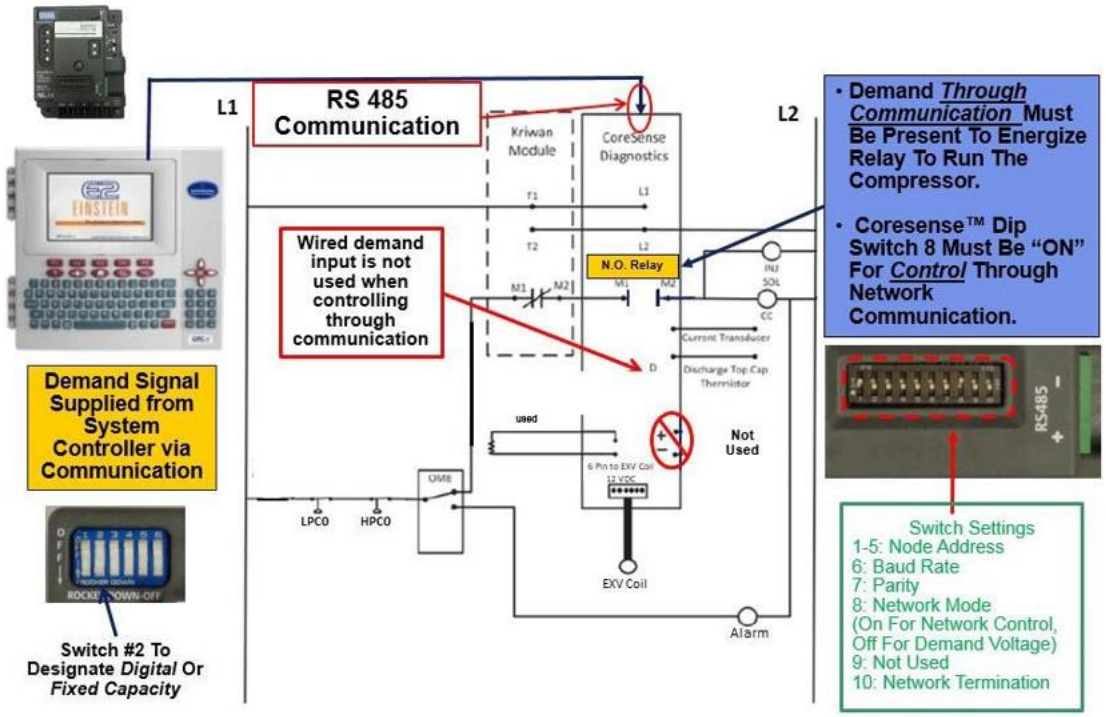
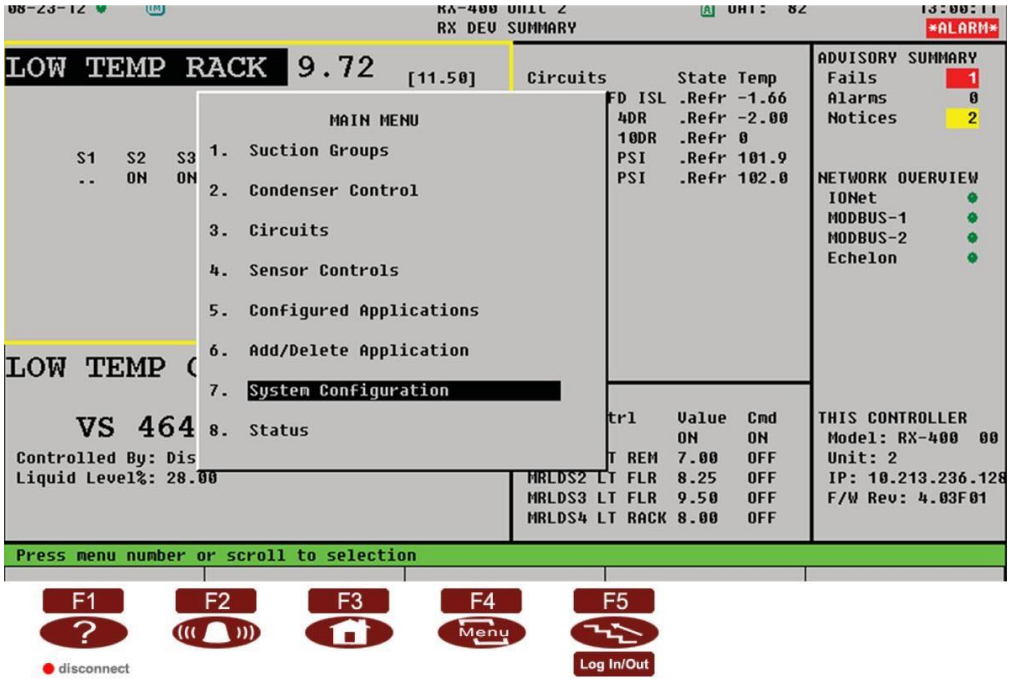


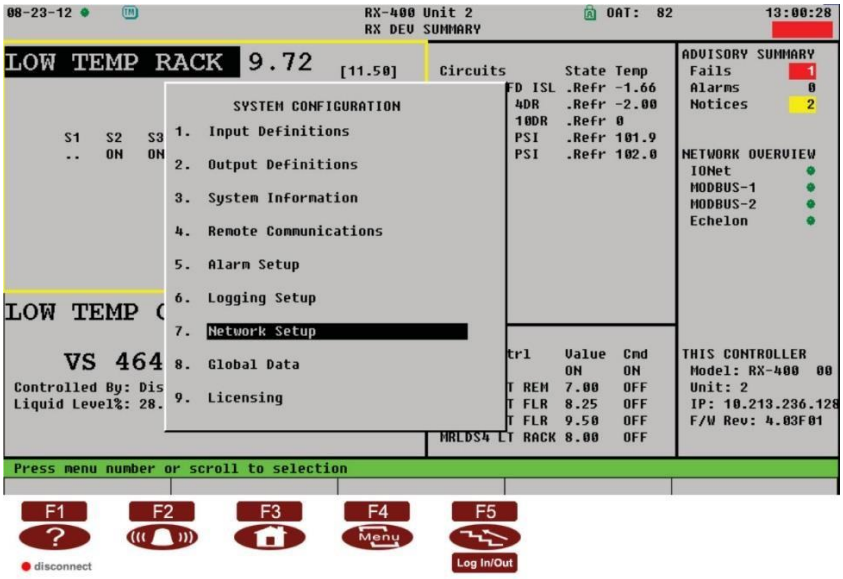
Figure 13 - Compressors Using Control via Communications

Programming Instructions

CoreSense Diagnostics E2 Programming Instructions

1. Press Menu to enter the Main Menu.
Select 7. System Configuration.
2. From the System Configuration Menu select 7. Network Setup

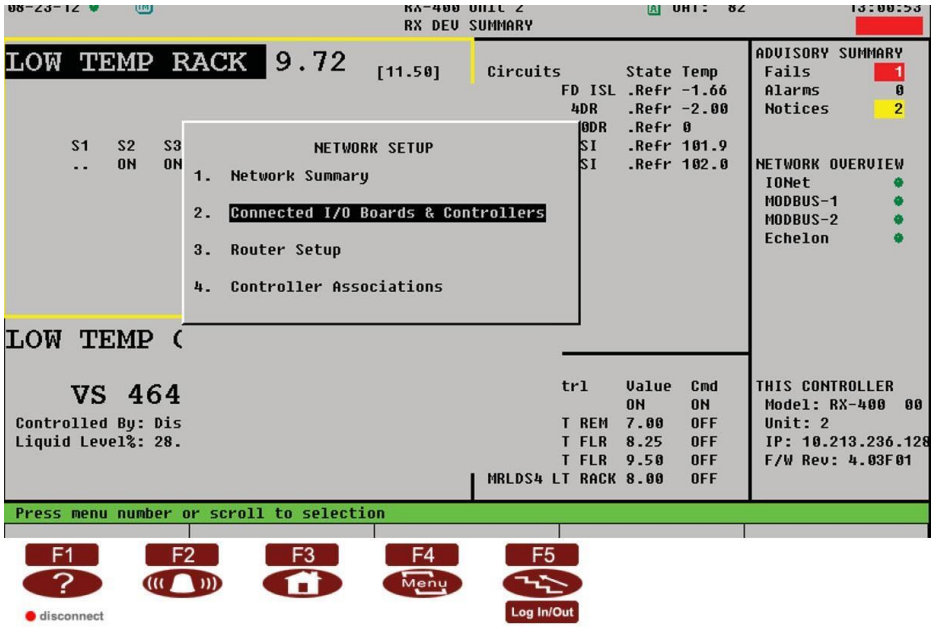


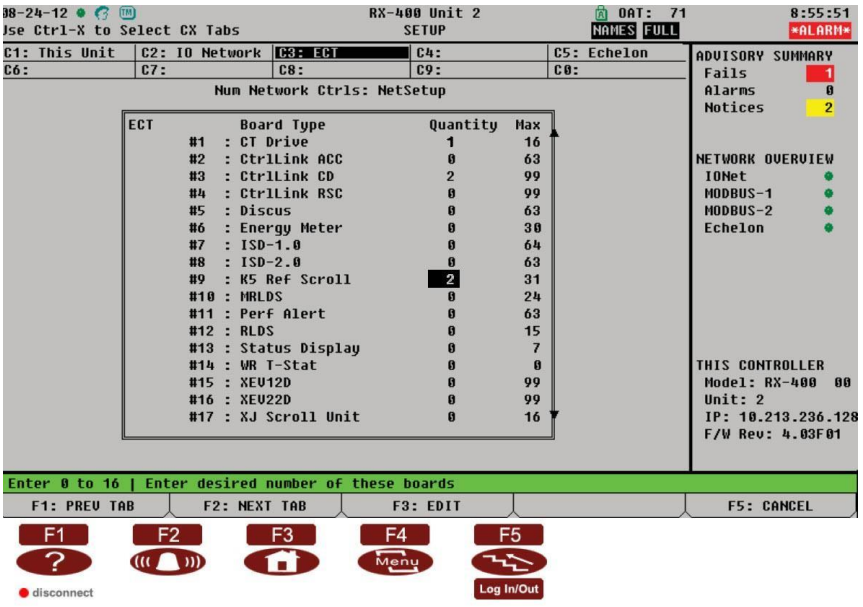


CoreSense K5 Programming Instructions

3. From the Network Setup Menu select 2. Connected I/O Boards and Controllers
4. From the Setup Screen go to the C3: ECT Tab (Press Ctrl + 3)
5. In Option #9, enter the number of K5 compressors being controlled by the E2.

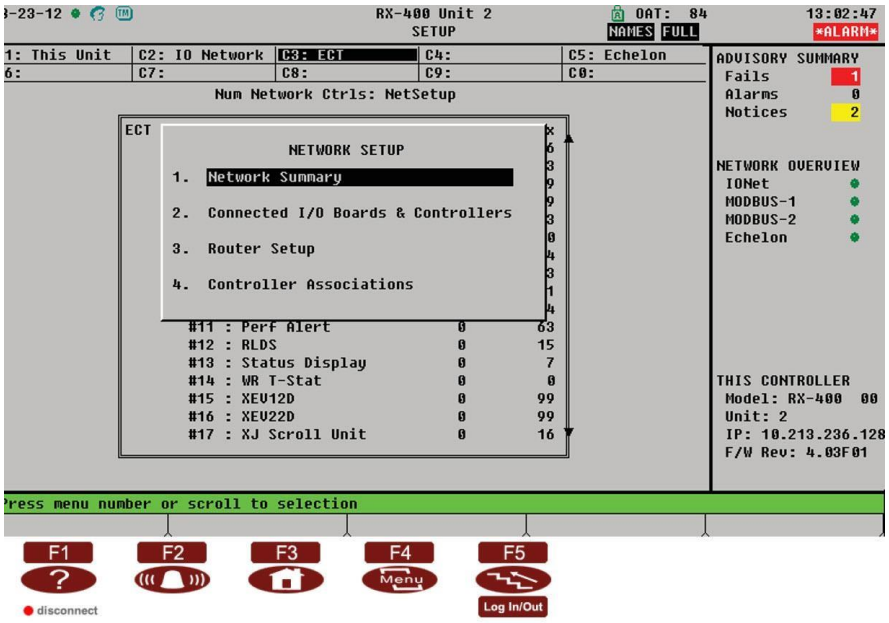
Press Menu to save changes and return to the previous screen.

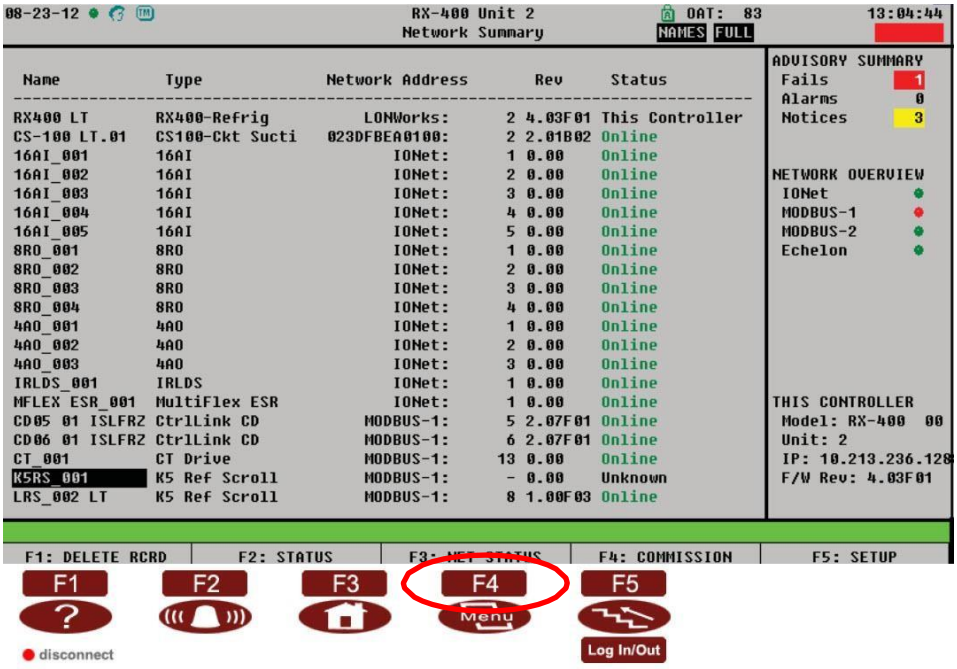




6. From the Network Setup Menu select 1. Network Summary

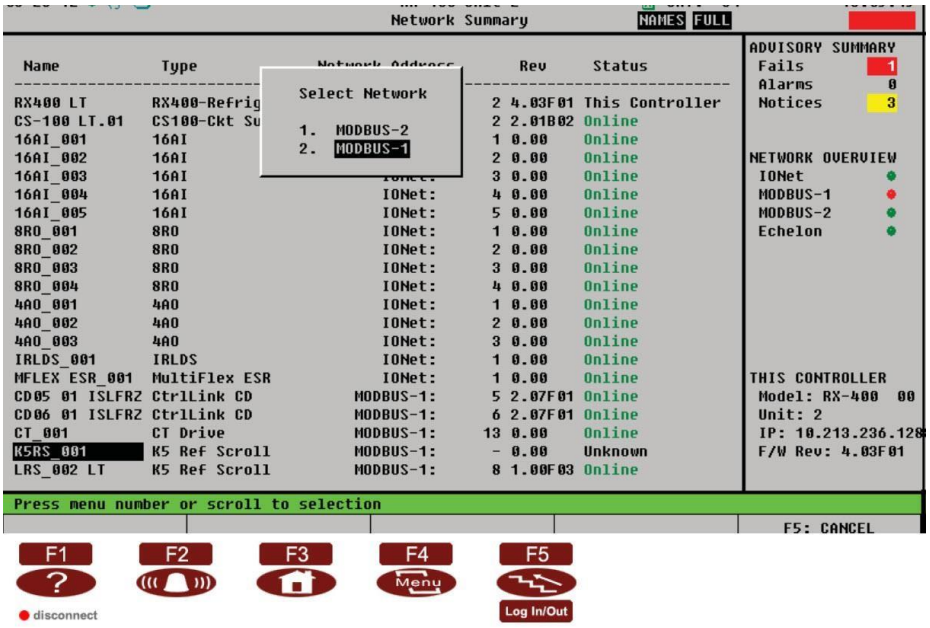
7. The CoreSense K5 devices should be present on the Network. Select the CoreSense K5 module to be commissioned. Press F4: Commission

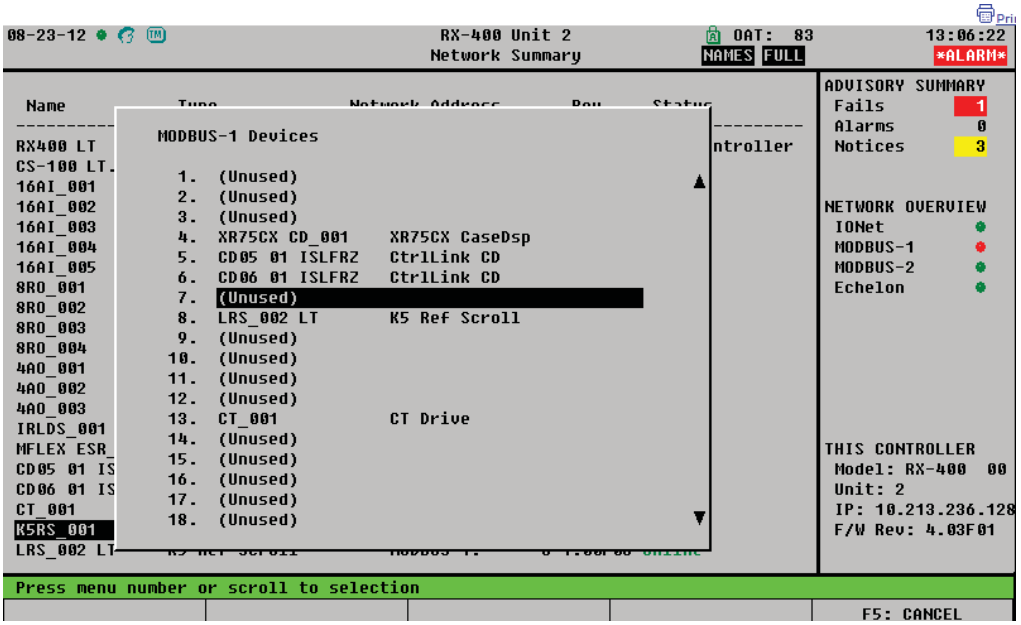




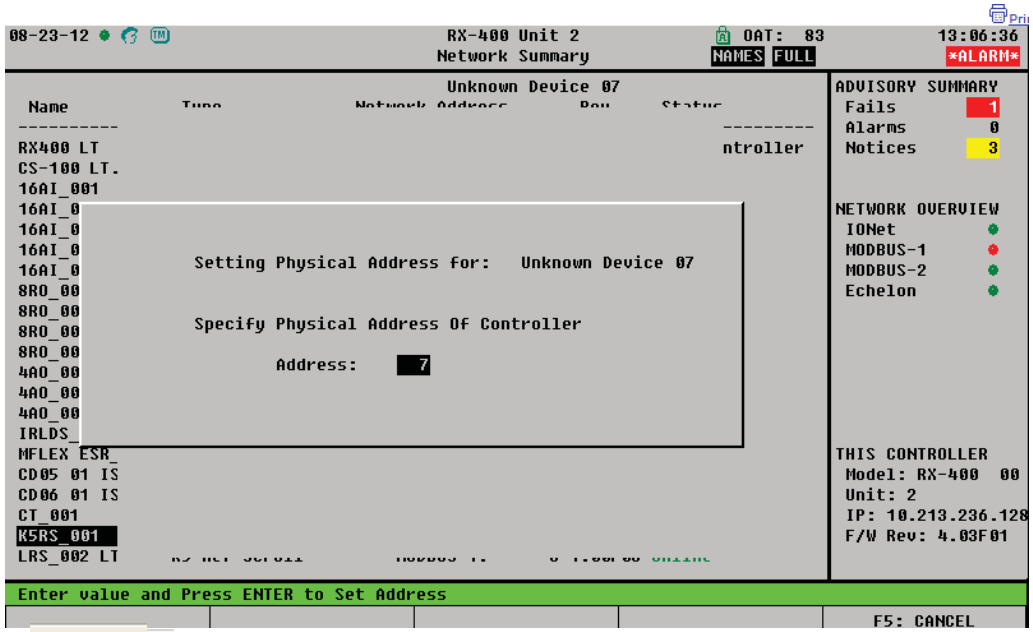
8. Select the Modbus® that the CoreSense device is connected to. (If only Modbus® network is connected, this step will automatically complete itself, skip to step 9)

9. From the Modbus® Device Menu select an unused space that matches the DIP switch Address of the CoreSense device and press Enter.





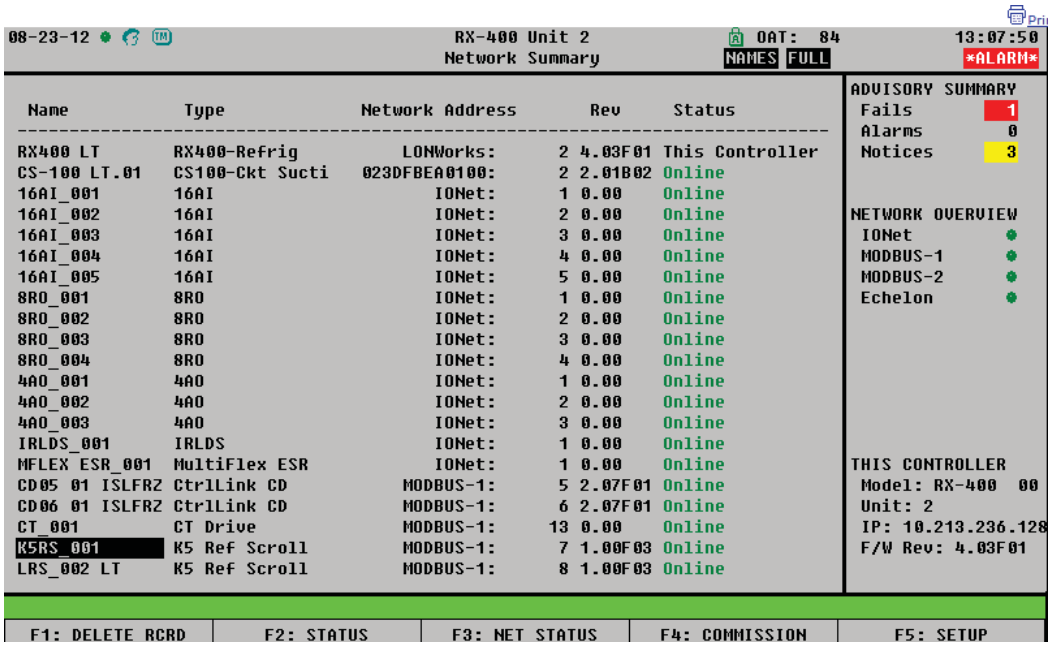
10. Verify the address matches the address assigned by the CoreSense module's DIP switch settings and press Enter.



11. Press  to return to the Network Summary screen. The device should now be "Online".

Repeat steps 8-10 to address the remaining CoreSense K5 modules.

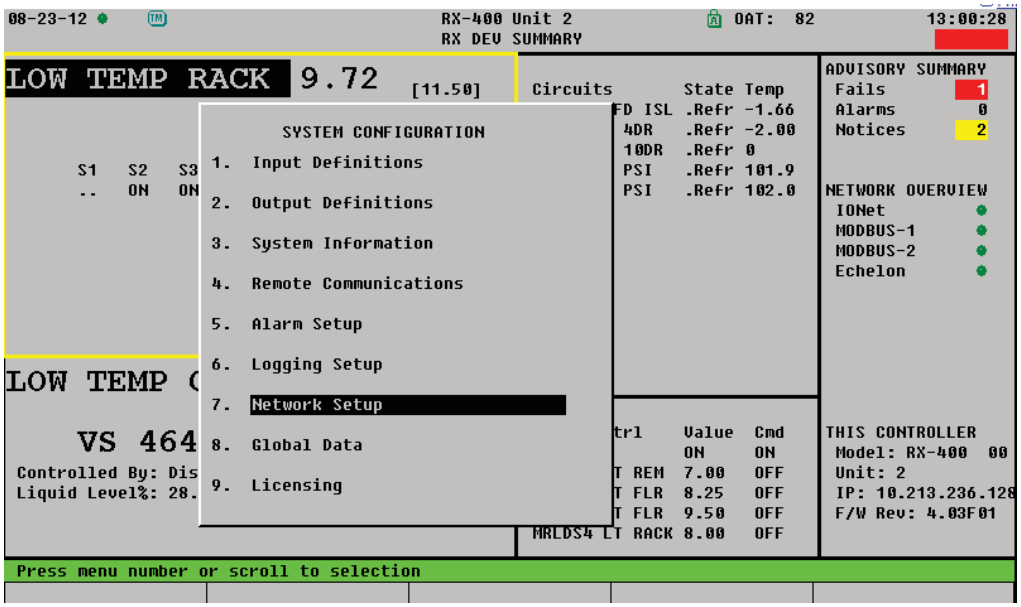
12. Once all the devices are addressed, press  to save changes and exit the Network Summary.

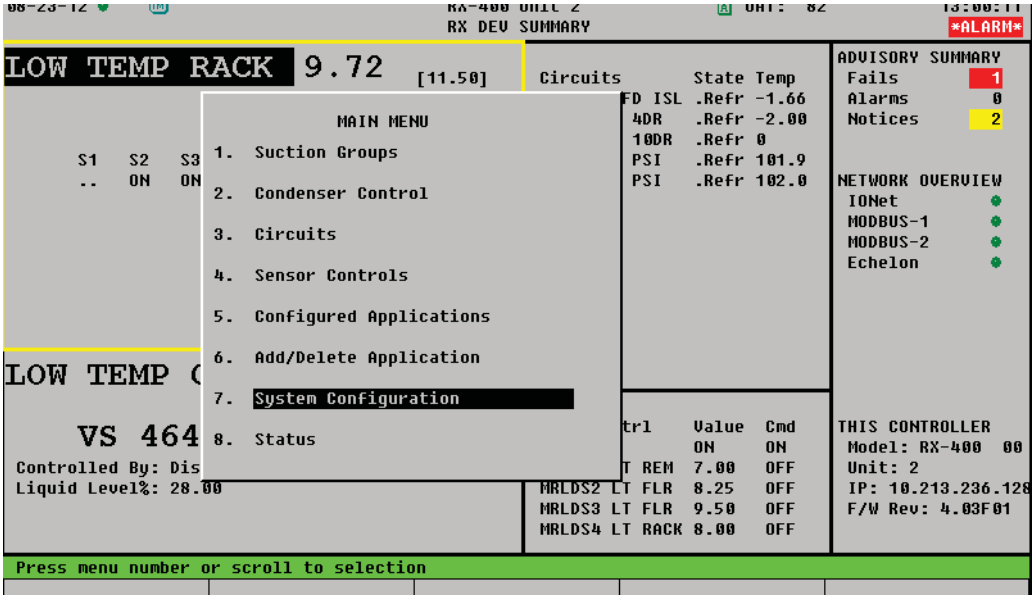


13. Press 

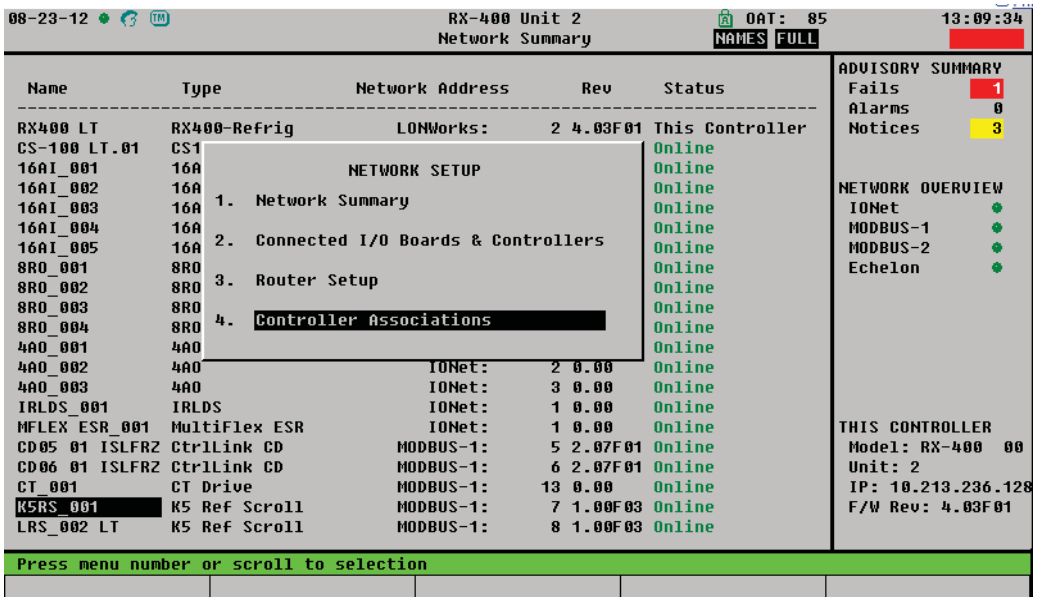
to enter the Main Menu. Select 7. System Configuration.

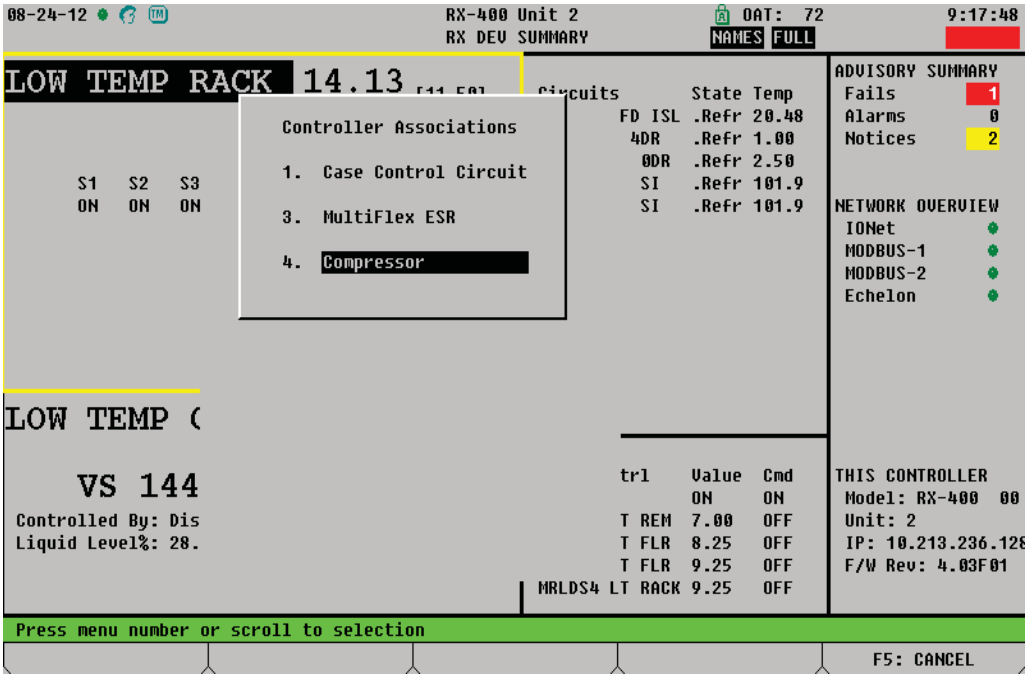
14. From the System Configuration Menu select 7. Network Setup



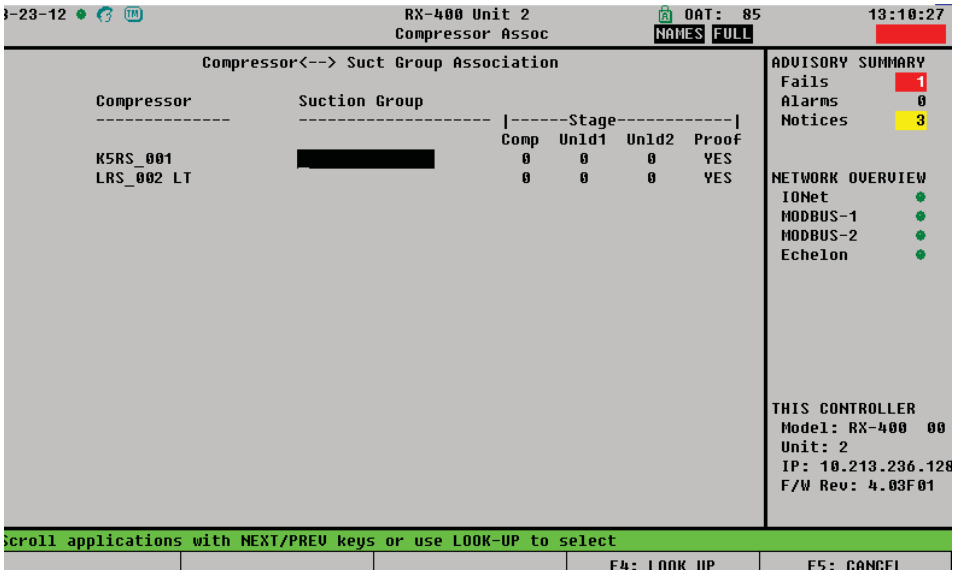


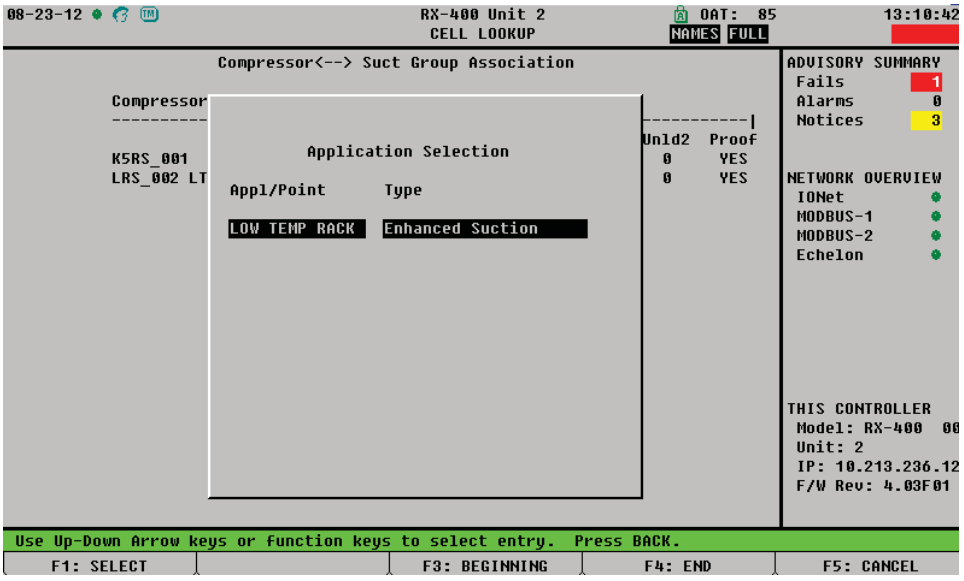
15. From the Network Setup Menu, select 4. Controller Associations. Then Select 4. Compressor (Press Enter)





16. Highlight the Suction Group[2] field, select F4: Look Up (Press F4) and select the appropriate suction group for the device and press Enter.

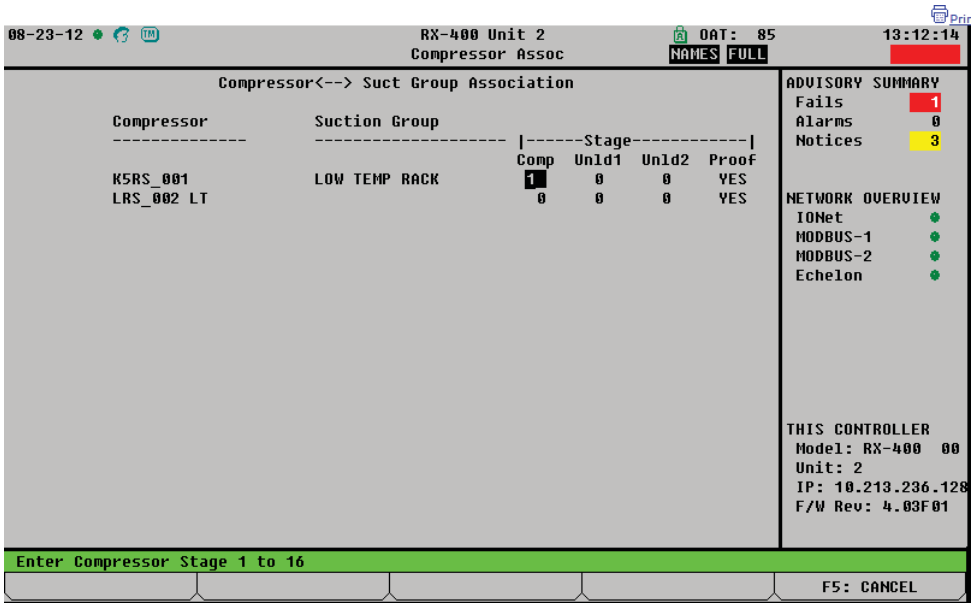




2 For more information on setting up suction groups in the E2, consult your Copeland Retail Solutions representative.

17. Scroll over to the Comp Stage and type in the compressor stage. (CoreSense Protection provides proofing only on the compressor.)

Note! The compressor stage number should correspond to the stage numbers in the suction group setup (Step 7)



CoreSense Diagnostics E2 Programming Instructions for Enhanced Suction Group

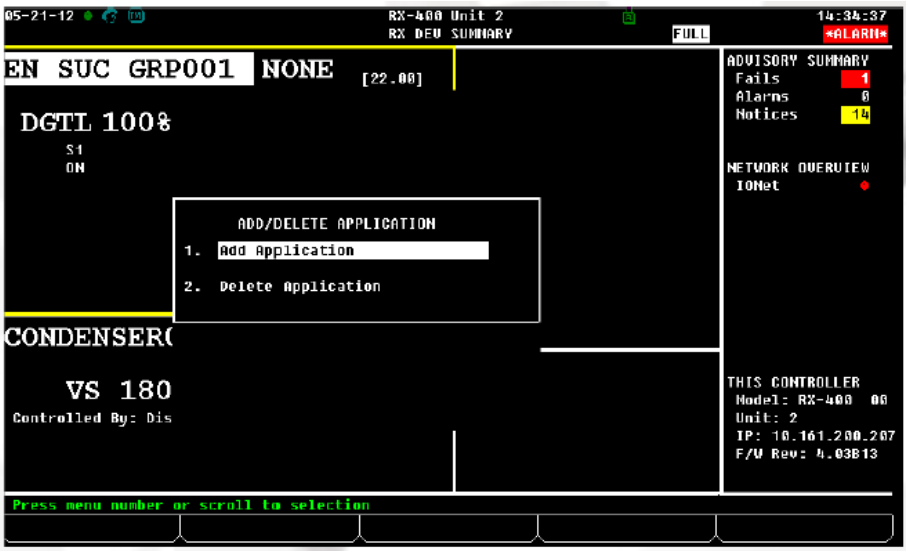
The Enhanced Suction Group has all the important features of the older Suction Group application, but instead of employing user-configured PID constants to optimize operation, the Enhanced Suction Group determines optimum control by “learning” the effect each compressor and circuit load has on the suction input. The Enhanced Suction Group is easier to configure and more conservative with compressor cycling than the standard Suction Group. In addition, the Enhanced Suction Group also supports use of the Copeland Digital Scroll and Copeland Digital Discus compressors.

1. Logging into E2.

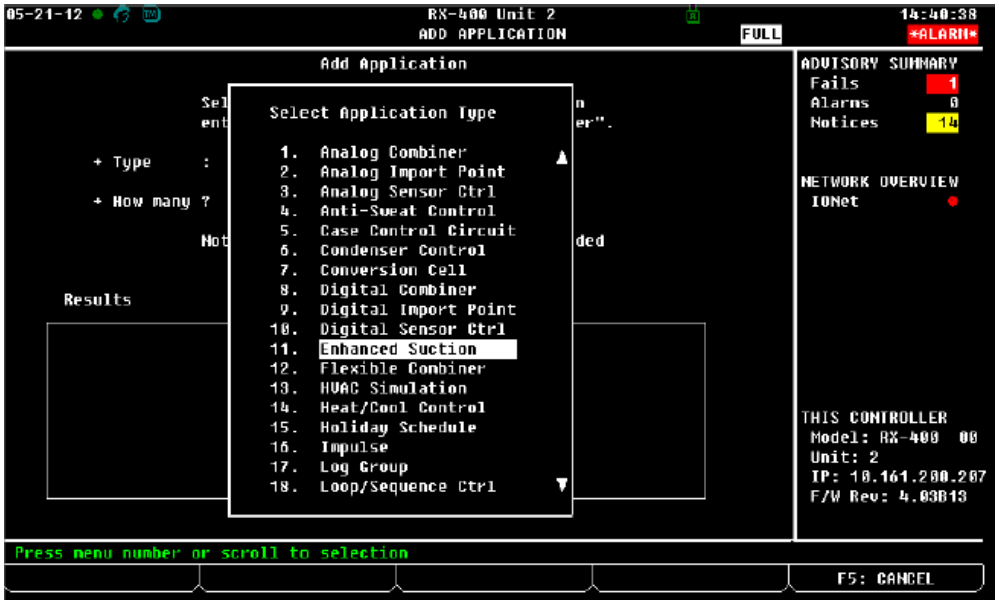
- ***Press the o Button.***
- Type in “USER” in the Username field.
- Press the e button.
- Type in “PASS” in the Password field.
- Press the e button.

2. Press 6 for Add/Delete Application Menu.

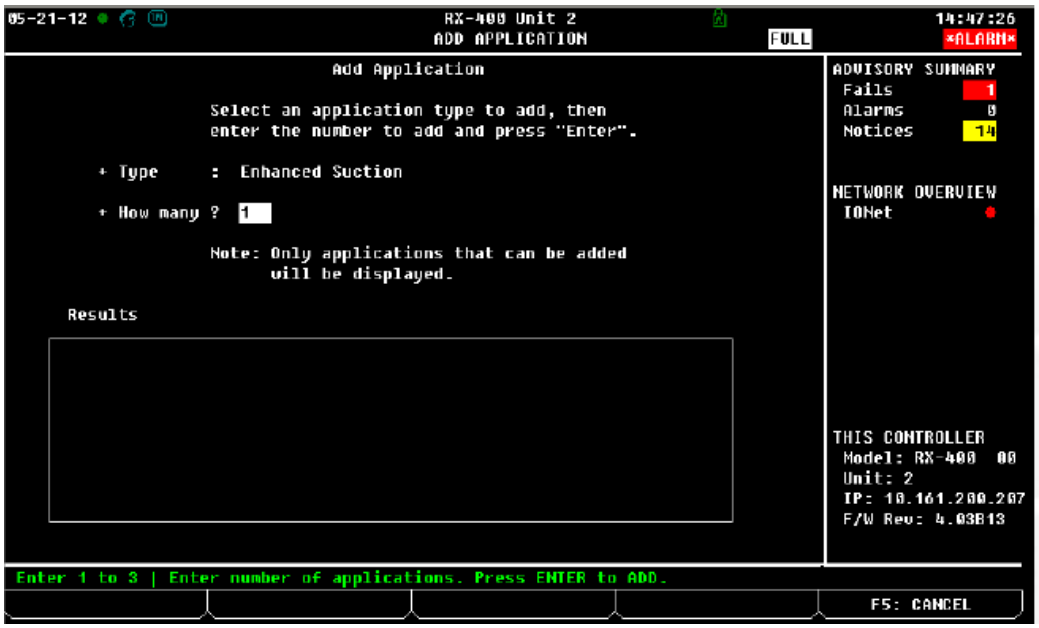
Press 1 to Add Application.



3. Press $ for Look Up and search for Enhanced Suction application.
Press Enter once Enhanced Suction is highlighted.

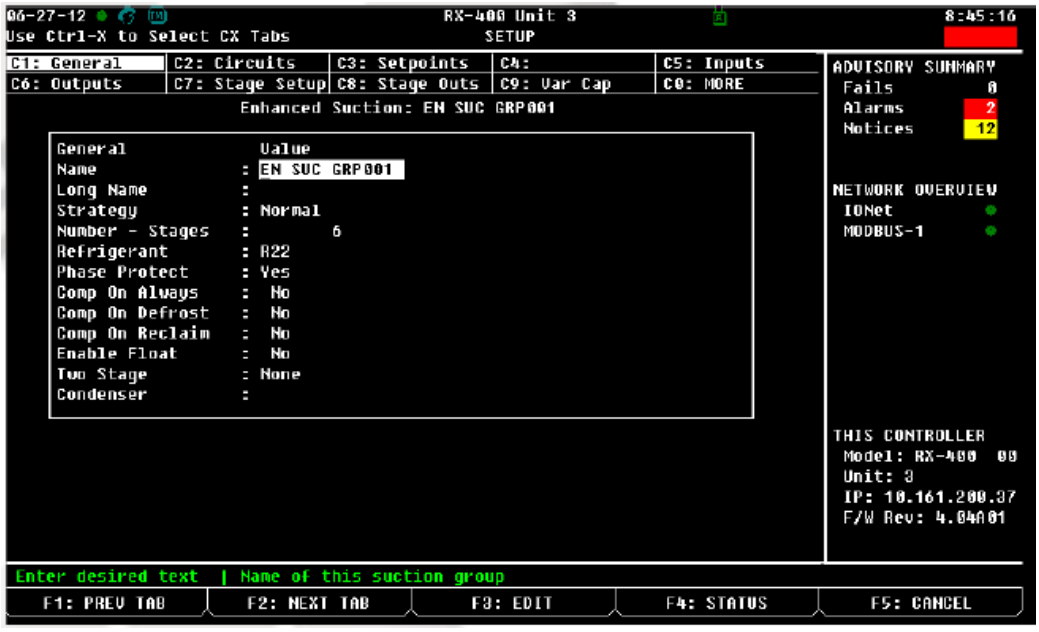


4. Press the down arrow to the "How many?" field and type in the required number of applications needed. (Refer to programming details.)



5. Enhanced Suction Group Set Up

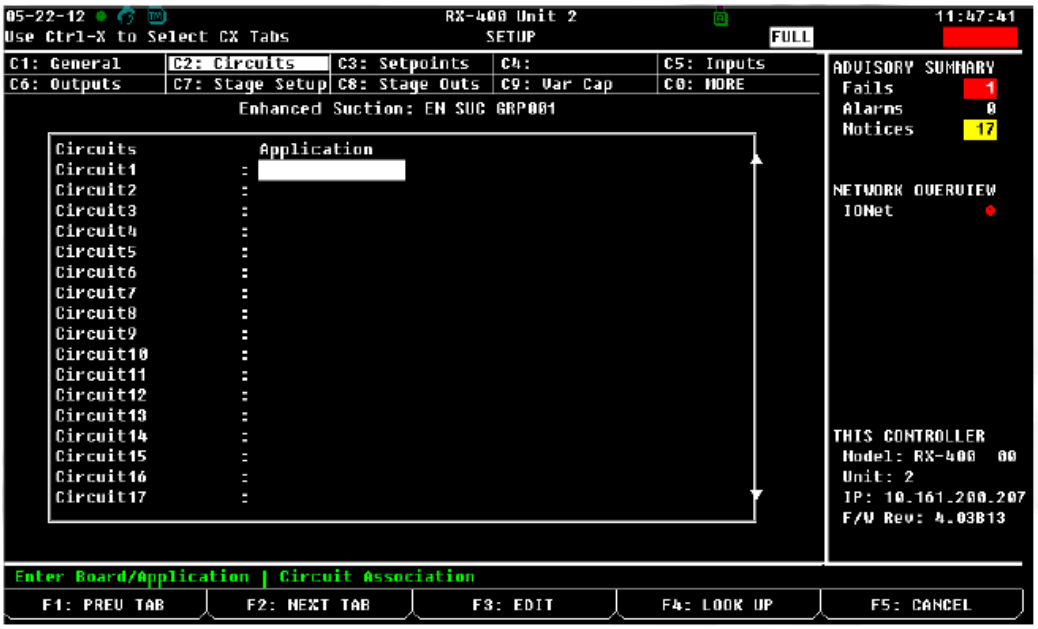
In the C1: General Tab, this allows the user to change the name, set the number of stages (compressors and unloaders), condenser and set the required parameters needed. (Refer to programming details.)

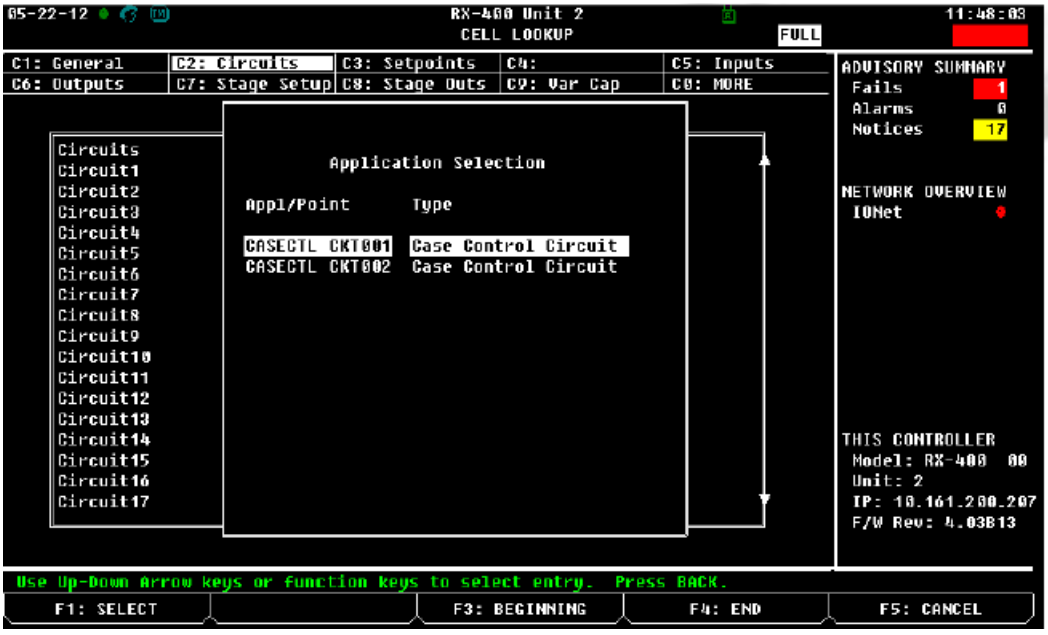


Highlight the condenser parameter and press the $ key to see the options

6. When done, press @ to go to C2: Circuits Tab. This screen associates the Standard and Case Control Circuits to the Enhanced Suction Group. (Refer to programming details.)

Under Application, press $ for Look Up, this will display all Circuits that are set up in the E2.

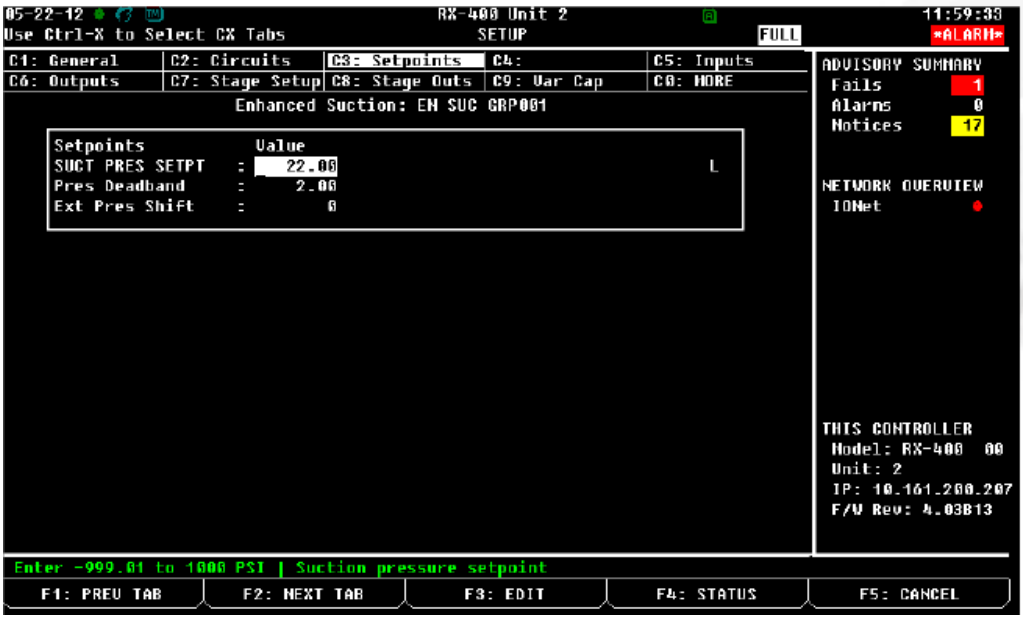




Press 

to associate the Circuit in the Enhanced Suction Group.

7. When done, Press @ to go to C3: Setpoints Tab. This screen enables the user to set the Suction Pressure setpoint to be maintained by the Enhanced Suction Group. (Refer to programming details.)



Type in the required suction pressure setpoint.

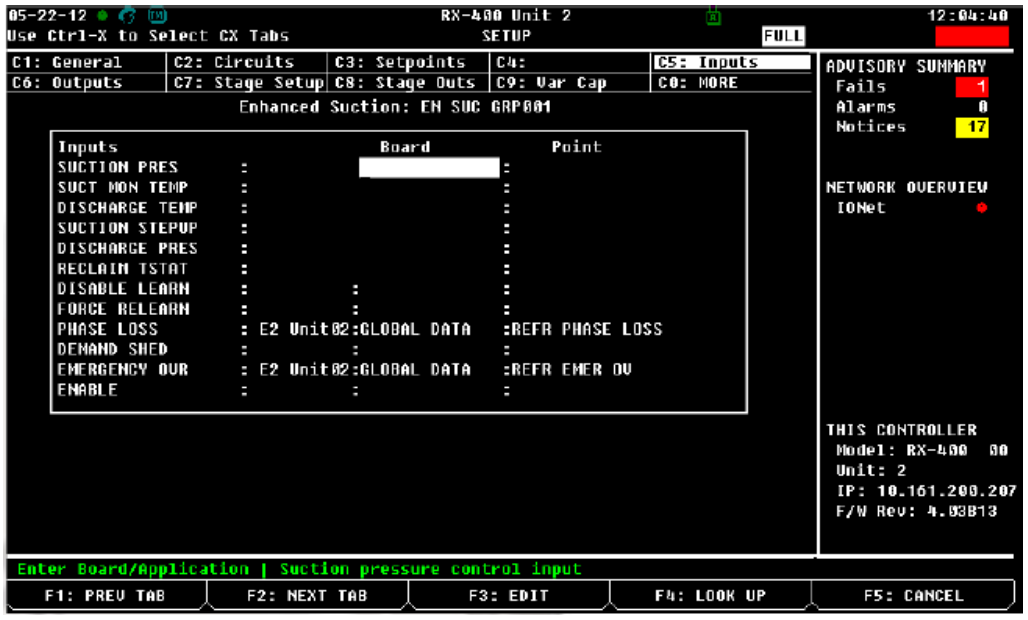
Press the key and type in the desired dead band.

Recommended dead band:

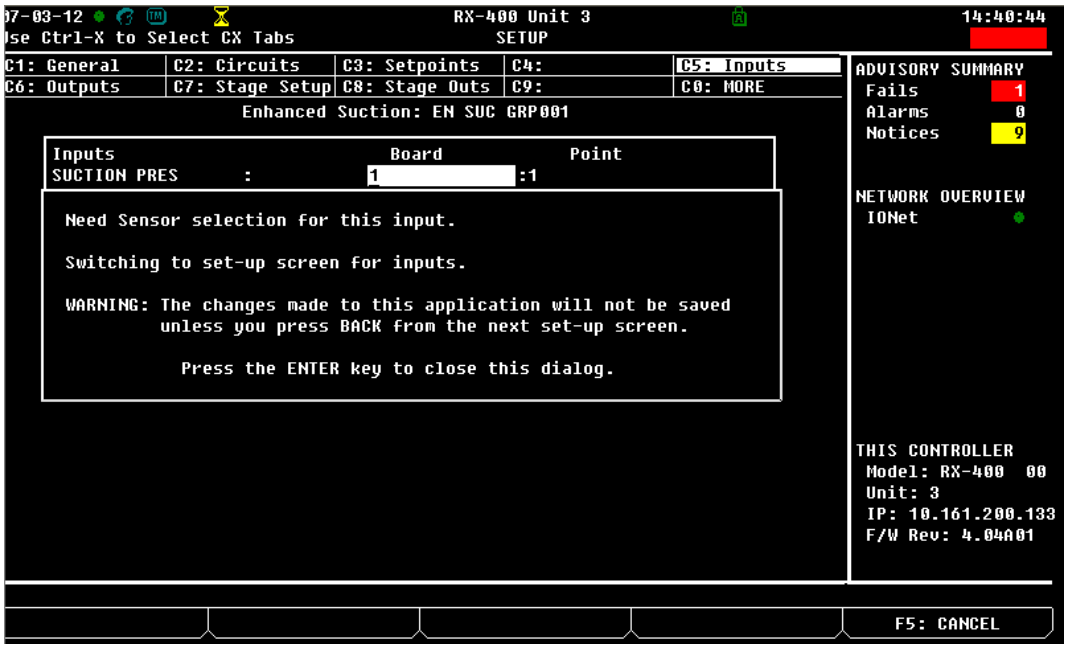
Less than 3 compressors = 3 – 4

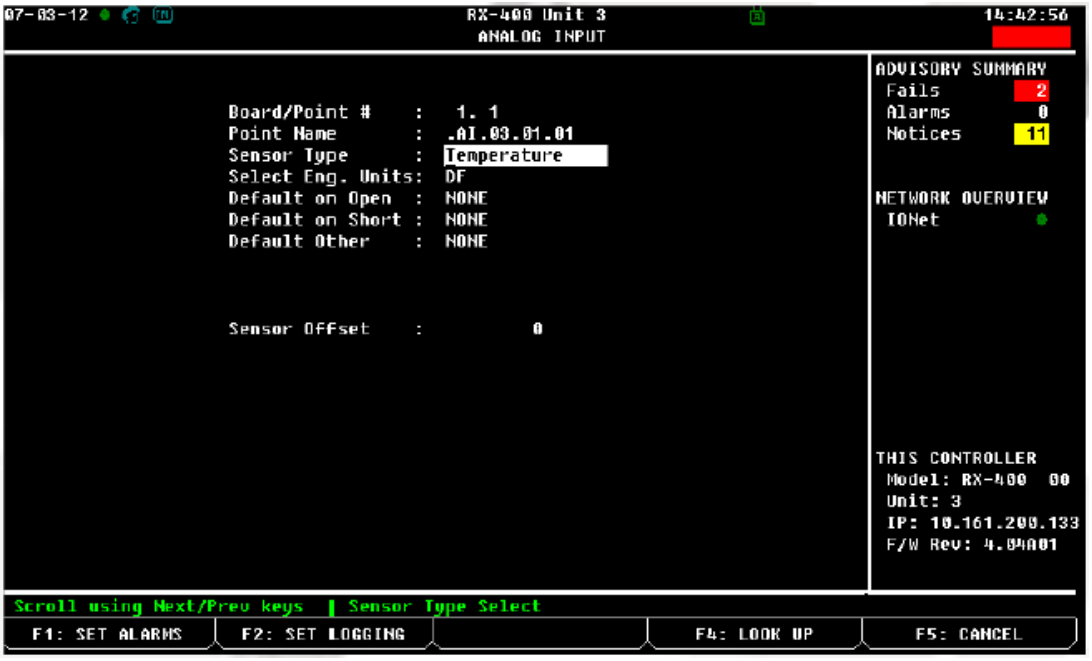
More than 3 compressors = 2

- ***8. When done, press @ to go to C5: Inputs Tab. This screen enables the user to set the necessary sensors and transducers that are at a minimum suction pressure as required. (Refer to programming details.)***



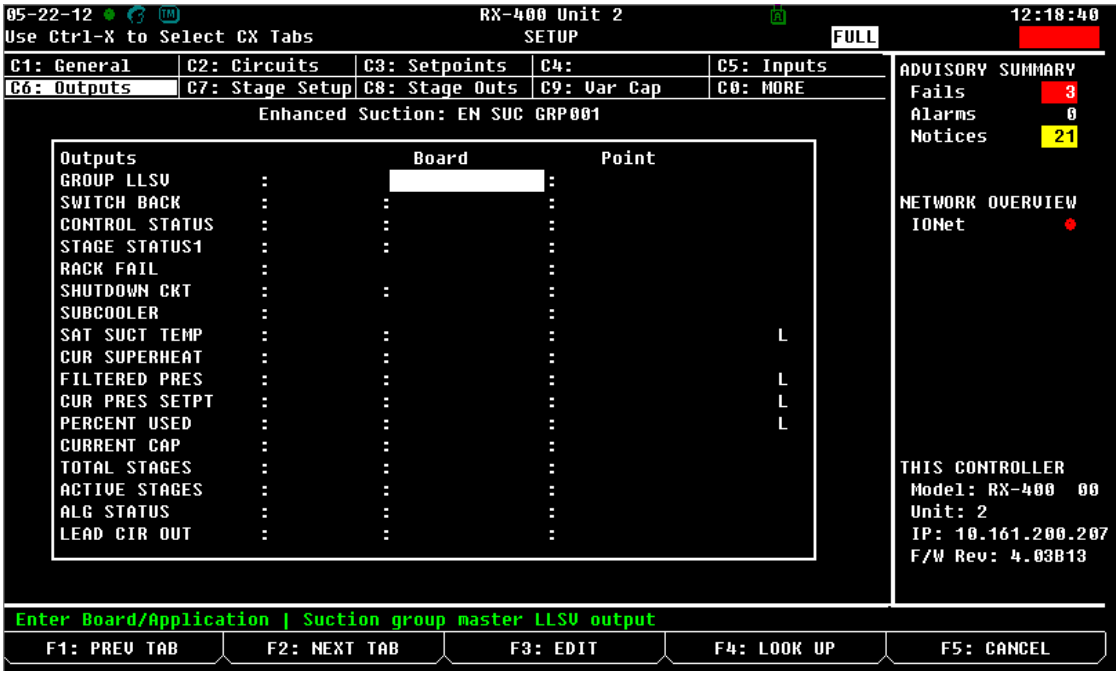
Note: Once a board and point for the Input is configured, a dialogue box will appear that a sensor must be selected



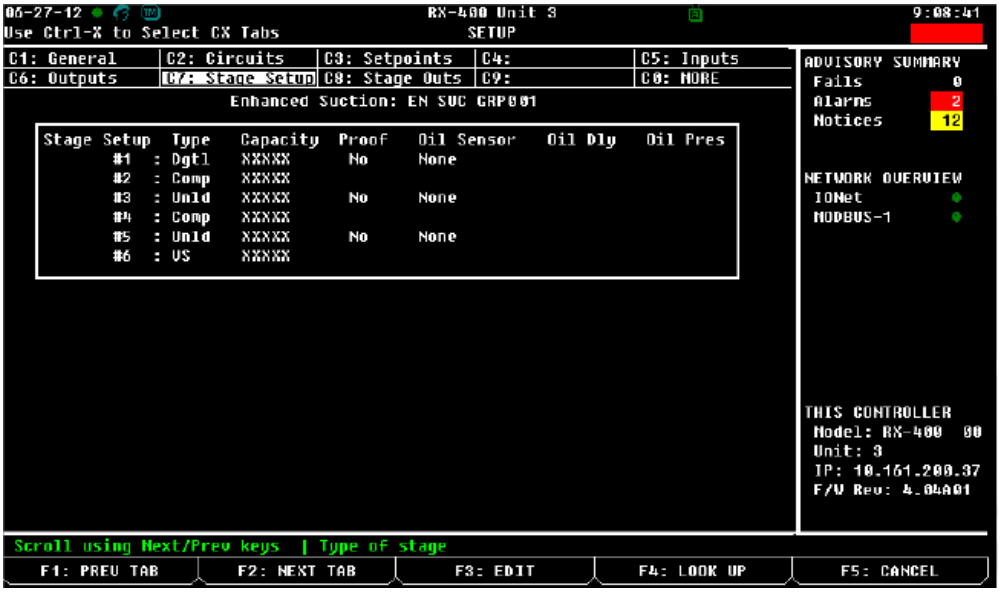


9. Press $ for Look Up and select appropriate sensor.
Press e button
Press the) button to save.

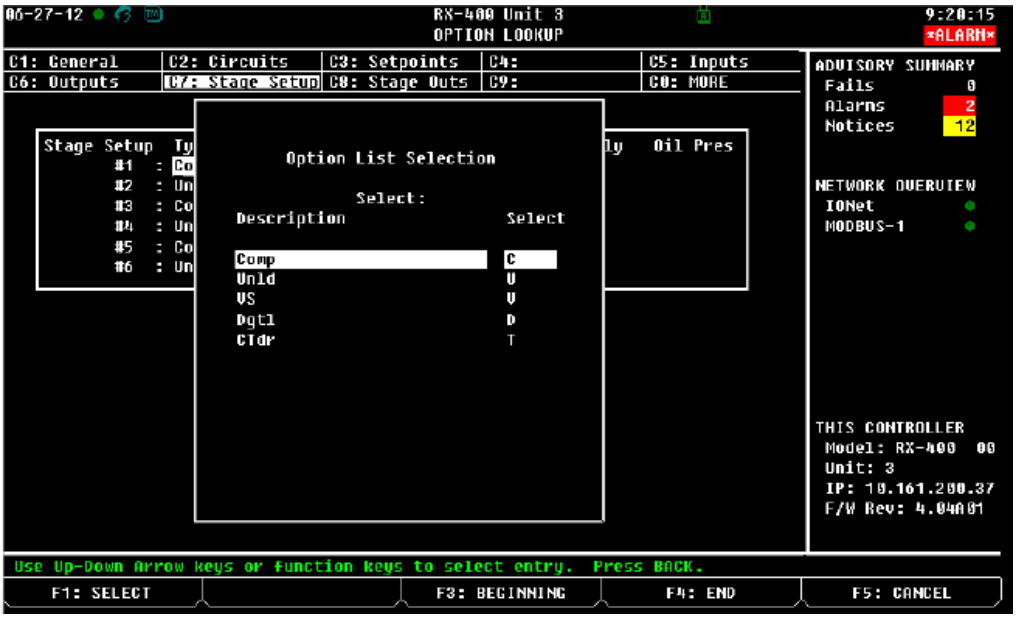
10. When done, press @ to go to C6: Outputs Tab. (If system has no related functions, leave Outputs in default.) (Refer to programming details.)



11. When done, press @ to go to C7: Stage Setup Tab. This screen enables the user to set the configuration of the compressors if it is running with an unloader if it is controlled by a variable frequency drive or if it is controlled digitally. For compressors with unloaders, the unloader must always follow a compressor. It is recommended that the compressor with the largest capacity should be placed first. (Refer to programming details.)



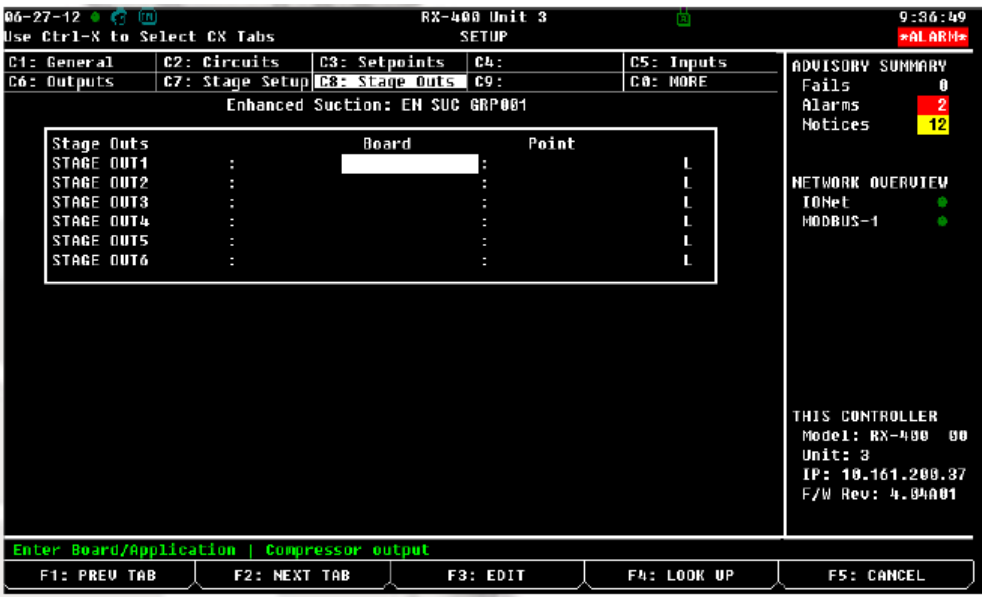
Press $ for Look Up and select the proper configuration of the compressor.



Press the e button to set the configuration.

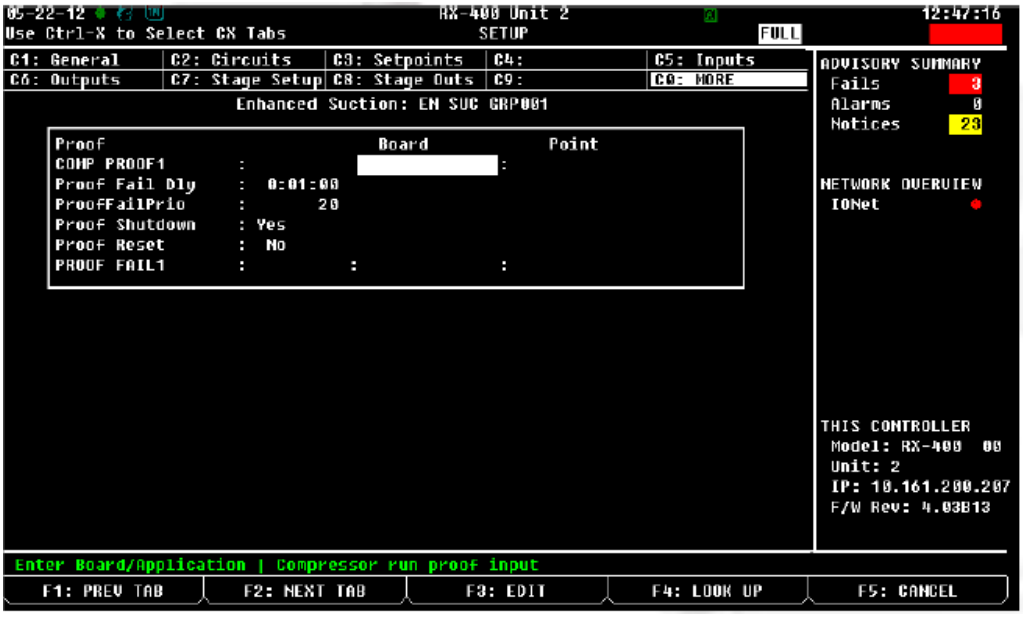
To change the value in the "Capacity" column, highlight the number to the right of the compressor and enter its capacity.

12. When done, press @ to go to C8: Stage Outs Tab. The Stage Outs activates the compressor or unloader in the appropriately numbered Stage Out output definition. Enter the respective board and point for each compressor and unloader. (Refer to programming details.)



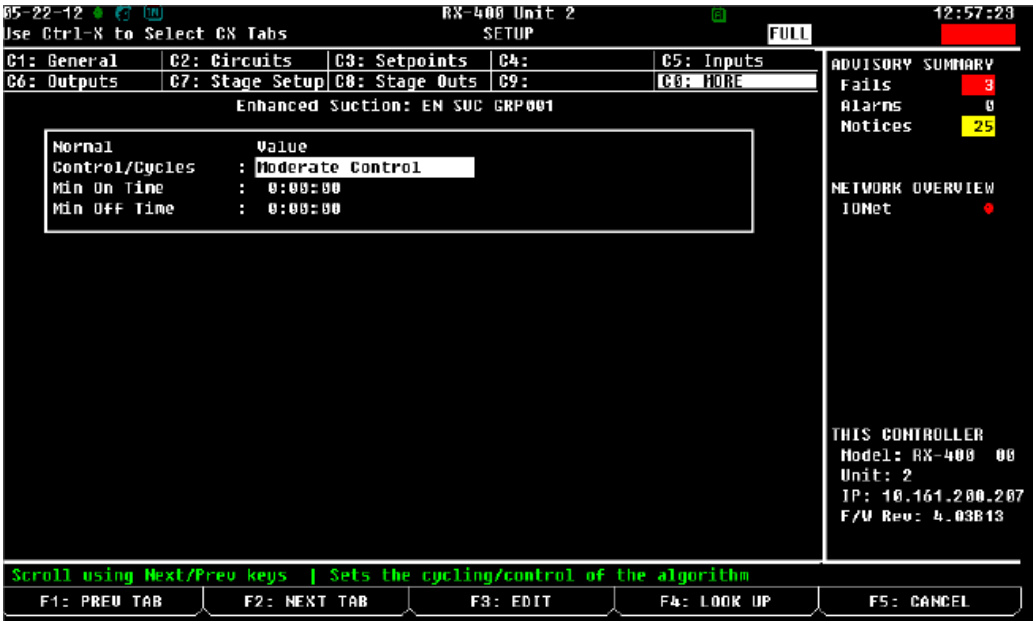
Press $ for Look Up and select the necessary board and point for the Stage Out.

14. When done, Press @ twice to go to C0: More Tab and open the Compressor Proof Screen. This is a digital or an analog sensor input to which tells the E2 that the compressor is running or not when it is being called to operate. This act as a safety function, which will shut down the compressors to prevent damage to the equipment or the system. (Refer to programming details.)



Press $ and select the necessary board and point where the input is located.

15. When done, press the @ button twice to go to Control Cycling screen. This parameter can be adjusted to reduce or increase the number of times the compressor is being switched. (Refer to programming details.)



It is recommended to use Moderate Control for first time running operation. This enables the E2 to learn the frequency of compressor cycling and this offers a balance between the compressor cycling and the tightest control of the suction pressure.

If the user wants to improve the accuracy of the suction pressure and the compressors does not experience excessive cycling, the parameter can be set to the tightest control. The suction pressure will be maintained in a tighter control range; however, this will likely increase compressor cycling as a result. (See table for Control / Cycles definition)

Table 2 – Control / Cycles Definition

Control/Cycles	
Tightest Control	Maintains the suction pressure accurately close to the setpoint because the compressor is being switched on and off at a rapid rate and this results to increased compressor cycling.
Tight Control	Maintains the suction pressure very close to the setpoint because the compressor is being switched on and off at a rapid rate and this result to increased compressor cycling.
Moderate Control	Balances the compressor cycling and maintains the suction pressor in a tight control.
Less Cycling	This reduces compressor cycling and it reduces its accuracy in maintaining the suction pressure.
Least Cycling	This has very low compressor cycling and low accuracy in maintaining the suction pressure.

Alert Codes & Troubleshooting Tips

Table 3 is an explanation of the alert codes for the CoreSense and what the flash codes mean. It is also available on the inside of the terminal box lid on all 7.0 – 15 HP compressors or as part of the 2.0 – 7.0 HP kits. **Table 4** are some trouble shooting tips for the alert codes. There are 4 colors that can flash from the module:

Green: all is o.k.

Yellow: There has been a system trip, and this will auto reset once the trip has cleared.

Red is a lockout and will require a manual reset on the contractor's part. This means the power must be cycled to the CoreSense.

Blue is used for digital applications and will light up when the scroll set is unloaded. There are also trouble shooting tips to help identify and fix the issue.

Table 3 – Alert Code Description

Alert Code		Code Description	Protection Shutdown (Default)	Protection off Time (Default)	Consecutive Detections Until Lockout
Lockout feature is NOT enabled form the factory except on code 7					
	1	High Discharge Temp - See diagram for setting	Yes	20 Min.	4
	2	Excess System Limit Trips - 4 consecutive system limit trips having 1-15 Min Runtime Each	Yes	5 Min.	No Lockout
	3	Excessive Demand Cycling - Default is 240 cycles per 24 hr. period	No	-	-
	4	Locked Rotor - Compressor did not start within allotted time	Yes	20 Min.	4
	5	Demand Present - No current detected over 4hr. period	No	-	-
	6	Phase Loss Detected	Yes	20 Min.	10
	7	Reversed Phase Detected	Yes	Until Module is Reset	1
	8	Welded Contactor - Current detected without demand[1]	No	-	-
	9	Low Module Voltage	Yes	5 Min.	No Lockout
	10	Module Communications Error	No	-	-
	11	Discharge Temperature Sensor Error	No	-	-
	12	Current Transducer Error	No	-	-
		Digital Alert Codes: 1 - Loss of analog demand - Check analog voltage 2 - Network mode ON, 1 - 5 V input present- Check position of DIP Switch #8 3 - Network mode OFF, receiving Modbus™ communication - Check position of DIP switch #8			
Lockouts can be enabled by DIP switch 6 setting					
[1] Code 8 displays for 24 hours after last detection The M1-M2 relay only opens during a protection shutdown. To reset module, cycle module power. Module must be reset for DIP switch changes to take effect. For technical support call 1-888-367-9950 or visit Copeland.com/OPI Refer to **AE-1383** for more details.					

LED	SOLID	FLASHING
	Normal	ALERTS
	Demand, No Current	TRIP (Auto Reset)
	-	LOCK OUT (Manual Reset)
	Digital	

Blue LED Added For
1. Digital Alerts
* Quick Flashes
2. Digital Unloader
* Solid LED

Table 4 - CoreSense Diagnostics Module Troubleshooting

Status LED	Status LED Description	Status LED Troubleshooting Information
Yellow Alert LED 4 Flashes	Locked Rotor Compressor is drawing current without rotating or four consecutive compressor trips after run time of 1-15 seconds	1. Low Line voltage (contact utility if voltage at disconnect is low). 2. Verify presence of all legs of power line. 3. Excessive liquid refrigerant in compressor. 4. Compressor bearings are seized. 5. Verify operating current.
Yellow Alert LED 6 Flashes	Missing Phase Demand signal is present, but current is missing in one phase.	1. Improper wiring. Correct order of phases in wires. 2. Failed contactor. Check contacts for pitting. 3. Compressor current could be too low. Refer to Specifications. 4. Verify presence of all legs of power line.
Yellow Alert LED 9 Flashes	Low Voltage Detected Control voltage dips below 85V for 110V or 170V for 220V	1. Low Line voltage (contact utility if voltage at disconnect is low). 2. Check wiring connections.
Red Alert LED 1 Flash	LOCKED OUT ON: High Discharge Line Temperature Trip See inside label to determine cut out temp.	1. Possible loss of refrigerant charge. 2. Blocked condenser. 3. Verify that discharge valve is open. 4. On low temperature scroll compressors check liquid injection.
Red Alert LED 4 Flashes	LOCKED OUT ON: 4 Consecutives Locked Rotors Detected Compressor is drawing current without rotating or four consecutive compressor trips after run time of 1-15 seconds.	1. Low Line voltage (contact utility if voltage at disconnect is low). 2. Verify presence of all legs of power line. 3. Excessive liquid refrigerant in compressor. 4. Compressor bearings are seized. 5. Verify operating current.
Red Alert LED 6 Flashes	LOCKED OUT ON: 10 Missing Phase Detections Demand signal is present but current is missing in one phase.	1. Improper wiring. Correct order of phases in wires. 2. Failed contactor. Check contacts for pitting. 3. Compressor current could be too low. Refer to Specifications. 4. Verify presence of all legs of power line.
Red Alert LED 7 Flashes	LOCKED OUT ON: 1 Reverse Phase Detected Demand signal is present but current is not detected in the correct sequence.	1. Improper wiring. Correct order of phases in wires. 2. Compressor current could be too low. Refer to Specifications. 3. Verify presence of all legs of power line.

Kits & Accessories

Kits and accessories are available through Copeland Distribution Services. Below are references for the kit part numbers you will need when ordering parts. Please note that there are different lists for 7.0 – 17 HP, 2 – 4.0 HP and 0 – 7.5HP Copeland Scroll compressors when searching for kit numbers.

*Table 5 - CoreSense Diagnostics Service Kits for 7.0 – 17 HP Scroll compressors (ZB*K5 & ZF*K5)*

P/N	Modules
943-0159-00	Current Sensing Module
943-0209-00	CoreSense Diagnostic Module

P/N	Crankcase Heaters
918-0047-00	120 V Crankcase Heater 90W 48" Lead Length
918-0047-01	240 V Crankcase Heater 90W 48" Lead Length
918-0047-02	480 V Crankcase Heater 90W 48" Lead Length
918-0047-03	575 V Crankcase Heater 90W 48" Lead Length
998-7029-00	Crankcase Heater Enclosure Box

P/N	Digital Components
998-0060-03	120V Digital Solenoid Coil
998-0060-04	240V Digital Solenoid Coil
998-0189-00	Closed Loop Digital Controller (Single Compressor Applications)
998-0341-00	1 - 5 V Analog Input Wire Kit
998-0342-00	Digital Solenoid Coil Wire (CoreSense Module to Digital Solenoid Coil)

P/N	Discharge Line Thermostats/Thermistors
998-0176-00	Thermistor Kit (Includes Top Cap, and DLT Thermistors)
998-0229-00	Top Cap Thermistor Kit (Top Cap Thermistor Only)

P/N	Liquid Injection Components
998-0177-00	DTC Vapor Injection Adapter
998-0340-00	Electronic Liquid Injection Valve Kit
998-0359-00	Liquid Solenoid Cable Kit
998-0500-03	DTC Kit, 250F Set Point DTC With 268F Thermistor for Liquid Injection

P/N	Motor Protection
971-0641-00	External Motor Protection Module

P/N	Mounting
527-0116-00	Spacer Mounting Kit, 30-35 Durometer, 1.45" OD, 0.44" ID, 0.75" Height
527-0210-00	Spacer Mounting Kit, 55-65 Durometer, 1.62" OD, 0.44" ID, 1.75" Height
998-0178-00	Hard Mount Kit, 1.87" OD, 0.69" ID, 0.31" Height

P/N	Oil Management
65365	Oil Management Control w/ Junction Box 24V, 50/60Hz
65366	Oil Management Control w/ Series Relief Connector 24V, 50/60Hz
66652	Oil Management, OMB Adapter (One Piece)

P/N	Service Valves and Adaptors
998-0034-08	Rotalock to Stub Tube Adapter, 1 1/4"-12 Thread to 7/8" Sweat
998-0034-13	Rotalock to Stub Tube Adapter, 1 3/4"-12 Thread to 1 3/8" Sweat
998-0034-18	Rotalock to Stub Tube Adapter, 1"-14 Thread to 1/2" Sweat
998-0510-90	Service Valve Kit, 1 1/4"-12 Thread to 7/8" Sweat
998-0510-46	Service Valve Kit, 1 3/4"-12 Thread to 1 3/8" Sweat
998-5100-27	Service Valve Kit, 1 3/4"-12 Thread to 1 3/8" Sweat and 1 1/4"-12 Thread to 7/8" Sweat

Table 6 - 2.0 – 7.5HP Copeland Scroll Compressors Service Kits

2.0 - 7.0 HP Medium Temp Kit (P/N 943-0050-00)	P/N's included
CoreSense Module	543-0223-00
Current Transducer Module	543-0159-00
Thermistor- Top Cap and Line	998-0176-00
CoreSense Information/Alert Code Label	052-2852-00
Digital Solenoid Wire	029-0512-01
RS485 Connector	021-0408-00

→ For use on these Models

Medium Temp Models	
ZB*KA- 4 – 7.5HP	ZBD*KC 4 – 7.5HP Digital
ZB*KC*- 4 – 7.5HP	ZBD*KQ 4 – 7.5HP Digital
ZB*KA 2 – 4.0HP	
ZB*KQ 2 – 4.0HP	ZBD*KC 2 – 4.0HP Digital
ZB*KC 2 – 4.0HP	ZB*KQ 2.0 – 4.0HP Digital

4 .0 – 7.5 HP Copeland Scroll Compressors Low Temp Kit (P/N 943-0051-00)	P/N's included
CoreSense Module	543-0223-00
Current Transducer Module	543-0159-00
EXV - 1.3mm orifice w/ 1" Rotalock	510-0881-00
Stepper Motor	050-0345-00
Seal - Rotalock Fitting (3 pcs.)	020-0028-00
Tee Fitting	036-1372-00
FM-2014ECT-57 INSTRUCTIONS	FM-2014ECT57
Digital Solenoid Wire	029-0512-01
FM-2014ECT-58 INSTRUCTIONS	FM-2014ECT58
Top Cap Thermistor	085-0240-00
Syringe- Dielectric Grease	093-0044-00
CoreSense Information/Alert Code Label	052-3149-00
Silicone Sealant	999-5170-66
RS485 Connector	021-0408-00

→ For use on these Models

Low Temp Models	
ZF*KV- 4.0 – 7.5HP EVI	ZFD*KV- 4.0 – 7.5HP Digital EVI

4.0 – 7.5HP Scroll Compressors Low Temp Kit (P/N 943-0051-01)	P/N's included
CoreSense Module	543-0223-00
Current Transducer Module	543-0159-00
EXV - 1.3mm orifice w/ 11/16" Rotalock	510-0880-00
Stepper Motor	050-0345-00
Seal - Rotalock Fitting (3 pcs.)	020-0903-02
CoreSense Information/Alert Code Label	052-3149-00
FM-2014ECT-57 INSTRUCTIONS	FM-2014ECT57
Digital Solenoid Wire	029-0512-01
FM-2014ECT-58 INSTRUCTIONS	FM-2014ECT58
Top Cap Thermistor	085-0240-00
Syringe- Dielectric Grease	093-0044-00
Silicone Sealant	999-5170-66
RS485 Connector	021-0408-00

For use on these Models →

Low Temp Models	
ZF*K4- 4.0 – 7.5HP	ZF*KQE- 4.0 – 7.5HP

2.0 – 4.0HP Scroll Compressors Low Temp Kit (P/N 943-0051-02)	P/N's included
CoreSense Module	543-0223-00
Current Transducer Module	543-0159-00
EXV - 1.0mm orifice w/ 11/16" Rotalock	510-0928-00
Stepper Motor	050-0345-00
Seal - Rotalock Fitting (3 pcs.)	020-0903-02
CoreSense Information/Alert Code Label	052-3149-00
FM-2014ECT-57 INSTRUCTIONS	FM-2014ECT57
Digital Solenoid Wire	029-0512-01
FM-2014ECT-58 INSTRUCTIONS	FM-2014ECT58
Top Cap Thermistor	085-0240-00
Syringe- Dielectric Grease	093-0044-00
Silicone Sealant	999-5170-66
RS485 Connector	021-0408-00

For use on these Models →

Low Temp Models	
ZF*K4 2.0 – 4.0HP	ZF*KQE 2.0 – 4.0HP
ZS*K4 2.0 – 4.0HP Extended Medium Temp	

Table 7 – Harness and Misc. Kits

4.0 – 7 HP Scroll Compressors Digital Kits	Kit Number
110 V Solenoid	923-0058-08
220 V Solenoid	923-0058-09
Digital Tubing Kit- (4.0 – 7.5HP Scroll compressors)	998-0073-00

For use on these Models

Digital Models	
ZBD30KCE-TFD	ZFD13KVE-TFD
ZBD38KCE-TFD	ZFD18KVE-TFD
ZBD45KCE-TFD	ZFD25KVE-TFD
ZBD57KCE-TFD	

2.0 – 4.0HP Scroll Compressors Digital Kits	Kit Number
110 V Solenoid	923-0058-08
220 V Solenoid	923-0058-09
Digital Tubing Kit- (2.0 – 4.0HP Scroll compressors)	998-0066-09

For use on these Models

Digital Models	
ZBD21KCE-TFD/TF5	ZBD19KQB-TFD
ZBD21KCL-TFD/TF5	ZBD21KQ-TFD/TF5/TF7
ZBD29KCE-TFD/TF5	ZBD21KQE-TFD/TF5/TF7
	ZBD24KQB-TFD
	ZBD29KQ-TFD/TF5/TF7
	ZBD29KQE-TFD/TF5/TF7

2.0 – 7.0 HP Scroll compressors Models Extension Harnesses	Length	Cable P/N	Kit Number
Current Transducer Module Extension Cable	3'	529-0297-00	529-0297-00
Current Transducer Module Extension Cable	10'	529-0297-01	529-0297-01
EXV Extension Cable for Liquid Injection	8'	529-0298-00	543-0253-00
EXV Extension Cable for Liquid Injection	10'	529-0298-01	543-0253-01
EXV Extension Cable for Liquid Injection	12'	529-0298-02	543-0253-02
EXV Extension Cable for Liquid Injection	15'	529-0298-03	543-0253-03
EXV Extension Cable for Liquid Injection	18'	529-0298-04	543-0253-04
EXV Extension Cable for Liquid Injection	20'	529-0298-05	543-0253-05
Top Cap Thermistor Extension Cable	8'	529-0299-00	529-0299-00
Top Cap Thermistor Extension Cable	10'	529-0299-01	529-0299-01
Top Cap Thermistor Extension Cable	12'	529-0299-02	529-0299-02
Top Cap Thermistor Extension Cable	15'	529-0299-03	529-0299-03
Top Cap Thermistor Extension Cable	18'	529-0299-04	529-0299-04
`Top Cap Thermistor Extension Cable	20'	529-0299-05	529-0299-05
Digital Tray Cable	8'	529-0300-00	529-0300-00
Digital Tray Cable	10'	529-0300-01	529-0300-01
Digital Tray Cable	12'	529-0300-02	529-0300-02
Digital Tray Cable	15'	529-0300-03	529-0300-03
Digital Tray Cable	18'	529-0300-04	529-0300-04
Digital Tray Cable	20'	529-0300-05	529-0300-05
1-5V Analog Input wire with Butt Splice		529-0347-00	
1-5 V Analog Input wire without Butt Splice		029-0511-00	998-0341-00
Liquid Line solenoid cable (non digital applications)		029-0512-01	998-0359-00

Table 8 - Miscellaneous Kit 2HP-17HP Copeland Scroll Compressors model

Miscellaneous Kits	P/N	Kit Number
Current Transducer Module	543-0159-00	943-0159-00
CoreSense Module- (2 – 7.5HP Scroll Compressors models)	543-0223-00	943-0223-00
CoreSense Module-(K5 Models)	543-0209-00	943-0209-00
Liquid Injection Kit for 11/16" Rotalock Fitting (036-1638-00) includes stepper motor & harness	510-0880-00	998-0740-00
Liquid Injection Kit for 1" Rotalock Fitting (036-1506-00) includes stepper motor & harness	510-0881-00	998-0741-00
Stepper Motor		950-0188-00
4.0 -7.0 HP Scroll compressors K4E Models -510-0881-00 Liquid Injection Valve Assembly Only- (1.3mm orifice injection valve 11/16" rotalock)		910-0046-00
4.0 -7.0 HP Scroll compressors KVE Models - 510-0880-00 Liquid Injection Valve Assembly Only- (1.3mm orifice injection valve 1" rotalock)		910-0045-00
K5 Liquid Injection valve assembly (1.8mm orifice injection valve with 1" Rotalock)		910-0047-00
2.0 -4.0 HP Scroll Compressors Models - 510-0928-00 Liquid Injection valve assembly 1.0mm with 11/16" rotalock	510-0928-00	910-0045-01

2.0 HP – 7.0 HP Copeland Scroll Compressors model designation.

Table 9 - 4.0 - 7.5HP Copeland Scroll compressors model for Medium Temperature Application Kit P/N: 943-0050-00

4.0 HP - 7.0 HP Copeland Scroll Compressor Models Medium Temperature Application				
ZB*KA (Obsoleted models)	**ZB*KC***	**ZBD*KC Digital**	**ZBD*KQ Digital**	**ZS*K4 - Extended Medium Temp**
ZB30KA-TFD/TFE/TF5	ZB30KC-TFD/TFE/TF5/TF7	ZBD28KCB-TFD	ZBD31KQB-TFD	ZS30K4-TFD/TF5
ZB38KA-TFD/TFE	ZB30KCE-TFD/TFE/TF5/TF7	ZBD30KC-TFD/TF5/TF7	ZBD38KQ-TFD/TF5/TF7	ZS30K4E-TFD/TFE/TF5/TF7
ZB45KA-TFD/TFE/TF5	ZB30KCL-TFD/TFE/TF5/TF7	ZBD30KCE-TFD/TFE/TF5	ZBD38KQE-TFD/TF5/TF7	ZS30K4L-TFD/TFE/TF5/TF7
	ZB38KC-TFD/TFE/TF5/TF7	ZBD38KCE-TFD/TFE/TF5/TF7	ZBD38KQE-TFD/TF5/TF8	ZS38K4-TFD/TF5
	ZB38KCE-TFD/TFE/TF5/TF7	ZBD38KCL-TFD/TFE/TF5	ZBD45KQ-TFD/TF5/TF7	ZS38K4E-TFD/TFE/TF5/TF7
	ZB38KCP-TFD/TFE/TF5	ZBD38KCP-TFD/TF5	ZBD45KQE-TFD/TF5/TF8	ZS38K4L-TFD/TFE/TF5/TF7
	ZB38KCL-TFD/TFE/TF5	ZBD45KC-TFD/TFE/TF5/TF7	ZBD48KQE-TFD/TF5/TF7	ZS45K4-TFD/TF5
	ZB45KC-TFD/TFE/TF5/TF7	ZBD45KCE-TFD/TFE/TF5/TF7	ZBD38KQE-TFD/TF5/TF7	ZS45K4E-TFD/TFE/TF5/TF7
	ZB45KCE-TFD/TFE/TF5/TF7	ZBD45KCL-TFD/TFE/TF5/TF8		ZS45K4L-TFD/TFE/TF5/TF7
	ZB45KCL-TFD/TFE/TF5/TF7			
	ZB48KC-TFD/TFE/TF5/TF7			
	ZB48KCE-TFD/TFE/TF5/TF7			
	ZB48KCL-TFD/TFE/TF5/TF7			
	ZB57KCE-TFD/TFE/TF5/TF8			
	ZB57KCL-TFD/TFE/TF5/TF7			

Table 10 - 4.0 - 7.5HP Copeland Scroll compressors model for Low Temp. Applications Kit P/N: 943-0051-00 & 943-0051-01

4.0 - 7.5HP Copeland Scroll Compressors models			
ZF*K4- Quest	**ZF*KQE- Quest**	**ZF*KV- Quest EVI**	**ZFD*KV- Quest Digital EVI**
11/16" Rotalock models	**11/16" Rotalock models**	**1" Rotalock models**	**1" Rotalock models**
ZF13K4-TFD/TF5/TF7	ZF13KQE-TFD/TFC/TF5/TF7	ZF13KVE-TFD/TFC/TF5/TF7	ZFD13KVE-TFD/TFC/TF5/TF7
ZF13K4E-TFD/TFE/TF5/TF7	ZF15KQE-TFD/TFE/TF5/TF7	ZF15KVE-TFD/TFE/TF5/TF7	ZFD13KVL-TFD/TFC/TF5/TF7
ZF13K4L-TFD/TFE/TF5/TF7	ZF18KQE-TFD/TFE/TF5/TF7	ZF18KVE-TFD/TFE/TF5/TF7	ZFD18KVE-TFD/TFC/TF5/TF7
ZF15K4-TFD/TF5/TF7	ZF25KQE-TFD/TFE/TF5/TF7	ZF18KVL-TFD/TFE/TF5/TF7	ZFD18KVL-TFD/TFC/TF5/TF7
ZF15K4E-TFD/TFE/TF5/TF7	ZF28KQE-TFD/TFE/TF5/TF7	ZF25KVE-TFD/TFE/TF5/TF7	ZFD25KVE-TFD/TFE/TF5/TF7
ZF15K4L-TFD/TFE/TF5/TF7		ZF25KVL-TFD/TFE/TF5/TF7	ZFD25KVL-TFD/TFE/TF5/TF7
ZF18K4-TFD/TFE/TF5/TF7		ZF28KVE-TFD/TFE/TFC/TF7	
ZF18K4E-TFD/TFE/TF5/TF7		ZF28KVL-TFD/TFE/TFC/TF7	
ZF18K4L-TFD/TFE/TF5/TF7			
ZF25K4-TFD/TFE/TF5/TF7			
ZF25K4E-TFD/TFE/TF5/TF7			
ZF25K4L-TFD/TFE/TF5/TF7			
ZF28K4E-TFD/TFC/TFE/TF7			

Table 11 - 2.0 - 4.0HP Copeland Scroll compressors model for Medium Temperature Applications Kit P/N: 943-0050-00

2.0 HP - 4.0 HP Copeland Scroll Compressor Models Medium Temp. Applications				
ZB*KA	**ZB*KC**	**ZB*KQ**	**ZBD*KC Digital**	**ZB*KQ Digital**
ZB21KA-TFD/TFE/TF5	ZB12KCU-TFD	ZB15KQ-TFD/TF5/TF7	ZBD21KCE-TFD/TF5	ZBD19KQB-TFD
	ZB15KC-TFD/TF5	ZB15KQE-TFD/TF5/TF7	ZBD21KCL-TFD/TF5	ZBD21KQ-TFD/TF5/TF7
	ZB15KCE-TFD/TF5	ZB19KQ-TFD/TF5/TF7	ZBD29KCE-TFD/TF5	ZBD21KQE-TFD/TF5/TF7
	ZB15KCL-TFD/TF5	ZB19KQB-TFD		ZBD24KQB-TFD
	ZB17KCU-TFD/TFM	ZB19KQE-TFD/TF5/TF7		ZBD29KQ-TFD/TF5/TF7
	ZB19KC-TFD/TF5	ZB21KQ-TFD/TF5/TF7		ZBD29KQE-TFD/TF5/TF7
	ZB19KCU-TFD/TF6			
	ZB19KCE-TFD/TF5	ZB21KQE-TFD/TF5/TF7		
	ZB19KCL-TFD/TF7	ZB29KQ-TFD/TF5/TF7		
	ZB20KCU-TFD/TFM	ZB29KQE-TFD/TF5/TF7		
	ZB21KC-TFD/TF5			
	ZB21KCE-TFD/TFE/TF5/TF7			
	ZB21KCL-TFD/TFE/TF5/TF7			
	ZB26KC-TFD/TF5			
	ZB26KCE-TFD/TF5			
	ZB26KCL-TFD/TF5			
	ZB28KCB-TFD			
	ZB29KCE-TFD/TFE/TF5/TF7			

Table 12 - 2.0 HP - 4.0 HP Copeland Scroll Compressors models for Low Temp. Applications Kit P/N: 943-0051-02

2.0 - 4.0HP Copeland Scroll Compressors Models Low Temp. Applications		
ZF*K4-	ZF*KQE-	ZS*K4 Extended Medium Temp
11/16" Rotalock models	11/16" Rotalock models	11/16" Rotalock models
ZF06K4-TFD/TF5	ZF06KQE-TFD/TFC/TFP/TF5	ZS15K4-TF5
ZF06K4E-TFD/TF5	ZF08KQE-TFD/TFC/TFP/TF5	ZS15K4E-TFD/TF5
ZF06K4L-TFD/TF5	ZF09KQE-TFD/TFC/TFP/TF5	ZS15K4L-TFD/TF5
ZF08K4-TFD/TF5	ZF11KQE-TFD/TFC/TFP/TF5	ZS19K4-TFD/TF5
ZF08K4E-TFD/TF5		ZS19K4E-TFD/TF5
ZF08K4L-TFD/TF5		ZS19K4L-TFD/TF5
ZF09K4-TFD/TFE/TF5		ZS21K4-TFD/TF5
ZF09K4E-TFD/TFE/TF5		ZS21K4E-TFD/TFE/TF5
ZF09K4L-TFD/TFE/TF5		ZS21K4L-TFD/TFE/TF5
ZF11K4-TFD/TF5		ZS26K4-TFD/TF5
ZF11K4E-TFD/TFE/TF5		ZS26K4E-TFD/TFE/TF5
ZF11K4L-TFD/TFE/TF5		ZS26K4L-TFD/TFE/TF5

Revision Tracking R4

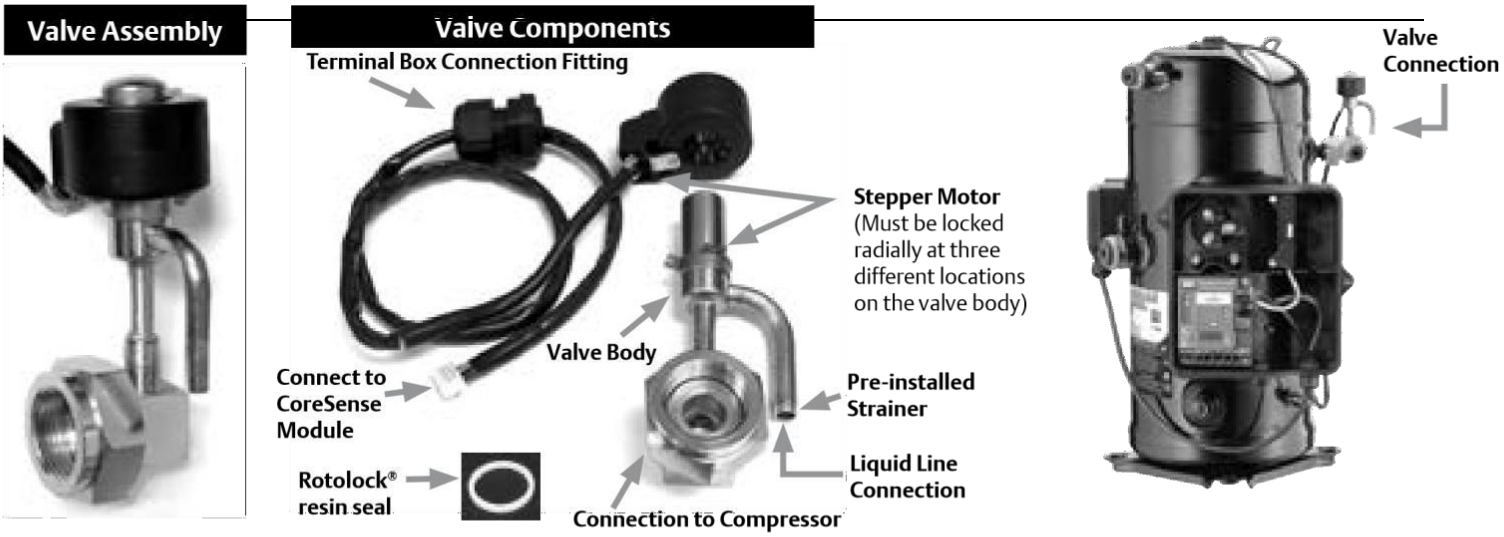
The document format has been updated to the new Copeland format

All occurrences of "Emerson" have been removed

A note regarding A3 and R290 venting has been updated

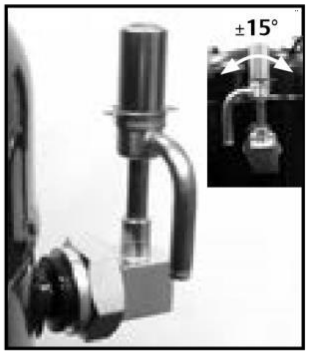
Appendix A

Electronic Liquid Injection Valve Kits

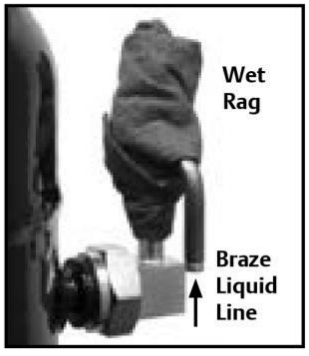


Electronic Liquid Injection Valve Installation

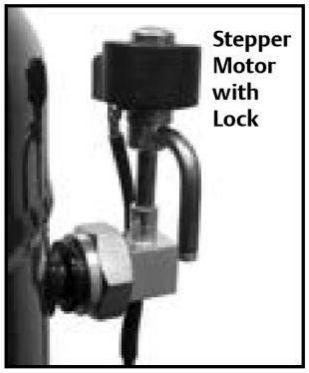
1. Assemble valve body onto the compressor. Make sure valve orientation is within ± 15° and apply full torque (620 ±20 inch-pound). Make sure compressor fitting has Rotolock seal installed.



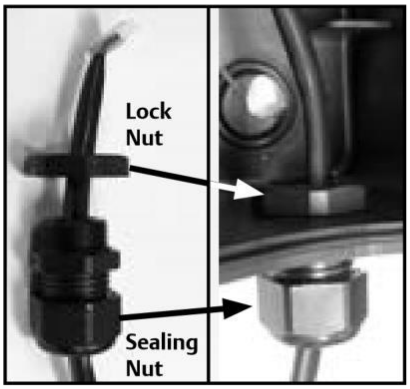
2. When brazing incoming liquid line, wet rag valve body completely. Allow the body to cool down before removing the wet rag.



3. Install the stepper motor. **Lock** the motor on the valve body using any one of the three locations.



4. Use ¾" knockout as shown. For terminal box mounting, run the wire through the box. For panel mounting, run the wire directly to the CoreSense module. Apply torques below.

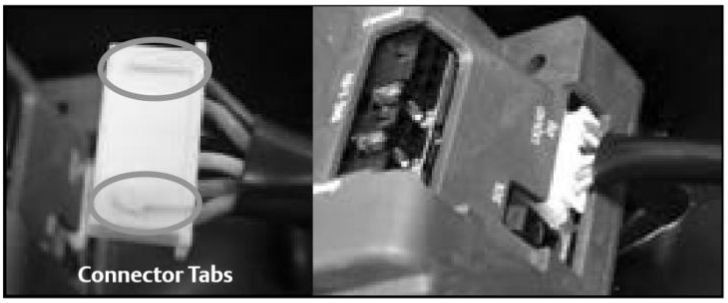


Sealing nut = 50-60 in-lb

Lock nut = 40-45 in-lb

Do not over-torque.

5. With tabs facing up, insert the connector from stepper motor into the 'LIQUID INJ' port on CoreSense™ module.



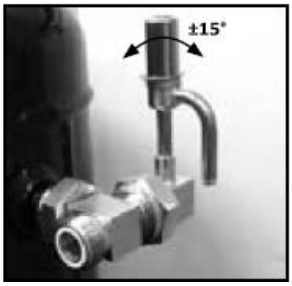
For more details refer to Application Engineering bulletin AE-1383.

Electronic Liquid Injection Valve Installation with T-Fitting Adapter Kit

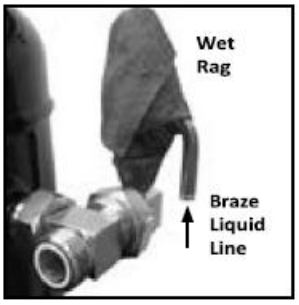
1. T-fitting kit# 998-0177-00 for wet injection application

2. Assemble T-fitting onto the compressor. Make sure fitting orientation is horizontal and has Rotolock seal. Apply torque 620 ±20 inch-pound.

3. Assemble the valve body onto the T-fitting. Make sure valve orientation is within ± 15° and apply full torque (620 ±20 inch-pound)

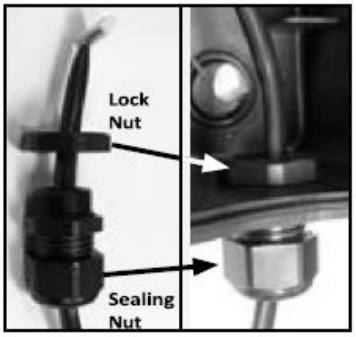


4. When brazing incoming liquid line, wet rag valve body completely. Allow the body to cool down before removing the wet rag.



5. Install the stepper motor. **Lock** the motor on the valve body using any one of the three locations.

7. Use ¾" knockout as shown. For terminal box mounting, run the wire through the box. For panel mounting, run the wire directly to the CoreSense module. Apply torques below.

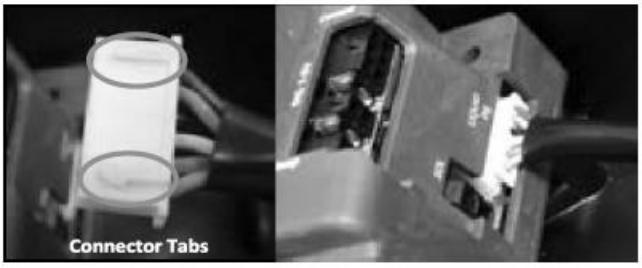


Sealing nut = 50-60 in-lb

Lock nut = 40-45 in-lb

Do not over-torque.

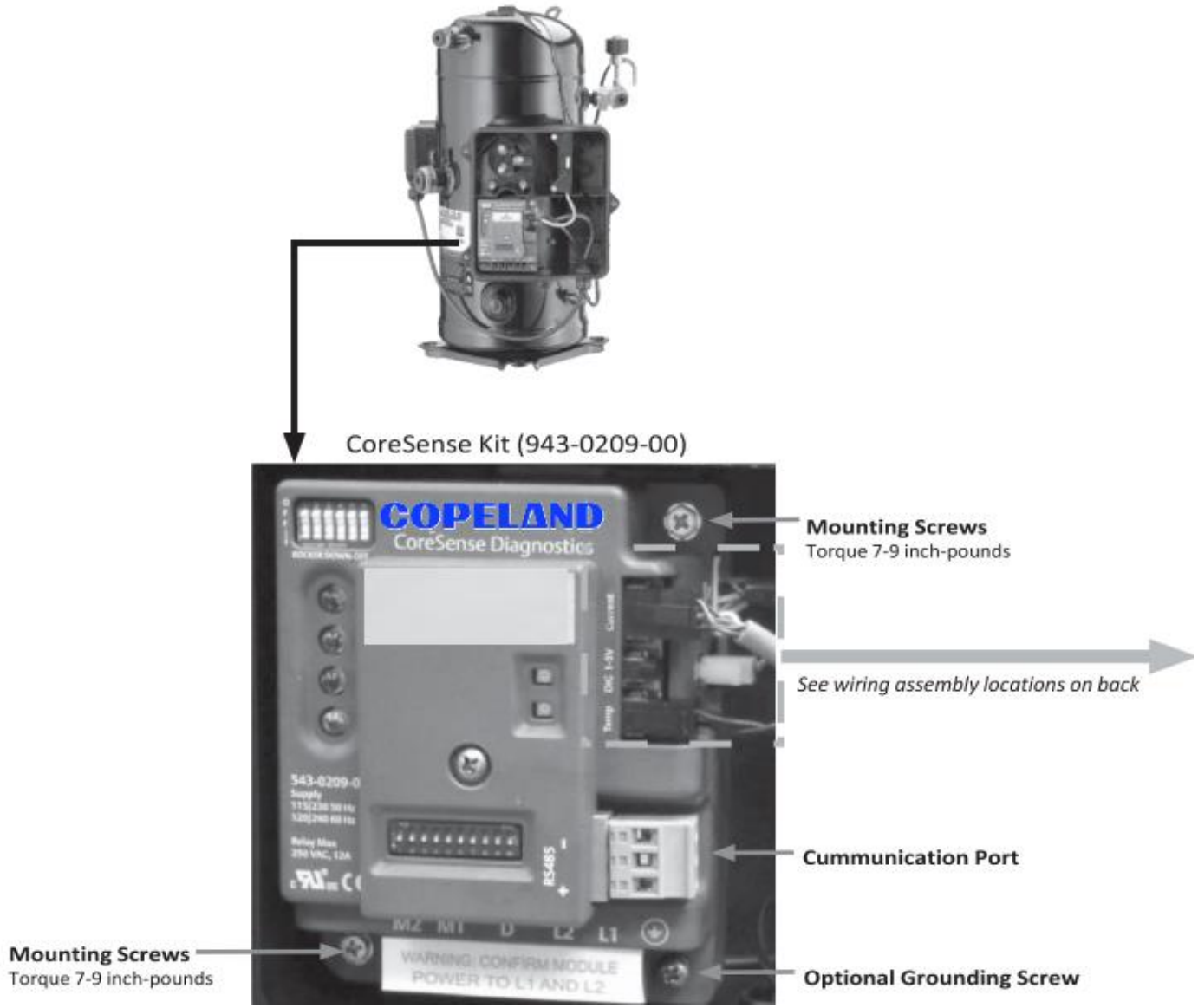
8. With tabs facing up, insert the connector from stepper motor into the 'LIQUID INJ' port on CoreSense module.



For more details refer to Application Engineering bulletin AE-1383.

Appendix B

Refrigeration K5 CoreSense and Wire Kit (943-0209-00)



Remove warning label to connect M1, M2, L1 and L2

Refrigeration K5 CoreSense and Wire Kit (998-0341-00, 998-0342-00 and 998-0359-00)