Application Engineering

CoreSense Communications for 20 to 40 Ton Copeland Scroll Air Conditioning Compressors

BULLETIN NO: AE8-1384 R8

Contents

COPELAND

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

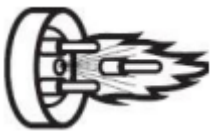
• OEMs are responsible for system design, selection of appropriate components, integration of this component into the system, and testing the system. OEMs must ensure that staff involved in these activities are competent and qualified.

• 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.

Introduction

Overview

CoreSense Communications is a breakthrough innovation for 20-to-40-ton Copeland Scroll air conditioning compressors. The CoreSense Communications module, installed in the compressor electrical box, provides advanced diagnostics, protection, and communications that enhance compressor performance and reliability.

Features

CoreSense Communications has the following key features:

1 Motor temperature protection
2 Scroll high temperature protection
3 Missing phase protection
4 Reverse phase protection
5 Low control circuit voltage protection
6 Short cycling detection and alert
7 Communication to system controller through RS485/Modbus
8 Storage of operational history, runtime information, fault counters, etc.
9 Display of status, warning, and alert information via LEDs

CoreSense Communications provides compressor and system protection through its proprietary lockout feature. Depending on the severity and frequency of the fault that caused the trip condition, the CoreSense Communications module can lockout the compressor contactor to prevent damage to the compressor and system components. Less severe fault conditions resulting in an occasional trip will not result in a lockout condition.

Flashing red and green LEDs communicate Status, Warning, and Alert codes to the service technician and the master controller.

Application Usage

WARNING

CoreSense Communications modules are not interchangeable with any other brand of motor protection module that may have been previously used with Copeland Scroll compressors.

CoreSense Communications modules are not intended to be used as field retrofits for other motor protection modules that may have been previously used with Copeland Scroll compressors. The motor and scroll thermistor circuits are configured differently for Copeland Scroll with CoreSense Communications and are not compatible with motor protection modules that were previously used.

Copeland Scroll compressors equipped with CoreSense Communication swill have an "**E**" in the electrical code. An example is the 40-ton scroll, ZP485KCE-T**E**D.

Module Part Numbers

OEM and service compressors will have the CoreSense Communications module installed in the compressor electrical box. Individually packaged modules are available to the aftermarket for component replacement. Part numbers for OEM and service applications are listed in **Table 1** at the end of this bulletin.

Agency Recognition

CoreSense Communications carries the following agency recognitions:

U.L. file E253322, Volume 7, Software Class B CB Test Certificate

Product Specifications

CoreSense specifications are shown in **Table 2**. Many of the electrical specifications are the same as previously used electronic motor protection modules.

Installation

Mounting

As mentioned above, CoreSense Communications will be shipped already installed in the compressor electrical box. Two holding tabs secure the module in the box. To remove the module, depress the holding tabs and remove the module.

WARNING

Always disconnect and lockout the power supply before removing the compressor electrical box cover for servicing.

Terminal Description and Basic Field Wiring

Figure 2 at the end of this bulletin shows the CoreSense Communications module. **Figures 1a** and **1b** are the terminal box wiring diagrams. An explanation of the terminal designations follows:

T2-T1: Module power supply, 24 or 120/240 VAC.

L1-L2-L3: Phase inputs corresponding to compressor input power L1-L2-L3.

M2-M1: Normally open control circuit contacts; M2-M1 should be wired in series with the compressor contactor.

A (+), GND, B (-): RS485 communications.

Temperature Plug: See Figure 3 for identification of the PTC, NTC, and common connections.

When multiple CoreSense Communications modules are networked, a shielded, twisted pair cable such as Belden #8761 (22 AWG) should be used for the communication wiring.

NOTICE

The RS485 is polarity sensitive. When "daisy chaining" modules the A (+) must connect to other A (+) terminals and B (-) must connect to other B (-) terminals.

Dielectric (Hipot) Testing

CAUTION

Use caution with high voltage and never hipot when compressor is in a vacuum.

U.L. sets the requirement for dielectric strength testing and should be consulted for the appropriate voltage and leakage values. Copeland does not recommend hipot testing at voltages higher than 1,000 VAC.

Operation

WARNING

Always disconnect and lockout the power supply before removing the compressor electrical box cover for servicing

A solid green LED indicates the module is powered and operation is normal. A solid red LED indicates an internal problem with the module. See the **Troubleshooting** section of this bulletin for more information on what to do if the red LED is solid.

CoreSense Communications communicates **Warning** codes via a green flashing LED. Warning codes do not result in a trip or lockout condition. Alert codes are communicated via a red flashing LED. **Alert** codes will result in a trip condition and possibly a lockout condition.

Warning Codes (Green LED Flash Code)

Code 1 - Loss of Communication

The module will flash the green Warning LED one time indicating the module has not communicated with the master controller for longer than 5 minutes. Once communication is reinitiated, the Warning will be cleared.

Code 2 - Reserved For Future Use

Code 3 - Short Cycling

The module will flash the green **Warning** LED three times indicating the compressor has short cycled more than 48 times in24hours. A short cycle is defined as compressor runtime of less than 3 minutes. The **Warning** will be activated when the “Short Cycling” dipswitch (#10) is “off” or in the “down” position. When fewer than 48 short cycles are accumulated in 24 hours the **Warning** code will be cleared.

Code 4 - Open/Shorted Scroll Thermistor

The module will flash the green **Warning** LED four times indicating the scroll NTC thermistor has a resistance value that indicates an open/shorted thermistor (see **Table 2**). The **Warning** will be cleared when the resistance value is in the normal range.

Alert/Lockout Codes (Red LED Flash Code)

Code 1 - Motor High Temperature

The module will flash the red **Alert** LED one time indicating the motor PTC circuit has exceeded 4.5K Ohms ± 25%. A code 1 **Alert** will open the M2-M1 contacts. The **Alert** will reset after 30 minutes and the M2-M1 contacts will close if the resistance of the motor PTC circuit is below 2.75K Ohms. Five consecutive Code 1 **Alerts** will lockout the compressor. Once the module has locked out the compressor, a power cycle or Modbus reset command will be required for the lockout to be cleared.

Code 2 - Open/Shorted Motor

Thermistor The module will flash the red **Alert** LED two times indicating the motor PTC thermistor circuit has a resistance value that indicates an open/shorted thermistor chain (see **Table 2**). A Code 2 Alert will open the M2-M1 contacts. The **Alert** will reset after 30 minutes and the M2-M1 contacts will close if the resistance of the motor PTC circuit is back in the normal range. The module will lockout the compressor if the trip condition exists for longer than 6 hours.

Once the module has locked out the compressor, a power cycle or Modbus reset command will be required to clear the lockout.

Code 3 - Short Cycling

The module will flash the red **Alert** LED three times indicating the compressor is locked out due to short cycling. A Code 3 **Alert** will open the M2-M1 contacts. Code 3 will be enabled when the “Short Cycling” dipswitch (#10) is “on” or in the “up” position and the compressor has exceeded the number of short cycles configured by the user in a 24-hour period. Once the module has locked out the compressor, a power cycle or Modbus reset command will be required to clear the lockout.

Code 4 - Scroll High Temperature

The module will flash the red **Alert** LED four times indicating the scroll NTC circuit is less than 2.4K Ohms. A Code 4 **Alert** will open the M2-M1 contacts. The Alert will reset after 30 minutes and the M2-M1 contacts will close if the resistance of the scroll NTC circuit is higher than 5.1K Ohms. The module will lockout the compressor if the number of Code 4 **Alerts** exceeds the user configurable number of Code 4 events within a 24-hour period. Once the module has locked out the compressor, a power cycle or Modbus reset command will be required to clear the lockout.

Code 5 - Reserved for Future Use

Code 6 - Missing Phase

The module will flash the red **Alert** LED six times, indicating a missing phase in one of the three leads to the compressor. A Code 6 Alert will open the M2-M1 contacts. **The compressor will be locked out if more than 10 consecutive Code 6 Alerts are detected.**

The number of events to lockout is configurable over Modbus and default value is 10.

. The **Alert** will reset after 5 minutes and the M2- M1 contacts will close if the missing phase condition is not present.

Code 7 - Reverse Phase

The module will flash the red **Alert** LED seven times indicating a reverse phase in two of the three leads to the compressor. A Code 7 **Alert** will open the M2- M1 contacts. The module will lockout the compressor after one Code 7

Alert. A power cycle or Modbus reset command will be required to clear the lockout.

Code 8 - Reserved for Future Use

Code 9 - Module Low Voltage

The module will flash the red **Alert** LED nine times indicating low module voltage (see **Table 2**) on the T2- T1 terminals for more than 5 seconds. A Code9 **Alert** will open the M2-M1 contacts. The **Alert** will reset after 5 minutes and the M2-M1 contacts will close if the T2-T1 voltage is above the reset value in **Table 2**.

Please see **Table 6** for a summary of **Warning** and **Alert** codes and troubleshooting information.

Resetting Alert Codes

Resetting **Alert** codes can be accomplished in two different ways. First, **Alert** codes can be reset manually by cycling power to the module (disconnect T2 or T1 for 5 seconds). The second way to reset **Alert** codes is to send a Modbus reset command from the master controller.

Power Up Delay

When CoreSense Communications is cycled off, there is a thirteen to fifteen second delay before the module is active.

If the fault that initiated the **Alert** code is absent after one of the above resets is performed, the **Alert** code will be cleared and CoreSense will allow normal operation. If the fault is still present after the reset is performed the fault code will continue to be displayed via the green or red flashing LED.

Commissioning

Communications

Programming knowledge and a familiarity with Modbus will be required by the system designer to use the communications features of CoreSense Communications. CoreSense Communications has opto-isolated RS485 for the physical layer. The communication protocol is Standard Modbus and Copeland Modbus. CoreSense Communications will act as the Modbus slave, while the master will be implemented in a system controller, PC software, or any other equivalent external device. Use of the communications feature of CoreSense Communications allows the master access to much of the data that resides in the CoreSense Communications module. Copeland Modbus has six message categories:

1 Device ID Messages
2 CoreSense Status Messages
3 CoreSense History Status Messages
4 Configuration Messages
5 Command Messages
6 Firmware Update Messages

CoreSense status, configuration, history, and device information messages available to the master include those listed in **Table 4**.

The history status messages give the order in which the **Warning/Alert** has happened, with the total compressor run time. Information about the **Warning/Alert** occurrence during the last 7 days and the cumulative **Warning/Alert** counter are also available.

For more information on CoreSense Communications features and to request Modbus maps please contact your Application Engineer.

DIP Switch Configuration

DIP switch selection for the Modbus address, baud rate, parity, and other operating conditions simplify service and start-up procedures. **Table 5** lists the purpose of each switch.

NOTICE

The module must be reset after changing any of the DIP switch settings for changes to take effect.

CoreSense Communications modules are shipped from the factory with the DIP switches set to default settings for standalone operation. Default settings are shown in **Table 5**. Switch 1 is turned “on” as part of a quality control check to verify communications capability of the module before it

leaves the compressor manufacturing plant. Switch 9 is also turned “on” for TE* motor code. All other DIP switch default settings are in the “off” position.

NOTICE

If DIP switch settings are inadvertently changed, the compressor will operate, but could have some loss of protection. Scroll temperature protection and short cycle protection could be disabled.

The following steps cover the DIP switch settings throughout the commissioning process for a multiple compressor system with communications.

1 Switches 1 through 5 are used for setting the device address. DIP switch 1 is the least significant bit (LSB) and switch 5 is the most significant bit (MSB). DIP switch addresses 0 through 31 are shown in **Figure 4**. Each CoreSense Communications module that is daisy chained and connected to a master controller must have a unique node address (as determined by the DIP switch settings).

2 Switch 6 defines the communication baud rate for the CoreSense Communications module. If the switch is “off”, the baud rate is 19200. If the switch is “on” the baud rate is 9600. The baud rate of each CoreSense Communications module should be set to match the master controller baud rate.

3 Switch 7definesthe communications parity. The default parity setting for the CoreSense Communications module is no parity. If the switch is set to “on” the module will communicate using even parity. The parity setting must match the parity setting of the master controller.

4 Switch 8 defines the control mode. The default setting is standalone mode (off). If communications with a master controller is desired, switch 8 should be turned “on” to network.

5 Switch 9 defines the thermistor configuration. If the compressor has a voltage code of TE*, the compressor has PTC and NTC thermistors for motor and scroll temperature protection. If the compressor voltage code is TW*, the compressor has only PTC thermistors for motor and scroll temperature protection. The default setting is “on” for PTC and NTC thermistor types.

6 Switch 10 enables short cycling protection if turned “on”. The default setting is “off”.

Jumper Setting

CoreSense Communications modules are shipped with the jumper installed. For standalone operation the jumper should remain installed. For daisy chained applications the jumper should remain installed for the modules on the ends of the daisy chain. All other jumpers in the sequence of daisy chained modules should be removed. The jumper can be removed using miniature electronics needle nose pliers.

PC Interface Software

PC interface software is available from Copeland Online Product Information (OPI). The PC interface software allows the design engineer access to status, configuration, history, and data logging via a computer. This method of connecting and communicating with CoreSense is very helpful during the unit development stage if CoreSense is in stand-alone mode and not communicating with a master controller.

The RS-485/USB adapter used to connect the laptop to the CoreSense is Copeland part number 929-0011-00. For more information on the PC interface software, how to obtain it, and a tutorial on its use, please contact your Application Engineer.

Service

Field Service

Service compressors will be shipped with the CoreSense Communications module installed in the compressor terminal box. Special attention should be given to the module DIP switch settings of the compressor being replaced so the DIP switch settings can be transferred to the module of the replacement compressor. As mentioned earlier, the CoreSense Communications module is a

recognized safety device and shall be used only with approved compressors with TE* motor codes.

NOTICE

If a compressor with CoreSense Communications fails in the field, the CoreSense module should remain with the failed compressor so Copeland technicians can download the CoreSense data to assist with determining the root cause of compressor failure.

Troubleshooting

WARNING

Always disconnect and lockout the power supply before removing the compressor electrical box cover for servicing.

For troubleshooting purposes, the scroll and motor thermistor circuits are like those of other Copeland Scrolls with one exception, the scroll thermistor is a negative temperature coefficient (NTC) type thermistor. This means that as the dis-charge temperature increases, the resistance of the thermistor decreases. The motor has positive temperature coefficient (PTC) type thermistors; as the motor temperature increases, so does the resistance of the thermistor chain. To measure the resistance of the PTC and NTC circuits simply remove the temperature plug from the CoreSense module and measure the resistance in the appropriate pins shown in **Figure 3**. The measured values should be in the ranges listed in **Table 2**. For information on trouble shooting causes of high motor and scroll temperatures please refer to the application engineering bulletin for the compressor.

A loss of communications with the master controller for more than five minutes is communicated via a green flash code 1 if DIP switch #8 is enabled. CoreSense Communications has no provisions to detect incorrect wiring neither between daisy chained modules nor to the master controller. Ideally, the master controller will contain advanced troubleshooting menus for help in diagnosing communications issues between the master controller and the CoreSense module.

NOTICE

In some rare cases communication between the master controller and the CoreSense module is problematic. Reversing the polarity will re-initiate communication.

To reverse polarity:

1 Adjust CoreSense to negative
2 Adjust master controller to positive

Figures & Tables

Table 1 CoreSense Communications Module Part Numbers

Voltage	OEM Part Number	Service Part Number
24	571-0065-05 (ZP, ZR, ZH)	971-0065-04
120/240	571-0064-06 (ZP, ZR, ZH)	971-0064-05
24	571-0109-00 (YP)	971-0109-00
120/240	571-0108-00 (YP)	971-0108-00
24	571-0109-01 (YA)	971-0109-01
120/240	571-0108-01 (YA)	971-0108-01

Table 2 CoreSense Communications Module Specifications

Module Part Number (ZP)	571-0065-05	571-0064-06
Module Voltage & Frequency	24 VAC, 50/60 HZ	120/240 VAC, 60HZ
		115/230 VAC, 50 HZ
Allowable Voltage Range	18 - 30 VAC	85 - 265 VAC
T2/T1 Low Voltage Trip	18 VAC	85/170 VAC
T2/T1 Low Voltage Reset	19 VAC	95/185 VAC
Power Consumption	5 VA	5 VA
M1/M2 Contact Rating	2.5A Max	2.5A Max
Motor Temperature Trip Resistance	> 4.5KΩ ± 25%	> 4.5KΩ ± 25%
Open Motor Thermistor Trip Resistance	>220KΩ	>220KΩ
Shorted Motor Thermistor Trip Resistance	<40Ω	<40Ω
Temperature Reset Resistance	< 2.75KΩ	< 2.75KΩ
Scroll Temperature Trip Resistance	< 2.4KΩ	< 2.4KΩ

Open Scroll Thermistor Trip Resistance	>370KΩ	>370KΩ
Shorted Scroll Thermistor Trip Resistance	<1KΩ	<1KΩ
Scroll Temperature Reset Resistance	> 5.1KΩ	> 5.1KΩ
Reset Time After Trip	30 minutes	30 minutes
Operating Temperature	-40° to 150°F (-40° to 65°C)	-40° to 150°F (-40° to 65°C)
Storage Temperature	-60° to 175°F (-51° to 80°C)	-60° to 175°F (-51° to 80°C)
Scroll High Temp. Trip Set Point	284°F (165°C)	284°F (165°C)
Scroll High Temp. Reset Set Point	230°F (135°C)	230°F (135°C)

Module Part Number (YP)	571-0109-00	571-0108-00
Module Voltage & Frequency	24 VAC, 50/60 HZ	120/240 VAC, 60HZ
		115/230 VAC, 50 HZ
Allowable Voltage Range	18 - 30 VAC	85 - 265 VAC
T2/T1 Low Voltage Trip	18 VAC	85/170 VAC
T2/T1 Low Voltage Reset	19 VAC	95/185 VAC
Power Consumption	5 VA	5 VA
M1/M2 Contact Rating	2.5A Max	2.5A Max
Motor Temperature Trip Resistance	> 3.52 kΩ ± 25%	> 3.52 kΩ ± 25%
Open Motor Thermistor Trip Resistance	>220KΩ	>220KΩ
Shorted Motor Thermistor Trip Resistance	<41Ω	<41Ω
Temperature Reset Resistance	< 2.2 kΩ	< 2.2 kΩ
Scroll Temperature Trip Resistance	< 1.33 kΩ	< 1.33 kΩ
Open Scroll Thermistor Trip Resistance	> 324.3 kΩ	> 324.3 kΩ
Shorted Scroll Thermistor Trip Resistance	<1KΩ	<1KΩ
Scroll Temperature Reset Resistance	> 2.66 kΩ	> 2.66 kΩ
Reset Time After Trip	30 minutes	30 minutes
Operating Temperature	-40° to 150°F (-40° to 65°C)	-40° to 150°F (-40° to 65°C)

Storage Temperature	-40° to 150°F (-40° to 65°C)	-40° to 150°F (-40° to 65°C)
Scroll High Temp. Trip Set Point	329°F (165°C)	329°F (165°C)
Scroll High Temp. Reset Set Point	275°F (135°C)	275°F (135°C)

Module Part Number (YA)	571-0109-01	571-0108-01
Module Voltage & Frequency	24 VAC, 50/60 HZ	120/240 VAC, 60HZ
		115/230 VAC, 50 HZ
Allowable Voltage Range	18 - 30 VAC	85 - 265 VAC
T2/T1 Low Voltage Trip	18 VAC	85/170 VAC
T2/T1 Low Voltage Reset	19 VAC	95/185 VAC
Power Consumption	5 VA	5 VA
M1/M2 Contact Rating	2.5A Max	2.5A Max
Motor Temperature Trip Resistance	> 3.52 kΩ ± 25%	> 3.52 kΩ ± 25%
Open Motor Thermistor Trip Resistance	>220KΩ	>220KΩ
Shorted Motor Thermistor Trip Resistance	<41Ω	<41Ω
Temperature Reset Resistance	< 2.2 kΩ	< 2.2 kΩ
Scroll Temperature Trip Resistance	< 1.66 kΩ	< 1.66 kΩ
Open Scroll Thermistor Trip Resistance	> 324.3 kΩ	> 324.3 kΩ
Shorted Scroll Thermistor Trip Resistance	<1KΩ	<1KΩ
Scroll Temperature Reset Resistance	> 3.43 kΩ	> 3.43 kΩ
Reset Time After Trip	30 minutes	30 minutes
Operating Temperature	-40° to 150°F (-40° to 65°C)	-40° to 150°F (-40° to 65°C)
Storage Temperature	-40° to 150°F (-40° to 65°C)	-40° to 150°F (-40° to 65°C)
Scroll High Temp. Trip Set Point	311°F (155°C)	311°F (155°C)
Scroll High Temp. Reset Set Point	257°F (125°C)	257°F (125°C)

Table 3 CoreSense Communications Accessory Parts

Part Description	Part Number
Scroll/Motor Thermistor Harness	529-0102-00

Table 4 CoreSense Modbus Map

NOTE: Number of registers value to be send in the query = Number in the column “Message Length With Zero Stuffing” / 2 (e.g. number of reg required to read “Seven day Warning history with cumulative count” is 36 (72/2)

Read Only Data
Read Write Data
Write Only Data

Parameters can be read using Function code 4 (Read Input Register)				
Location in Hex	**Parameter**	**Message Length in Bytes**	**Message Length with Zero Stuffing**	**Description**
300	CoreSense Module Firmware Version	8	16	
308	CoreSense Module Model Number	12	24	
314	ASSET Serial Number	12	24	
320	ASSET Model Number	18	36	
332	CoreSense Module Serial Number	11	22	
33D	Division Name	29	58	
35A	Product Code	9	18	
363	Product Name	7	14	
36A	Product type	1	2	
36B	Endian Convention	1	2	
36C	Dip switch Setting	2	2	

Unused (18 bytes)				
380	Alarm Code	1	2	0 - Normal Operation 1 - Loss of Communication to E2 2 - Open OR Short Spare Thermistor Warning 3 - Open OR Short Scroll Thermistor Warning 4 - Short Cycle Warning 5 - Module Low Voltage Trip 6 - Spare High Temperature Trip 7 - Missing Phase Trip 8 - Scroll High Temperature Trip 9 - Motor Thermistor Open OR Short Trip 10 - Motor High Temperature Trip 11 - Short Cycle Lockout 12 - Spare High Temperature Lockout 13 - Motor High Temperature Open OR Short Lockout 14 - Reverse Phase Lockout 15 - Missing Phase Lockout 16 - Scroll High Temperature Lockout 17 - Motor High Temperature Trip Lockout 18 - P47 Module Failure
381	Input and Output status	4	4	0x0001 - PTC Status (OK-1/Not OK-0) 0x0002 - Scroll High Temp NTC Status (OK-1/Not OK-0) 0x0004 - Spare Temp NTC Status (OK-1/Not OK-0) 0x0008 - L1 Voltage Status (Present-1/Absent-0) 0x0010 - L2 Voltage Status (Present-1/Absent-0) 0x0020 - L3 Voltage Status (Present-1/Absent-0) 0x0040 - Line Phase Voltage Status (OK-1/Not OK-0) 0x0080 - Line Reverse Voltage Status (OK-1/Not OK-0) 0x0100 - Pilot Voltage Status (OK-1/Not OK-0)
385	Scroll Temperature Value	2	2	(Scroll High Temp Sensor Value) Range = -0°C to 655.36°C
387	Spare Temperature Value	2	2	(Spare Temp Sensor Value) Range = -0°C to 655.36°C
389	Pilot Voltage Value	2	2	Pilot Voltage Value - Range 0 to 655.36 V

Unused (117 bytes)				
400	Ten most recent alarms with time stamp	40	60	
428	Compressor run history with cumulative count	11	20	
433	Compressor start history with cumulative count	19	20	
446	Short Cycle history with cumulative count	11	20	
Unused (30 bytes)				
46F	Seven-day Warning history with cumulative count	40	72	
497	Seven-day Trip history with cumulative count	60	108	
4D3	Seven-day Lockout history with cumulative count	70	126	

Parameters can be read using Function code 3 (Read Holding Register)			
Location in Hex	**Parameter**	**Message Length in Bytes**	**Message Length with Zero Stuffing**
100	Customer Id Code	4	8
104	Customer Location	17	34
115	Customer Name	17	34
126	Compressor Model Number Modified	18	36
138	Compressor Serial Number	12	24
144	Application Code	3	6
147	Temperature Code	4	8
14B	Refrigerant Code	7	14
152	Functional Configuration	2	2
154	Compressor run time to count as short cycle	1	2
155	Scroll High Temp Trip	2	2
157	Scroll High Temp Reset	2	2
15A	Future Use	1	2
15B	Future Use	2	2
15D	Future Use	2	2
15F	No. of Events to Scroll High Temp Lockout	1	2
160	No. of Events to Short Cycling Warning	1	2

Parameters can be write using Function code 16 (Preset Multiple Registers)					
Location in Hex	**Parameter**	**Message Length in Bytes**	**Message Length with Zero Stuffing**	**Range**	**Default**
100	Customer Id Code	4	8		
104	Customer Location	17	34		
115	Customer Name	17	34		
126	Compressor Model Number Modified	18	36		
138	Compressor Serial Number	12	24		
144	Application Code	3	6		
147	Temperature Code	4	8		
14B	Refrigerant Code	7	14		
152	Functional Configuration	2	2		
154	Compressor run time to count as short cycle	1	2	Range: 1 min to 6 min	3
155	Scroll High Temp Trip	2	2	Range: 110 deg C to 150 deg C	140
157	Scroll High Temp Reset	2	2	Note: Reset set point value should be always (Trip set point value - 30 deg C)	
159	No. of Events to Phase Loss Lockout	1	2	Range: 4 to 24	
15A	Future Use	1	2		
15B	Future Use	2	2		
15D	Future Use	2	2		
15F	No. of Events to Scroll High Temp Lockout	1	2	Range: 4 to 36	20
160	No. of Events to Short Cycling Warning	1	2	Range: 20 to 200	48
16A	Write Command	2	2	Options: 0x0800(Alarm Reset) & 0x8000(Module Reset)	

*Condition is set according to position of DIP switch #10

Table 5 DIP Switch Purpose

DIP Switch Number	On	Off
1 through 5	Modbus Module Address	
6	Baud Rate = 9600	Baud Rate = 19200
7	Even Parity	No Parity
8	Network Mode	Stand Alone
9[1]	TE*: NTC & PTC	TW*: PTC ONLY
10	Enable Short Cycle Protection	Disable Short Cycle Protection

[1] Thermistor Configuration: TE* = PTC & NTC (3 wire connectors), TW* = PTC only (2 wire connectors)

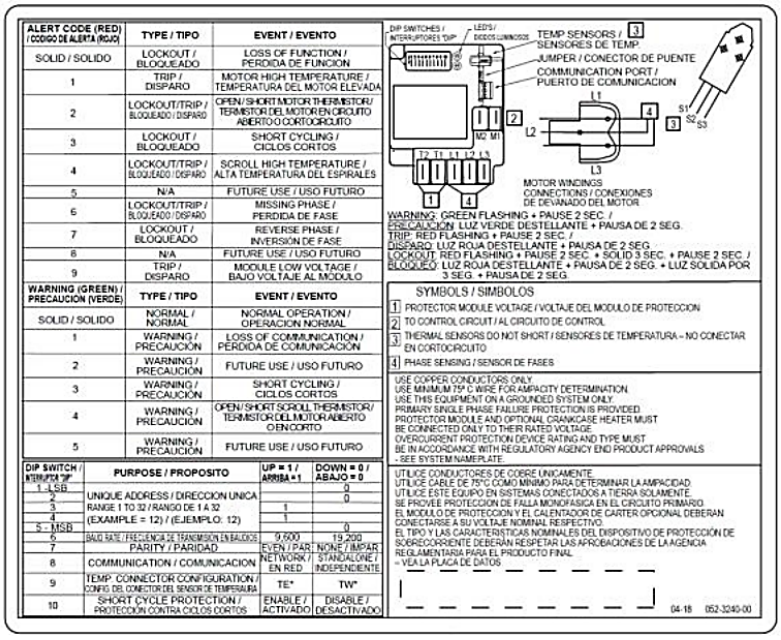
Table 6 CoreSense Communications LED Flash Code Information

The flash code number corresponds to the number of LED flashes, followed by a pause, and then the flash code is repeated. A lockout condition produces a red flash, followed by a pause, a solid red, a second pause, and then repeated.

Status	Fault Condition	Code Fault Description	Code Reset Description	Trouble Shooting Information
Solid Green	Normal Operation	Module is powered and operation is normal.	N/A	N/A
Solid Red	Module Malfunction	Module has internal fault.	N/A	1) Reset module by removing power fromT2- T1 2) Replace module
Warning LED Flash				
Green Flash Code 1	Loss of Communication	Module and master controller have lost communications with each other for more than 5 minutes.	When communications are confirmed	1) Check the control wiring 2) Verify dipswitch 8 is “on”
Green Flash Code 2	Future Use	N/A	N/A	N/A
Green Flash Code 3	Short Cycling	Run time of less than 3 minutes, number of short cycles exceed 48 in 24 hours	< 48 short cycles in 24 hours	1) Check system charge and pressure control setting 2) Adjust set-point of temperature controller 3) Install anti-short cycling control
Green Flash Code 4	Open/ Shorted Scroll Thermistor	Ω > 370K or Ω < 1K	5.1K < Ω < 370K	1) Check for poor connections at module and thermistor fusite 2) Check continuity of thermistor wiring harness
Green Flash Code 5	Future Use	N/A	N/A	N/A

Alert/Lockout LED Flash				
Red Flash Code 1	Motor High Temperature	Ω > 4.5K ± 25%; Lockout after 5 Alerts	When communications are confirmed	1) Check the control wiring 2) Verify dipswitch 8 is “on”
Red Flash Code 2	Open/Shorted Motor Thermistor	Ω > 220K or Ω < 40; Lockout after 6 hours	40 < Ω < 2.75K and 30 minutes	1) Check for poor connections at module and thermistor fusite 2) Check continuity of thermistor wiring harness
Red Flash Code 3	Short Cycling	Run time of less than 3 minutes; Lockout if the number of Alerts exceeds the number configured by the user in 24 hours	Interrupt power to T2-T1 or perform Modbus reset command	1) Check system charge and pressure control setting 2) Adjust set-point of temperature controller 3) Install anti-short cycling control
Red Flash Code 4	Scroll High Temperature	Ω < 2.4K; Lockout if the number of Alerts exceeds the number configured by the user in 24 hours	Interrupt power to T2-T1 or perform Modbus reset command	1) Check system charge and superheat 2) Check system operating conditions 3) Check for abnormally low suction pressure
Red Flash Code 5	Future Use	N/A	N/A	N/A
Red Flash Code 6	Missing Phase	Missing phase Lockout after 10 Alerts	After 5 minutes and missing phase condition is not present	1) Check incoming power 2) Check fuses/breakers 3) Check contactor 4) The number of events to lockout is configurable over Modbus and default value is 10.
Red Flash Code 7	Reverse Phase	Reverse phase; Lockout after 1 Alert	Interrupt power to T2-T1 or perform Modbus reset command	1) Check incoming phase sequence 2) Check contactor 3) Check module phasing wires A-B-C
Red Flash Code 8	Future Use	N/A	N/A	N/A
Red Flash Code 9	Module Low Voltage	Low voltage on T2-T1 terminals1	After 5 minutes and the voltage is back in the normal range	1) Verify correct module p/n 2) Check VA rating of transformer 3) Check for blown fuse in transformer secondary

Figure 1a Terminal Box Wiring Diagram (Excluding Models Listed Below)

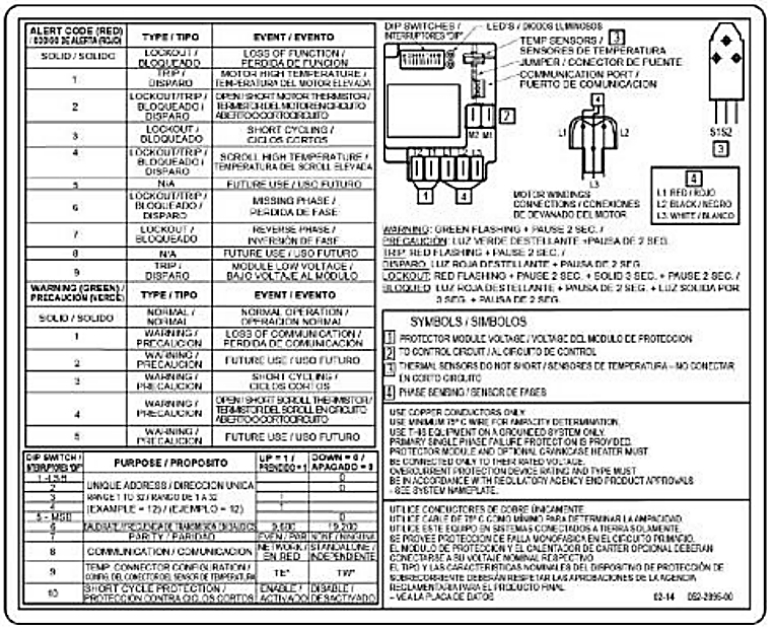


ALERT CODE (RED) / CODIGO DE ALERTA (ROJO)	TYPE / TIPO	EVENT / EVENTO
SOLID / SOLIDO	LOCKOUT / BLOQUEADO	LOSS OF FUNCTION / PERDIDA DE FUNCION
1	TRIP / DISPARO	MOTOR HIGH TEMPERATURE / TEMPERATURA DEL MOTOR ELEVADA
2	LOCKOUT/TRIP / BLOQUEADO / DISPARO	OPEN/SHORT MOTOR THERMISTOR/ TERMISTOR DEL MOTOR EN CIRCUITO ABIERTO O CORTOCIRCUITO
3	LOCKOUT / BLOQUEADO	SHORT CYCLING / CICLOS CORTOS
4	LOCKOUT/TRIP / BLOQUEADO / DISPARO	SCROLL HIGH TEMPERATURE / ALTA TEMPERATURA DEL ESPIRALES
5	N/A	FUTURE USE / USO FUTURO
6	LOCKOUT/TRIP / BLOQUEADO / DISPARO	MISSING PHASE / PERDIDA DE FASE
7	LOCKOUT / BLOQUEADO	REVERSE PHASE / INVERSIÓN DE FASE
8	N/A	FUTURE USE / USO FUTURO
9	TRIP / DISPARO	MODULE LOW VOLTAGE / BAJO VOLTAJE AL MODULO

WARNING (GREEN) / PRECAUCION (VERDE)	TYPE / TIPO	EVENT / EVENTO
SOLID / SOLIDO	NORMAL / NORMAL	NORMAL OPERATION / OPERACION NORMAL
1	WARNING / PRECAUCION	LOSS OF COMMUNICATION / PERDIDA DE COMUNICACION
2	WARNING / PRECAUCION	FUTURE USE / USO FUTURO
3	WARNING / PRECAUCION	SHORT CYCLING / CICLOS CORTOS
4	WARNING / PRECAUCION	OPEN/SHORT SCROLL THERMISTOR/ TERMISTOR DEL MOTOR ABIERTO O EN CORTO
5	WARNING / PRECAUCION	FUTURE USE / USO FUTURO

DIP SWITCH / INTERRUPTOR "DIP"	PURPOSE / PROPOSITO	UP = 1 / ARRIBA = 1	DOWN = 0 / ABAJO = 0
1 - LSB	UNIQUE ADDRESS / DIRECCION UNICA (EXAMPLE = 12) / (EJEMPLO: 12)		0
2			0
3		1	
4		1	
5 - MSB			0
6	BAUD RATE / FRECUENCIA DE TRANSMISION EN BAUDIOS	9,600	19,200
7	PARITY / PARIDAD	EVEN / PAR	NONE / IMPAR
8	COMMUNICATION / COMUNICACION	NETWORK / EN RED	STANDALONE / INDEPENDIENTE
9	TEMP. CONNECTOR CONFIGURATION / CONFIG. DEL CONECTOR DEL SENSOR DE TEMPERATURA	TE*	TW*
10	SHORT CYCLE PROTECTION / PROTECCION CONTRA CICLOS CORTOS	ENABLE / ACTIVADO	DISABLE / DESACTIVADO

Figure 1b ZP236/296 Terminal Box Wiring Diagram

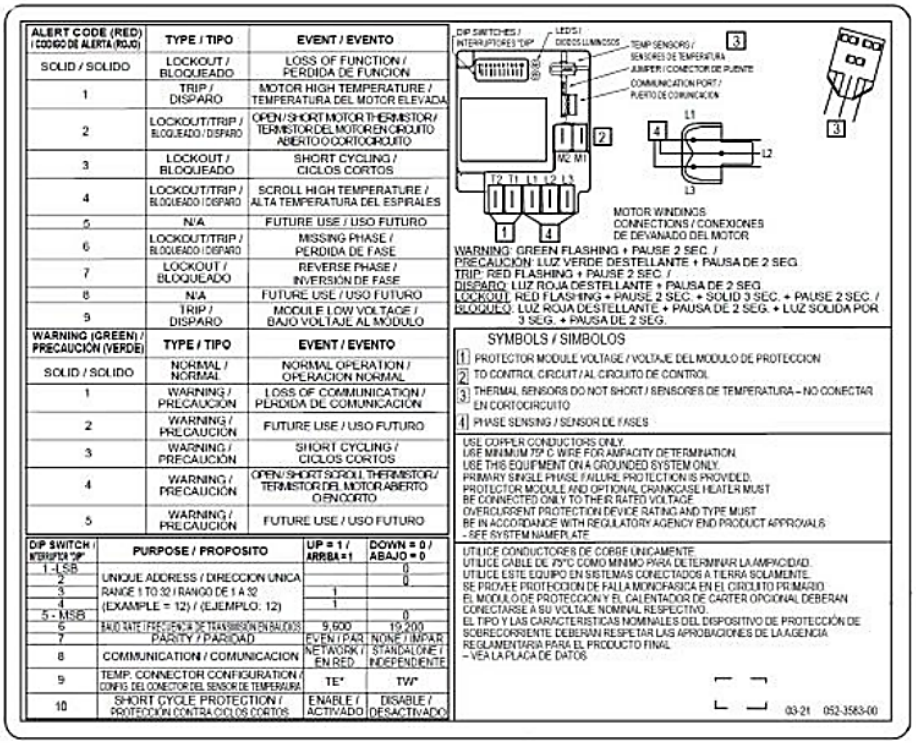


ALERT CODE (RED) / CODIGO DE ALERTA (ROJO)	TYPE / TIPO	EVENT / EVENTO
SOLID / SOLIDO	LOCKOUT / BLOQUEADO	LOSS OF FUNCTION / PERDIDA DE FUNCION
1	TRIP / DISPARO	MOTOR HIGH TEMPERATURE / TEMPERATURA DEL MOTOR ELEVADA
2	LOCKOUT/TRIP / BLOQUEADO / DISPARO	OPEN/SHORT MOTOR THERMISTOR/ TERMISTOR DEL MOTOR EN CIRCUITO ABIERTO O CORTOCIRCUITO
3	LOCKOUT / BLOQUEADO	SHORT CYCLING / CICLOS CORTOS
4	LOCKOUT/TRIP / BLOQUEADO / DISPARO	SCROLL HIGH TEMPERATURE / TEMPERATURA DEL SCROLL ELEVADA
5	N/A	FUTURE USE / USO FUTURO
6	LOCKOUT/TRIP / BLOQUEADO / DISPARO	MISSING PHASE / PERDIDA DE FASE
7	LOCKOUT / BLOQUEADO	REVERSE PHASE / INVERSION DE FASE
8	N/A	FUTURE USE / USO FUTURO
9	TRIP / DISPARO	MODULE LOW VOLTAGE / BAJO VOLTAJE AL MODULO

WARNING (GREEN) / PRECAUCIÓN (VERDE)	TYPE / TIPO	EVENT / EVENTO
SOLID / SOLIDO	NORMAL / NORMAL	NORMAL OPERATION / OPERACION NORMAL
1	WARNING / PRECAUCION	LOSS OF COMMUNICATION / PERDIDA DE COMUNICACION
2	WARNING / PRECAUCION	FUTURE USE / USO FUTURO
3	WARNING / PRECAUCION	SHORT CYCLING / CICLOS CORTOS
4	WARNING / PRECAUCION	OPEN/SHORT SCROLL THERMISTOR/ TERMISTOR DEL SCROLL EN CIRCUITO ABIERTO O CORTOCIRCUITO
5	WARNING / PRECAUCION	FUTURE USE / USO FUTURO

DIP SWITCH / INTERRUPTOR "DIP"	PURPOSE / PROPOSITO	UP = 1 / PRENDIDO = 1	DOWN = 0 / APAGADO = 0
1 - LSB	UNIQUE ADDRESS / DIRECCION UNICA (EXAMPLE = 12) / (EJEMPLO = 12)		0
2			0
3		1	
4		1	
5 - MSB			0
6	BAUD RATE / FRECUENCIA DE TRANSMISION EN BAUDIOS	9,600	19,200
7	PARITY / PARIDAD	EVEN / PAR	NONE / IMPAR
8	COMMUNICATION / COMUNICACION	NETWORK / EN RED	STANDALONE / INDEPENDIENTE
9	TEMP. CONNECTOR CONFIGURATION / CONFIG. DEL CONECTOR DEL SENSOR DE TEMPERATURA	TE*	TW*
10	SHORT CYCLE PROTECTION / PROTECCION CONTRA CICLOS CORTOS	ENABLE / ACTIVADO	DISABLE / DESACTIVADO

Figure 1c ZP233/293, YA219/275 & YP233/293 Terminal Box Wiring Diagram



ALERT CODE (RED) / CODIGO DE ALERTA (ROJO)	TYPE / TIPO	EVENT / EVENTO
SOLID / SOLIDO	LOCKOUT / BLOQUEADO	LOSS OF FUNCTION / PERDIDA DE FUNCION
1	TRIP / DISPARO	MOTOR HIGH TEMPERATURE / TEMPERATURA DEL MOTOR ELEVADA
2	LOCKOUT/TRIP / BLOQUEADO / DISPARO	OPEN / SHORT MOTOR THERMISTOR / TERMISTOR DEL MOTOR EN CIRCUITO ABIERTO O CORTOCIRCUITO
3	LOCKOUT / BLOQUEADO	SHORT CYCLING / CICLOS CORTOS
4	LOCKOUT/TRIP / BLOQUEADO / DISPARO	SCROLL HIGH TEMPERATURE / ALTA TEMPERATURA DEL ESPIRALES
5	N/A	FUTURE USE / USO FUTURO
6	LOCKOUT/TRIP / BLOQUEADO / DISPARO	MISSING PHASE / PERDIDA DE FASE
7	LOCKOUT / BLOQUEADO	REVERSE PHASE / INVERSION DE FASE
8	N/A	FUTURE USE / USO FUTURO
9	TRIP / DISPARO	MODULE LOW VOLTAGE / BAJO VOLTAJE AL MODULO
WARNING (GREEN) / PRECAUCION (VERDE)	**TYPE / TIPO**	**EVENT / EVENTO**
SOLID / SOLIDO	NORMAL / NORMAL	NORMAL OPERATION / OPERACION NORMAL
1	WARNING / PRECAUCION	LOSS OF COMMUNICATION / PERDIDA DE COMUNICACION
2	WARNING / PRECAUCION	FUTURE USE / USO FUTURO
3	WARNING / PRECAUCION	SHORT CYCLING / CICLOS CORTOS
4	WARNING / PRECAUCION	OPEN / SHORT SCROLL THERMISTOR / TERMISTOR DEL MOTOR ABIERTO O EN CORTO
5	WARNING / PRECAUCION	FUTURE USE / USO FUTURO

DIP SWITCH / INTERRUPTOR "DIP"	PURPOSE / PROPOSITO	UP = 1 / ARRIBA = 1	DOWN = 0 / ABAJO = 0
1 - LSB	UNIQUE ADDRESS / DIRECCION UNICA RANGE 1 TO 32 / RANGO DE 1 A 32 (EXAMPLE = 12) / (EJEMPLO: 12)		0
2			0
3		1	
4		1	
5 - MSB			0
6	BAUD RATE / FRECUENCIA DE TRANSMISION EN BAUDIOS	9,600	19,200
7	PARITY / PARIDAD	EVEN / PAR	NONE / IMPAR
8	COMMUNICATION / COMUNICACION	NETWORK / EN RED	STANDALONE / INDEPENDIENTE
9	TEMP. CONNECTOR CONFIGURATION / CONFIG. DEL CONECTOR DEL SENSOR DE TEMPERATURA	TE*	TW*
10	SHORT CYCLE PROTECTION / PROTECCION CONTRA CICLOS CORTOS	ENABLE / ACTIVADO	DISABLE / DESACTIVADO

DIP SWITCHES / INTERRUPTORES "DIP"
LEDS / DIODOS LUMINOSOS
TEMP. SENSORS / SENSORES DE TEMPERATURA
JUMPER / CONECTOR DE PUENTE
COMMUNICATION PORT / PUERTO DE COMUNICACION
MOTOR WINDINGS CONNECTIONS / CONEXIONES DE DEVANADO DEL MOTOR

WARNING: GREEN FLASHING + PAUSE 2 SEC. /
PRECAUCION: LUZ VERDE DESTELLANTE + PAUSA DE 2 SEG.
TRIP: RED FLASHING + PAUSE 2 SEC. /
DISPARO: LUZ ROJA DESTELLANTE + PAUSA DE 2 SEG.
LOCKOUT: RED FLASHING + PAUSE 2 SEC. + SOLID 3 SEC. + PAUSE 2 SEC. /
BLOQUEO: LUZ ROJA DESTELLANTE + PAUSA DE 2 SEG. + LUZ SOLIDA POR 3 SEG. + PAUSA DE 2 SEG.

SYMBOLS / SIMBOLOS

1. PROTECTOR MODULE VOLTAGE / VOLTAJE DEL MODULO DE PROTECCION
2. TO CONTROL CIRCUIT / AL CIRCUITO DE CONTROL
3. THERMAL SENSORS DO NOT SHORT / SENSORES DE TEMPERATURA – NO CONECTAR EN CORTOCIRCUITO
4. PHASE SENSING / SENSOR DE FASES

USE COPPER CONDUCTORS ONLY.
USE MINIMUM 75° C WIRE FOR AMPACITY DETERMINATION.
USE THIS EQUIPMENT ON A GROUNDED SYSTEM ONLY.
PRIMARY SINGLE PHASE FAILURE PROTECTION IS PROVIDED.
PROTECTOR MODULE AND OPTIONAL CRANKCASE HEATER MUST BE CONNECTED ONLY TO THEIR RATED VOLTAGE.
OVERCURRENT PROTECTION DEVICE RATING AND TYPE MUST BE IN ACCORDANCE WITH REGULATORY AGENCY AND PRODUCT APPROVALS - SEE SYSTEM NAMEPLATE.

UTILICE CONDUCTORES DE COBRE UNICAMENTE.
UTILICE CABLE DE 75°C COMO MINIMO PARA DETERMINAR LA AMPACIDAD.
UTILICE ESTE EQUIPO EN SISTEMAS CONECTADOS A TIERRA SOLAMENTE.
SE PROVEE PROTECCION DE FALLA MONOFASICA EN EL CIRCUITO PRIMARIO.
EL MODULO DE PROTECCION Y EL CALENTADOR DE CARTER OPCIONAL DEBERAN CONECTARSE A SU VOLTAJE NOMINAL RESPECTIVO.
EL TIPO Y LAS CARACTERISTICAS NOMINALES DEL DISPOSITIVO DE PROTECCIÓN DE SOBRECORRIENTE DEBERAN RESPETAR LAS APROBACIONES DE LA AGENCIA REGLAMENTARIA PARA EL PRODUCTO FINAL.
– VEA LA PLACA DE DATOS.

03-21 052-3583-00

Figure 2 CoreSense Communications Module

Figure 3 Thermistor Circuit Cable

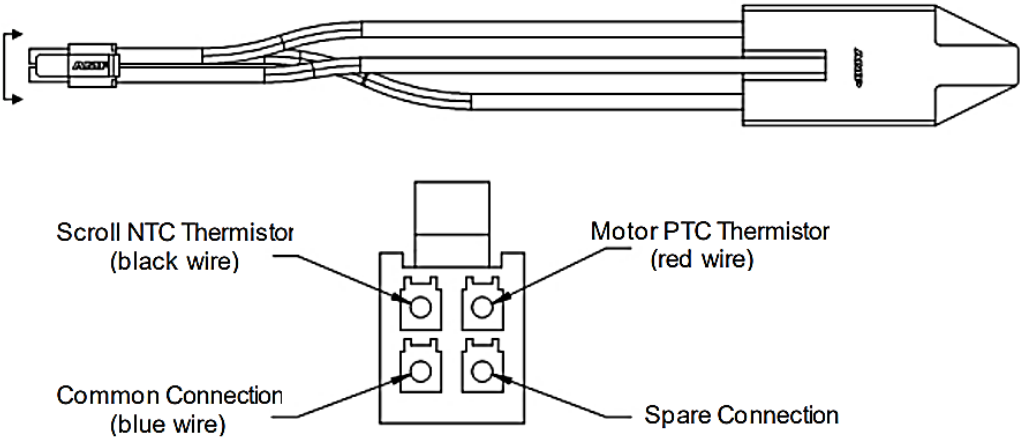
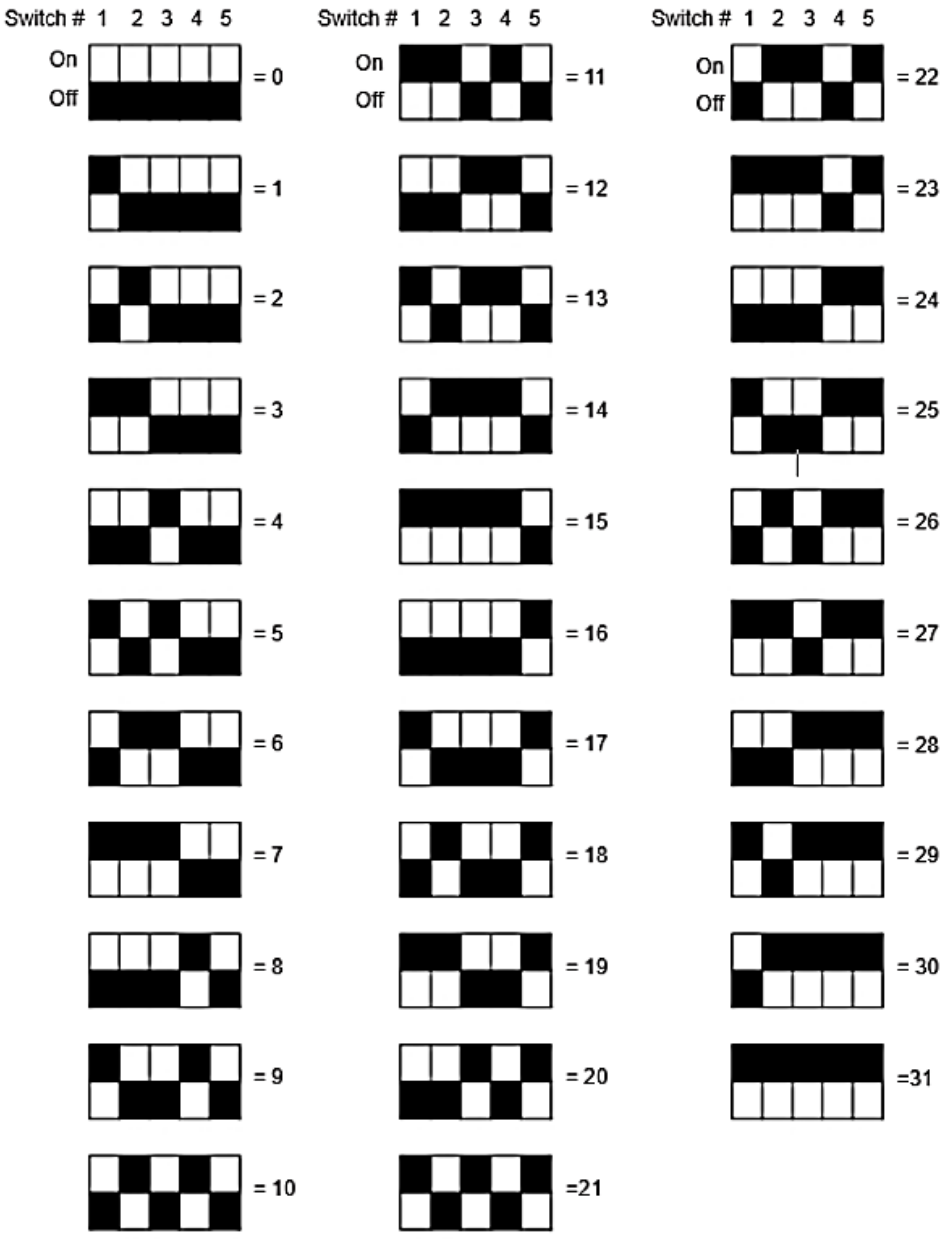


Figure 4 Modbus Addressing



Revision Tracking R8

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