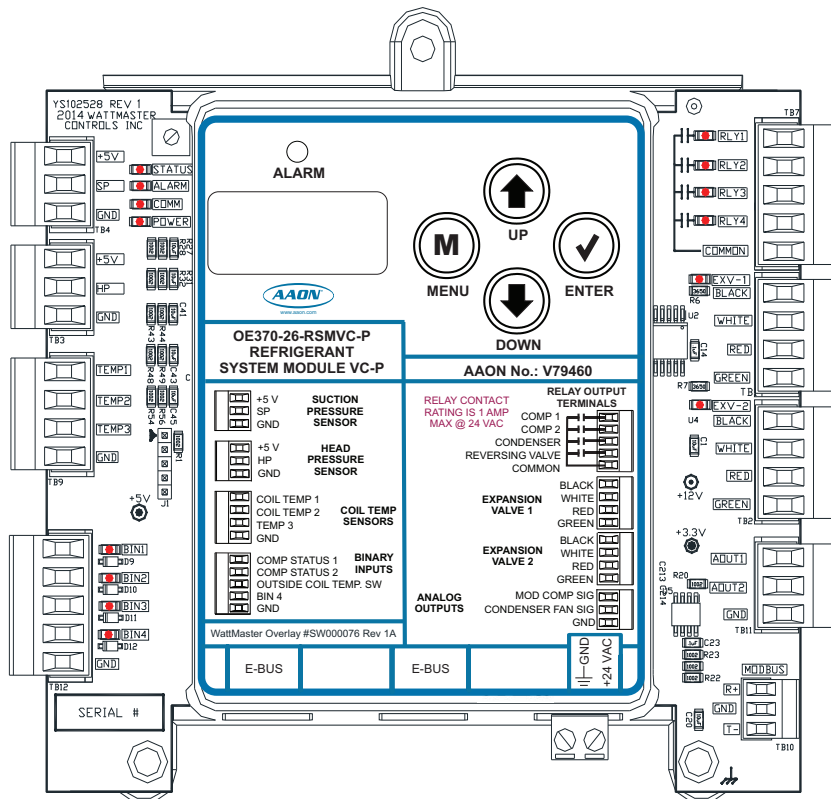




RSMVC-P Technical Guide





www.aaon.com

WattMaster Controls Inc.
8500 NW River Park Drive · Parkville, MO 64152
Toll Free Phone: 866-918-1100
PH: (816) 505-1100 · FAX: (816) 505-1101
E-mail: mail@wattmaster.com
Visit our web site at www.orioncontrols.com

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RSMVC-P Overview

RSMVC-P Features & Applications

The OE370-26-RSMVC-P Refrigerant System Module for Copeland VFD Compressors (RSMVC-P) monitors and controls one refrigeration circuit of the HVAC unit. The module is designed for R410-A refrigerant.

The RSMVC-P is connected to the VCCX-P Controller. There are 2 E-BUS Expansion Ports and one MODBUS Connector.

The RSMVC-P provides 4 analog inputs, 3 binary inputs, 4 relays, and 2 analog outputs. See **Figures 2 & 3, pages 6 & 7** for wiring.

The RSMVC-P Module provides the following:

- Controls the Compressors to satisfy the Supply Air Temperature Setpoint (Supply Air Temperature sent by VCCX-P Controller) during Cooling Mode. During Dehumidification Mode, it controls the Compressors to the Suction (Saturation) Temperature Setpoint
- Communicates to the Copeland VFD Drive for control and fault monitoring
- Modulates the Condenser Fan to maintain the Head Pressure Setpoint
- Provides alarms and safeties for the compressor and condenser operation.
- Contains a 2 x 8 LCD character display and 4 buttons that allow for status display, setpoint changes, and configuration changes.

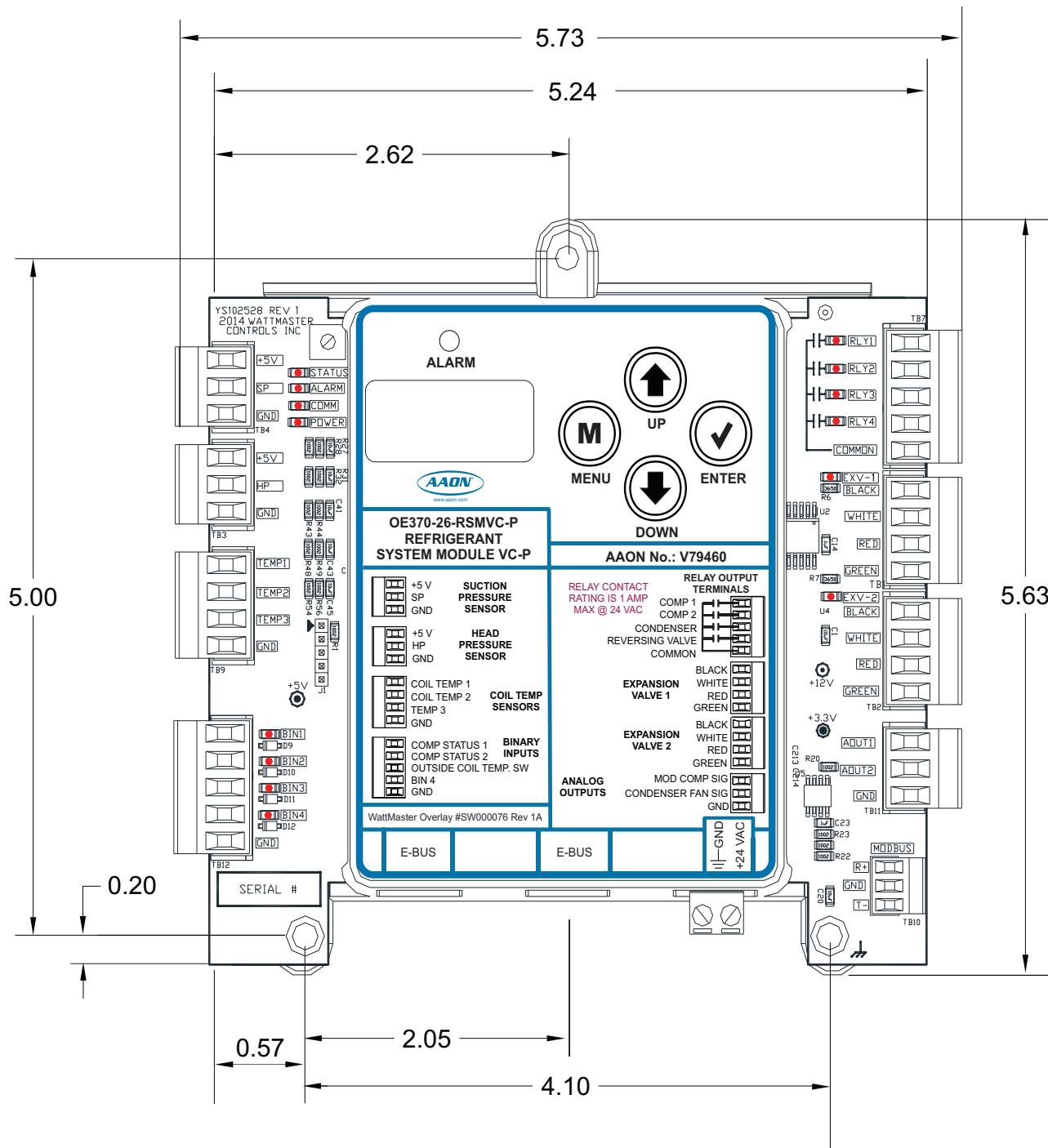


Figure 1: Refrigerant System Module Dimensions

WIRING

RSMVC-P Inputs Wiring

RSMVC-P Wiring

The RSMVC-P is connected to the VCCX-P Controller. There are 2 E-BUS Expansion Ports and one MODBUS Connector which allow the use of communicating sensors and the E-BUS Modules.

The RSMVC-P provides 4 analog inputs, 3 binary inputs, 4 relays, and 2 analog outputs. See **Figure 2, below** for inputs wiring and **Figure 3, page 7** for outputs wiring.

Suction Pressure Sensor Wiring

The OE275-01 Suction Pressure Transducer must be wired as shown in **Figure 2, below**. It is required for all compressorized VCCX-P applications.

The Suction Pressure Sensor is used to measure suction pressure at the HVAC unit's DX evaporator coil suction line. This suction line pressure is converted to saturated refrigerant temperature by the RSMVC-P Module. This temperature is used by the RSMVC-P to accurately control the speed of the compressor to maintain the Supply Air Temperature. In this application, the sensor is used as a backup sensor. The primary sensor is located on the EXV Controller.

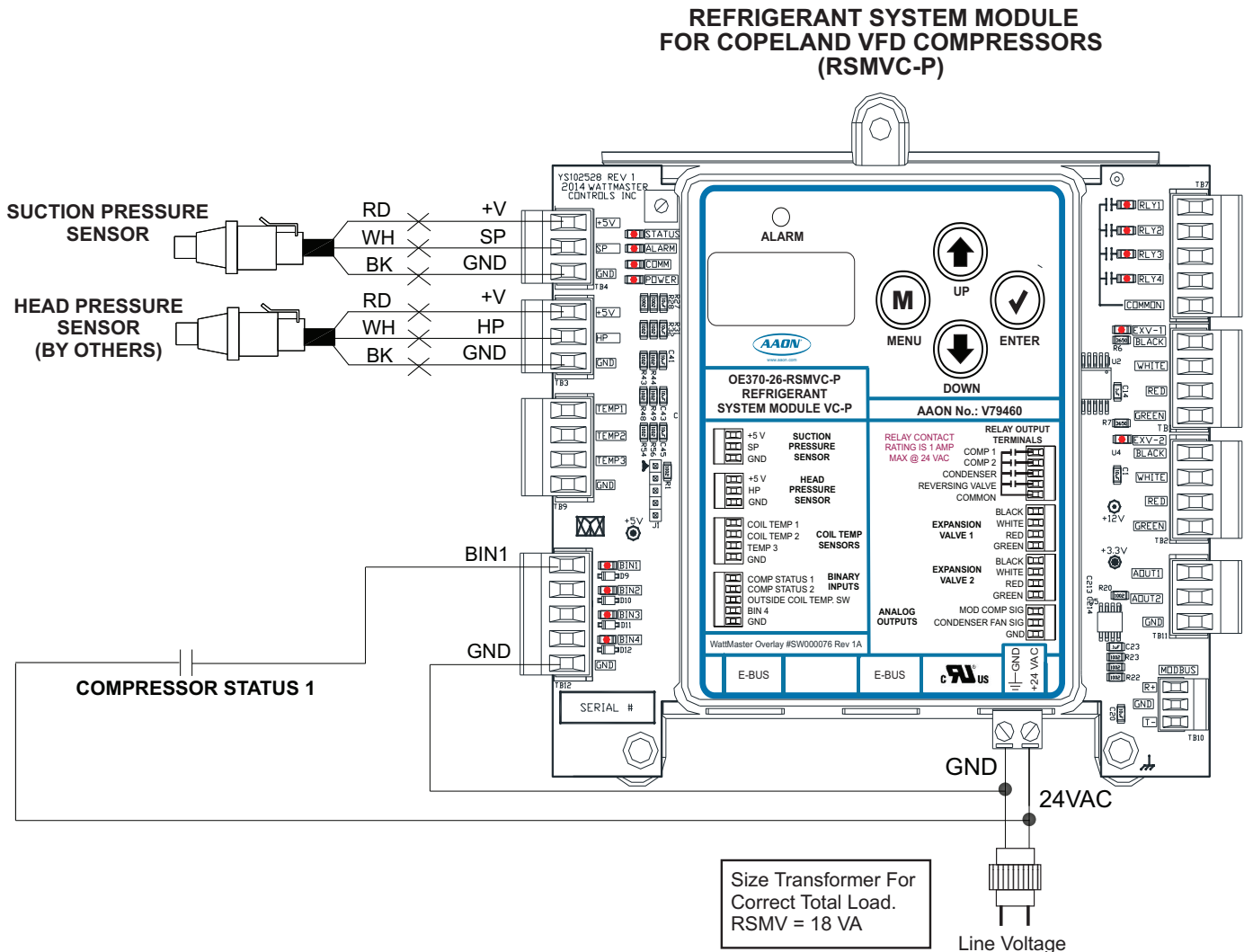


Figure 2: RSMVC-P Inputs Wiring

RSMVC-P Outputs Wiring

CAUTION: The Shraeder port used for installation of the suction pressure transducer should be located in a vertical position of the suction line to prevent refrigerant oil from accumulating in the sensor.

Head Pressure Control

The RSMVC-P can monitor a Head Pressure Transducer and control Condenser Fans to maintain a Head Pressure Setpoint. The Condenser Fan will be controlled with a 0-10 VDC output signal.

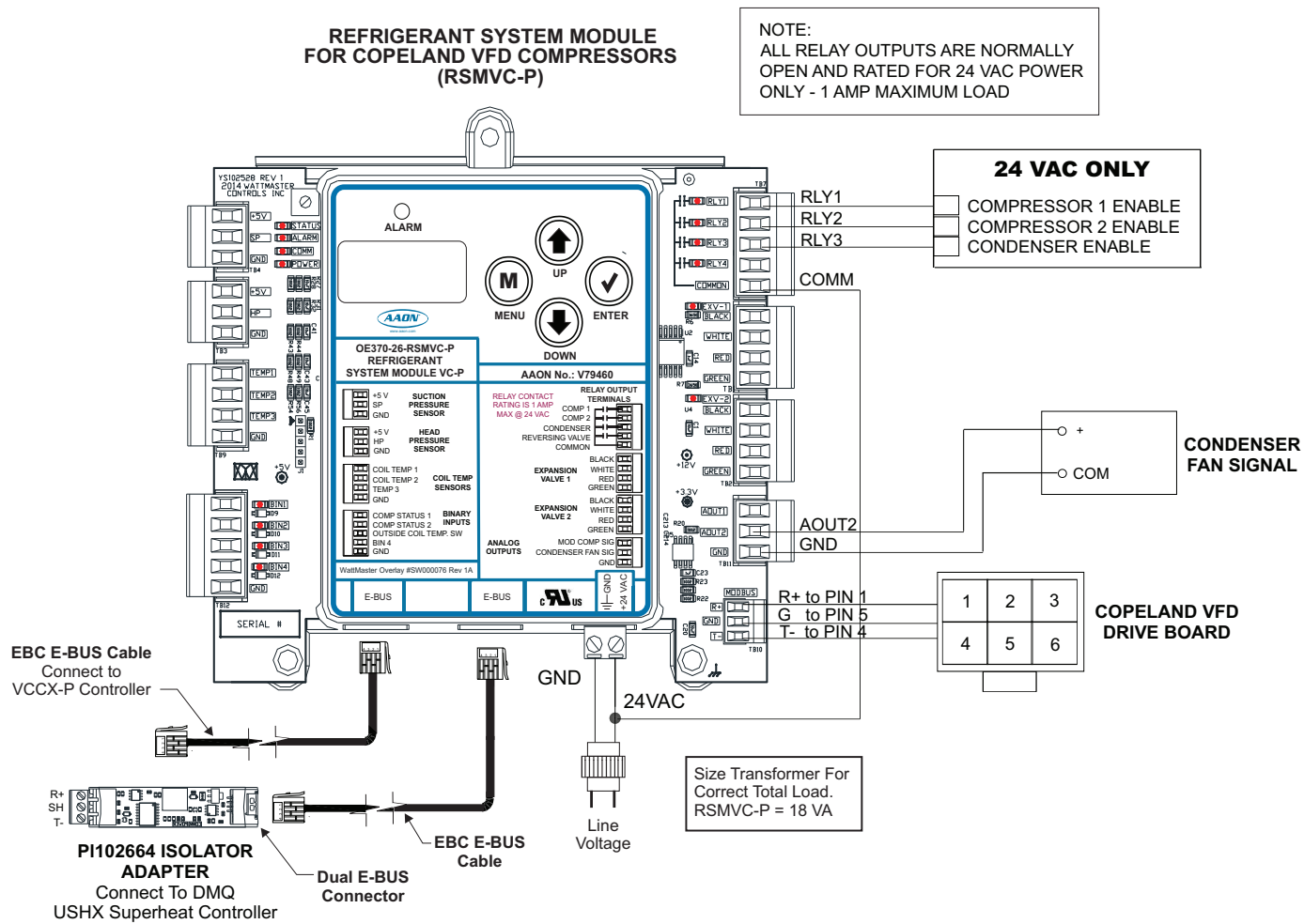


Figure 3: RSMVC-P Outputs Wiring

INPUTS & OUTPUTS

RSMVC-P Module Input/Output Maps

Input/Output Map

See **Table 1** for the RSMV for Copeland VFD Compressor Inputs/Outputs.

REFRIGERATION SYSTEM MODULE FOR VFD COMPRESSORS	
Analog Inputs	
1	Suction Pressure Sensor (SP)
2	Head Pressure Sensor (HP)
3	Not Used (TEMP1)
4	Not Used (TEMP2)
Binary Inputs	
1	Compressor Status 1 (BIN1)
2	Not Used (BIN2)
Analog Outputs (0-10 VDC)	
1	Not Used (AOUT1)
2	Condenser Fan Signal (AOUT2)
Stepper Motor Outputs	
1	Not Used (EXV-1)
2	Not Used (EXV-2)
Binary Outputs (24 VAC)	
1	Compressor 1 Enable Relay (R1)
2	Not Used (R2)
3	Condenser Enable Relay (R3)

Table 1: RSMVC-P Inputs & Outputs

RSMVC-P - Inputs & Outputs

+5V VDC Power

This output is a 5 VDC output that supplies power to the Suction Pressure Transducer.

SP - Suction Pressure Transducer

The Suction Pressure Sensor is used to measure suction pressure at the HVAC unit's DX evaporator coil suction line. This suction line pressure is converted to saturated refrigerant temperature by the RSMVC-P Module. This temperature is used by the RSMVC-P to accurately control the speed of the compressor to maintain the Supply Air Temperature. In this application, the sensor is used as a backup sensor. The primary sensor is located on the EXV Controller.

+5V VDC Power

This output is a 5 VDC output that supplies power to the Head Pressure Transducer.

HP - Head Pressure Transducer

The Head Pressure Transducer is used to measure Head Pressure at the discharge line. This Head Pressure is used to drive the Condenser Fans to maintain a given Head Pressure Setpoint.

TEMP1 & TEMP2 - Coil (Suction Line) Temperature Sensor 1 & Sensor 2 Input

Not used.

BIN1 - Compressor Status 1

When this wet contact input closes, a 24 volt signal to Binary Input #1 indicates that Compressor 1 is running. Typically, the source for this is a relay output from the compressor VFD drive. If Binary Input 1 opens, Compressor 1 Enable Relay will de-energize and a Compressor Alarm will be generated.

BIN2 - Compressor Status 2

Not used.

NOTE: The Binary Inputs require wet contacts (24 VAC only) to recognize an active input. If you provide dry contacts, the contact closure will not be recognized.

AOUT1 - Modulating Compressor Signal

Not used.

AOUT2 - Condenser Fan VFD Signal

This is a direct acting output signal that is used to modulate the Condenser Fan VFD (0-10 VDC signal) on an Air Cooled unit.

EXV-1

Not used.

EXV-2

Not used.

RLY1 - Compressor 1 Enable

This relay turns on the Modulating Compressor.

RLY2 - Compressor 2 Enable

Not used

RLY3 - Condenser Enable

This relay turns on the Condenser Fan / Water Valve.

SEQUENCE OF OPERATIONS

Cooling Mode & Head Pressure Control Operation

Cooling Mode Operation

In the Cooling Mode, as the Supply Air Temperature (SAT) rises above the Active SAT Cooling Setpoint, the compressors will stage on and modulate to maintain the Active SAT Cooling Setpoint. Minimum off times must also be met before compressors can stage on and minimum run times must be met before compressors can stage off.

Head Pressure Control

The Refrigeration System Module for Copeland VFD Compressors (RSMVC-P) can monitor a Head Pressure Transducer and control a Condenser Fan to maintain a Head Pressure Setpoint. The RSMVC-P must be configured for an Air Cooled Condenser.

A Condenser Relay is commanded on when the first compressor is enabled (except if the unit is in Heat Pump Defrost Mode). On an Air Cooled Unit, the Condenser Fan will be controlled with 0-10 VDC output signal or a PWM output signal. Both outputs operate simultaneously.

When the Condenser Signal first activates, it maintains at 100% for 10 seconds.

In the Cooling Mode, the Condenser Signal will modulate to maintain the Cooling Head Pressure Setpoint. The signal can modulate between 15% and 100%. If the Head Pressure exceeds 550 PSIG, the condenser control signal will immediately go to 100% and a High Head Pressure Alarm will be generated. The alarm will be deactivated when the Head Pressure drops below 540 PSIG.

High Head Pressure conditions produce the same effects in Dehumidification or Cooling Modes.

If no Head Pressure Sensor is detected, the Condenser Output Signal will be maintained at 100%.

Compressor and Condenser Fan Operation

Compressor Speed Limits

The Copeland VFD compressor modulation minimum and maximum speed varies based on its current operating envelope calculations and also is limited by the input current setting to stay below a maximum current limit. This ensures safe operation of the compressor and prevents damage.

Oil Boost Cycle

If the compressor speed stays low for two consecutive hours, an oil boost cycle will occur. During the oil boost cycle, the compressor will increase speed for five minutes.

Copeland VFD Input Current Limit

The controls are configured with a non-user-adjustable current limit setpoint that the controls will not allow the drive to exceed.

Condenser Fan Operation

For Copeland VFD compressors, the condenser fan will continue to run for thirty seconds after compressor drive is commanded off. The Copeland VFD compressor has a ramp down sequence and this will ensure the fan does not stop before the ramp down sequence is finished.

Alarms

Alarms

High Head Pressure Detected

This indicates a High Head Pressure Alarm condition which is activated when the Head Pressure rises above 550 PSIG. This will cause the condenser to go to 100%.

No Head Pressure Sensor Detected

This alarm indicates the Head Pressure Sensor is not detected by the system. The Condenser Output Signal will be maintained at 100%. The system will reset at the next system startup.

Compressor A1 Failure

This alarm will occur if the compressor fails to run 45 seconds after the relay is activated. This alarm will send notification to the Main Controller for staging and an alarm and will shut down the compressor (relay) until the unit goes to off/vent mode.

Copeland VFD Faults

If any faults occur from the VFD drive, the controller will not attempt reset for 5 minutes. There are certain faults that are not resettable without removing power to the VFD drive for 2 minutes. See Copeland manual for more information.

LCD Display Screen & Navigation Keys

LCD Display Screen & Navigation Keys

The LCD display screens and buttons allow you to view status and alarms, and enable force modes. See **Figure 4, below** and refer to **Table 2** for descriptions.

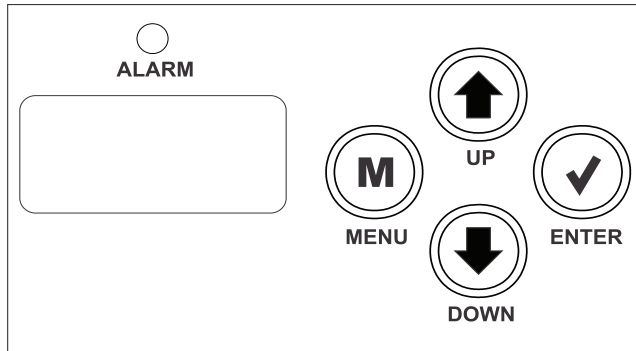


Figure 4: LCD Display and Navigation Keys





NAVIGATION KEY	KEY FUNCTION
MENU 	Use the MENU key to move through screens within Main Menu categories and return to the Main Menu while at other screens.
UP 	Use this key to adjust setpoints and change configurations.
DOWN 	Use this key to adjust setpoints and change configurations.
ENTER 	Use the ENTER key to navigate through the Main Menu Screen categories.

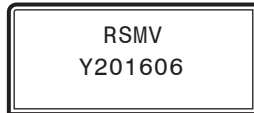
Table 3: Navigation Key Functions

RSMVC-P LCD SCREENS

Main Screen Map & RSMV Module Screens

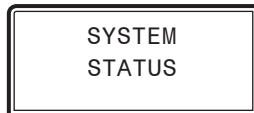
RSMV Main Screens Map

Refer to the following map when navigating through the LCD Main Screens. To scroll through the screens, press the **<MENU>** button.



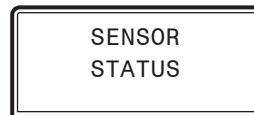
Press to scroll through REFRIG MODULE Screens.

Press to go to SYSTEM STATUS Screens.



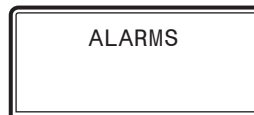
Press to scroll through SYSTEM STATUS Screens.

Press to go to SENSOR STATUS Screen.



Press to scroll through SENSOR STATUS Screens.

Press to go to ALARMS Screens.



Press to scroll through ALARMS Screens.

Press to go to ALARM HISTORY Screens.



Press to scroll through ALARM HISTORY Screens.

Press to go to SETPOINT STATUS Screens.



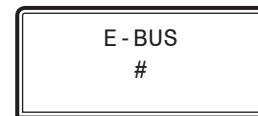
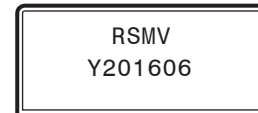
Press to scroll through SETPOINT STATUS Screens.

Press to go to COPELAND VFD Screens.



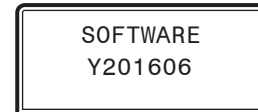
RSMV Module Screens

Refer to the following map when navigating through the RSMV Screens. From the RSMV Screen, press **<ENTER>** to scroll through the screens.



E-BUS COMMUNICATION DIAGNOSTICS

Number of COMM packets received.

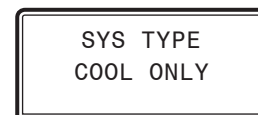


CURRENT SOFTWARE VERSION

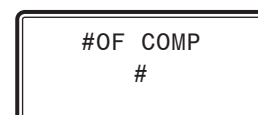
You can access the protected screens from this screen by holding the **<UP>** button for 5 seconds.



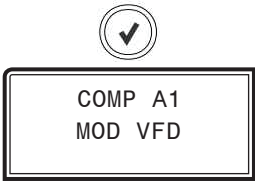
CURRENT BOARD ADDRESS



CURRENT SYSTEM TYPE



OF COMPRESSORS



COMPRESSOR A1 STATUS



**COMPRESSOR A2
Not Used**

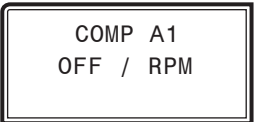
System Status Screens

Refer to the following map when navigating through the System Status Screens. From the SYSTEM STATUS Screen, press **<ENTER>** to scroll through the screens.



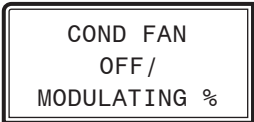
SYSTEM MODE

Possible choices are
OFF, COOL, HEAT, DEHUMID, FORCE



**COMPRESSOR A1
(based on board address)
OFF / RPM**

OFF: Compressor is off.
MODULATING RPM



**CONDENSER FAN
OFF, MOD POSITION**

OFF: Condenser is off.
MODULATING PERCENTAGE: 0-100%

Sensor Status Screens

Sensor Status Screens

Refer to the following map when navigating through the Sensor Status Screens. From the SENSOR STATUS Screen, press **<ENTER>** to scroll through the screens.

SENSOR
STATUS



*SUCTION
XXX PSI

SUCTION PRESSURE READING FROM INPUT

If the screen has an * on the top line, it means the DMQ Superheat Controller is configured and communicating. If it does not have an * on the top line, then it is using the on-board suction pressure sensor.



HEAD
XXX PSI

HEAD PRESSURE READING FROM INPUT



*COIL 1
XX DEG

COIL TEMPERATURE 1 READING FROM TEMPERATURE SENSOR INPUT

If the screen has an * on the top line, it means the DMQ Superheat Controller is configured and communicating.



COIL 2
XX DEG

COIL TEMPERATURE 2 Not Used.



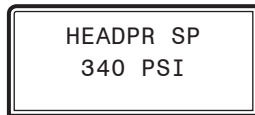
CALC CT
XX DEG

CALCULATED COIL TEMPERATURE FROM SUCTION PRESSURE INPUT

Setpoint Status Screens & Alarms Screen & Alarm History

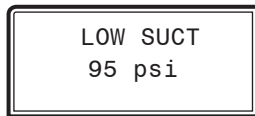
Setpoint Status Screens

Refer to the following map when navigating through the Setpoint Status Screens. From the SETPOINT STATUS Screen, press **<ENTER>** to scroll through the screens.



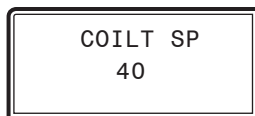
HEAD PRESSURE SETPOINT

Valid range is 275 to 475 PSI. Default is 340 PSI.



LOW SUCTION PRESSURE SETPOINT SETTING

Default is 95 PSI.



COIL TEMPERATURE SETPOINT SETTING

Valid range is 35 to 70 degrees. Default is 40 degrees.

Alarms Screens

If an alarm is present, the ALARM LED above the LCD display will light up red and blink. The Alarms will display and scroll automatically from the ALARMS screen when alarms are present.



NO ALARMS: This will be shown if there are no current alarms.

HIGH HEAD PRESSURE (HP) DETECTED: This indicates a High Head Pressure Alarm condition which is activated when the Head Pressure rises above 550 PSIG. This will cause the condenser to go to 100%.

NO HEAD PRESSURE SENSOR (HEAD) DETECTED: This alarm indicates the Head Pressure Sensor is not detected by the system. This will cause the condenser to go to 100%.

COMPRESSOR (COMP) A1 FAILURE: This alarm will occur if the compressor fails to run 45 seconds after the relay is activated or if the signal is lost after activation. This will cause an alarm and will shut down the compressor (relay). The system will retry after 5 minutes.

EBUS SLAVE (SLV) TIMEOUT: This alarm indicates that communication has been lost between the RSMVC-P and the Main controller or other E-BUS modules that may be connected. This can be the result of a bad cable, a missing cable, or the module not being configured properly.

COMP VFD FAULT: This alarm indicates there is a fault detected from the VFD drive.

Alarm History & Copeland VFD Screens

Alarm History Screens

The ALARM HISTORY Screen displays past alarms, if any, and how long ago the last of each type occurred. From the ALARM HISTORY Screen, press **<ENTER>** to scroll through the history screens.



The Alarm will appear on the first line and the second line will display how long ago each alarm last occurred. As a result, the alarms listed on the ALARMS screen will be abbreviated as follows in order of the way they are listed in the prior ALARMS screen section.

HIGH HP—High Head Pressure

HP SENSE—No Head Pressure Sensor Detected

COMP 1 FL—Compressor 1 Failure

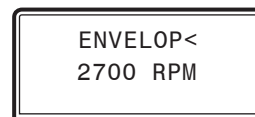
COMM T/O—E-BUS Slave Timeout

COMP VFD FAULT—VFD Compressor Failure

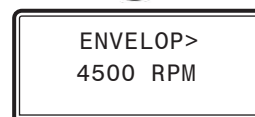
NOTE: The screen will display minutes for the first 60 minutes of alarm occurrence, hours for the next 72 hours of alarm occurrence, and days for the next 30 days of alarm occurrence. After 30 days, the alarm will clear. Alarm history is not stored in memory. So, if power is lost, the alarms will clear.

Copeland VFD Screens

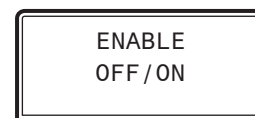
Refer to the following map when navigating through the Copeland VFD Screens. From the COPELAND VFD Screen, press **<ENTER>** to scroll through the screens.



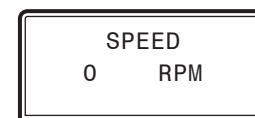
MINIMUM COMPRESSOR SPEED LIMIT



MAXIMUM COMPRESSOR SPEED LIMIT

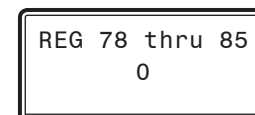


FORCE COMPRESSORS ON/OFF



CURRENT SPEED OF COMPRESSOR

When in Force Mode, speed can be adjusted from this screen by using the Up and Down arrow keys.



COPELAND VFD FAULT CODES 78 THROUGH 85

Used for troubleshooting faults. See Copeland manual for descriptions.



TO CLEAR
FAULT: UP

CLEAR FAULTS

To clear faults at the VFD, press the UP key. Faults will automatically clear after 5 minutes on their own.



MODEL #
0

MODEL NUMBER

Displays compressor model number that is configured into the drive. Model number must match compressor to ensure safe speed limit and current limit operation



I LIMIT
8.7AMPS

CURRENT LIMIT SETPOINT CONFIGURED

Not user-adjustable.



VFD STAT
0

VFD STATUS

Displays code for VFD drive status bits. Refer to Copeland manual for more information.

Protected Screens Map

Refer to the following map when navigating through the LCD Protected Screens. From the RSMV Screen, press **<ENTER>** twice to get to the Software Screen. Then hold the **<UP>** button for 5 seconds. To scroll through the rest of the screens, press the **<MENU>** button.

REFRIG
MODULE



E - BUS
+0



SOFTWARE
Y201606

Hold for 5 seconds.

DIAGNSTC



ALARM
COUNTS



VFD TEST



ADDRESS
1 (152)

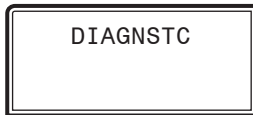


ENTER TO
EXIT

Diagnostic Screens

Diagnostic Screens

Refer to the following map when navigating through the Diagnostic Screens. From the DIAGNSTC Screen, press **<ENTER>** to scroll through the screens.



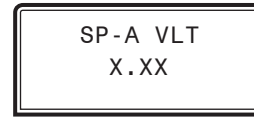
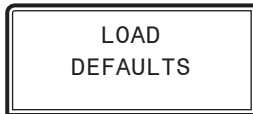
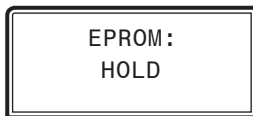
WATCH DOG TIMER

Displays the number of times the board has been reset due to watch-dog timer overflow.



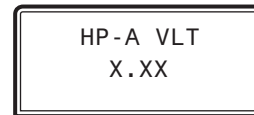
POWER LOSS COUNT

Displays the number of times the board has been reset due to power loss.



SUCTION PRESSURE SENSOR VOLTAGE

Displays the current voltage of the Suction Pressure Sensor.



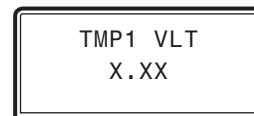
HEAD PRESSURE SENSOR VOLTAGE

Displays the current voltage of the Head Pressure Sensor.



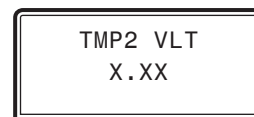
BINARY INPUTS #1 - #4

Displays the current status of each Binary Input.



COIL TEMPERATURE SENSOR 1 VOLTAGE

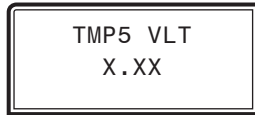
Displays the current voltage of the 1st Coil Temperature Sensor.



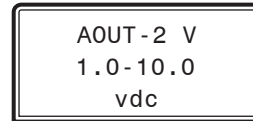
COIL TEMPERATURE SENSOR 2 VOLTAGE

Displays the current voltage of the 2nd Coil Temperature Sensor.



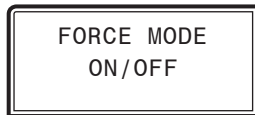


TEMPERATURE SENSOR 5 VOLTAGE (NOT USED)



CONDENSER FAN FORCE MODE

1.0 to 10.0 = Active Force Mode.
Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value.



FORCE MODE

Displays the current status of Force Mode. Values are ON/OFF.



If forced on, the following screens will appear:



RELAYS 1 - 4 FORCE MODE

Press the **<UP>** and **<DOWN>** buttons to select ON or OFF for each relay



ALARM COUNTS Screens

From the ALARM COUNTS Screen, press **<ENTER>** to scroll through the screens. Each screen will display the name of the alarm and how many times the alarm has occurred since you last cleared the alarms. The only way to clear these alarm counts is by using Prism 2 and selecting, "Select Alarms to Delete" from the ALARM button menu. See "Alarm Polling" in the *Prism2 Technical Guide* for more information.

VFD Test Screens & Address Screen

VFD Test Screens

VFD test screens are only used when VFD is connected via MODBUS communications. These screens are for Factory-Use only.

Address Screen



CURRENT BOARD ADDRESS

Configure the address according to which refrigerant circuit this module represents—1=A, 2=B, 3=C, 4=D. In this Y201606 application, the address should always be set to 1.

Number in parentheses is E-BUS address.

Using RSMVC-P LEDs To Verify Operation

The RSMVC-Ps are equipped with LEDs that can be used to verify operation and perform troubleshooting. There are LEDs for communication, operation modes, and diagnostic codes. See **Figure 5, below** for the LED locations. The LEDs associated with these inputs and outputs allow you to see what is active without using a voltmeter. The LEDs and their uses are as follows:

Diagnostic LEDs

STATUS - If the software is running, this LED should blink at a rate of 1 blink per second.

ALARM (on board) - If the module does not receive communications for more than 1 minute, this LED will light up, the relays will turn off, and the Analog Outputs will go to 0 VDC.

ALARM (above LCD display) This red LED will light up and stay lit when there is an alarm present. The type of alarm will display on the LCD display. The ALARM LED also blinks when the expansion valve is initializing at startup.

COMM - Every time the module receives a valid E-BUS request from the VCCX-P Controller, this LED will blink on and then off, signifying that it received a valid request and responded.

POWER - This LED will light up to indicate that 24 VAC power has been applied to the controller.

Binary Input LEDs

BIN1 - This green LED will light up when Compressor Status 1 contact is closed.

BIN2 - Not used.

Relay LEDs

RLY1 - RLY4 - These green LEDs will light up when the relays are enabled and will stay lit as long as they are active.

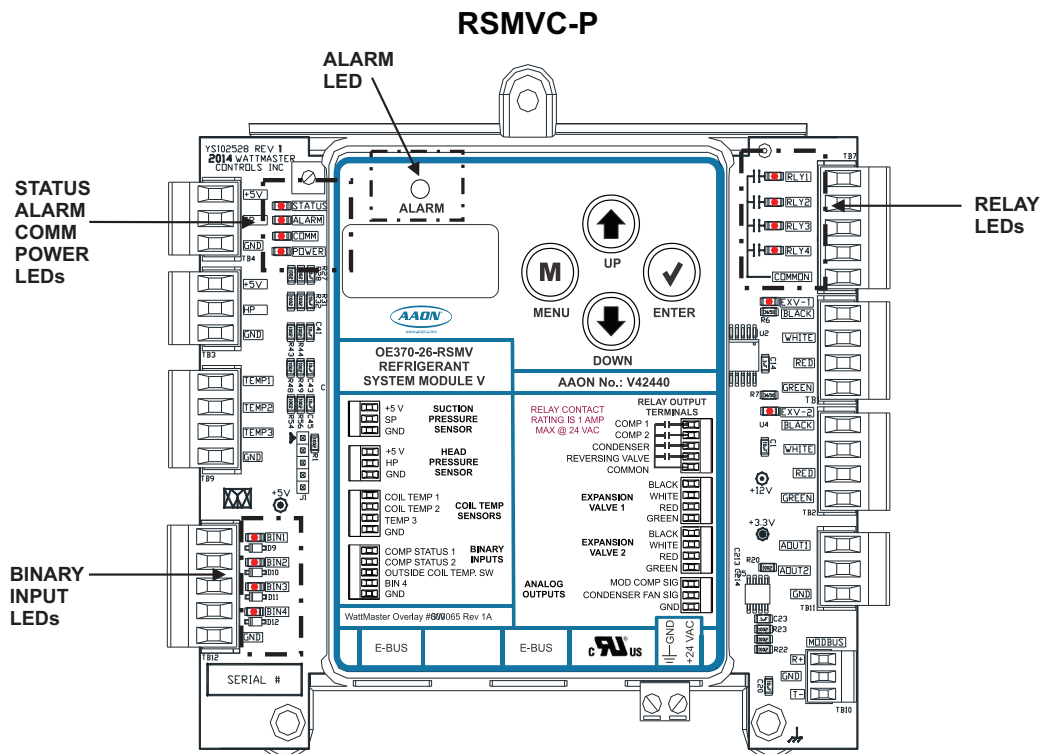


Figure 5: RSMVC-P LED Locations



2425 So. Yukon Ave • Tulsa, OK • 74107-2728

Ph: (918) 583-2266 • Fax: (918) 583-6094

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