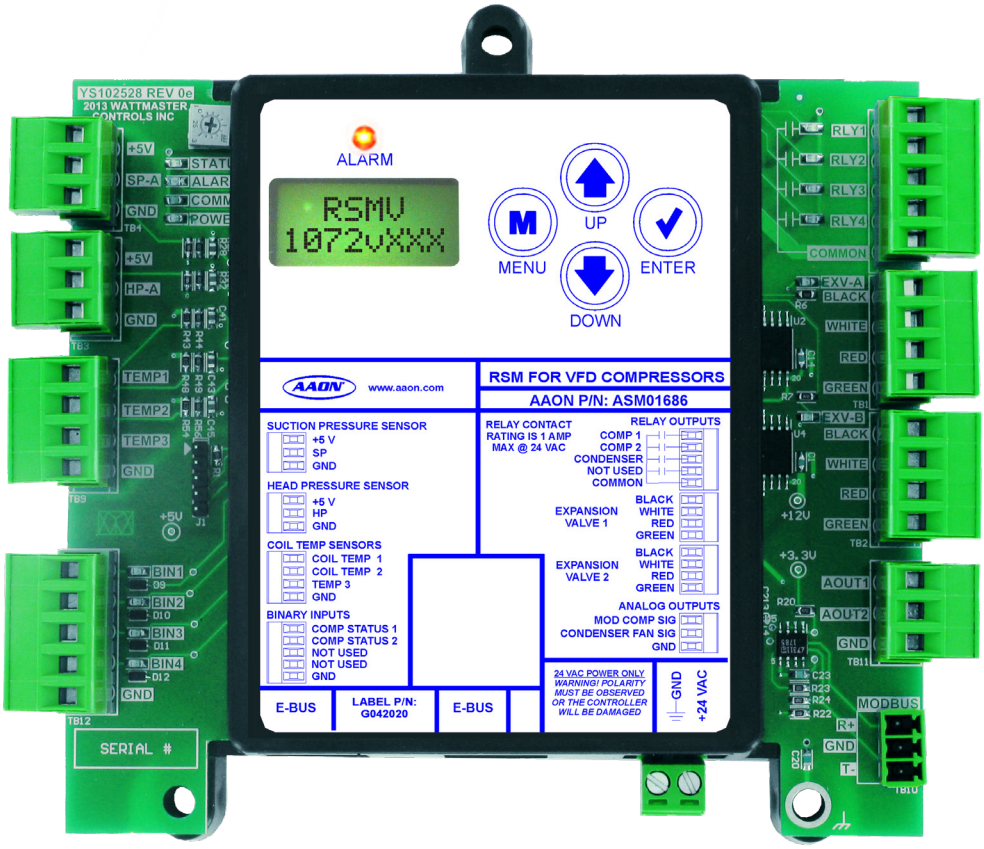
RSMV
Technical Guide



RSMV REVISION LOG

REVISION & DATE	CHANGE
Rev. 01D, February 14, 2021	Updated part numbers, alarms and alarm history, Prism 2 Screens, and RSMV label. Added figure/table content pages, part description table, and wiring consideration content, and Fahrenheit/Celsius temperature conversion. Removed VFD test screens.

RSMV PARTS REFERENCE

PART DESCRIPTION	PART NUMBER
Refrigerant System Module for VFD Compressors (RSMV)	ASM01686
VCCX2 Controller	ASM01698
AAON Unit Controller	Varies
Prism 2	ASM02533
IP Module Kit	ASM01902
CommLink 5	ASM01874
EBC E-BUS Cable Assembly E-BUS Power & Comm 1.5 Ft, 3 Ft, 10 Ft, 25 Ft, 50 Ft, 75 Ft, 100 Ft, 150 Ft, 250 Ft, and 1000 Foot Spool	G029440 (1.5 Ft), G012870 (3 Ft), G029460 (10 Ft), G045270 (25 Ft), G029510 (50 Ft), G029530 (75 Ft), G029450 (100 Ft), G029470 (150 Ft), V36590 (250 Ft), G018870 (SPOOL)
Modular Service Tool SD - Operator Interface	ASM01895

www.aaon.com

This manual is also available for download from —www.aaon.com/VCCX2 or www.aaon.com/controlsmanuals, where you can always find the latest literature updates.

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AAON P/N: V87390, Rev. 01D

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FIGURES

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RSMV Features & Application

The ASM01686 Refrigerant System Module for VFD Compressors (RSMV) monitors and controls one refrigeration circuit of the HVAC unit. The module is designed for R410-A refrigerant.

The RSMV is connected to the VCCX2 Controller or other AAON Unit Controller. Up to 4 RSMV's can be connected, depending on the size of the system. There are 2 E-BUS Expansion Ports which allow the use of communicating sensors and E-BUS Modules.

The RSMV provides 4 analog inputs, 3 binary inputs, 3 relays, and 4 analog outputs. See **Figures 2 & 3, pages 8 & 9** for wiring.

The RSMV Module provides the following:

- Modulates the Compressors to satisfy the Suction Coil (Saturated) Temperature. The Suction Coil (Saturated) Temperature Setpoint is reset by the VCCX2 Controller to maintain the Supply Air Temperature during Cooling Mode. During Dehumidification Mode, it controls the Compressors to the Suction (Saturation) Temperature Setpoint.
- Modulates the Condenser Fan to maintain the Head Pressure Setpoint.
- Modulates the Expansion Valves to maintain the Superheat Setpoint.
- Provides alarms and safeties for the compressor and condenser operation.
- Provides a 2 x 8 LCD character display and 4 buttons that allow for status of system operation, system setpoints, system configurations, sensors, and alarms, and to change the module's address, if necessary.

RSMV Dimensions

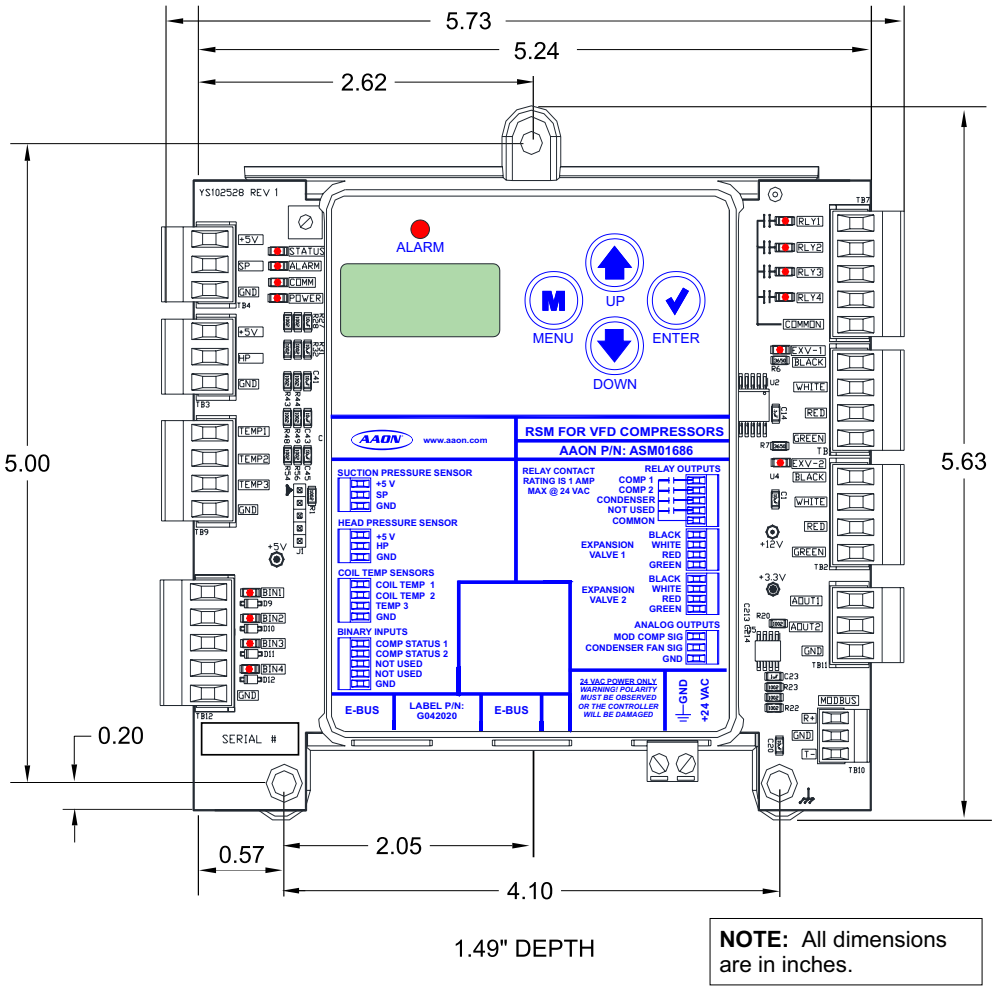


Figure 1: Refrigerant System Module Dimensions

General

Correct wiring of the Main Unit Controller and its modules is the most important factor in the overall success of the controller installation process. The Main Unit Controller and Modules are factory installed and wired at the AAON factory. Some of the following information may not apply to your installation if it was pre-wired at the factory. However, if troubleshooting of the controller or modules is required, it is a good idea to be familiar with the system wiring.

Wiring

The modules must be connected to an 18-30 VAC power source of the proper size for the calculated VA load requirements. All transformer sizing should be based on the VA ratings listed in **Table 1**, below.

Control Device	Voltage	VA Load	Operating Temperature	Humidity (Non-Condensing)
RSMV Controller	18-30VAC	18	-22°F to 158°F -30ºC to 70ºC	0-95% RH
	Inputs		Resistive Inputs require 10KΩ Type 3 Thermistor	
			24VAC Inputs provide 4.7kΩ Load	
	Outputs		Relay Outputs: 1 Amp maximum per output.	

Table 1: RSMV Controller Electrical and Environmental Requirements

NOTE: If the temperature at the controller is below -22ºF (-30ºC), the display refresh rate could be less responsive.

WARNING: When using a single transformer to power more than one controller or expansion module, the correct polarity must always be maintained between the boards. Failure to observe correct polarity will result in damage to the Unit Controller, RSMV, and any associated module.

Please carefully read and apply the following information when wiring the Unit Controller, RSMV, and any associated module.

1. All wiring is to be in accordance with local and national electrical codes and specifications.
2. All 24 VAC wiring must be connected so that all ground wires remain common. Failure to follow this procedure can result in damage to the controller and connected devices.
3. Minimum wire size for 24 VAC wiring should be 18-gauge.
4. Minimum wire size for all sensors should be 24-gauge. Some sensors require 2-conductor wire and some require 3-or 4-conductor wire.
5. Minimum wire size for 24 VAC thermostat wiring should be 22-gauge.
6. Be sure that all wiring connections are properly inserted and tightened into the terminal blocks. Do not allow wire strands to stick out and touch adjoining terminals which could potentially cause a short circuit.
7. When communication wiring is to be used to interconnect HVAC Unit Controllers together or to connect to other communication devices, all wiring must be plenum-rated, minimum 18-gauge, 2-conductor, twisted pair with shield. AAON can supply communication wire that meets this specification and is color coded for the network or local loop. Please consult your AAON distributor for information. If desired, Belden #82760 or equivalent wire may also be used.
8. Before applying power to the HVAC Unit Controller, RSMVs, and any associated modules, be sure to recheck all wiring connections and terminations thoroughly.

Powering Up

When the Controller and Modules are first powered up, the POWER LED should light up and stay on continuously. If it does not light up, check to be sure that you have 24 VAC connected to the controller, that the wiring connections are tight, and that they are wired for the correct polarity. The 24 VAC power must be connected so that all ground wires remain common. If after making all these checks, the POWER LED does not light up, please contact AAON Controls Support for assistance.

RSMV Inputs Wiring

RSMV Wiring

The RSMV is connected to the VCCX2 Controller. Up to 4 RSMV's can be connected, depending on the size of the system. There are 2 E-BUS Expansion Ports which allow the use of communicating sensors and E-BUS Modules.

The RSMV provides 4 analog inputs, 3 binary inputs, 3 relays, and 4 analog outputs. See **Figure 2**, below for inputs wiring and **Figure 3**, **page 9** for outputs wiring.

Suction Pressure Sensor Wiring

The Suction Pressure Transducer must be wired as shown in **Figure 2**, below. It is required for all compressorized VCCX2 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 RSMV Controller. This temperature is used by the RSMV to accurately control the Expansion Valves to maintain Superheat to provide optimum performance of the system. The saturated refrigerant temperature is used to properly control the compressors to maintain a given Suction Coil (Saturated) Temperature Setpoint. In Cooling and Heat Pump mode, the VCCX2 resets the Suction Coil (Saturated) Temperature Setpoint to maintain a given supply air temperature setpoint. In Dehumidification mode, the Suction Coil (Saturated) Temperature Setpoint is a user configurable setpoint that can be reset based on indoor humidity levels.

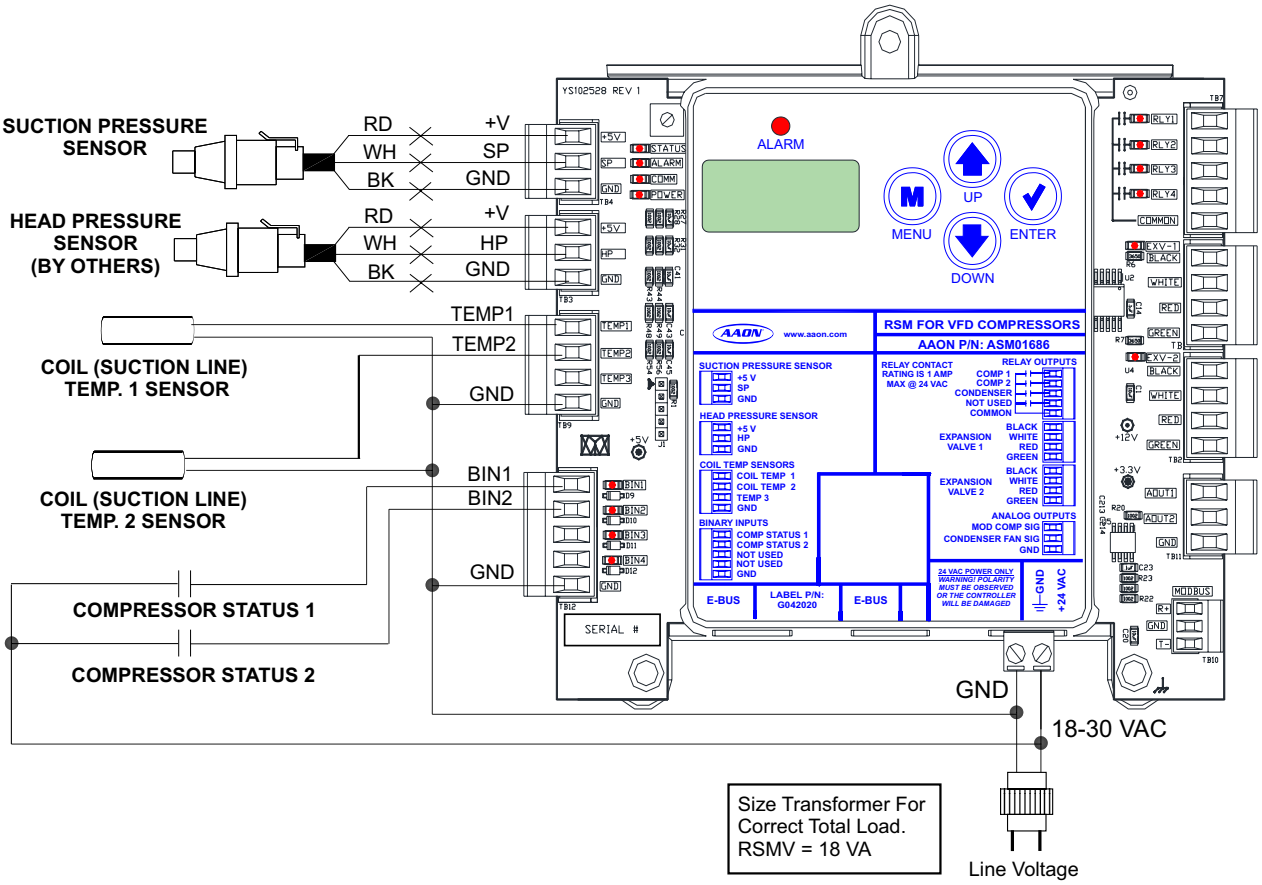


Figure 2: RSMV Inputs Wiring

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 RSMV 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.

Coil Temperature Sensors

Coil Temperature Sensors are used to measure Coil Temperature after each evaporator coil line. This temperature, combined with the calculated saturated refrigerant temperature, is used to calculate the Superheat of each individual evaporator coil. The Superheat is used to drive the Expansion Valves to maintain a given Superheat Setpoint.

Condenser Configuration Options

Please see **Appendix A**, **page 26** for Condenser Configuration details.

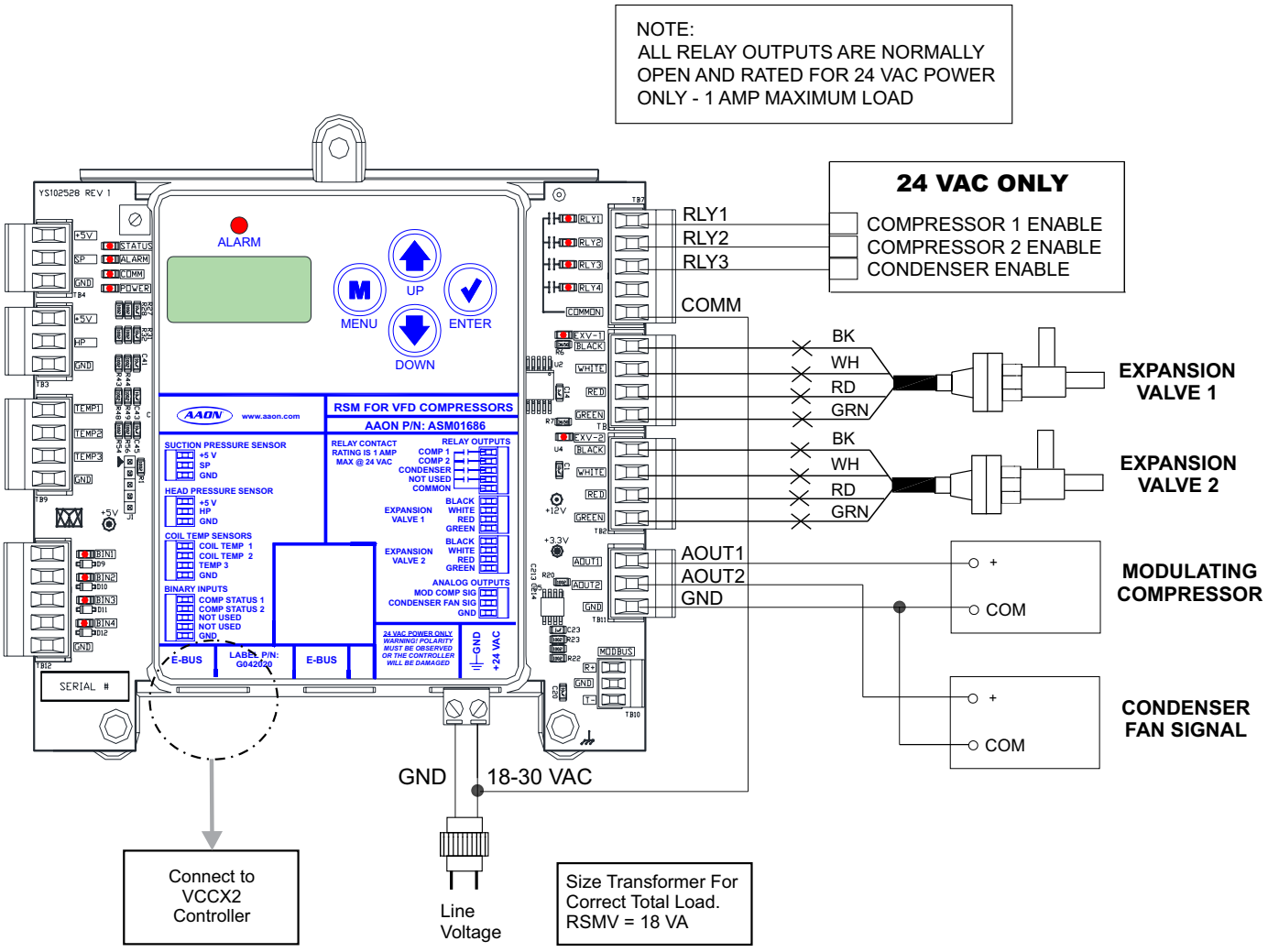


Figure 3: RSMV Outputs Wiring

RSMV Module Inputs/Outputs Map

Inputs/Outputs Map

See **Table 2**, below for the RSMV inputs and outputs.

RSMV Inputs/Outputs	
Analog Inputs	
1	Suction Pressure Sensor (SP)
2	Head Pressure Sensor (HP)
3	Coil (Suction Line) Temperature Sensor 1 (TEMP1)
4	Coil (Suction Line) Temperature Sensor 2 (TEMP2)
Binary Inputs	
1	Compressor Status 1 (BIN1)
2	Compressor Status 2 (BIN2)
Analog Outputs (0-10 VDC)	
1	Modulating Compressor (AOUT1)
2	Condenser Fan Signal (AOUT2)
Stepper Motor Outputs	
1	Expansion Valve 1 (EXV-1)
2	Expansion Valve 2 (EXV-2)
Binary Outputs (24 VAC)	
1	Compressor 1 Enable Relay (R1)
2	Compressor 2 Enable Relay (R2)
3	Condenser Enable Relay (R3)

Table 2: RSMV Inputs and Outputs

RSMV - 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. This temperature combined with the measured temperature of the coil temperature sensors is used to calculate Superheat. The Superheat is used to drive the Expansion Valves to maintain a certain Superheat Setpoint. The saturated refrigerant temperature is also used in the Dehumidification mode of operation to properly control the compressors to maintain a given Suction Coil (Saturated) Temperature Setpoint.

+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

These Sensors are used to measure the Coil (Suction Line) Temperature after each evaporator coil line. This temperature combined with the calculated saturated refrigerant temperature is used to calculate the Superheat of each individual evaporator coil. The Superheat is used to drive the Expansion Valves to maintain a given Superheat Setpoint.

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

When this wet contact input closes, a 24 volt signal to Binary Input #2 indicates that Compressor 2 is running. Typically, the source for this is a relay output from the auxiliary contact on the compressor starter. If Binary Input 2 opens, Compressor 2 Enable Relay will de-energize and a Compressor Alarm will be generated.

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

This 0-10 VDC output is used to control a Modulating Compressor to maintain the Cooling Supply Air Temperature Setpoint.

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

The Electronic Expansion Valve 1 is driven to maintain Superheat for Evaporator Coil 1 of its particular refrigerant system.

EXV-2

The Electronic Expansion Valve 2 is driven to maintain Superheat for Evaporator Coil 2 of its particular refrigerant system.

RLY1 - Compressor 1 Enable

This relay turns on the Modulating Compressor.

RLY2 - Compressor 2 Enable

This relay turns on the Fixed Compressor.

RLY3 - Condenser Enable

This relay turns on the Condenser Fan / Water Valve.

Cooling Mode and Dehumidification 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 Evaporator Coil Suction (Saturated) Temperature Setpoint. One set of tandem compressors (a VFD compressor and a fixed stage compressor) are controlled per RSMV. Multiple RSMVs are needed for multiple sets of tandem compressors.

In units with one set of tandem compressors, if the VFD compressor modulates to 100% and the SAT is still above the SAT Cooling Setpoint for the Cooling Stage Up Delay, then the fixed compressor will stage on. The VFD compressor will then be allowed to modulate as necessary to maintain the Active Evaporator Coil Suction (Saturated) Temperature Setpoint. Minimum off times must also be met before compressors can stage on.

Stage Down Compressors

If the VFD compressor(s) have modulated down to 30% for the Stage Down Delay period and the SAT has fallen below the SAT Cooling Setpoint minus the Stage Control Window, then the last compressor to have staged on (VFD or Fixed) will stage off – assuming its Minimum Run Time has been met. Any remaining VFD compressors are then allowed to modulate as needed. If the last remaining VFD compressor reaches 0% for the Stage Down Delay, it will stage off.

Dehumidification Operation

Once in Dehumidification Mode, units with fixed compressors will activate the compressors to maintain the Evaporator Coil Suction (Saturated) Temperature Setpoint. An RSMV Module will be required for each fixed compressor or each fixed compressor tandem pair in order to monitor the suction (saturated) temperature and control the compressor(s) accordingly. Each RSMV will independently activate and stage its compressor(s) to maintain that circuit's Suction (Saturated) Temperature Setpoint. The staging of compressors on an RSMV is subject to Stage Up and Stage Down Delays as well as compressor Minimum Run Times and Minimum Off Times.

A suction pressure transducer is used and the VCCX2 Controller converts that to a Suction (Saturated) Temperature value.

On units with one or more sets of VFD/Fixed tandem compressors, each set of tandem compressors (one circuit) will be controlled by a separate RSMV Module with its own Suction Pressure Transducer (converted to a Suction (Saturated) Temperature). Once the unit enters the Dehumidification Mode, each RSMV will initially activate the VFD compressor as required to maintain the Suction (Saturated) Temperature Setpoint. At that point, each RSMV will modulate its VFD compressor and enable the fixed compressor, as necessary, to maintain the Suction (Saturated) Temperature Setpoint for that circuit.

If the VFD compressor reaches 100% for the Stage Up Delay and the Suction (Saturated) Temperature is still above setpoint, then the fixed compressor will stage on while the VFD compressor modulates as needed. If the VFD compressor has modulated down to 0% and the Suction (Saturated) Temperature is 5ºF below the Suction (Saturated) Temperature for the Stage Down Delay period, the fixed compressor will stage off and the VFD compressor will continue to modulate. During this operation, compressor Minimum Run Times and Minimum Off Times must be met.

NOTE: If the Coil Temperature drops below 32˚F, any cooling remaining on will be forced to stage off.

Electronic Expansion Valve (EXV) Operation

If EXV's are being used, a Coil (Suction Line) Temperature Sensor will measure the Coil (Suction Line) Temperature after each Evaporator Coil line for each compressor, and this sensor will be connected to an RSMV Module. This temperature will be used in conjunction with the calculated saturated refrigerant temperature to calculate the Superheat of each evaporator coil. The EXV for each coil will then be controlled to maintain the Superheat Setpoint.

Head Pressure Control

The RSMV can monitor a Head Pressure Transducer and control a Condenser Fan to maintain a Head Pressure Setpoint. The RSMV 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.

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.

In the Dehumidification Mode, the Condenser Output Signal controls to the Reheat Head Pressure Setpoint. High Head Pressure conditions produce the same effects as in the Cooling Mode.

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

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 3** for descriptions.

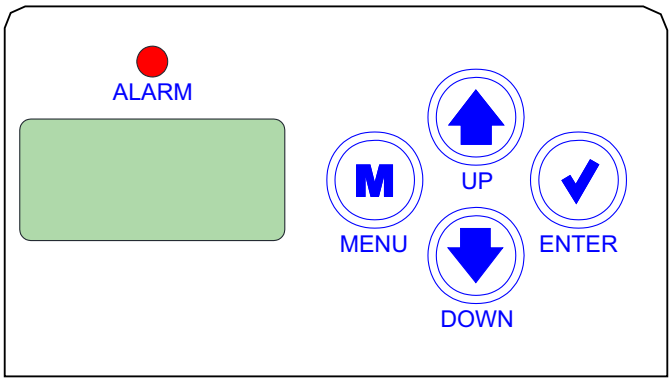


Figure 4: LCD Display and Navigation Keys

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

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.

RSMV
1072vXXX

Press ✓ to scroll through REFRIG MODULE Screens.

Press M to go to SYSTEM STATUS Screens.

SYSTEM
STATUS

Press ✓ to scroll through SYSTEM STATUS Screens.

Press M to go to SENSOR STATUS Screens.

SENSOR
STATUS

Press ✓ to scroll through SENSOR STATUS Screens.

Press M to go to ALARMS Screens.

ALARMS

Press ✓ to scroll through ALARMS Screens.

Press M to go to ALARM HISTORY Screens.

ALARM
HISTORY

Press ✓ to scroll through ALARM HISTORY Screens.

Press M to go to SETPOINT STATUS Screens.

SETPOINT
STATUS

Press ✓ to scroll through SETPOINT STATUS Screens.

RSMV Module Screens

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

RSMV
1072vXXX

✓

E-BUS
#

E-BUS COMMUNICATION DIAGNOSTICS
Number of COMM packets received.

✓

SOFTWARE
1072vXXX

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

✓

ADDRESS
#

CURRENT BOARD ADDRESS

✓

SYS TYPE
COOLONLY

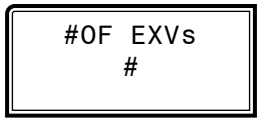
CURRENT SYSTEM TYPE

✓

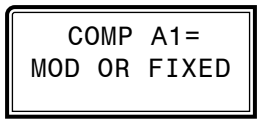
#OF COMP
#

 # OF COMPRESSORS

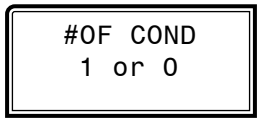
System Status Screens



 # OF EXPANSION VALVES



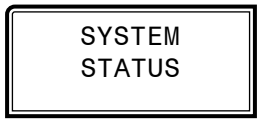
COMPRESSOR A1 STATUS

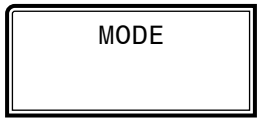


 # OF CONDENSERS

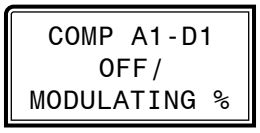
System Status Screens

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

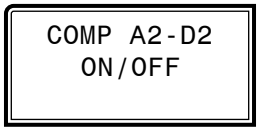




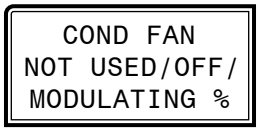
SYSTEM MODE
Possible choices are
OFF, COOL, HEAT, DEHUMID, FORCE



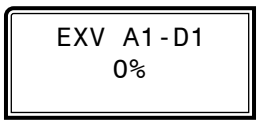
COMPRESSOR A1, B1, C1, D1
(based on board address)
OFF / MOD POSITION
OFF: Compressor is off.
MODULATING PERCENTAGE: 0-100%



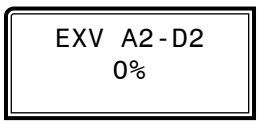
COMPRESSOR A2, B2, C2, D2
(based on board address)
ON, OFF, FORCE
ON: Compressor is on. **OFF:** Compressor is off.



CONDENSER FAN
NOT USED, OFF, MOD POSITION
OFF: Condenser is off.
MODULATING PERCENTAGE: 0-100%



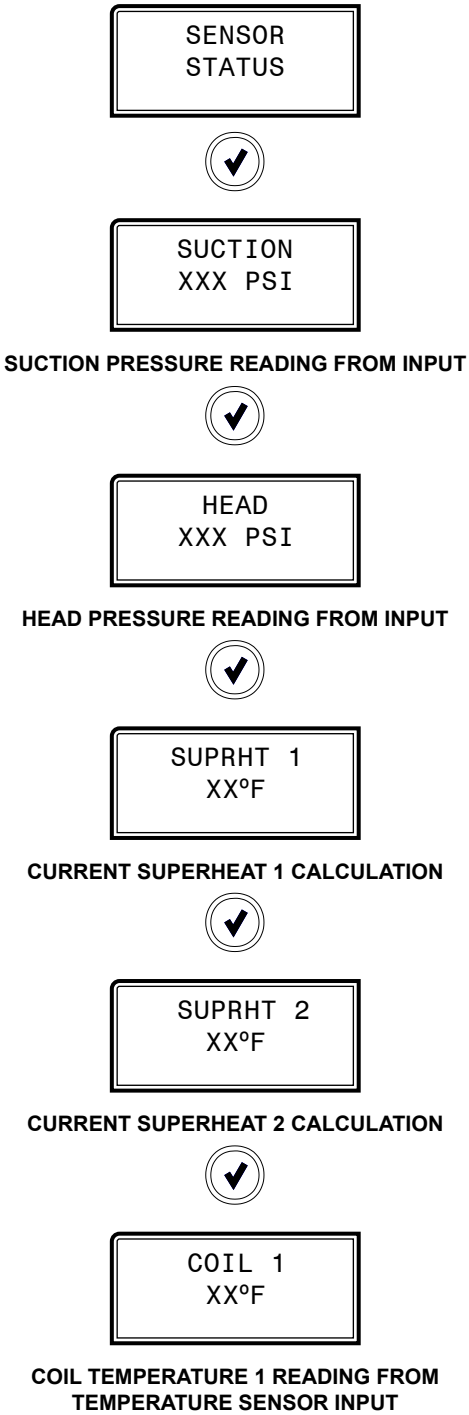
EXV A1, B1, C1, D1
(based on board address)
EXV VALVE POSITION
0 to 100 percent



EXV A2, B2, C2, D2
(based on board address)
EXV VALVE POSITION
0 to 100 percent

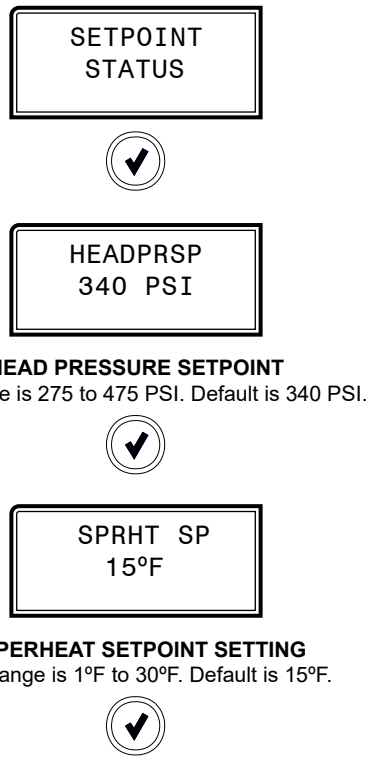
Sensor Status Screens

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

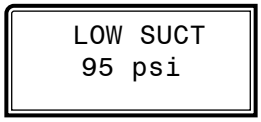


Setpoint Status Screens

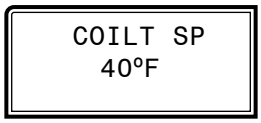
Refer to the following map when navigating through the Setpoint Status Screens. From the SETPOINT STATUS Screen, press **<ENTER>** to scroll through the screens.



Setpoint Status Screens and Alarms Screen



LOW SUCTION PRESSURE SETPOINT SETTING
Default is 95 PSI.



COIL TEMPERATURE SETPOINT SETTING
Valid range is 35ºF to 70ºF. Default is 40ºF.

Alarms Screen

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.

NO SUCTION PRESSURE SENSOR (SUCT) DETECTED: This alarm indicates the Suction Pressure Sensor is not detected by the system. The system will shut down due to Unsafe Suction safety and will retry after 5 minutes.

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%.

COIL TEMP A1 FAILURE: This alarm will occur if the coil temperature is not within operable range (below -32ºF or above 310ºF). This could be the result of a bad sensor or faulty wiring. This alarm will shut down the system. The system will reset after 5 minutes if the sensor is detected.

COIL TEMP A2 FAILURE: This alarm will occur if the coil temperature is not within operable range (below -32ºF or above 310ºF). This could be the result of a bad sensor or faulty wiring. This alarm will shut down the system. The system will reset after 5 minutes if the sensor is detected.

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.

COMPRESSOR (COMP) A2 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.

LOW SUPERHEAT 1 (SH1) DETECTED: This alarm will be activated when the Superheat is less than 4ºF for 2 minutes during normal operation or for 4 minutes during the first 10 minutes. The system will shut down and will retry after 5 minutes.

LOW SUPERHEAT 2 (SH2) DETECTED: This alarm will be activated when the Superheat is less than 4ºF for 2 minutes during normal operation or for 4 minutes during the first 10 minutes. The system will shut down. The system will shut down and will retry after 5 minutes.

HIGH SUPERHEAT 1 (SH1) WARNING: If superheat is above 25ºF for 2 minutes, this alarm will appear on the module only. It will not be sent to the main controller to display on Prism 2.

HIGH SUPERHEAT 2 (SH2) WARNING: If superheat is above 25ºF for 2 minutes, this alarm will appear on the module only. It will not be sent to the main controller to display on Prism 2.

HIGH SUPERHEAT 1 (SH1) FAILURE: If superheat is above 30ºF for 10 minutes, it will fail the compressors. It will retry after 5 minutes. If it fails twice in 2 hours, it will lock out the compressors.

HIGH SUPERHEAT 2 (SH2) FAILURE: If superheat is above 30ºF for 10 minutes, it will fail the compressors. It will retry after 5 minutes. If it fails twice in 2 hours, it will lock out the compressors.

HIGH SUPERHEAT LOCKOUT: If the module fails on high superheat twice in 2 hours, it will lock out the compressors.

LOW SUCTION PRESSURE (SP) DETECTED: This alarm will occur if suction pressure falls below the low suction pressure setpoint for 20 seconds. The system will try to protect by lowering compressor modulation percentage.

LOW SUCTION PRESSURE (SP) FAILURE: This alarm will occur if suction pressure stays below the low suction pressure setpoint for 1 minute or falls below 40 psi for 5 seconds. This alarm will shut down the system. The system will retry after 5 minutes.

EBUS SLAVE (SLV) TIMEOUT: This alarm indicates communication has been lost between the RSMV and the main controller. This can be the result of a bad cable, a missing cable, or the main controller or module not being configured properly.

COPELAND VFD ALARM: Indicates there is an alarm on the Copeland VFD.

MODBUS MASTER COMM TIMEOUT: Communications has been lost between the RSM and the VFD that may be connected. This can be the result of a bad cable, a missing cable, or the module not being configured properly.

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.

LOW SP—Low Suction Pressure

UNSAFE SP—Unsafe Suction Pressure

SP SENSE—No Suction Pressure Sensor Detected

HIGH HP—High Head Pressure

HP SENSE—No Head Pressure Sensor Detected

CL TMP1—Coil Temp 1 Failure

CL TMP2—Coil Temp 2 Failure

COMP1 FL—Compressor 1 Failure

COMP2 FL—Compressor 2 Failure

LOW SH1—Low Superheat 1

LOW SH2—Low Superheat 2

HI SH1—High Superheat 1 Failure

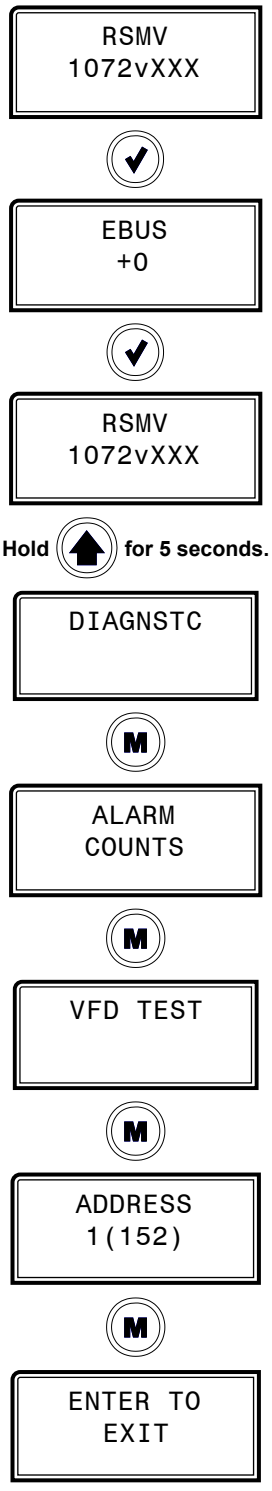
HI SH2—High Superheat 2 Failure

COMM T/O—E-BUS Slave Timeout

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.

Protected Screens Map

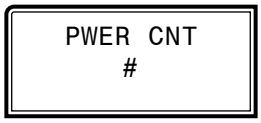
Refer to the following map when navigating through the LCD Protected Screens. From the RSMV Screen, press **<ENTER>** twice to get to the Software Screen. Then hold the **<UP>** button for 5 seconds. To scroll through the rest of the screens, press the **<MENU>** button.



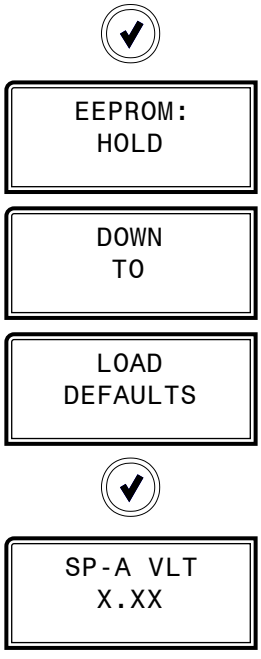
Diagnostic Screens

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 watchdog timer overflow.

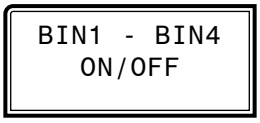


POWER LOSS COUNT
Displays the number of times the board has been reset due to power loss.

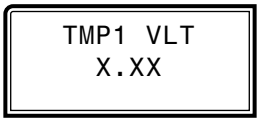


SUCTION PRESSURE SENSOR VOLTAGE
Displays the current voltage of the Suction Pressure Sensor.

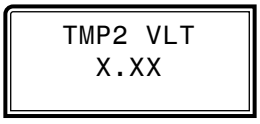
HEAD PRESSURE SENSOR VOLTAGE
Displays the current voltage of the Head Pressure Sensor.



BINARY INPUTS #1 - #4
Displays the current status of each Binary Input.

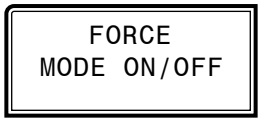


COIL TEMPERATURE SENSOR 1 VOLTAGE
Displays the current voltage of the 1st Coil Temperature Sensor.



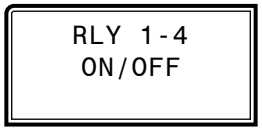
COIL TEMPERATURE SENSOR 2 VOLTAGE
Displays the current voltage of the 2nd Coil Temperature Sensor.

TEMPERATURE SENSOR 5 VOLTAGE (NOT USED)

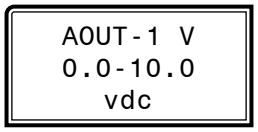


FORCE MODE
Displays the current status of Force Mode. Values are ON/OFF.

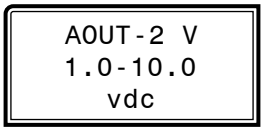
If forced on, the following screens will appear:



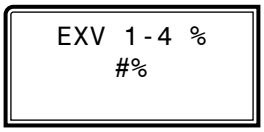
RELAYS 1 - 4 FORCE MODE
Press the **<UP>** and **<DOWN>** buttons to select ON or OFF for each relay.



MODULATING COMPRESSOR FORCE MODE
0.0 to 10.0 = Active Force Mode.
Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value.



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

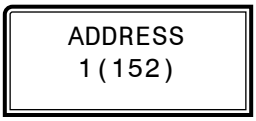


EXPANSION VALVES OPEN PERCENTAGE
1.0 to 10.0 = Active Force Mode.
Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value.

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 *Prism 2 Technical Guide* for more information.

Address Screen



CURRENT BOARD ADDRESS
Configure the address according to which refrigerant circuit this module represents—1=A, 2=B, 3=C, 4=D.
Number in parentheses is E-BUS address.
Module 1's address is 152, Module 2's address is 153, Module 3's address is 154, Module 4's address is 155.

RSMV LED Diagnostics

Using RSMV LEDs to Verify Operation

The RSMVs 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 VCCX2 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** - This green LED will light up when Compressor Status 2 switch is closed.

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.

RSMV Stepper Motor Valve LEDs

- **EXV-1** - This green LED will light up when Expansion Valve 1 is modulating.
- **EXV-2** - This green LED will light up when Expansion Valve 2 is modulating.

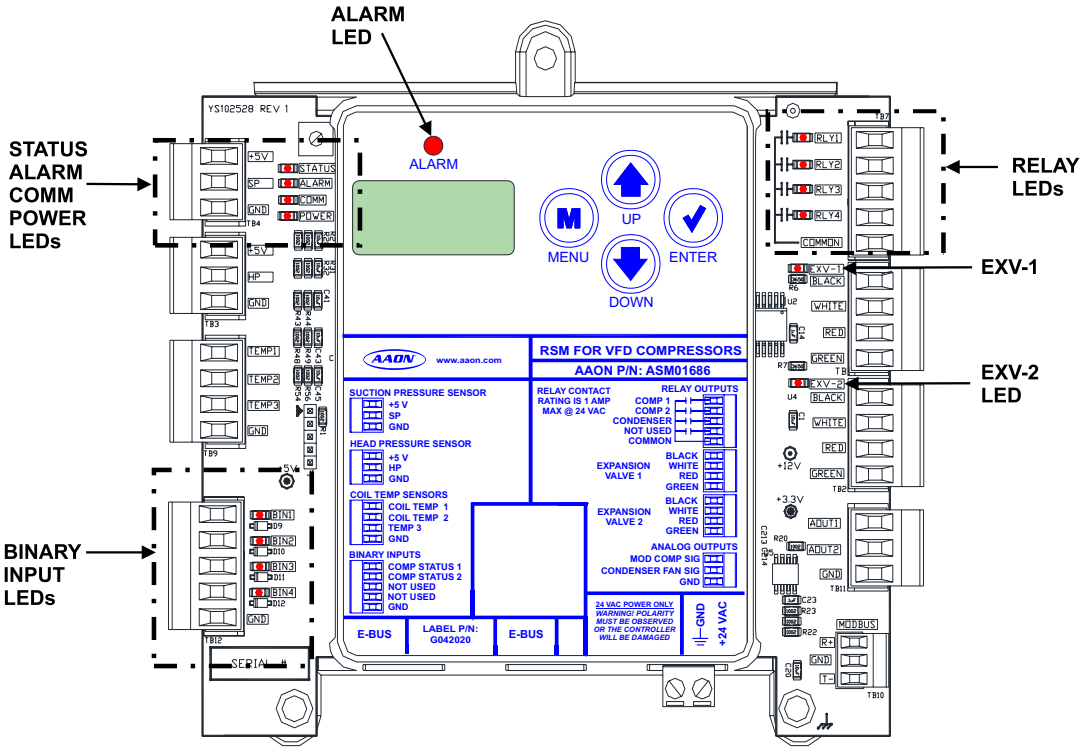


Figure 5: RSMV LED Locations

Suction Pressure Transducer Testing for R410A Refrigerant

The Evaporator Coil Temperature is calculated by converting the Suction Pressure to Temperature. The Suction Pressure is obtained by using the Suction Pressure Transducer, which is connected into the Suction Line of the Compressor.

Use the voltage column to check the Suction Pressure Transducer while connected to the RSMV Module(s). The VCCX2 and the RSMV Module(s) must be powered for this test. Read voltage with a meter set on DC volts. Place the positive lead from the meter on the SP terminal located on the RSMV Module(s) terminal block. Place the negative lead from the meter on the ground (GND) terminal located adjacent to the SP terminal on the RSMV Module(s) terminal block. Use a refrigerant gauge set and/or an accurate electronic thermometer to measure the temperature or suction line pressure near where the Suction Pressure Transducer is connected to the suction line. Measure the Voltage at the SP and GND terminals and compare it to the appropriate chart depending on the refrigerant you are using. If the temperature/voltage or pressure/voltage readings do not align closely with the chart, your Suction Pressure Transducer is probably defective and will need to be replaced.

See **Table 4** for Suction Pressure Transducer Coil Pressure, Temperature, and Voltage Chart for R410A Refrigerant testing. The charts show a temperature range from 20°F to 80°F. For troubleshooting purposes, the DC Voltage readings are also listed with their corresponding temperatures and pressures.

Suction Pressure Transducer Coil Pressure – Temperature – Voltage Chart for R410A Refrigerant

Temperature °F	Temperature °C	Pressure PSI	Signal DC Volts
21	-6.1	80.94	1.8
24	-4.4	87.16	1.9
27	-2.8	93.39	2.0
30	-1.1	99.62	2.1
33	0.6	105.84	2.2
36	2.2	112.07	2.3
39	3.9	118.29	2.4
42	5.6	124.52	2.5
44	6.7	130.75	2.6
47	8.3	136.97	2.7
49	9.4	143.2	2.8
52	11.1	149.42	2.9
54	12.2	155.65	3.0
56	13.3	161.88	3.1
59	15	168.10	3.2
61	16.1	174.32	3.3
63	17.2	180.55	3.4
65	18.3	186.78	3.5
67	19.4	193.00	3.6
69	20.6	199.23	3.7
71	21.7	205.46	3.8
72	22.2	211.68	3.9
74	23.3	217.91	4.0
76	24.4	224.14	4.1
78	25.6	230.36	4.2
80	26.7	236.59	4.3

Table 4: Coil Pressure/Voltage/Temp for Suction Pressure Transducers - R410A Refrigerant

Temperature Sensor Testing

Sensor Voltage and Resistance

The following sensor voltage and resistance table is provided to aid in checking sensors that appear to be operating incorrectly. See **Table 5**, below. Many system operating problems can be traced to incorrect sensor wiring. Be sure all sensors are wired per the wiring diagrams in this manual.

If the sensors still do not appear to be operating or reading correctly, check voltage and/or resistance to confirm that the sensor is operating correctly per the tables. Please follow the notes and instructions that appear after the chart when checking sensors.

Thermistor Sensor Testing Instructions

Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered).

Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the "-" (minus) lead on GND terminal and the "+" (plus) lead on the sensor input terminal being investigated.

If the voltage is above 4.88 VDC, then the sensor or wiring is "open." If the voltage is less than 0.05 VDC, then the sensor or wiring is shorted.

Temperature – Resistance – Voltage for Type III 10 K Ohm Thermistor Sensors

Temp (ºF)	Temp (ºC)	Resistance (Ohms)	Voltage @ Input (VDC)	Temp (ºF)	Temp (ºC)	Resistance (Ohms)	Voltage @ Input (VDC)
-10	-23.3	93333	4.51	72	22.2	11136	2.635
-5	-20.6	80531	4.45	73	22.8	10878	2.605
0	-17.8	69822	4.37	74	23.3	10625	2.576
5	-15	60552	4.29	75	23.9	10398	2.549
10	-12.2	52500	4.2	76	24.4	10158	2.52
15	-9.4	45902	4.1	77	25	10000	2.5
20	-6.6	40147	4.002	78	25.6	9711	2.464
25	-3.9	35165	3.891	80	26.7	9302	2.41
30	-1.1	30805	3.773	82	27.8	8893	2.354
35	1.7	27140	3.651	84	28.9	8514	2.3
40	4 4.4	23874	3.522	86	30	8153	2.246
45	7.2	21094	3.39	88	31.1	7805	2.192
50	10	18655	3.252	90	32.2	7472	2.139
52	11.1	17799	3.199	95	35	6716	2.009
54	12.2	16956	3.143	100	37.8	6047	1.884
56	13.3	16164	3.087	105	40.6	5453	1.765
58	14.4	15385	3.029	110	43.3	4923	1.65
60	15.6	14681	2.972	115	46.1	4449	1.54
62	16.7	14014	2.916	120	48.9	4030	1.436
64	17.8	13382	2.861	125	51.7	3656	1.339
66	18.9	12758	2.802	130	54.4	3317	1.246
68	20	12191	2.746	135	57.2	3015	1.159
69	20.6	11906	2.717	140	60	2743	1.077
70	21.1	11652	2.691	145	62.7	2502	1.001
71	21.7	11379	2.661	150	65.6	2288	0.931

Table 5: 0-5V Temperature Sensor - Voltage & Resistance for Type III Sensors

If you suspect there is a problem related to the head pressure transducer, measurements can be taken at the HP terminal. See **Table 6**, below.

Head Pressure Transducer Chart			
Voltage	**Pressure**	**Voltage**	**Pressure**
0.5	0	2.6	350
0.6	17	2.7	367
0.7	33	2.8	384
0.8	50	2.9	400
0.9	67	3.0	417
1.0	83	3.1	434
1.1	100	3.2	450
1.2	117	3.3	467
1.3	133	3.4	484
1.4	150	3.5	500
1.5	167	3.6	517
1.6	183	3.7	534
1.7	200	3.8	550
1.8	217	3.9	567
1.9	233	4.0	584
2.0	250	4.1	600
2.1	267	4.2	617
2.2	283	4.3	634
2.3	300	4.4	650
2.4	317	4.5	667
2.5	334		

Table 6: Head Pressure Transducer Chart

Single Condenser Configuration

Single Condenser Per One Module

In Single Condenser Per One Module wiring configuration, the Condenser Signal is wired to AO2 and the Condenser Relay (RLY3) is enabled. Refer to **Figure 6**, below for Prism 2 configuration.

Modular Service Tool Screen

RSMV Condenser Options Configuration Screen

```
RSM#1-4 CONFIGURATION
  Condenser Options
  1 Cond per 1 RSMV
USE < or > TO CHANGE
```

Select the “1 Condenser per 1 RSMV” option on the above Hand Held Service Tool Screen.

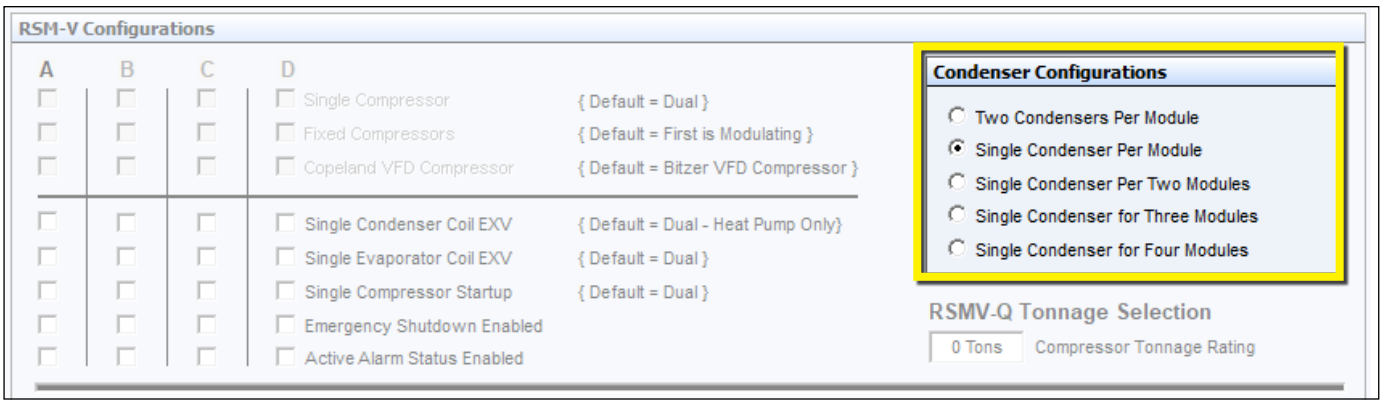


Figure 6: Prism 2 Condenser Configuration - Single Condenser Per Module

Single Condenser Per Two Modules

In Single Condenser Per Two Modules wiring configuration, if using 2 modules, the Condenser Signal is wired to AO2 on the 1st module but not the 2nd module and the Condenser Relay (RLY3) is enabled on the 1st module but not the 2nd module.

If using 4 modules, the Condenser Signal is wired to AO2 on the 1st and 3rd modules but not the 2nd and 4th modules and the Condenser Relay RLY3 is enabled on the 1st and 3rd modules but not the 2nd and 4th modules.

Refer to **Figure 7**, below for Prism 2 configuration.

Modular Service Tool Screen

RSMV Condenser Options Configuration Screen

```
RSM#1-4 CONFIGURATION
  Condenser Options
 1 Cond per 2 RSMVs
USE < or > TO CHANGE
```

Select the “1 Condenser per 2 RSMVs” option on the above Hand Held Service Tool Screen.

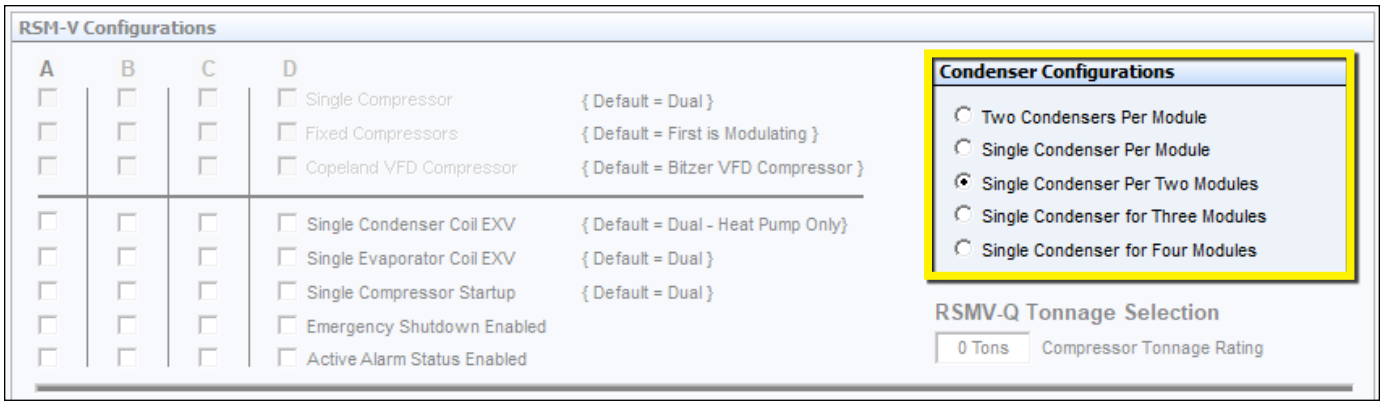


Figure 7: Prism 2 Condenser Configuration - Single Condenser Per Two Modules

Single Condenser Configuration

Single Condenser for Three Modules

In Single Condenser for Three Modules wiring configuration, the Condenser Signal is wired to AO2 on the 1st module but not the 2nd & 3rd modules and the Condenser Relay (RLY3) is enabled on the 1st module but not the 2nd & 3rd modules.

Refer to **Figure 8**, below for Prism 2 configuration.

Modular Service Tool Screen

RSMV Condenser Options Configuration Screen

```
RSM#1-4 CONFIGURATION
  Condenser Options
 1 Cond for 3 RSMVs
USE < or > TO CHANGE
```

Select the “1 Condenser for 3 RSMVs” option on the above Hand Held Service Tool Screen.

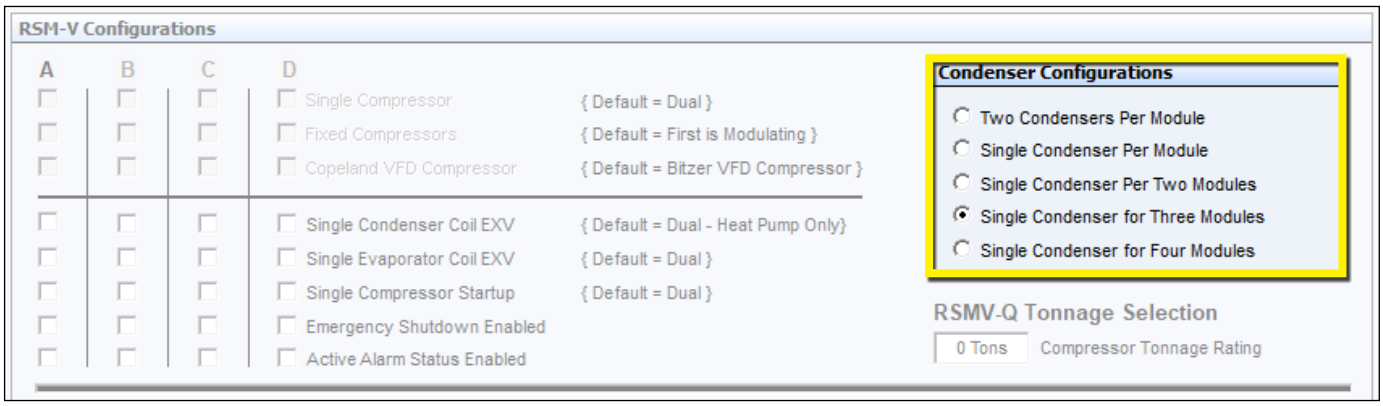


Figure 8: Prism 2 Condenser Configuration - Single Condenser for Three Modules

Single Condenser Per Four Modules

In Single Condenser Per Four Modules wiring configuration, the Condenser Signal is wired to AO2 on the 1st module but not the 2nd, 3rd, or 4th modules and the Condenser Relay (RLY3) is enabled on the 1st module but not the 2nd, 3rd, or 4th modules.

Refer to **Figure 9**, below for Prism 2 configuration.

Modular Service Tool Screen

RSMV Condenser Options Configuration Screen

```
RSM#1-4 CONFIGURATION
  Condenser Options
 1 Cond for 4 RSMVs
USE < or > TO CHANGE
```

Select the “1 Condenser for 4 RSMVs” option on the above Hand Held Service Tool Screen.

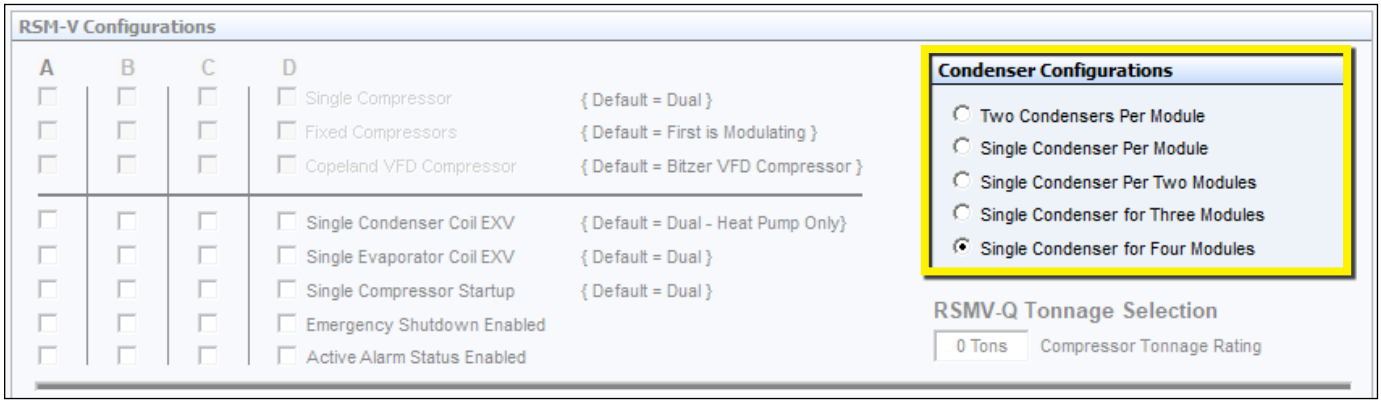


Figure 9: Prism 2 Condenser Configuration - Single Condenser for Four Modules

System Configuration

General

Refer to **Figure 10**, below in setting RSMV configuration options.

The following features are not compatible with the RSMV:

- RSMV-Q Tonnage Selection
- Two Step Timing

Compressor Configurations

Make selection from the drop-down menu for Module A, see **Figure 11**.

> **Note:** Danfoss compressors are not compatible with the RSMV.

For the remaining modules, select the appropriate compressor. Select "No Compressor Configured" when there are no additional compressors.

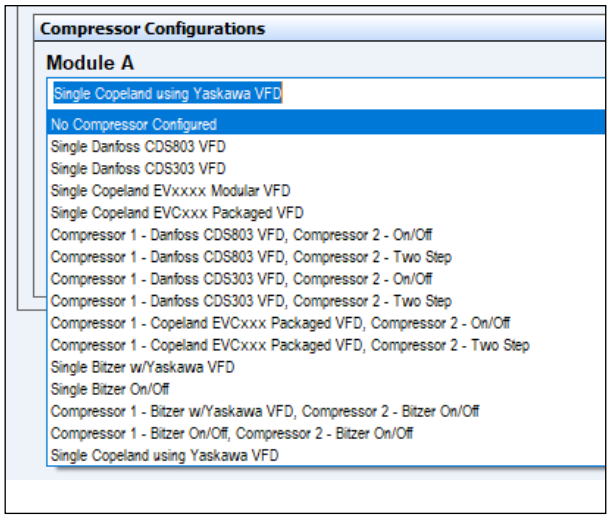


Figure 11: RSMV Module A Compressor Type

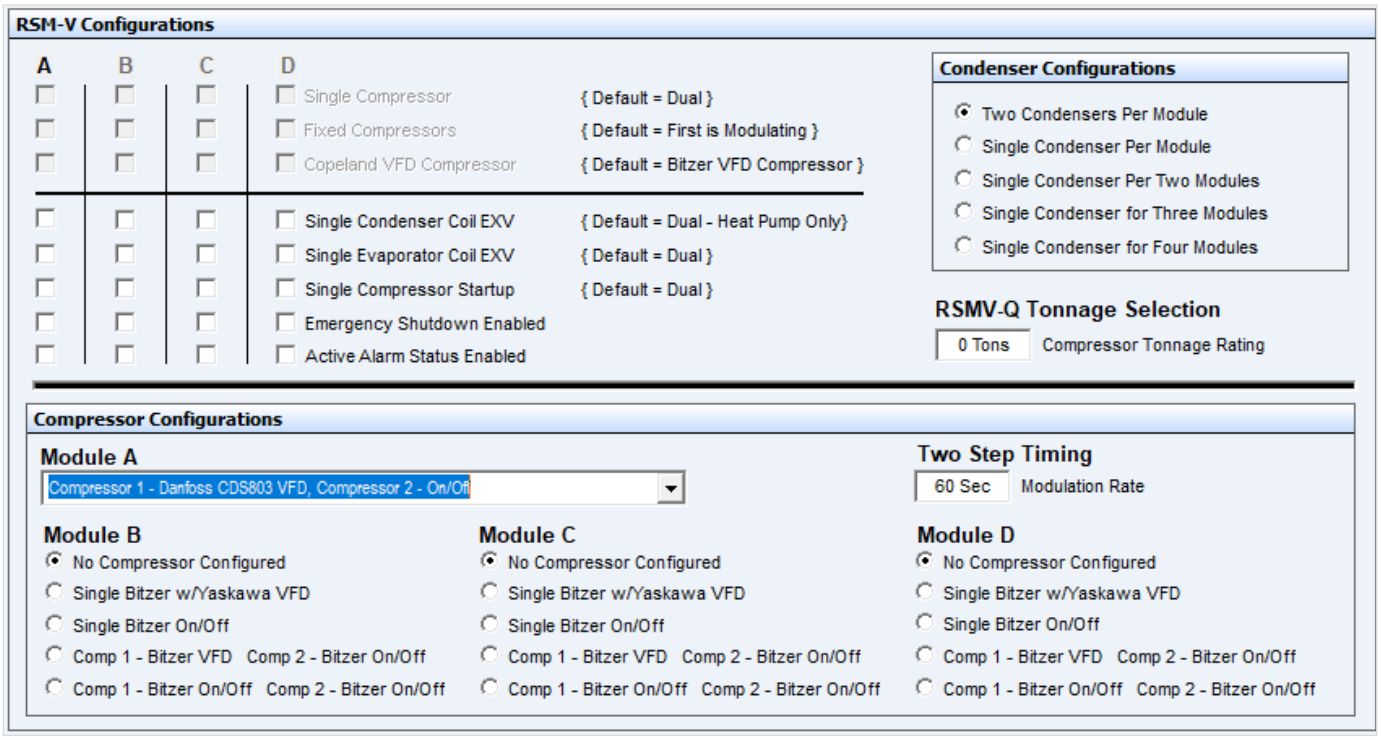


Figure 10: Prism 2 RSMV Configuration Screen

RSMV Technical Guide

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AAON Factory Technical Support: 918-382-6450

techsupport@aaon.com

AAON Controls Support: 866-918-1100
Monday through Friday, 7:00 AM to 5:00 PM
Central Standard Time

Controls Support website:
www.aaon.com/controlstechsupport

NOTE: Before calling Technical Support, please have the model and serial number of the unit available.

PARTS: For replacement parts, please contact your local AAON Representative.

2425 South Yukon Ave • Tulsa, OK • 74107-2728
Ph: (918) 583-2266 • Fax: (918) 583-6094
AAON P/N: **V87390**, Rev. 01D