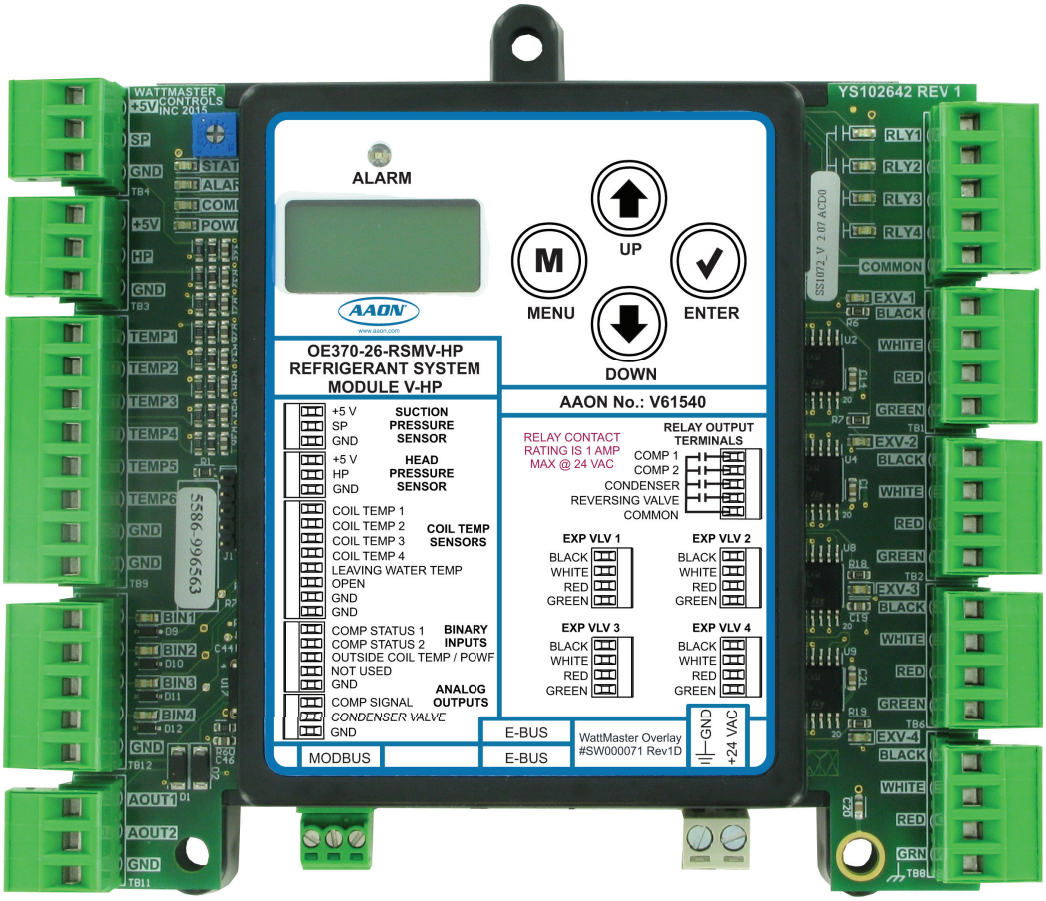
RSMV-HP
Technical Guide



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RSMV-HP Overview

Features & Applications

The OE370-26-RSMV-HP Refrigerant System Module for VFD Heat Pump Compressors (RSMV-HP) (AAON Part No: V61540) monitors and controls one refrigeration circuit of the HVAC unit. The module is designed for R410-A refrigerant.

The RSMV-HP is connected to the VCC-X / VCCX2 Controller. Up to 4 RSMV-HP'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 the E-BUS Modules.

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

The RSMV-HP Module provides the following:

- Modulates the Compressors to satisfy the Suction Coil (Saturated) Temperature. The Suction Coil (Saturated) Temperature Setpoint is reset by the VCC-X / 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.

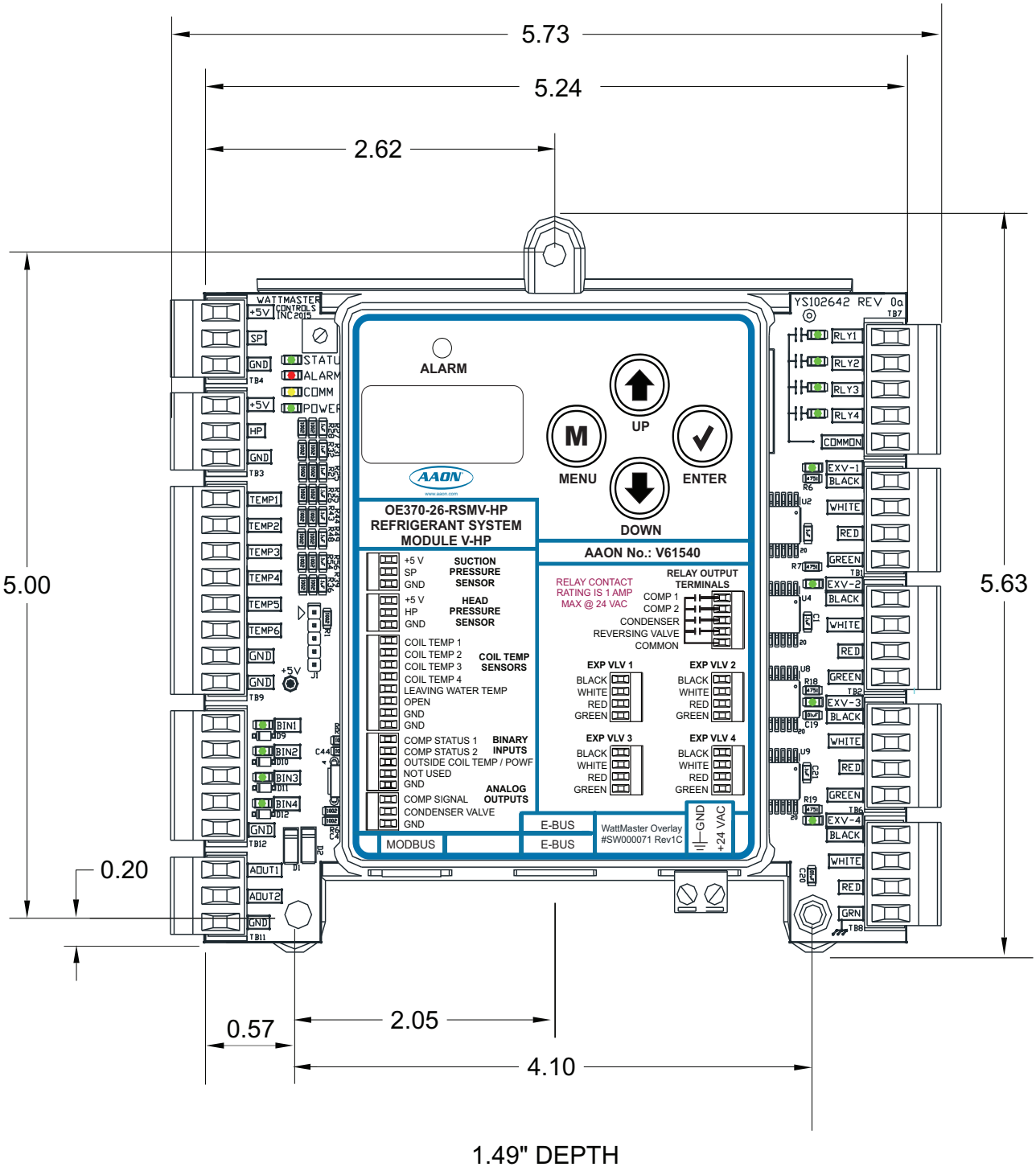


Figure 1: RSMV-HP Dimensions

RSMV-HP Inputs Wiring

RSMV-HP Wiring

The RSMV-HP monitors and controls one refrigeration circuit of the HVAC unit. The module is designed for R410-A refrigerant.

The RSMV-HP is connected to the VCC-X / VCCX2 Controller. Up to 4 RSMV-HP'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 the E-BUS Modules.

The RSMV-HP provides 6 analog inputs, 4 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 VCC-X / VCCX2 applications.

The Suction Pressure Sensors are 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. 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 VCC-X / 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 does not reset.

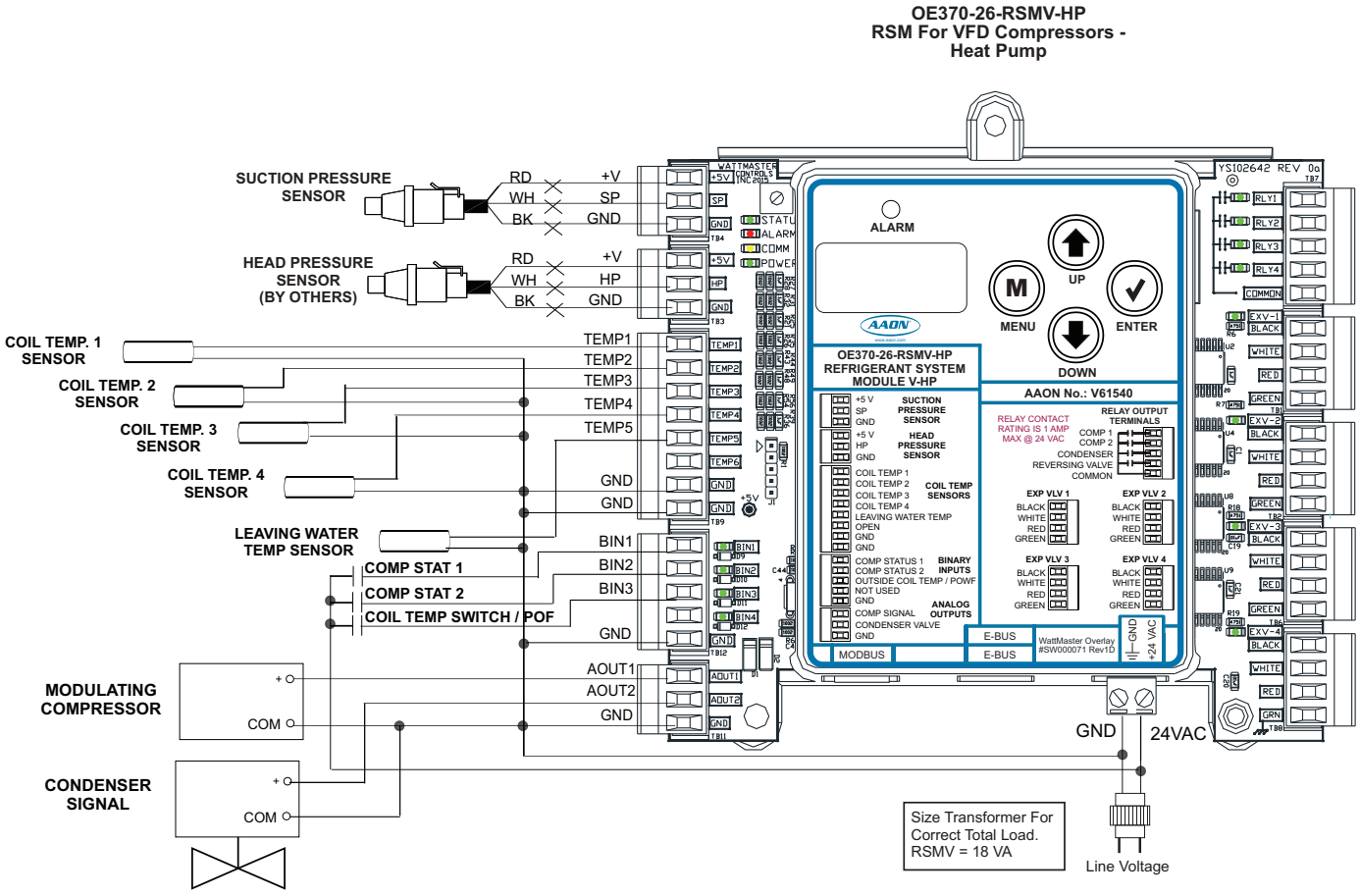


Figure 2: RSMV-HP Inputs Wiring

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-HP 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. Head pressure control can also be used to modulate the water valve when configured as a water source heat pump. The water valve signal is 2-10 volts.

Coil Temperature Sensors

The 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.

Leaving Water Temperature Sensor

The Leaving Water Temperature Sensor is used to measure the Leaving Water Temperature when used on a WSHP unit.

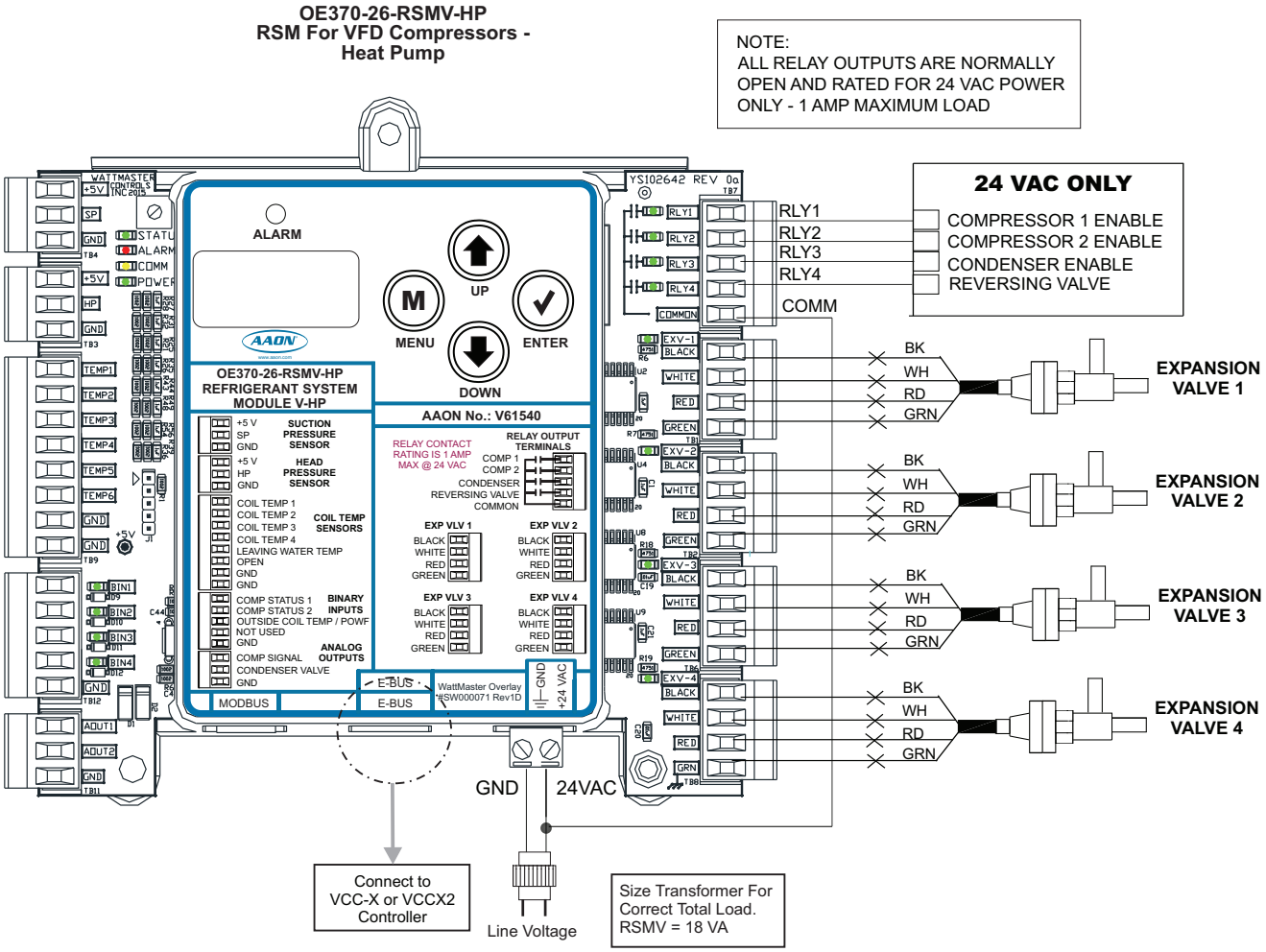


Figure 3: RSMV-HP Outputs Wiring

RSMV-HP Input/Output Map

Input/Output Map

See **Table 1, below** for the RSMV-HP Inputs/Outputs.

REFRIGERATION SYSTEM MODULE FOR VFD HEAT PUMP COMPRESSORS	
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)
5	Coil (Suction Line) Temperature Sensor 3 (TEMP3)
6	Coil (Suction Line) Temperature Sensor 4 (TEMP4)
7	Leaving Water Temperature Sensor 1 (TEMP5)
Binary Inputs	
1	Compressor Status 1 (BIN1)
2	Compressor Status 2 (BIN2)
3	Coil Temperature Switch / Proof of Water Flow (BIN3)
4	Not Used (BIN4)
Analog Outputs (0-10 VDC)	
1	Modulating Compressor (AOUT1)
2	Condenser Valve Signal (AOUT2)
Stepper Motor Outputs	
1	Expansion Valve 1 (EXV-1)
2	Expansion Valve 2 (EXV-2)
3	Expansion Valve 3 (EXV-3)
4	Expansion Valve 4 (EXV-4)
Binary Outputs (24 VAC)	
1	Compressor 1 Enable Relay (RLY1)
2	Compressor 2 Enable Relay (RLY2)
3	Condenser Enable Relay (RLY3)
4	Reversing Valve Relay (RLY4)

Table 1: RSMV-HP Inputs & Outputs

RSMV-HP - 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, TEMP3 & TEMP4 - Coil (Suction Line) Temperature Sensors 1 - 4 Inputs
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.

TEMP5 - Leaving Water Temperature Sensor Input
This sensor is used to measure the Leaving Water Temperature. This temperature is converted to the calculated saturated refrigerant temperature is used to properly control each individual compressor coil.

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.

BIN3 - Outside Coil Temperature Switch / Proof of Water Flow
When this wet contact input closes, a 24 volt signal to Binary Input #3 indicates that.

BIN4 - 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
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 - Operable in Cooling Mode
The Electronic Expansion Valve 1 is driven to maintain Superheat for Evaporator Coil 1 of its particular refrigerant system.

EXV-2 - Operable in Cooling Mode
The Electronic Expansion Valve 2 is driven to maintain Superheat for Evaporator Coil 2 of its particular refrigerant system.

EXV-3 - Operable in Heating Mode
The Electronic Expansion Valve 3 is driven to maintain Superheat for Evaporator Coil 3 of its particular refrigerant system.

EXV-4 - Operable in Heating Mode
The Electronic Expansion Valve 4 is driven to maintain Superheat for Evaporator Coil 4 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.

RLY4 - Reversing Valve Enable
This relay turns on the Reversing Valve.

Cooling Mode, EXV Operation & Head Pressure Control

Cooling Mode

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 Refrigerant System Module-VFD Compressor (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.

To 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 VCC-X / 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 5 degrees 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.

SAFETY: 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-HP 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 Refrigeration System Module for VFD Heat-Pump Compressors (RSMV-HP) can monitor a Head Pressure Transducer and control a Condenser Fan to maintain a Head Pressure Setpoint. The RSMV-HP 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.

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 the Condenser Output Signal will be maintained at 100%.

Heating and Cooling Superheat Control

When there is a demand for Heating, the reversing valve changes the direction and operation of the refrigerant system according to its configuration. EXV 1 and EXV 2 that are located at the evaporator coils are bypassed with a mechanical check valve during Heating. EXV 3 and EXV 4 (optional) that are located at the condenser coils are modulated to maintain a Superheat Setpoint. The calculated Superheat is derived from Coil Temperature Sensors 3 & 4 along with the Suction Pressure (Saturation) Temperature. The refrigerant system can be configured for one or two Condenser EXVs depending on the mechanical layout. If two Condenser EXVs are configured, both EXVs will be activated to maintain the Superheat Setpoint when any of the two compressors are activated.

When there is a demand for Cooling, the reversing valve changes the direction and operation of the refrigerant system according to its configuration. EXV 1 and EXV 2 that are located at the evaporator coils are modulated to maintain a Superheat Setpoint. The calculated Superheat is derived from Coil Temperature Sensors 1 and 2 along with the Suction Pressure (Saturation) Temperature. EXV 3 and EXV 4 (optional), located at the condenser coils, are bypassed with a mechanical check valve during Cooling. Since the evaporator coils are piped in parallel, both EXVs will be activated to maintain the Superheat Setpoint when any of the two compressors are activated.

Heat Pump Standard Defrost Operation

If using the RSMV-HP with an installed Coil Temperature Switch, a Defrost Cycle is available.

If the compressor(s) are operating in the Heating Mode and the Defrost Coil Temperature Switch closes, the unit will enter the Defrost Mode, provided the user-adjustable Defrost Interval Timer has elapsed since the last Defrost Cycle.

In the Defrost Cycle, the reversing valve signal is switched to the opposite operation, and the compressors are brought to maximum capacity. Auxiliary Heat will be used to attempt to maintain the Heating SAT Setpoint.

The unit will leave the Defrost Mode after 10 minutes have elapsed or the Coil Temperature Switch opens.

If the unit leaves the compressor heating mode, the Defrost Interval will restart once the unit re-enters the compressor heating mode.

Heat Pump Adaptive Defrost Operation

The Adaptive Defrost operation adjusts the time interval (Adaptive Defrost Timer) in between Defrost Mode cycles.

As stated above, the unit will leave the Defrost Mode after 10 minutes have elapsed or the Coil Temperature Switch opens. If the Defrost Cycle is terminated because the 10 minute timer runs out, this could be an indicator that the unit may need more defrost time. To address this issue, the Adaptive Defrost Timer value will be subtracted from the original Defrost Interval.

If the Defrost Cycle is terminated between the 8th and 9th minute, the Defrost Interval will not be changed.

If the Defrost Cycle is terminated before the 8th minute, this could be an indicator that the unit may need less defrost time. To address this issue, the Adaptive Defrost Timer value will be inversely proportionally added to the original Defrost Interval as the termination time moves from 8 minutes to 0 minutes.

Adaptive Defrost can be disabled by setting the VCC-X / VCCX2 Controller's Adaptive Defrost Timer Setpoint to 0.

Navigation Keys & Main Screen Map

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.

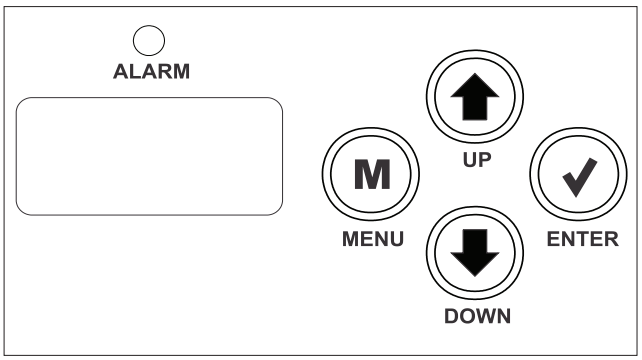


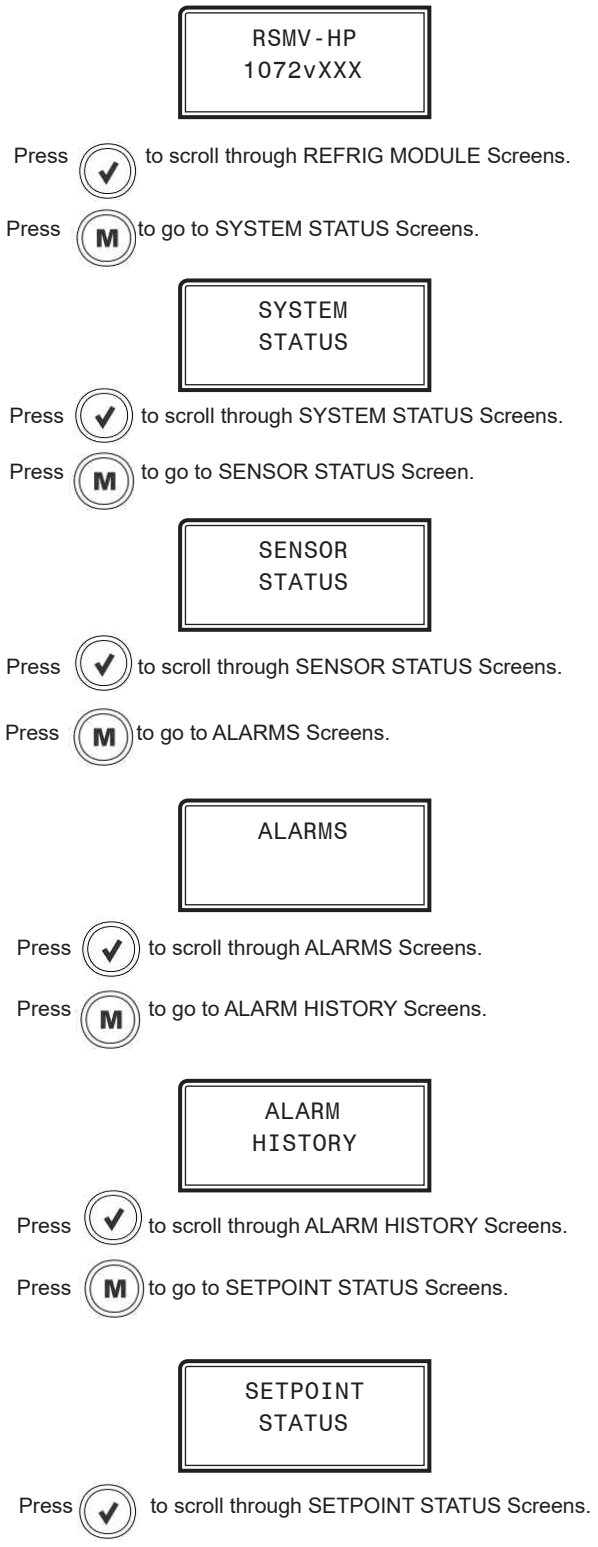
Figure 4: LCD Display and Navigation Keys

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 2: Navigation Key Functions

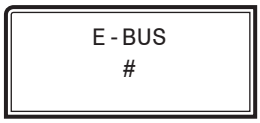
RSMV-HP Main Screens Map

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



RSMV-HP Module Screens

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



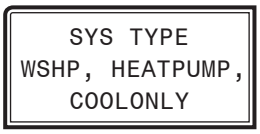
E-BUS COMMUNICATION DIAGNOSTICS

Number of COMM packets received.

CURRENT SOFTWARE VERSION

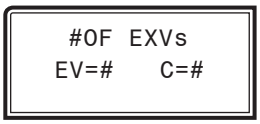
You can access the protected screens from this screen by holding the **<UP>** button for 5 seconds.

CURRENT BOARD ADDRESS

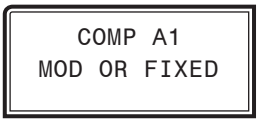


CURRENT SYSTEM TYPE

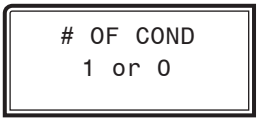
 # OF COMPRESSORS



 # OF EXPANSION VALVES
EV = Evaporator EXVs C = Condenser EXVs



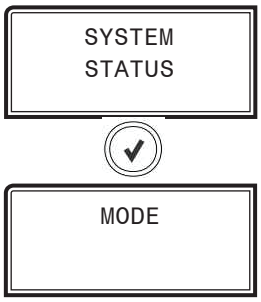
COMPRESSOR A1 STATUS



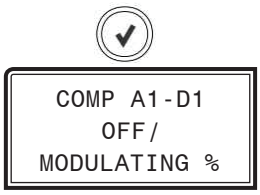
 # OF CONDENSERS

System Status Screens

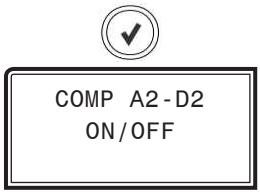
From the SYSTEM STATUS Screen, press **<ENTER>** to scroll through the screens.



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



COMPRESSOR A1, B1, C1, D1 (based on board address)
OFF / MODULATING POSITION (0-100%)

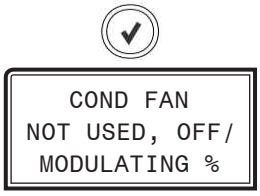


COMPRESSOR A2, B2, C2, D2 (based on board address)
ON, OFF, FORCE

IF WSHP

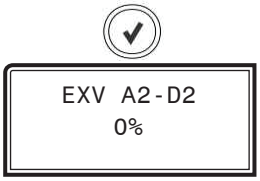
WATER VALVE - NOT USED, ON, OFF, FORCE

ELSE

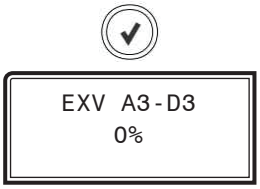


CONDENSER FAN - NOT USED, OFF, MODULATING POSITION (0-100%)

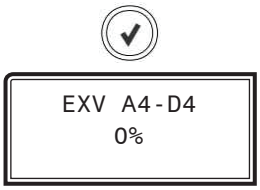
EXV A1, B1, C1, D1 (based on board address)
EXV VALVE POSITION - 0 to 100 percent



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



EXV A3, B3, C3, D3 (based on board address)
EXV VALVE POSITION - 0 to 100 percent



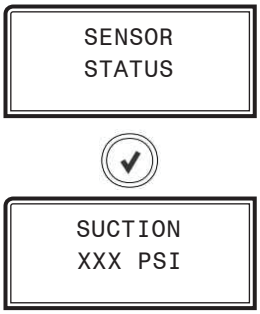
EXV A4, B4, C4, D4 (based on board address)
EXV VALVE POSITION - 0 to 100 percent

IF AIR TO AIR HEAT PUMP

DEFROST INTERVAL TIME UNTIL DEFROST

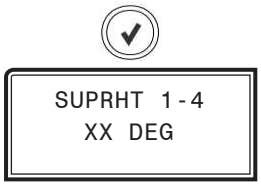
Sensor Status Screens

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

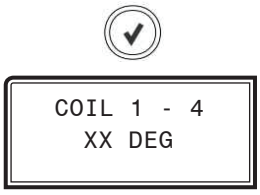


SUCTION PRESSURE READING FROM INPUT

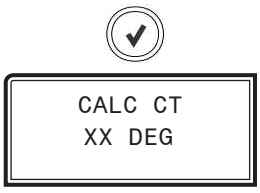
HEAD PRESSURE READING FROM INPUT



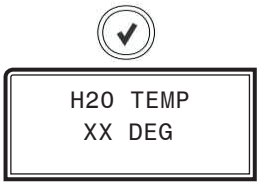
CURRENT SUPERHEAT 1 - 4 CALCULATIONS



COIL TEMPERATURES 1 - 4 READINGS FROM TEMPERATURE SENSORS INPUT



CALCULATED COIL TEMPERATURE FROM SUCTION PRESSURE INPUT

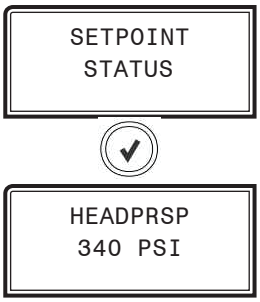


H20 TEMPERATURE FROM LEAVING WATER TEMPERATURE SENSOR INPUT

LEAVING WATER INPUT STATUS

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.



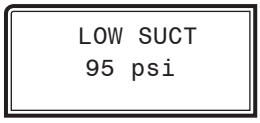
HEAD PRESSURE SETPOINT

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

SUPERHEAT SETPOINT STATUS

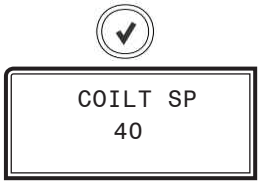
Valid range is 1 to 30 degrees. Default is 15 degrees.

Setpoint Status Screens & Alarms Screen



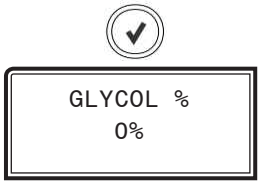
LOW SUCTION PRESSURE SETPOINT SETTING

Default is 95 PSI.



COIL TEMPERATURE SETPOINT SETTING

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



GLYCOL SETPOINT

Valid range is 0-100 percent. Default is 0 percent.

LOW H20 SETPOINT

Valid range is X-XX Deg F. Default is 37 Deg F.

DEFROST INTERVAL TIME

Time before defrost is allowed to activate.

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.

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 - D1, A2-D2, A3-D3, A4-D4 FAILURE: This alarm will occur if the coil temperature is not within operable range (below -32F or above 310F). 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 - 4 (SH1 - SH4) DETECTED: This alarm will be activated when the Superheat is less than 4 degrees 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.

HIGH SUPERHEAT 1 - 4 (SH1 - SH4) WARNING: If superheat is above 25 degrees 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 - 4 (SH1 - SH4) FAILURE: If superheat is above 30 degrees 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 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 that communication has been lost between the RSMV 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.

LOW LEAVING WATER TEMP: This alarm indicates that the Leaving Water Temperature is below the safe Leaving Water Temperature Setpoint.

NO WATER FLOW: This alarm indicates that the Proof of Water Flow Signal is not detected or is lost.

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.

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 TMP 1—Coil Temp 1 Failure

CL TMP 2—Coil Temp 2 Failure

CL TMP 3—Coil Temp 3 Failure

CL TMP 4—Coil Temp 4 Failure

COMP 1 FL—Compressor 1 Failure

COMP 2 FL—Compressor 2 Failure

LOW SH1—Low Superheat 1

LOW SH2—Low Superheat 2

LOW SH3—Low Superheat 3

LOW SH4—Low Superheat 4

HI SH1—High Superheat 1 Failure

HI SH2—High Superheat 2 Failure

HI SH3—High Superheat 3 Failure

HI SH4—High Superheat 4 Failure

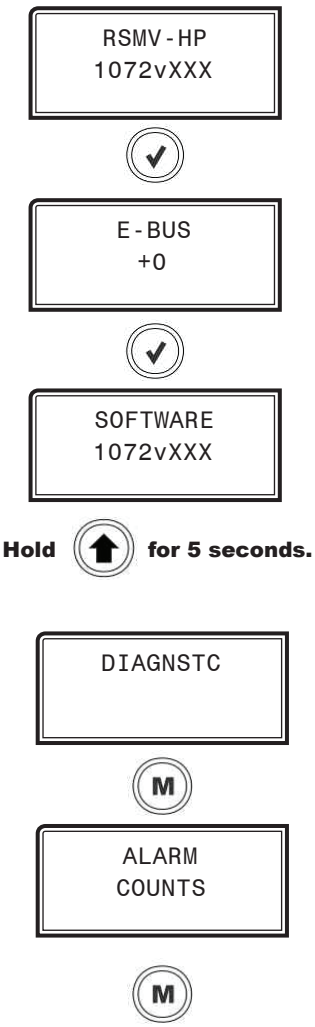
COMM T/0—E-BUS Slave Timeout

NO H2O FLO—No Proof of Water Flow

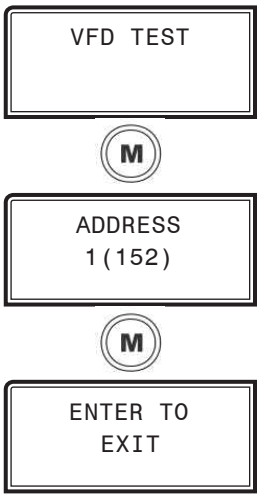
LO H2O TMP—Low Water Temperature

Protected Screens Map

Refer to the following map when navigating through the LCD Protected Screens. From the RSMV-HP 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.

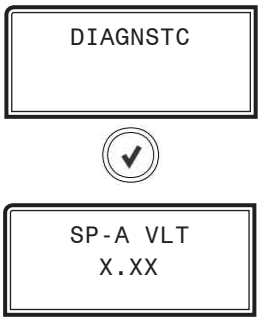


Diagnostic Screens



Diagnostic Screens

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



SUCTION PRESSURE SENSOR VOLTAGE

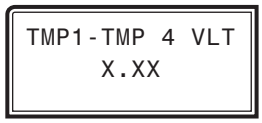
Displays the current voltage of the Suction Pressure Sensor.

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 SENSORS 1 - 4 VOLTAGES

Displays the current voltage of the Coil Temperature Sensor.

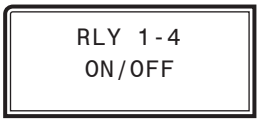
LEAVING WATER TEMPERATURE SENSOR 5 VOLTAGE

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

FORCE MODE

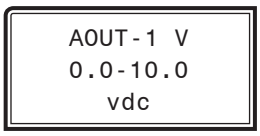
Displays the current status of Force Mode. Values are ON/OFF.

If forced on, the following screens will appear:



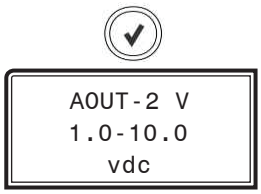
RELAYS 1 - 4 FORCE MODE

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



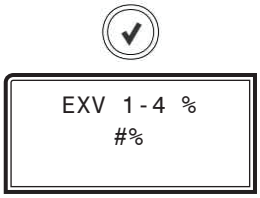
MODULATING COMPRESSOR FORCE MODE

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.

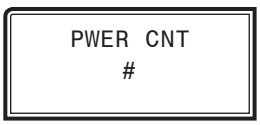


EXPANSION VALVES OPEN PERCENTAGE

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

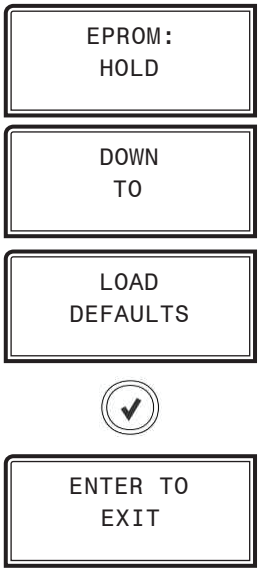
WATCH DOG TIMER

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.



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-HP LED Diagnostics

Using RSMV-HP LEDs To Verify Operation

The RSMV-HP's 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 VCC-X / 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.

BIN3 - This green LED will light up when the Outside Coil Temperature 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-HP 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.

EXV-3 - This green LED will light up when Expansion Valve 1 is modulating.

EXV-4 - This green LED will light up when Expansion Valve 2 is modulating.

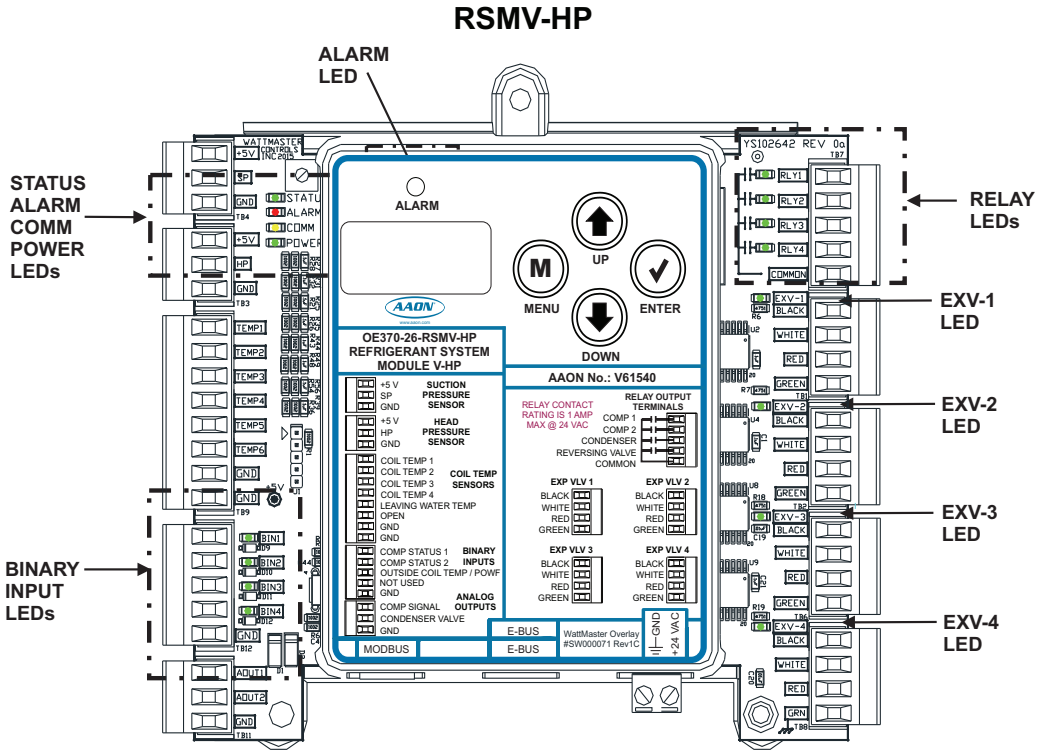


Figure 5: RSMV-HP LED Locations

OE275-01 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 OE275-01 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/RSMD Module(s). The VCC-X/VCCX2 and the RSMV/RSMD 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 PR OUT terminal located on the RSMV/RSMD Module(s) terminal block. Place the negative lead from the meter on the ground (GND) terminal located adjacent to the PR OUT terminal on the RSMV/RSMD 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 terminals PR OUT 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 the OE275-01 Suction Pressure Transducer, 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.

OE275-01 Suction Pressure Transducer Coil Pressure – Temperature – Voltage Chart for R410A Refrigerant					
Temperature °F	Pressure PSI	Signal DC Volts	Temperature °F	Pressure PSI	Signal DC Volts
21.19	80.94	1.8	59.03	168.10	3.2
24.49	87.16	1.9	61.17	174.32	3.3
27.80	93.39	2.0	63.19	180.55	3.4
30.99	99.62	2.1	65.21	186.78	3.5
33.89	105.84	2.2	67.23	193.00	3.6
36.80	112.07	2.3	69.24	199.23	3.7
39.71	118.29	2.4	71.15	205.46	3.8
42.30	124.52	2.5	72.95	211.68	3.9
44.85	130.75	2.6	74.76	217.91	4.0
47.39	136.97	2.7	76.57	224.14	4.1
49.94	143.2	2.8	78.37	230.36	4.2
52.23	149.42	2.9	80.18	236.59	4.3
54.50	155.65	3.0			
56.76	161.88	3.1			

Table 3: Coil Pressure/Voltage/Temp for OE275-01 Suction Pressure Transducers - R410A Refrigerant

Temperature Sensor Testing

Coil Temperature Sensor Testing

The following sensor voltage and resistance table is provided to aid in checking sensors that appear to be operating incorrectly. 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.

Temperature – Resistance – Voltage for Type III 10 K Ohm Thermistor Sensors			
Temp (ºF)	Temp (ºC)	Resistance (Ohms)	Voltage @ Input (VDC)
-10	-23.33	93333	4.51
-5	-20.55	80531	4.45
0	-17.77	69822	4.37
5	-15	60552	4.29
10	-12.22	52500	4.2
15	-9.44	45902	4.1
20	-6.66	40147	4.002
25	-3.88	35165	3.891
30	-1.11	30805	3.773
35	1.66	27140	3.651
40	4.44	23874	3.522
45	7.22	21094	3.39
50	10	18655	3.252
52	11.11	17799	3.199
54	12.22	16956	3.143
56	13.33	16164	3.087
58	14.44	15385	3.029
60	15.55	14681	2.972
62	16.66	14014	2.916
64	17.77	13382	2.861
66	18.88	12758	2.802
68	20	12191	2.746
69	20.55	11906	2.717
70	21.11	11652	2.691
71	21.66	11379	2.661
72	22.22	11136	2.635
73	22.77	10878	2.605

Table 4: Temperature/Resistance for Type III 10K Ohm Thermistor Sensors

Temperature – Resistance – Voltage for Type III 10 K Ohm Thermistor Sensors			
Temp (ºF)	Temp (ºC)	Resistance (Ohms)	Voltage @ Input (VDC)
74	23.33	10625	2.576
75	23.88	10398	2.549
76	24.44	10158	2.52
77	25	10000	2.5
78	25.55	9711	2.464
80	26.66	9302	2.41
82	27.77	8893	2.354
84	28.88	8514	2.3
86	30	8153	2.246
88	31.11	7805	2.192
90	32.22	7472	2.139
95	35	6716	2.009
100	37.77	6047	1.884
105	40.55	5453	1.765
110	43.33	4923	1.65
115	46.11	4449	1.54
120	48.88	4030	1.436
125	51.66	3656	1.339
130	54.44	3317	1.246
135	57.22	3015	1.159
140	60	2743	1.077
145	62.77	2502	1.001
150	65.55	2288	0.931

Table 4, cont.: Temperature/Resistance for Type III 10K Ohm Thermistor 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.

Head Pressure Transducer Troubleshooting

If you suspect there is a problem related to head pressure transducer measurements, reference **Table 5, 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 5: Head Pressure Transducer Chart

Single Condenser Per 1 Module

Single Condenser Per 1 Module

In Single Condenser Per 1 Module wiring configuration, the Condenser Signal is wired to AO2 and the Condenser Relay RLY3 is enabled. Refer to the figures below for Prism 2 configuration and Modular Service Tool Screen selection.

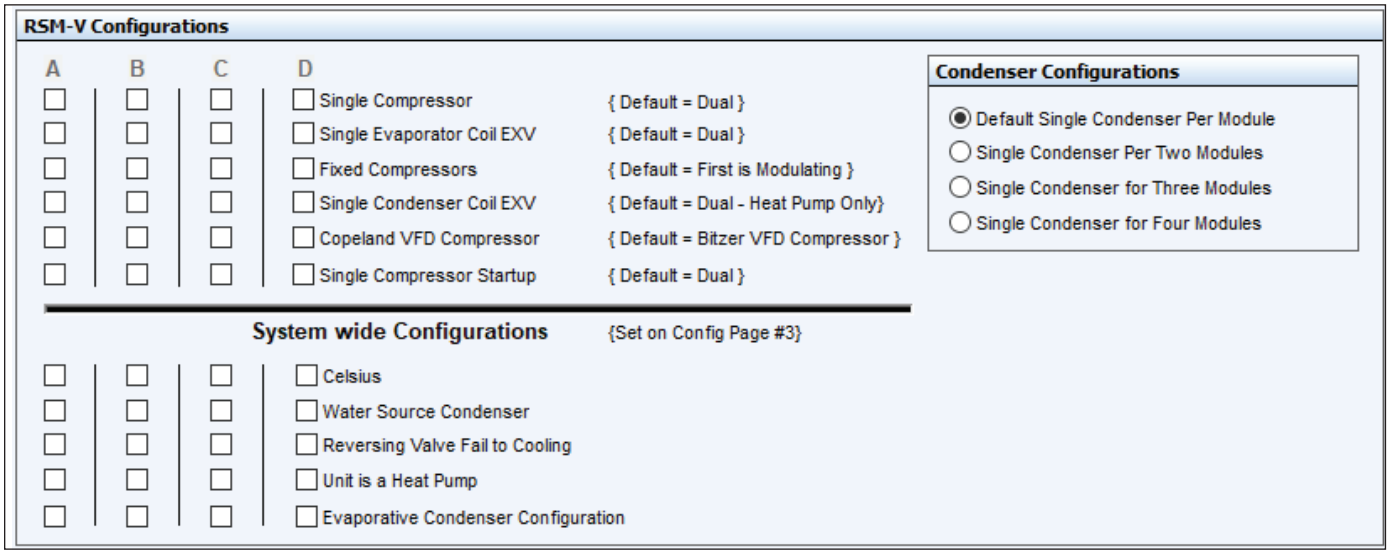


Figure 6: Prism 2 Condenser Configuration

RSMV & RSMV-HP 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.

Single Condenser Per 2 Modules

In Single Condenser Per 2 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 the figures below for Prism 2 configuration and Modular Service Tool Screen selection.

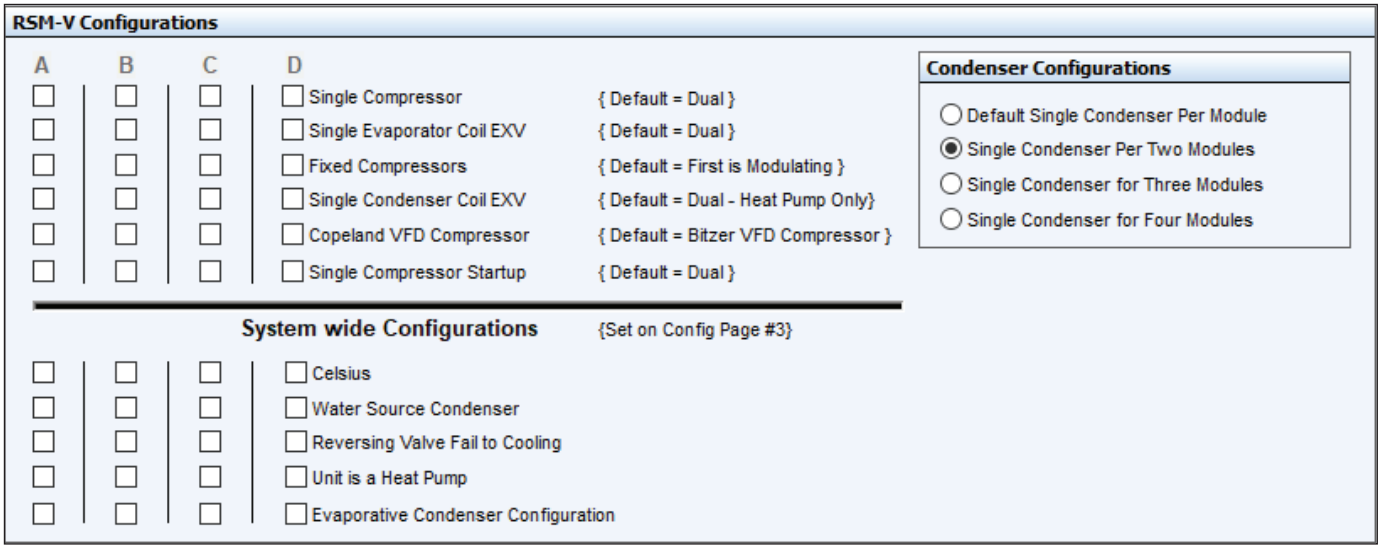


Figure 7: Prism 2 Condenser Configuration

RSMV & RSMV-HP 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.

Single Condenser for Three Modules

Single Condenser for 3 Modules

In Single Condenser for 3 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 the figures below for Prism 2 configuration and Modular Service Tool Screen selection.

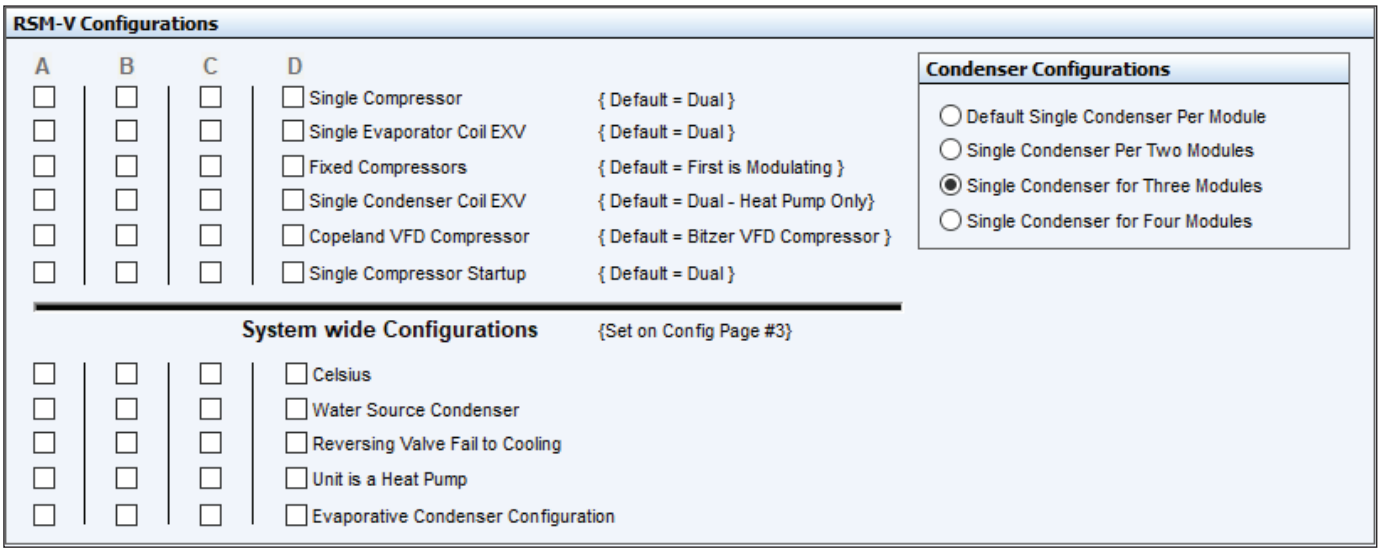


Figure 8: Prism 2 Condenser Configuration

RSMV & RSMV-HP 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.

Single Condenser for 4 Modules

In Single Condenser for 4 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 the figures below for Prism 2 configuration and Modular Service Tool Screen selection.

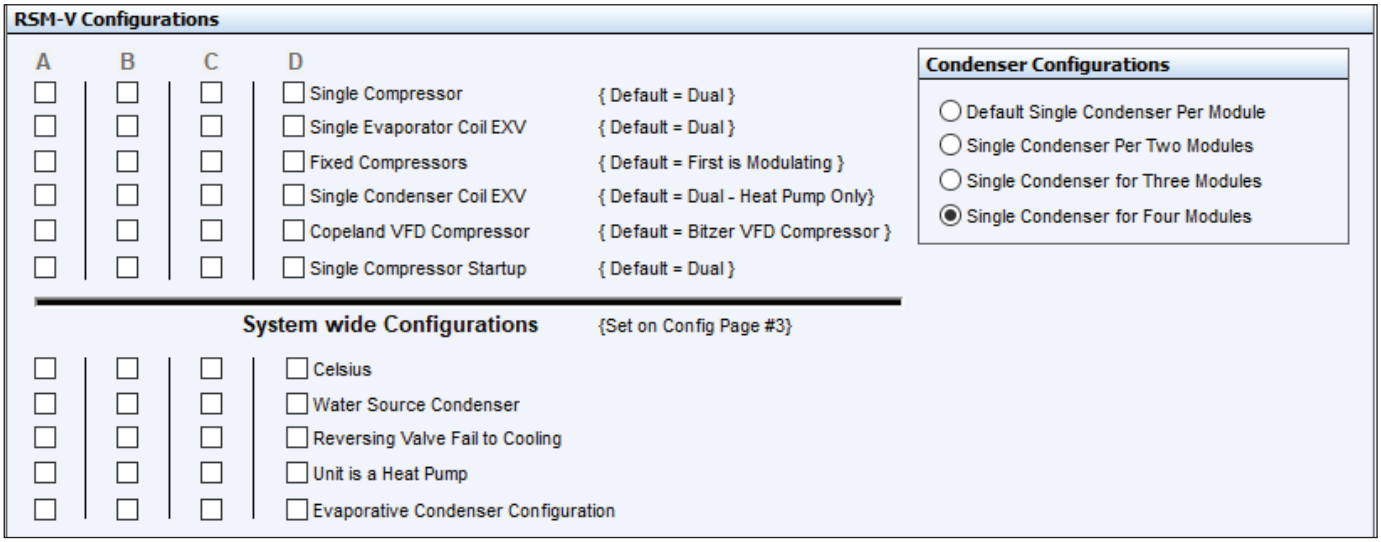


Figure 9: Prism 2 Condenser Configuration

RSMV & RSMV-HP 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.

System Configurations

System Configuration Using Prism 2

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

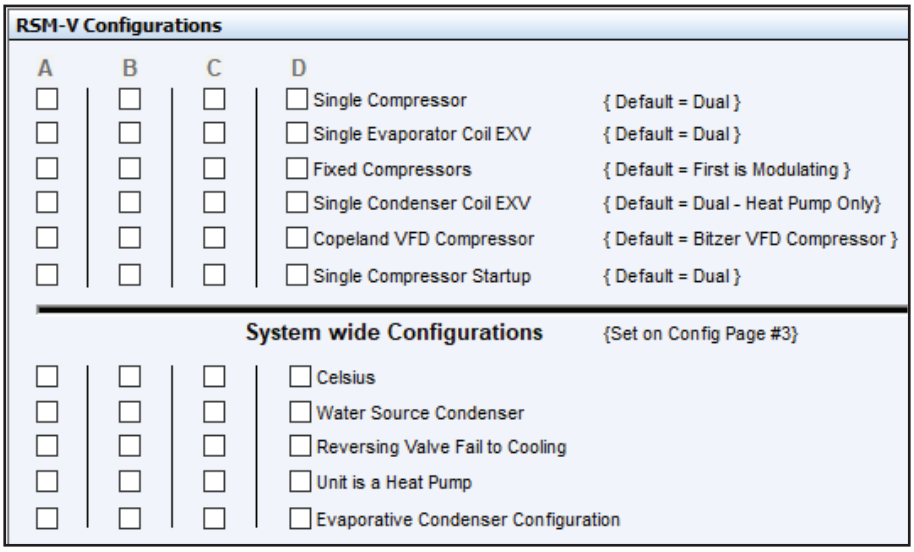


Figure 10: Prism 2 RSMV Configuration Screen

Single Compressor Configuration

Select this configuration if the RSMV only has one Compressor wired to it. If there are two Compressors, leave this selection blank.

Single Evaporator Coil Configuration

Select this configuration if the RSMV only has one Expansion Valve wired to it. If there are two Expansion Valves, leave this selection blank.

Fixed Compressors Configuration

Select this configuration if the RSMV only has Fixed Compressors wired to it. If the first Compressor is Modulating, leave this selection blank.

Single Condenser Coil Expansion Valve Configuration

This configuration only applies when using the RSMV-HP. Select this configuration when Expansion Valve 3 is wired and Expansion Valve 4 is not wired. If both are connected, leave this selection blank.

Copeland VFD Configuration

Select this configuration if the RSMV is controlling a Copeland VFD through the MODBUS connection.

Single Compressor Startup

Select this configuration if the desired startup routine enables one compressor at a time on the system. Leaving this blank makes the first compressor on each module enabled at startup which is the default method. Most systems require the first compressor on each module to be enabled to achieve the full evaporator coil face active.

NOTES

AAON Controls Support:
Support.Controls@aaon.com

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AAON Factory Technical Support:
Technical.Support@aaon.com

Phone
866-918-1100
Monday through Friday, 7:00 AM to 5:00 PM Central Time

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.

Are you an AAON Rep?
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