RSMV Technical Guide
# TABLE OF CONTENTS

## OVERVIEW  ................................................................. 4
- Features and Applications .................................................. 4
- Module Dimensions ............................................................ 5

## INSTALLATION & WIRING ............................................ 6
- Input Wiring ........................................................................ 6
  - Suction Pressure Sensor .................................................. 6
  - Head Pressure Sensor ...................................................... 6
  - Coil Temperature Sensors .................................................. 6
- Output Wiring ....................................................................... 7
  - Expansion Valves ............................................................... 7
  - Modulating Compressor .................................................... 7
  - Condenser Fan Signal ......................................................... 7

## INPUTS & OUTPUTS ..................................................... 8

## SEQUENCE OF OPERATIONS ....................................... 10
- Cooling Mode ..................................................................... 10
- Dehumidification Operation ............................................... 10
- Expansion Valve Operation ................................................ 11
- Head Pressure Control ....................................................... 11

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TABLE OF CONTENTS

RSMV LCD SCREENS .................................................................................................................. 12
  RSMV Main Screens Map ........................................................................................................ 13
  RSMV Module Screens ......................................................................................................... 13
  System Status Screens ...................................................................................................... 14
  Sensor Status Screens ....................................................................................................... 15
  Setpoint Status Screens ................................................................................................... 15
  Alarms Screen and Definitions ......................................................................................... 16
  Alarm History Screen ....................................................................................................... 17
  Protected Screens Map .................................................................................................... 17
  Diagnostics Screens ......................................................................................................... 18
  Alarm Counts Screen ....................................................................................................... 19
  VFD Test Screens ............................................................................................................ 20
  Address Screen .............................................................................................................. 20

TROUBLESHOOTING ........................................................................................................... 21
  LED Diagnostics ............................................................................................................... 21
  OE275-01 Suction Pressure Transducer Testing for R410A .................................................. 22
  Coil Temperature Testing ............................................................................................... 23
  Head Pressure Transducer Troubleshooting .................................................................... 24

APPENDIX: SYSTEM CONFIGURATION USING PRISM 2 .................................................. 25
  One Condenser Per RSMV ............................................................................................... 25
  One Condenser Per 2 RSMVs ......................................................................................... 26
  One Condenser For 3 RSMVs ......................................................................................... 27
  One Condenser For 4 RSMVs ......................................................................................... 28
  System Configuration Options ........................................................................................ 29
RSMV Features & Applications

The OE370-26-RSMV Refrigerant System Module for VFD Compressors (RSMV) (AAON Part No: V42440) monitors and controls one refrigeration circuit of the HVAC unit. The module is designed for R410-A refrigerant.

The RSMV is connected to the VCC-X / 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 the E-BUS Modules.

The RSMV provides 4 analog inputs, 3 binary inputs, 3 relays, and 4 analog outputs. See Figures 2 & 3, pages 6 & 7 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 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 safety 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: Refrigerant System Module Dimensions
**RSMV Wiring**

The RSMV is connected to the VCC-X or 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 the 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 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 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 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 can be reset based on indoor humidity levels.

![Figure 2: RSMV Inputs Wiring](image-url)

**Refrigerant System Module for VFD Compressors (RSMV)**

- **Suction Pressure Sensor**
- **Head Pressure Sensor (BY OTHERS)**
- **Coil (Suction Line) Temp. 1 Sensor**
- **Coil (Suction Line) Temp. 2 Sensor**
- **Compressor Status 1**
- **Compressor Status 2**
**RSMV Outputs Wiring**

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

**Head Pressure Control**
The 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**
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.

**Condenser Configuration Options**
Please see the Appendix on page 25 for Condenser Configuration details.

---

**Figure 3: RSMV Outputs Wiring**

**NOTE:**
ALL RELAY OUTPUTS ARE NORMALLY OPEN AND RATED FOR 24 VAC POWER ONLY - 1 AMP MAXIMUM LOAD

---

**REFRIGERANT SYSTEM MODULE**
FOR VFD COMPRESSORS (RSMV)

---

**24 VAC ONLY**

**COMPRESSOR 1 ENABLE**
**COMPRESSOR 2 ENABLE**
**CONDENSER ENABLE**

**EXPANSION VALVE 1**
**EXPANSION VALVE 2**

**MODULATING COMPRESSOR**

**CONDENSER FAN SIGNAL**

---

**Connect to VGC-X or VGCX2 Controller**

**Line Voltage**

**Size Transformer For Correct Total Load. RSMV = 18 VA**
## INPUTS & OUTPUTS

### RSMV Module Input/Output Maps

#### Input/Output Map

See Table 1 for the RSM for VFD Compressor Inputs/Outputs

<table>
<thead>
<tr>
<th>Analog Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Suction Pressure Sensor (SP)</td>
</tr>
<tr>
<td>2  Head Pressure Sensor (HP)</td>
</tr>
<tr>
<td>3  Coil (Suction Line) Temperature Sensor 1 (TEMP1)</td>
</tr>
<tr>
<td>4  Coil (Suction Line) Temperature Sensor 2 (TEMP2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Binary Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Compressor Status 1 (BIN1)</td>
</tr>
<tr>
<td>2  Compressor Status 2 (BIN2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analog Outputs (0-10 VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Modulating Compressor (AOUT1)</td>
</tr>
<tr>
<td>2  Condenser Fan Signal (AOUT2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stepper Motor Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Expansion Valve 1 (EXV-1)</td>
</tr>
<tr>
<td>2  Expansion Valve 2 (EXV-2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Binary Outputs (24 VAC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Compressor 1 Enable Relay (R1)</td>
</tr>
<tr>
<td>2  Compressor 2 Enable Relay (R2)</td>
</tr>
<tr>
<td>3  Condenser Enable Relay (R3)</td>
</tr>
</tbody>
</table>

Table 1: RSMV Inputs & 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.
SEQUENCE OF OPERATIONS

Cooling Mode & 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 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 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 Compressors (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 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 2 for descriptions.

<table>
<thead>
<tr>
<th>NAVIGATION KEY</th>
<th>KEY FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MENU</td>
<td>Use the MENU key to move through screens within Main Menu categories and return to the Main Menu while at other screens.</td>
</tr>
<tr>
<td>UP</td>
<td>Use this key to adjust setpoints and change configurations.</td>
</tr>
<tr>
<td>DOWN</td>
<td>Use this key to adjust setpoints and change configurations.</td>
</tr>
<tr>
<td>ENTER</td>
<td>Use the ENTER key to navigate through the Main Menu Screen categories.</td>
</tr>
</tbody>
</table>

**Figure 4: LCD Display and Navigation Keys**

**Table 2: 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 REFIRG 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 Screen.

- **SENSOR STATUS**
  - Press ✔ to scroll through SENSOR STATUS Screens.

- **ALARMS**
  - Press ✔ to go to ALARMS Screens.
  - Press M to go to ALARM HISTORY Screens.

- **ALARM HISTORY**
  - Press ✔ to scroll through ALARM HISTORY 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**
  - Press ✔

- **E-BUS #**

- **E-BUS COMMUNICATION DIAGNOSTICS**
  - Number of COMM packets received.

- **SOFTWARE 1072vXXX**
  - Press ✔

- **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 COOL ONLY**

- **CURRENT SYSTEM TYPE**

- **# OF COMP #**

- **# OF COMPRESSORS**
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.

**COMP A1-D1**
Off/Modulating %

**COMPRESSOR A1, B1, C1, D1**
(based on board address)
Off/Mod Position

**EXV A1-D1**
0%

**EXV A1, B1, C1, D1**
(based on board address)
EXV Valve Position
0 to 100 percent

**COMP A2-D2**
Off/On

**COMPRESSOR A2, B2, C2, D2**
(based on board address)
On, Off, Force

**EXV A2-D2**
0%

**EXV A2, B2, C2, D2**
(based on board address)
EXV Valve Position
0 to 100 percent

**SYSTEM STATUS**

**Comp A1 Status**
Mod or Fixed

**# OF EXPANSION VALVES**

**# OF CONDENSERS**

Possible choices are
Off, Cool, Heat, Dehumid, Force

**Cond Fan**
Not Used/Off/Modulating %

**EXV A1-D1**
0%

**EXV A1, B1, C1, D1**
(based on board address)
EXV Valve Position
0 to 100 percent

**EXV A2-D2**
0%

**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 & Alarms Screen**

**COIL TEMP A2 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 (SH1) 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.

**LOW SUPERHEAT 2 (SH2) 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. The system will shut down and will retry after 5 minutes.

**HIGH SUPERHEAT 1 (SH1) 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 2 (SH2) 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 (SH1) 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 2 (SH2) 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.

---

**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.

The alarms are as follows:

**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 -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.
Alarm History & Protected Screens

Alarm History Screens

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

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

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 TEMP 1—Coil Temp 1 Failure
CL TEMP 2—Coil Temp 2 Failure
COMP 1 FL—Compressor 1 Failure
COMP 2 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/0—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

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.

NOTE:

RSMV Technical Guide
Diagnostic Screens

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

**DIAGNSTC**

**WDOG CNT #**

**POWER CNT #**

**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.

**EPROM:**

**HOLD**

**DOWN TO**

**LOAD DEFAULTS**

**SP-A VLT X.XX**

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

**HP-A VLT X.XX**

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

**BIN 1 - BIN 4 ON/OFF**

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

**TMP1 VLT X.XX**

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

**TMP2 VLT X.XX**

**COIL TEMPERATURE SENSOR 2 VOLTAGE**
Displays the current voltage of the 2nd Coil Temperature Sensor.
RSMV LCD SCREENS

Diagnostic Screens

TEMPERATURE SENSOR 5 VOLTAGE (NOT USED)

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

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

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

Refer to the following map when navigating through the VFD Test Screens. VFD test screens are only used when VFD is connected via MODBUS communications. From the VFD TEST Screen, press <ENTER> to scroll through the screens.

VFD TEST ENABLED/DISABLED
Values are Enable or Disabled.

VFD COMPRESSOR TEST
Values are Enable or Disabled.

VFD FREQ
0.0 HZ

VFD COMPRESSOR FREQUENCY
Current VFD Frequency. Values are 0.0 HZ to

VFD VOLT
0.0

VFD COMPRESSOR VOLTAGE
Current VFD Voltage.

VFD AMPS
0

VFD COMPRESSOR AMPS
Current VFD Amps.

Address Screen

ADDRESS
1 (152)

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
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**

<table>
<thead>
<tr>
<th>LED</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATUS</td>
<td>If the software is running, this LED should blink at a rate of 1 blink per second.</td>
</tr>
<tr>
<td>ALARM (on board)</td>
<td>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.</td>
</tr>
<tr>
<td>ALARM (above LCD display)</td>
<td>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.</td>
</tr>
<tr>
<td>COMM</td>
<td>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.</td>
</tr>
<tr>
<td>POWER</td>
<td>This LED will light up to indicate that 24 VAC power has been applied to the controller.</td>
</tr>
</tbody>
</table>

**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 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**
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 Module(s). The VCC-X / 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 the OE275-01 Suction Pressure Transducer, Pressure, Temperature, and Voltage Chart for R410A Refrigerant. 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.
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, 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.

| 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               | 2.099            |
| 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            |
Head Pressure Transducer Troubleshooting

If you suspect there is a problem related to the head pressure transducer, measurements can be taken at the HP terminal. Reference Table 5, below.

### Table 5: Head Pressure Transducer Chart

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

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

Single Condenser Per Two 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

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

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.

![RSM-V Configurations](image)

**Figure 9: Prism 2 Condenser Configuration**

**RSMV & RSMV-HP Condenser Options Configuration Screen**

Select the “1 Condenser for 4 RSMVs” option on the above Hand Held Service Tool Screen.
System Configuration Using Prism 2

Refer to Figure 10 below in setting RSMV configuration options.

![Figure 10: Prism 2 RSMV Configuration Screen](image)

**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.