RSMD
Technical Guide

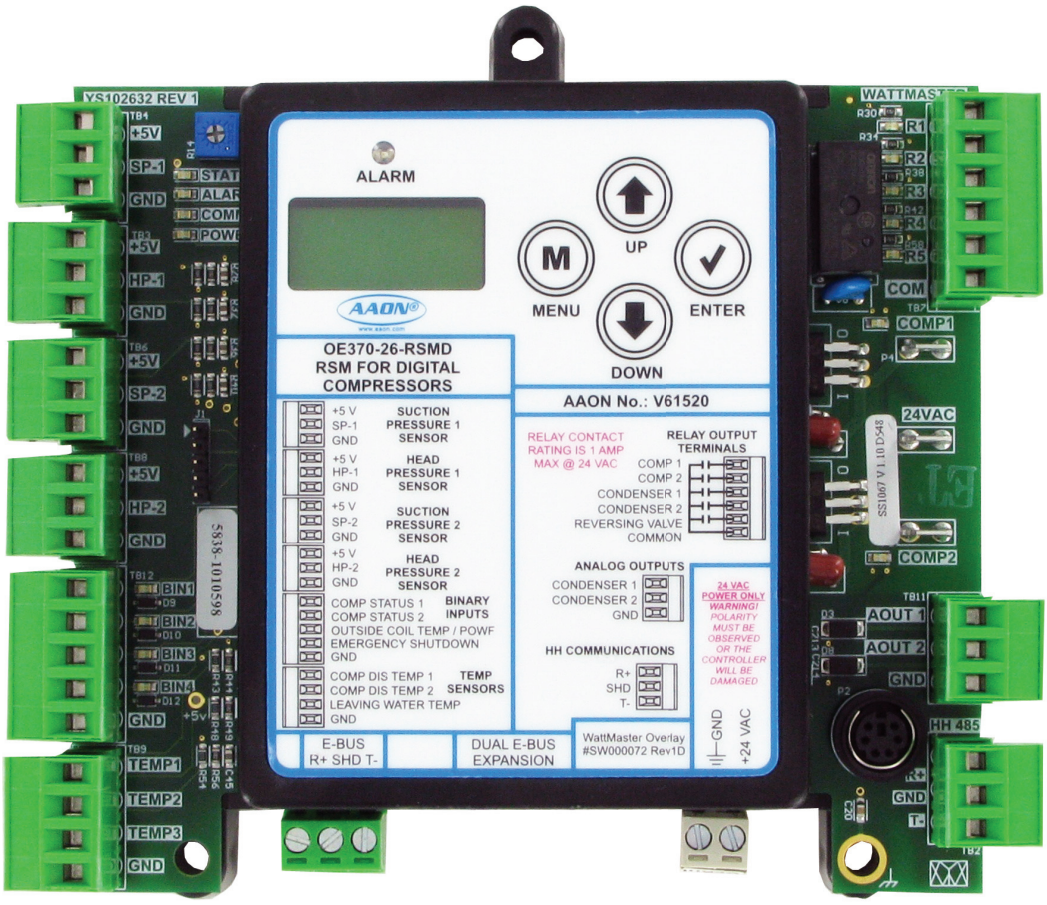


TABLE OF CONTENTS

www.aaon.com

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

WattMaster Form: AA-RSMD-TGD-01D

AAON Part Number: V87380

TABLE OF CONTENTS

RSMD Overview

Features & Applications

The OE370-26-RSMD Refrigerant System Module for Digital Compressors (RSMD) (AAON Part No: V61520) can monitor and control up to two compressors and condensers. The compressors can be in either a tandem or non-tandem configuration. The module is designed for R410-A refrigerant.

The RSMD is connected to the VCC-X / VCCX2 Controller. Up to 4 RSMD'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 RSMD provides 3 analog inputs, 4 binary inputs, 5 relays, and 2 analog outputs. See **Figures 2 & 3, pages 6 & 7** for wiring.

The RSMD 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.
- In Heating mode, the RSMD modulates and stages the compressors to maintain a given Supply Air Temperature Setpoint.
- Modulates the Condenser Fan or Valve to maintain the Head Pressure Setpoint.
- Provides alarms and safeties for the Compressor and Condenser operation.
- Allows connection of the Modular Service Tool SD to the module when required communication wire is run to the VCC-X / VCCX2 Controller.
- 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.

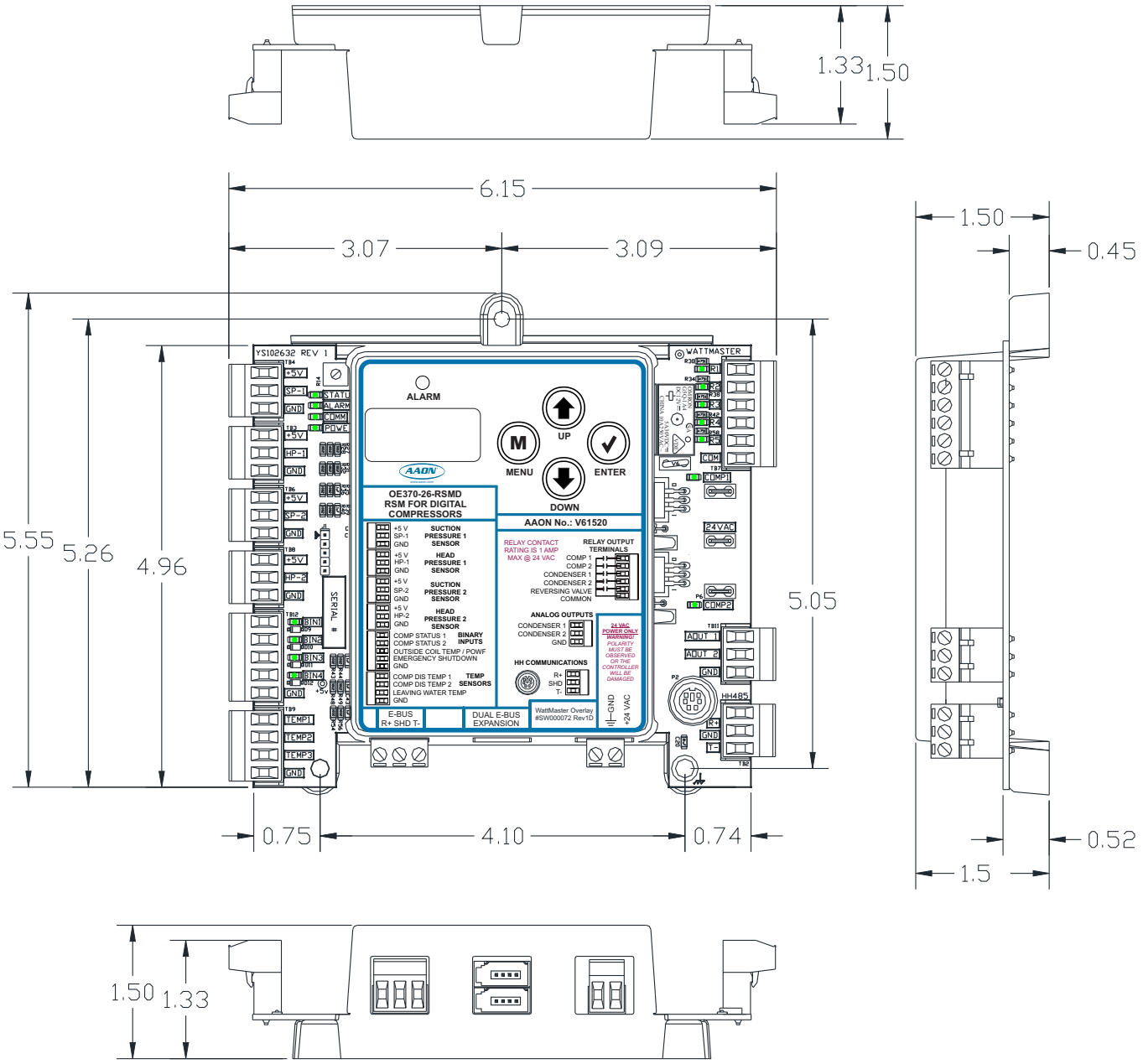


Figure 1: RSMD Dimensions

RSMD Inputs Wiring

RSMD Wiring

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

The RSMD is connected to the VCC-X or VCCX2 Controller. Up to 4 RSMD'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 RSMD provides 3 analog inputs, 4 binary inputs, 5 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 Transducers must be wired as shown in **Figure 2, below**. It is typically required for all 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 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.

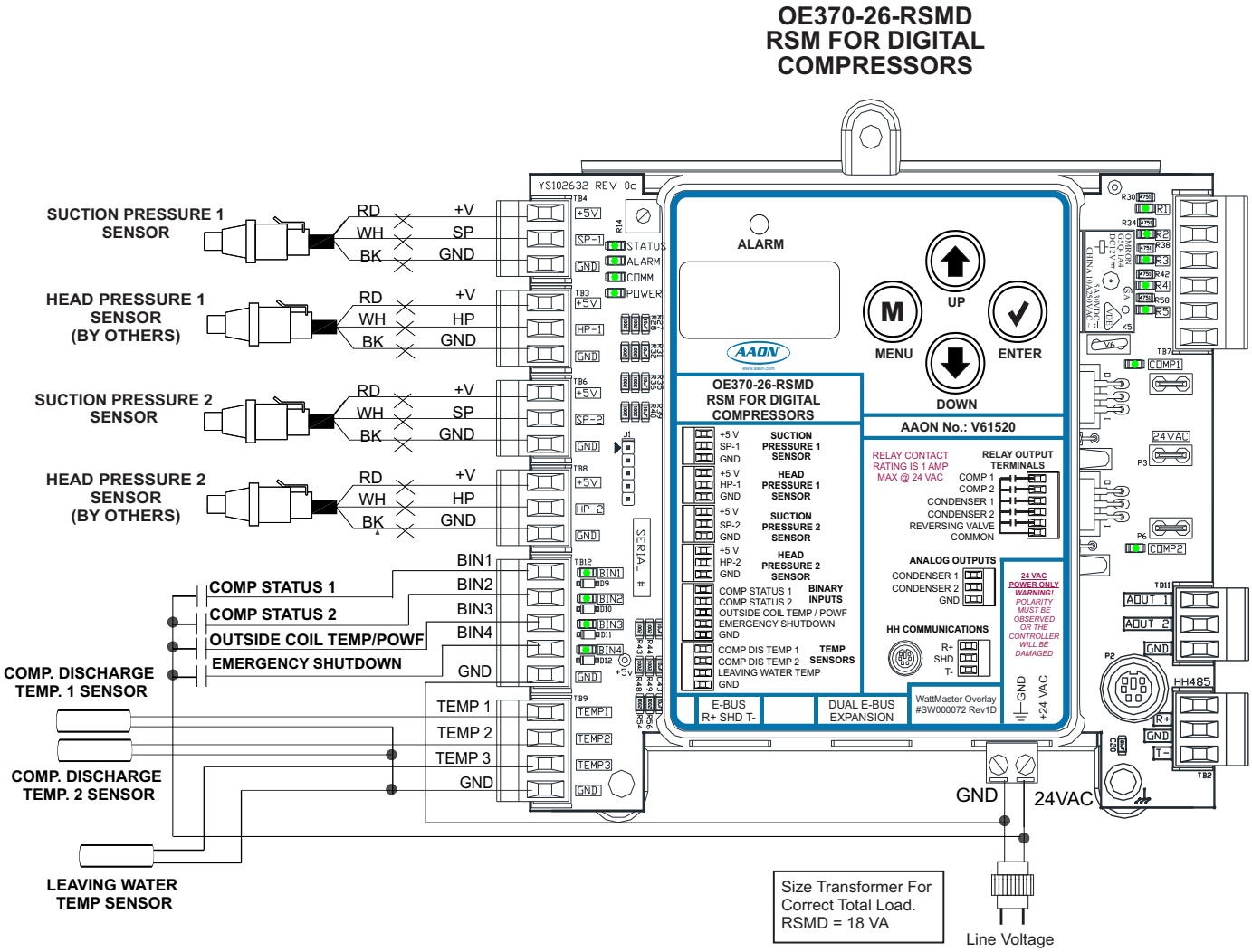


Figure 2: RSMD Inputs Wiring

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.

NOTE: If there are two Compressors on a single circuit (a tandem circuit), Suction Pressure 2, Head Pressure 2, and Condenser Signal 2 would not be used.

Head Pressure Control

The Head Pressure Transducers are used to measure Head Pressure at the discharge line. This Head Pressure is used to drive the Condenser Fans with a 0-10 VDC output signal or valve with a 2-10 VDC output signal to maintain a given Head Pressure Setpoint.

Compressor Discharge Sensors

The Digital Compressor Discharge Temperature Sensor monitors the discharge temperature from the Digital Compressor to protect against overheating.

Leaving Water Temperature Sensor

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

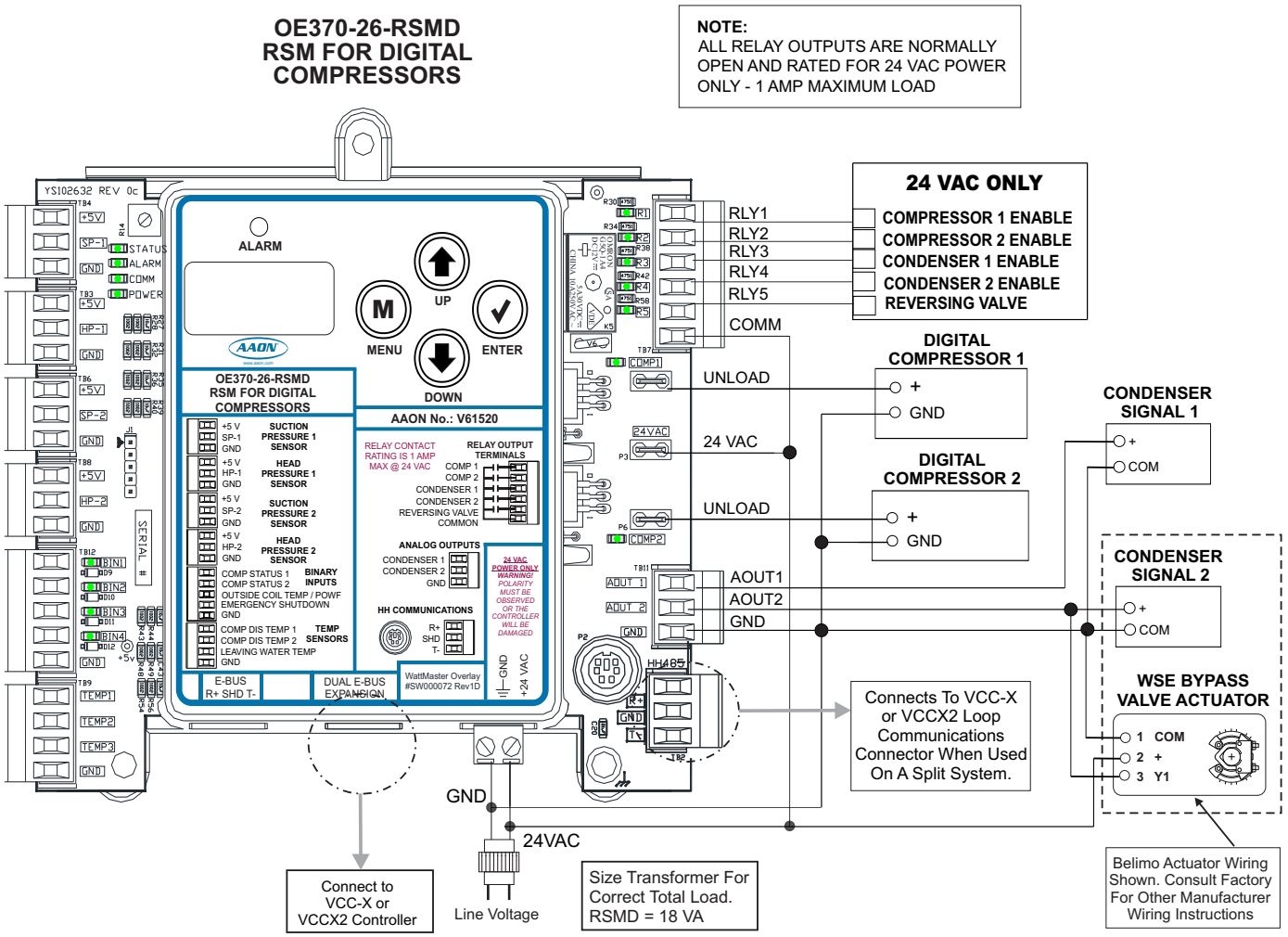


Figure 3: RSMD Outputs Wiring

RSMD Input/Output Map

REFRIGERATION SYSTEM MODULE FOR DIGITAL COMPRESSORS	
Analog Inputs	
1	Suction Pressure 1 Sensor (SP-1)
2	Head Pressure 1 Sensor (HP-1)
3	Suction Pressure 2 Sensor (SP-2)
4	Head Pressure 2 Sensor (HP-2)
5	Compressor Discharge Temperature Sensor 1 (TEMP1)
6	Compressor Discharge Temperature Sensor 2 (TEMP2)
7	Leaving Water Temperature Sensor (TEMP3)
Binary Inputs	
1	Compressor Status 1 (BIN1)
2	Compressor Status 2 (BIN2)
3	Outside Coil Temperature / Proof of Water Flow (BIN3)
4	Emergency Shutdown (BIN4)
Analog Outputs (0-10 VDC)	
1	Condenser 1 Fan Signal (AOUT1)
2	Condenser 2 Fan Signal (0-10 VDC) or WSE Bypass Actuator (2-10 VDC) (AOUT2)
Binary Outputs (24 VAC)	
1	Compressor 1 Enable Relay (RLY1)
2	Compressor 2 Enable Relay (RLY2)
3	Condenser 1 Enable Relay (RLY3)
4	Condenser 1 Enable Relay (RLY4)

Table 1: RSMD Inputs & Outputs

RSMD - Inputs & Outputs

+5V VDC Power
This output is a 5 VDC output that supplies power to the Suction Pressure Transducers.

SP-1 & SP-2 - Suction Pressure Transducers
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 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.

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

HP-1 & HP-2 - Head Pressure Transducers
The Head Pressure Transducers are 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 - Compressor Discharge Temperature Sensor 1 & Sensor 2 Input
The Digital Compressor Discharge Temperature Sensors monitor the discharge temperature from the Digital Compressor to protect against overheating.

TEMP3 - Leaving Water Temperature Sensor Input
This input monitors the Condenser Leaving Water Temperature and determines if the water source condenser is operating in a safe water temperature range.

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 relay output 1. 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 relay output 2. If Binary Input 2 opens, Compressor 2 Enable Relay will de-energize and a Compressor Alarm will be generated.

BIN3 - Outside Coil Temperature / Proof of Water Flow Status
This input can be used for the following two options:

Air to Air Heat Pump
This wet contact input monitors a Defrost Coil Temperature Switch on air to air heat pump units. If the compressors are operating in the Heating Mode and this switch closes, it will initiate a Defrost Mode.

Water Source Heat Pump
This wet contact input is for the Water Proof of Flow Switch. If the Water Proof of Flow Switch contact opens while the Condenser Valve is operating, the controller will react to protect the system depending on the current mode of operation.

BIN4 - Emergency Shutdown
This wet contact input is used to initiate shutdown of the HVAC unit when a N.C. Smoke Detector (by others), Firestat (by others), or other shutdown condition (by others) contact is opened. The controller remains active and can initiate alarm relays.

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 - Condenser Fan 1 Signal
This 0-10 VDC output is used to control/modulate the Condenser 1 Fan /Valve to maintain the Head Pressure Setpoint.

AOUT2 - Condenser Fan 2 Signal or Waterside Economizer Bypass Actuator Valve
This 0-10 VDC output is used to control/modulate the Condenser 2 Fan /Valve to maintain the Head Pressure Setpoint or this output signal is a Direct Acting 2-10 VDC output signal that is used to modulate the Water Side Economizer Bypass Actuator.

RLY1 - Compressor 1 Enable
This relay enables the Compressor 1.

RLY2 - Compressor 2 Enable
This relay enables the Compressor 2.

RLY3 - Condenser 1 Enable
This relay enables the Condenser 1 Fan / Water Valve.

RLY4 - Condenser 2 Enable
This relay enables the Condenser 2 Fan / Water Valve.

RLY5 - Reversing Valve Enable
This relay enables the Reversing Valve.

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. Two compressors are controlled per Refrigerant System Module (RSMD). Multiple RSMDs are needed when there are more than two compressors

In units with one digital and one fixed compressors, if the digital 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 digital 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.

In units with multiple digital compressors, if the 1st digital compressor modulates to 100% and the SAT is still above the SAT Cooling Setpoint for the Cooling Stage Up Delay, then the 2nd digital compressors will enable and the two digital Compressors will then modulate together to maintain the Active Evaporator Coil Suction (Saturated) Temperature Setpoint.

To stage down compressors, if the digital 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 (digital or Fixed) will stage off – assuming its Minimum Run Time has been met. Any remaining digital compressors are then allowed to modulate as needed. If the last remaining digital compressor reaches 0% for the Stage Down Delay, it will stage off.

Dehumidification Operation

The RSMD activates the Cooling Stages based on the actual Evaporator Coil Temperature compared to the Evaporator Coil Suction (Saturation) Temperature Setpoint. The Evaporator Coil Suction (Saturation) Temperature is calculated by using the Suction Pressure Sensor and converting the pressure to temperature.

For Copeland Digital Scroll™ Compressor units, the RSMD will modulate the Copeland Digital Scroll™ Compressor to maintain the Evaporator Coil Suction (Saturation) Temperature Setpoint and activate the Compressors as necessary.

On units that have one Digital and one Fixed Capacity Compressor, if the Fixed Capacity Compressor is activated, the Copeland Digital Scroll™ Compressor will only be allowed to modulate within the range of 70% - 100% in order to prevent the loss of reheat capacity during low load conditions. If, with both compressors on, the 1st digital compressor has modulated down to its 70% minimum and the Coil Suction Temperature falls below the Coil Temperature Setpoint minus the Cooling Stage Control Window, then the second compressor will stage off once its Compressor Minimum Run Time and the Stage Down Delay Timers have been met. At that point, the Copeland Digital Scroll™ Compressor can modulate down as needed to maintain the Coil Temperature Setpoint.

If the RSMD has two Digital Compressors, the 1st Compressor will be locked at 100% and the 2nd Compressor will modulate.

Head Pressure Control

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

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

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

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

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

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

LCD Display Screen & Navigation Keys

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.

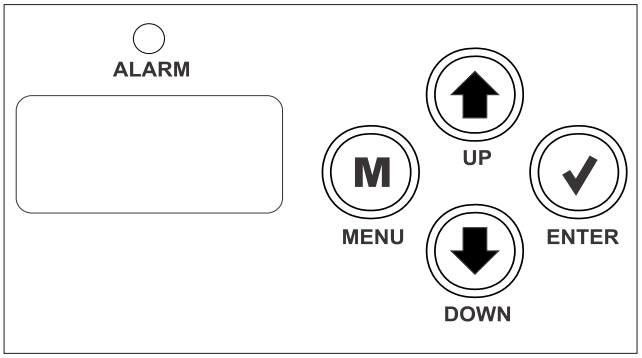


Figure 4: LCD Display and Navigation Keys

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

RSMD Main Screens Map

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

RSMD
1067vxxx

Press ✓ to scroll through REFRIG MODULE Screens.

Press M to go to SYSTEM STATUS Screens.

SYSTEM
STATUS

Press ✓ to scroll through SYSTEM STATUS Screens.

Press M to go to SENSOR STATUS Screen.

SENSOR
STATUS

Press ✓ to scroll through SENSOR STATUS Screens.

Press M to go to ALARMS Screens.

ALARMS

Press ✓ to scroll through ALARMS Screens.

Press M to go to ALARM HISTORY Screens.

ALARM
HISTORY

Press ✓ to scroll through ALARM HISTORY Screens.

Press M to go to SETPOINT STATUS Screens.

SETPOINT
STATUS

Press ✓ to scroll through SETPOINT STATUS Screens.

RSMD Module Screens

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

RSMD
1067vxxx

✓

EBUS COMM
PACKETS

E-BUS COMMUNICATION DIAGNOSTICS

Number of COMM packets received.

✓

SOFTWARE
1067vXXX

CURRENT SOFTWARE VERSION

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

✓

BOARD/EBUS
ADDRESS

CURRENT BOARD ADDRESS

✓

#COMP
CONFIGURED

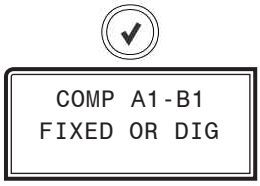
 # OF COMPRESSORS CONFIGURED

✓

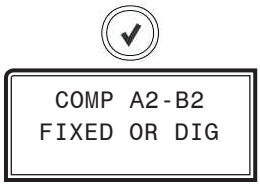
#COND
CONFIGURED

 # OF CONDENSERS CONFIGURED

System Status Screens



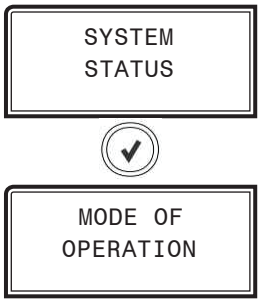
COMPRESSOR A1 or B1 - Fixed or Digital



COMPRESSOR A2 or B2 - Fixed or Digital

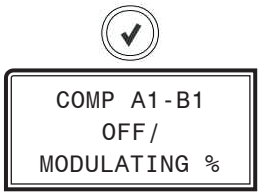
System Status Screens

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



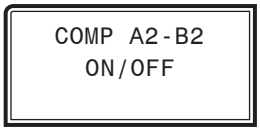
SYSTEM MODE OF OPERATION

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



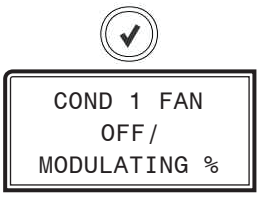
COMPRESSOR A1, B1
(based on board address)
OFF / MOD POSITION

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



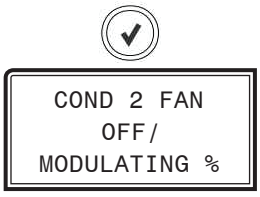
COMPRESSOR A2, B2
(based on board address)
ON, OFF, FORCE

ON: Compressor is on.
OFF: Compressor is off.



CONDENSER FAN 1
OFF, MOD POSITION

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

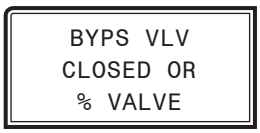


CONDENSER FAN 2
OFF, MOD POSITION

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

OR

IF CONFIGURED FOR WATER SIDE ECONOMIZER BYPASS



WATER SIDE ECONOMIZER BYPASS VALVE
CLOSED OR MOD POSITION

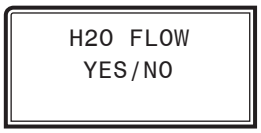
CLOSED: Valve is closed.
MODULATING PERCENTAGE: 0-100%

IF CONFIGURED FOR AIR TO AIR HEAT PUMP

DEFROST INTERVAL TIMER
 # MINUTES

OR

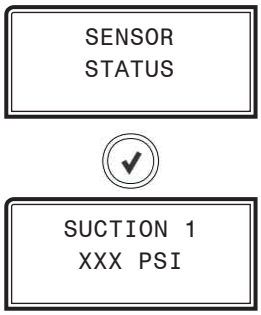
IF CONFIGURED FOR WATER SOURCE HEAT PUMP



WATER FLOW YES/NO

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 1 READING FROM INPUT

HEAD PRESSURE 1 READING FROM INPUT

SUCTION PRESSURE 2 READING FROM INPUT

HEAD PRESSURE 2 READING FROM INPUT

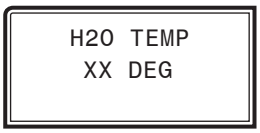
CALCULATED COIL TEMPERATURE 1 FROM SUCTION PRESSURE 1 INPUT

CALCULATED COIL TEMPERATURE 2 FROM SUCTION PRESSURE 2 INPUT

COMPRESSOR TEMPERATURE 1 READING FROM HEAD PRESSURE 1 INPUT

COMPRESSOR TEMPERATURE 2 READING FROM HEAD PRESSURE 2 INPUT

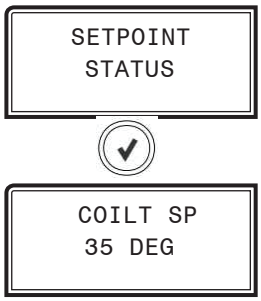
IF CONFIGURED FOR WATER SOURCE HEAT PUMP



WATER TEMPERATURE READING FROM LEAVING WATER TEMPERATURE SENSOR

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.



COIL TEMPERATURE SETPOINT STATUS

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

IF CONFIGURED FOR MODULATING CONDENSER, THE SCREEN BELOW WILL DISPLAY

HEAD PRESSURE SETPOINT STATUS

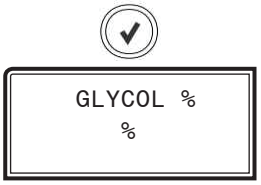
Valid range is 275 to 475 PSI. Default is 340 PSI.

IF CONFIGURED FOR FAN CYCLE, THE TWO SCREENS BELOW WILL DISPLAY

HEAD PRESSURE READING WHEN FAN CYCLE IS ON

HEAD PRESSURE READING WHEN FAN CYCLE IS OFF

IF CONFIGURED FOR WATER SOURCE HEAT PUMP, THE THREE SCREENS BELOW WILL DISPLAY



GLYCOL PERCENTAGE STATUS

LOW SUCTION PRESSURE SETPOINT STATUS

Default is 95 PSI.

LOW LEAVING WATER TEMPERATURE SETPOINT STATUS

Default is 37 Degrees F.

IF CONFIGURED FOR AIR TO AIR HEAT PUMP, THE SCREEN BELOW WILL DISPLAY

DEFROST INTERVAL SETPOINT STATUS

Default is 30 minutes.

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.

EBUS SLAVE (SLV) TIMEOUT: This alarm indicates that communication has been lost between the RSMD 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.

NO SUCTION PRESSURE SENSOR 1 (SUCT1) DETECTED: This alarm indicates the Suction Pressure Sensor 1 is not detected by the system. There is no compressor failure from this alarm. The failure will be unsafe suction pressure.

NO SUCTION PRESSURE SENSOR 2 (SUCT2) DETECTED: This alarm indicates the Suction Pressure Sensor 2 is not detected by the system. There is no compressor failure from this alarm. The failure will be unsafe suction pressure.

NO HEAD PRESSURE SENSOR 1 (HEAD1) DETECTED: This alarm indicates the Head Pressure Sensor 1 is not detected by the system. This will cause the condenser fan/valve to go to 100%.

NO HEAD PRESSURE SENSOR 2 (HEAD2) DETECTED: This alarm indicates the Head Pressure Sensor 2 is not detected by the system. This will cause the condenser fan/valve to go to 100%.

HIGH HEAD PRESSURE 1 (HP1) DETECTED: This indicates a High Head Pressure Alarm condition which is activated when the Head Pressure 1 rises above 550 PSIG. This will cause the condenser to go to 100%.

HIGH HEAD PRESSURE 2 (HP2) DETECTED: This indicates a High Head Pressure Alarm condition which is activated when the Head Pressure 2 rises above 550 PSIG. This will cause the condenser to go to 100%.

LOW SUCTION PRESSURE 1 (SP1) FAILURE: This alarm will occur if suction pressure 1 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. Power must be cycled to clear the alarm.

LOW SUCTION PRESSURE 2 (SP2) FAILURE: This alarm will occur if suction pressure 2 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. Power must be cycled to clear the alarm.

LOW SUCTION PRESSURE 1 (SP1) DETECTED: This alarm will occur if suction pressure 1 falls below the low suction pressure setpoint for 20 seconds. The system will try to protect by lowering compressor modulation percentage.

LOW SUCTION PRESSURE 2 (SP2) DETECTED: This alarm will occur if suction pressure 2 falls below the low suction pressure setpoint for 20 seconds. The system will try to protect by lowering compressor modulation percentage.

COMPRESSOR (COMP1) 1 FAULT: 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) 2 FAULT: 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 (COMP1) 1 BAD TEMPERATURE: This alarm will occur if the discharge temp sensor 1 measures less than -40 degrees F or more than 356 degrees F. This will cause an alarm and will shut down the compressor (relay). The system will retry after 5 minutes.

COMPRESSOR (COMP2) 2 BAD TEMPERATURE: This alarm will occur if the discharge temp sensor 2 measures less than -40 degrees F or more than 356 degrees F. This will cause an alarm and will shut down the compressor (relay). The system will retry after 5 minutes.

COMPRESSOR (COMP) 1 CUTOFF: This alarm will occur if the discharge temp sensor 1 measures more than 265 degrees F. This will cause an alarm and will shut down the compressor (relay). The system will can be restarted after 30 minutes.

COMPRESSOR (COMP) 2 CUTOFF: This alarm will occur if the discharge temp sensor 2 measures more than 265 degrees F. This will cause an alarm and will shut down the compressor (relay). The system will can be restarted after 30 minutes.

COMPRESSOR (COMP) 1 or 2 LOCKOUT: If active cutoff occurs 5 times within a 4 hour period, the compressor will be locked out. Must cycle power to RSMD to clear the alarm.

- If a circuit's Suction Pressure falls below the Low Suction Pressure Setpoint for longer than one minute twice within a two hour window, the compressor on that circuit will be locked out. Manual reset or change of mode is required to return to normal operation.
- If the Suction Pressure falls below the Unsafe Suction Setpoint for 5 seconds, that circuit's compressor will locked out. Power will need to be cycled to restart the unit.
- If the Leaving Water Temperature falls below setpoint, the last compressor will be locked out until the Leaving Water Temperature rises 6 degrees above setpoint.
- The Leaving Water Temperature remains below setpoint for 1 minute or falls 3 degrees below setpoint. This alarm will disable when the leaving water temperature rises 12 degrees above the setpoint.

NO PROOF OF H2O FLOW: There is a call for a compressor and there is no Proof of Flow Input Enable for more than 3 minutes or if during Heat Pump heating, the Proof of Flow Enable is open for more than 2 seconds. This alarm will disable when Proof of Flow is enabled.

LOW H2O TEMPERATURE: If both compressors are on and water temp goes below setpoint, compressor 2 will fail. If both compressors are on and water temp goes 3 degrees below setpoint, both compressors will fail. If second compressor is off or failed and water temp is still low for 1 minute, the first compressor will also fail. This alarm will disable when the leaving water temperature rises 6 degrees above the setpoint.

Alarm History & Protected Screens

EMERGENCY SHUTDOWN: If the Emergency Shutdown binary input is not activated, the compressors will shut off.

COMPRESSOR 1 FALSE ACTIVE INPUT: If the compressor relay is off but the compressor binary active input is activated for 60 seconds, it will cause an alarm.

COMPRESSOR 1 FALSE ACTIVE INPUT: If the compressor relay is off but the compressor binary active input is activated for 60 seconds, it will cause an alarm.

Alarm History Screens

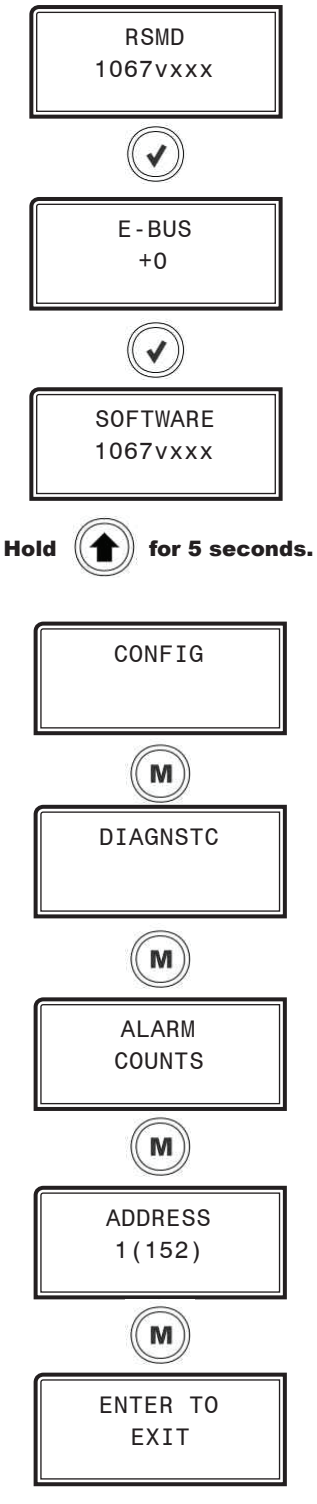
The ALARM HISTORY Screen displays past alarms, if any, and how long ago the last of each type occurred. From the ALARM HISTORY Screen, press **<ENTER>** to scroll through the history screens.

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.

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

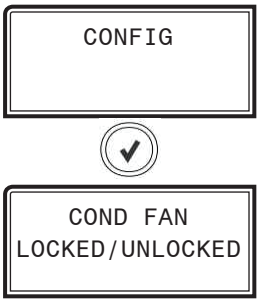
Protected Screens Map

Refer to the following map when navigating through the LCD Protected Screens. From the RSMD 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.



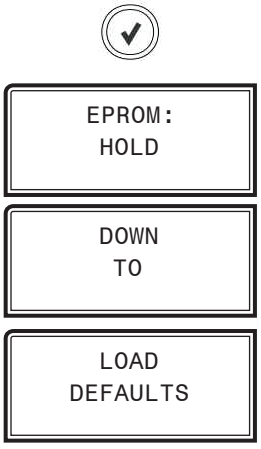
Configuration Screens

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



CONDENSER FAN LOCKED OR UNLOCKED

CONDENSER FAN LOCKED POSITION

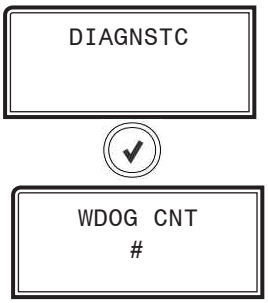


SUCTION PRESSURE SENSOR 1 VOLTAGE

Displays the current voltage of the Suction Pressure Sensor 1.

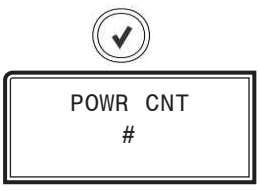
Diagnostic Screens

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



WATCH DOG TIMER

Displays the number of times the board has been reset due to watchdog timer overflow.



POWER LOSS COUNT

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

HEAD PRESSURE SENSOR 1 VOLTAGE

Displays the current voltage of the Head Pressure Sensor 1.

SUCTION PRESSURE SENSOR 2 VOLTAGE

Displays the current voltage of the Suction Pressure Sensor 2.

HEAD PRESSURE SENSOR 2 VOLTAGE

Displays the current voltage of the Head Pressure Sensor 2.

Diagnostic Screens

BINARY INPUTS #1 - #4

Displays the current status of each Binary Input.

COIL TEMPERATURE SENSOR 1 VOLTAGE

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

COIL TEMPERATURE SENSOR 2 VOLTAGE

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

TEMPERATURE SENSOR 3 VOLTAGE

Displays the current voltage of the Leaving Water Temperature Sensor.

FORCE MODE

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

IF FORCE MODE IS ON, THE FOLLOWING SCREENS WILL APPEAR:

RELAYS 1 - 5 FORCE MODE

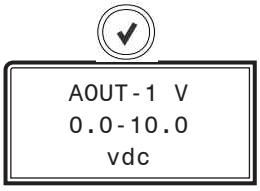
Press the **<UP>** and **<DOWN>** buttons to select ON or OFF for each relay

TRIAC 1

Displays the current status of Digital Compressor 1. Values are ON/OFF.

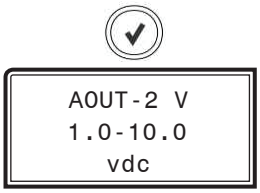
TRIAC 2

Displays the current status of Digital Compressor 2. Values are ON/OFF.



CONDENSER SIGNAL 1 FORCE

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



CONDENSER SIGNAL 2 FORCE

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

ALARM COUNTS Screens

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

Address Screen

CURRENT BOARD ADDRESS

Configure the address according to which refrigerant circuit this module represents—1=A, 2=B, 3=C, 4=D

Number in parentheses is E-BUS address.
Module 1's address is 152, Module 2's address is 153,
Module 3's address is 154, Module 4's address is 155

RSM LED Diagnostics

Using RSM LEDs To Verify Operation

The RSMs 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.

BIN4 - This green LED will light up when the Emergency Shutdown switch is closed.

Relay LEDs

RLY1 - **RLY5** - These green LEDs will light up when the relays are enabled and will stay lit as long as they are active.

Digital Compressor LEDs

COMP1 - This green LED will light up when Digital Compressor 1 is unloading.

COMP2 - This green LED will light up when Digital Compressor 2 is unloading.

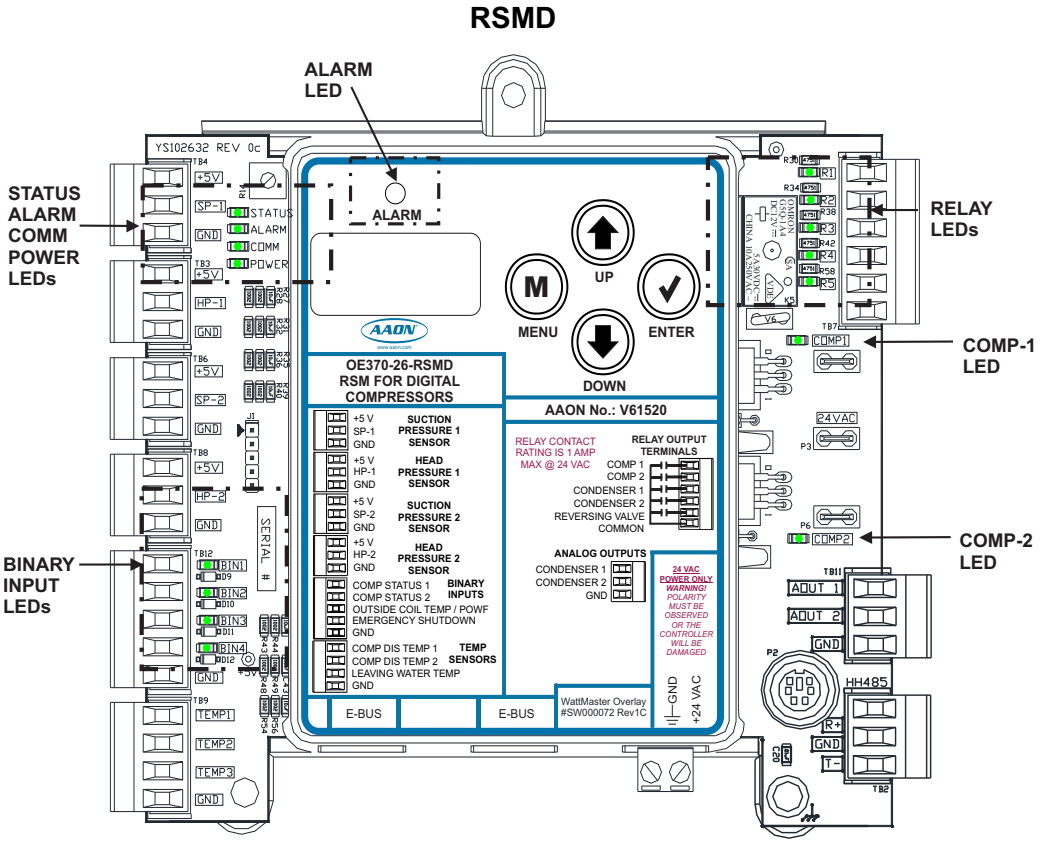


Figure 5: RSMD LED Locations

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 RSMD Module(s). The VCC-X/VCCX2 and the 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 SP1/SP2 terminal located on the RSMD Module(s) terminal block. Place the negative lead from the meter on the ground (GND) terminal located adjacent to the SP1/SP2 terminal on the 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 SP1/SP2 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

Copeland® Discharge Thermistor Temperature Sensor Testing

Copeland® Discharge Thermistor 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 table. Please follow the notes and instructions the appear after the chart when checking sensors.

Discharge Thermistor Temperature/ Resistance			
Temp (ºF)	Temp (ºC)	Resistance (K Ohms)	Voltage @ Input (VDC)
-40	-40	2889.60	4.98
-31	-35	2087.22	4.97
-22	-30	1522.20	4.96
-13	-25	1121.44	4.95
-4	-20	834.72	4.94
5	-15	627.28	4.92
14	-10	475.74	4.89
23	-5	363.99	4.86
32	0	280.82	4.82
41	5	218.41	4.77
50	10	171.17	4.72
59	15	135.14	4.65
68	20	107.44	4.57
77	25	86.00	4.47
86	30	69.28	4.36
95	35	56.16	4.24
104	40	45.81	4.10
113	45	37.58	3.94
122	50	30.99	3.77
131	55	25.68	3.59
140	60	21.40	3.40
149	65	17.91	3.20
158	70	15.07	3.00
167	75	12.73	2.80
176	80	10.79	2.59
185	85	9.20	2.39

Table 4: Discharge Thermistor Temperature/ Resistance

Discharge Thermistor Temperature/ Resistance			
Temp (ºF)	Temp (ºC)	Resistance (K Ohms)	Voltage @ Input (VDC)
194	90	7.87	2.19
203	95	6.77	2.01
212	100	5.85	1.84
221	105	5.09	1.68
230	110	4.45	1.53
239	115	3.87	1.39
248	120	3.35	1.25
257	125	2.92	1.12
266	130	2.58	1.02
275	135	2.28	0.92
284	140	2.02	0.83
293	145	1.80	0.76
302	150	1.59	0.68
311	155	1.39	0.61
320	160	1.25	0.55
329	165	1.12	0.50
338	170	1.01	0.45
347	175	0.92	0.42
356	180	0.83	0.38

Table 4, cont.: Discharge Thermistor Temperature/ Resistance

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 4.98 VDC, then the sensor or wiring is "open." If the voltage is less than 0.38 VDC, then the sensor or wiring is shorted.

Leaving Water 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 5: 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 5, 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 the head pressure transducer, measurements can be taken at the HP1 and HP2 terminals. Reference **Table 6, below**.

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

Table 6: Head Pressure Transducer Chart

Notes

Default: Two Condenser Operation

Two Condenser Operation

See **Figure 6, below** for Two Condenser Operation wiring. Refer to the figures on the following page for Prism 2 configuration, Modular Service Tool Screen selection, and HVAC unit application.

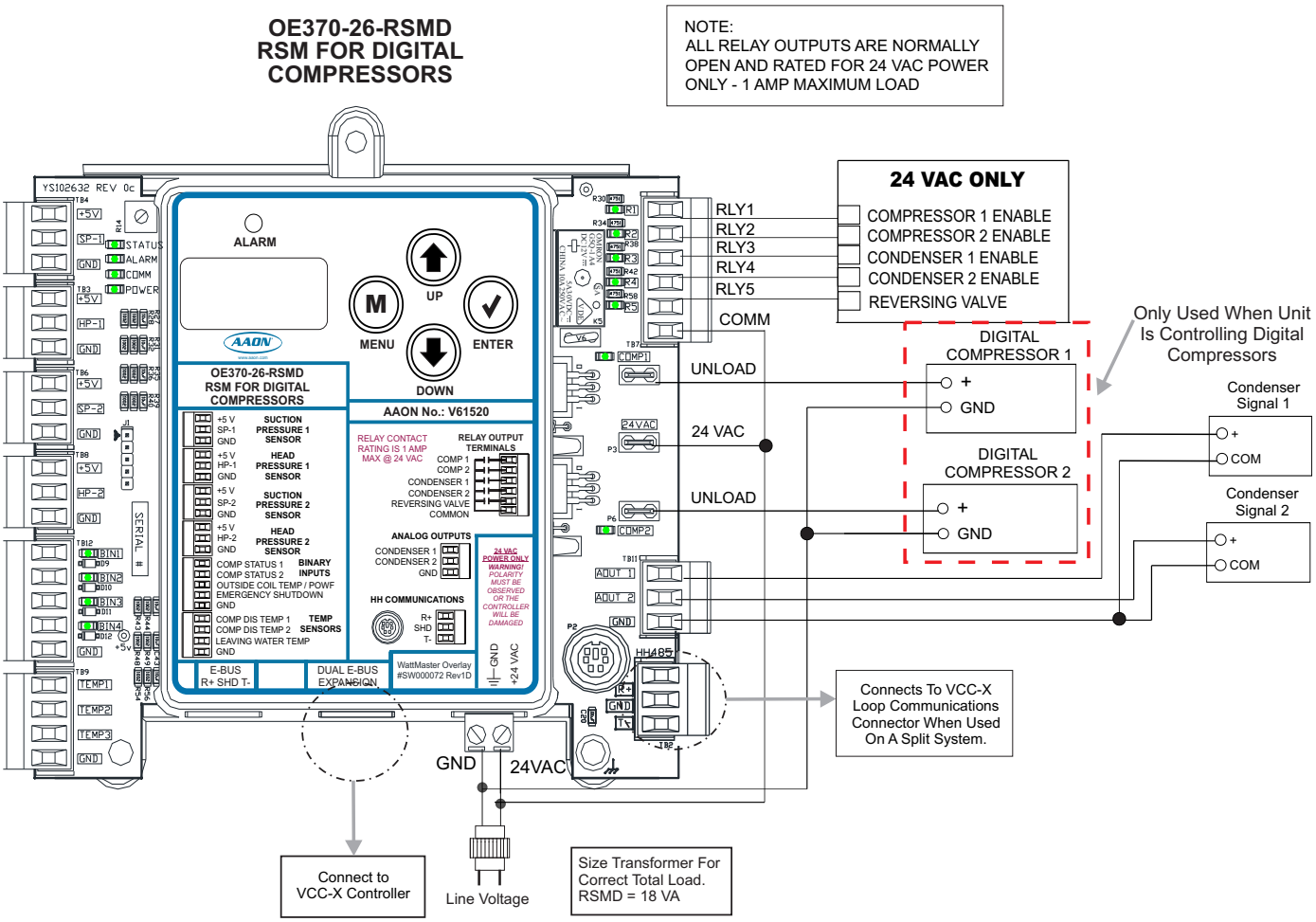


Figure 6: Default: Two Condenser RSMD Module Wiring

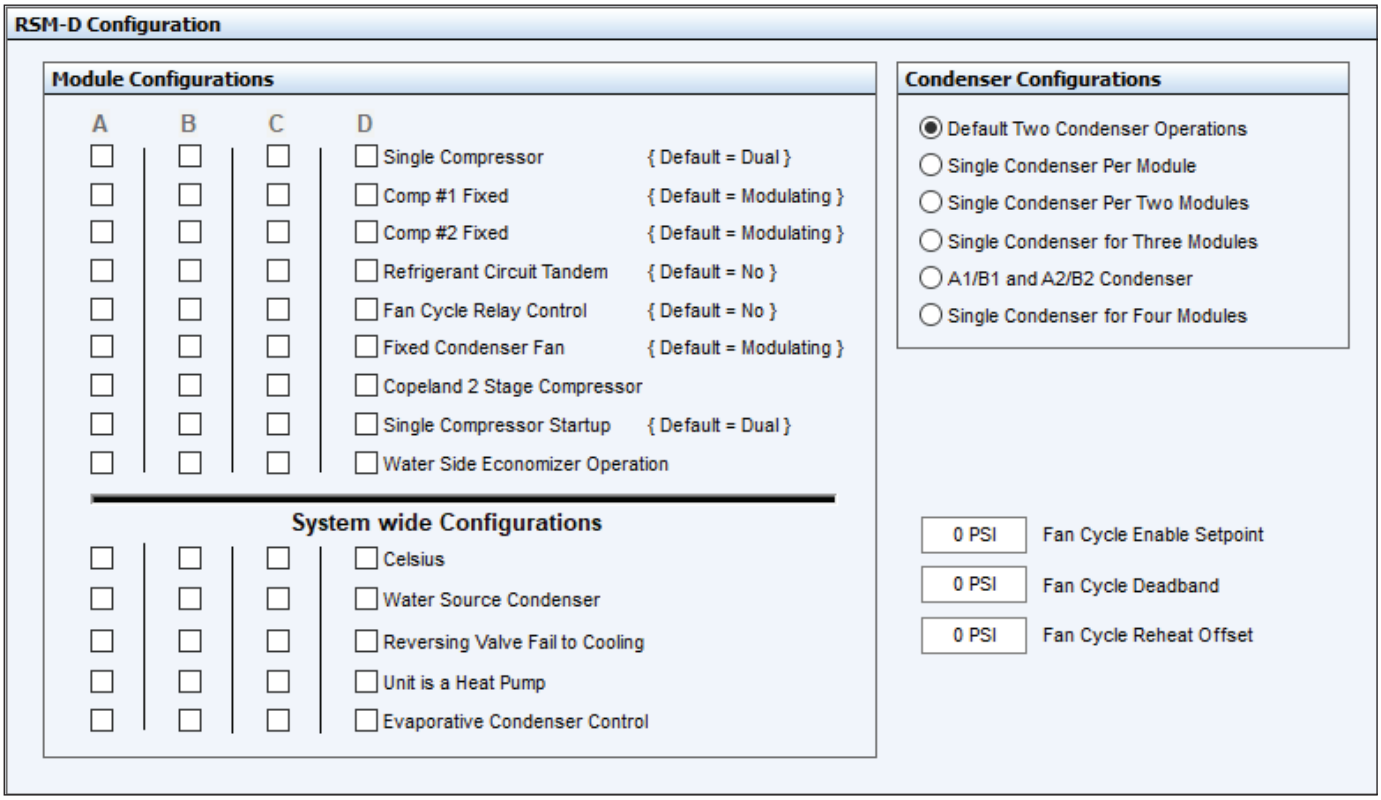


Figure 7: Prism 2 Condenser Configuration

RSMD Main Configuration Screen #2 - Condenser Options

```
RSMD CONFIGURATION
Condenser Options
2 Cond per RSMD
USE < or > TO CHANGE
```

Select the "2 Condensers for per RSMD" option on the above Hand Held Service Tool Screen.

HVAC Unit Application

The Two Condenser per RSMD configuration is used with the following HVAC units:

- **D-BOX 26-40 Ton**
- **C-BOX 16-20 Ton**
- **B-BOX**

Single Condenser Per Module

Single Condenser Per Module

See **Figure 8, below** for Single Condenser Per Module wiring. Refer to the figures on the following page for Prism 2 configuration, Modular Service Tool Screen selection, and HVAC unit application.

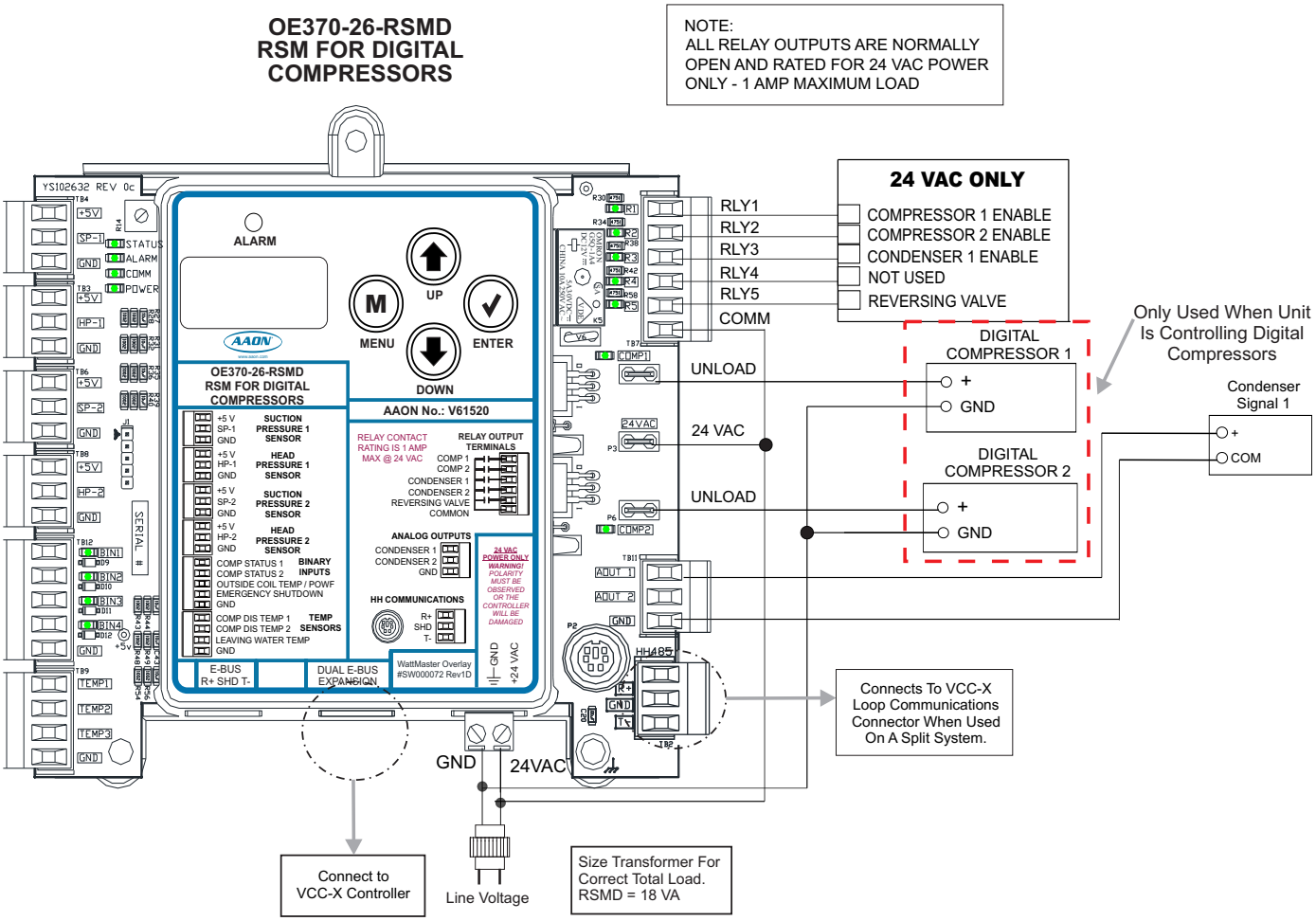


Figure 8: Single Condenser Per RSMD Module Wiring

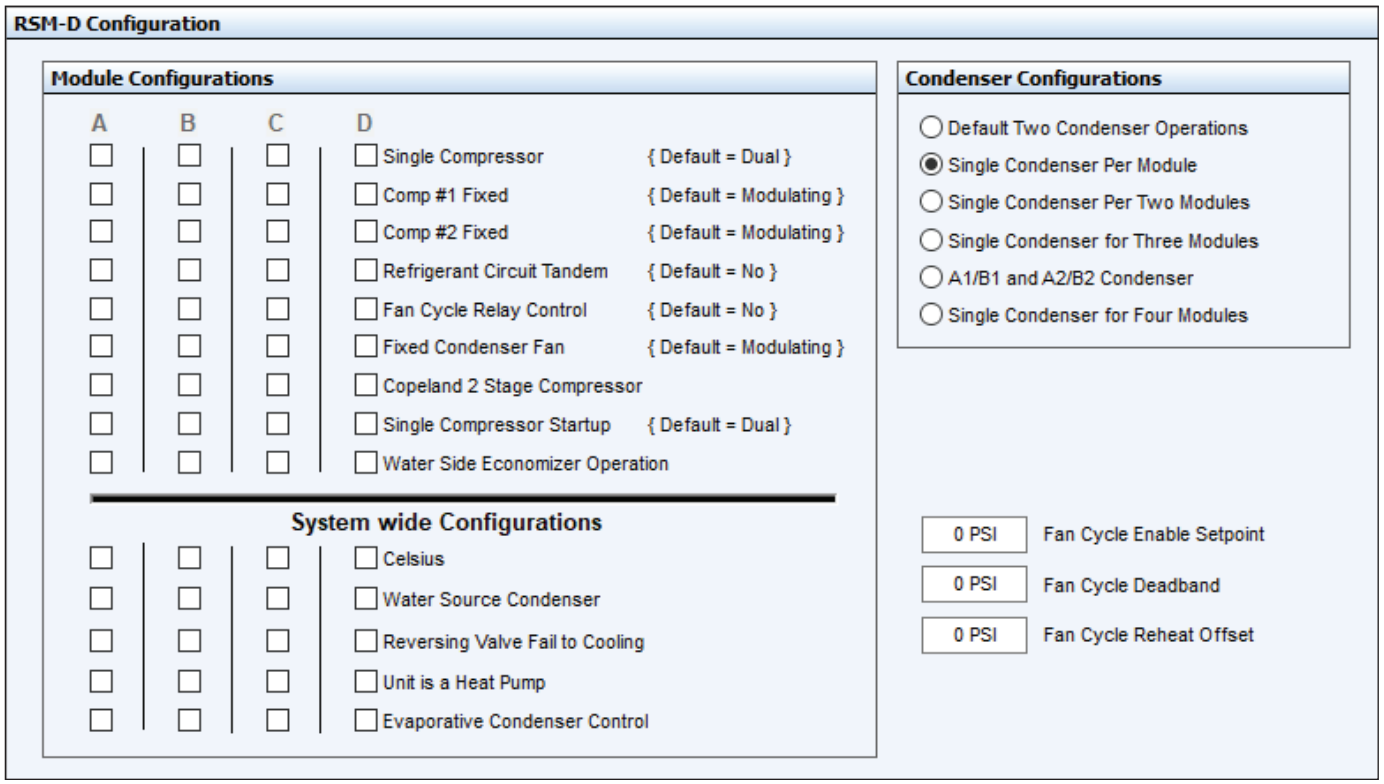


Figure 9: Prism 2 Condenser Configuration

RSMD Main Configuration Screen #2 - Condenser Options

```
RSMD CONFIGURATION
Condenser Options
1 Cond for 1 RSMD
USE < or > TO CHANGE
```

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

HVAC Unit Application

The One Condenser per RSMD configuration is used with the following HVAC units:

- **B-BOX Air to Air Heat Pump**
- **B-BOX WSHP**
- **C-BOX 25-30 Ton**
- **C-BOX Air to Air Heat Pump**
- **C-BOX WSHP**

Single Condenser Per Two Modules

Single Condenser Per 2 Modules

See **Figure 10, below** for Single Condenser Per 2 Modules wiring. Refer to the figures on the following page for Prism 2 configuration, Modular Service Tool Screen selection, and HVAC unit application.

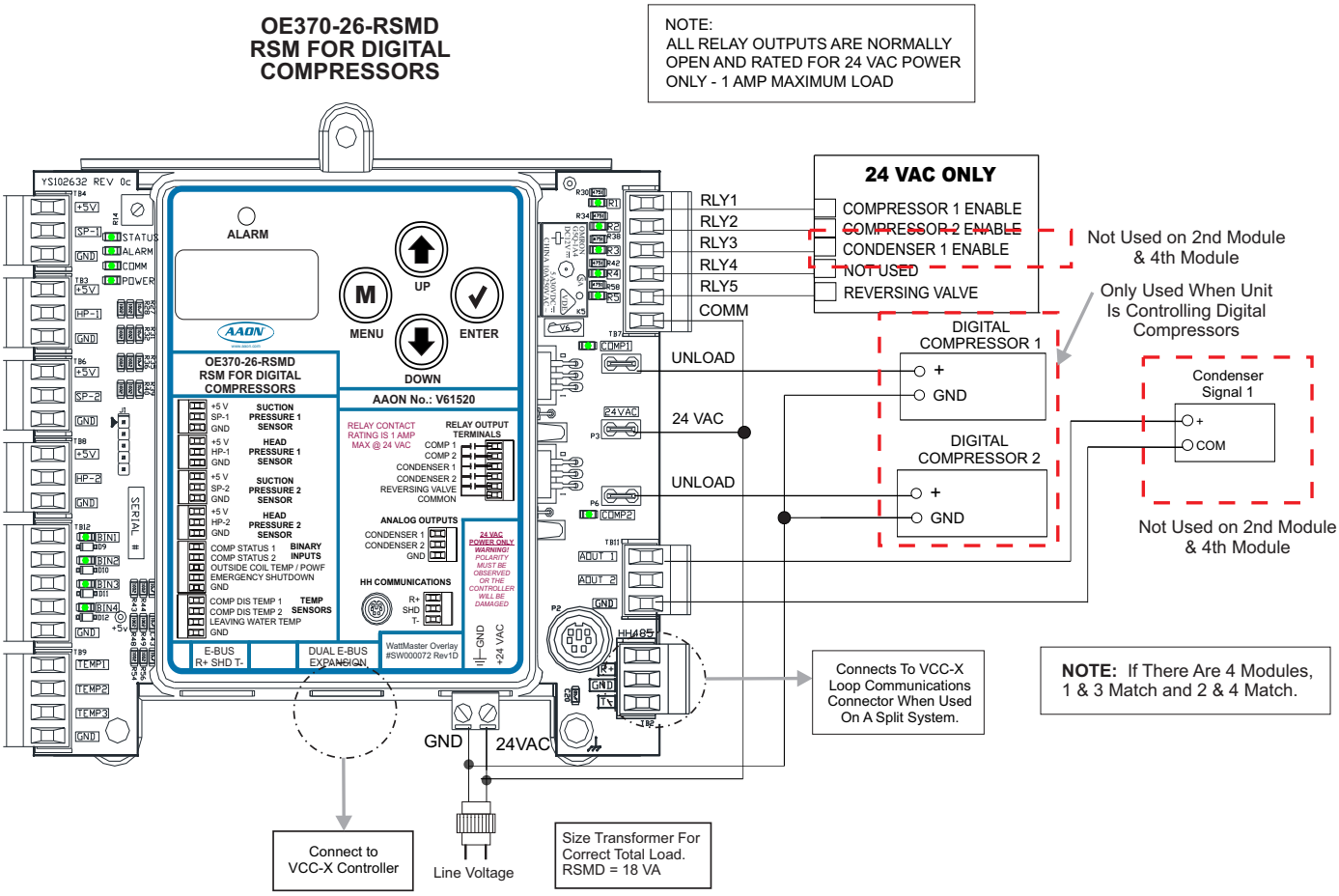


Figure 10: Single Condenser Per 2 RSMD Modules Wiring

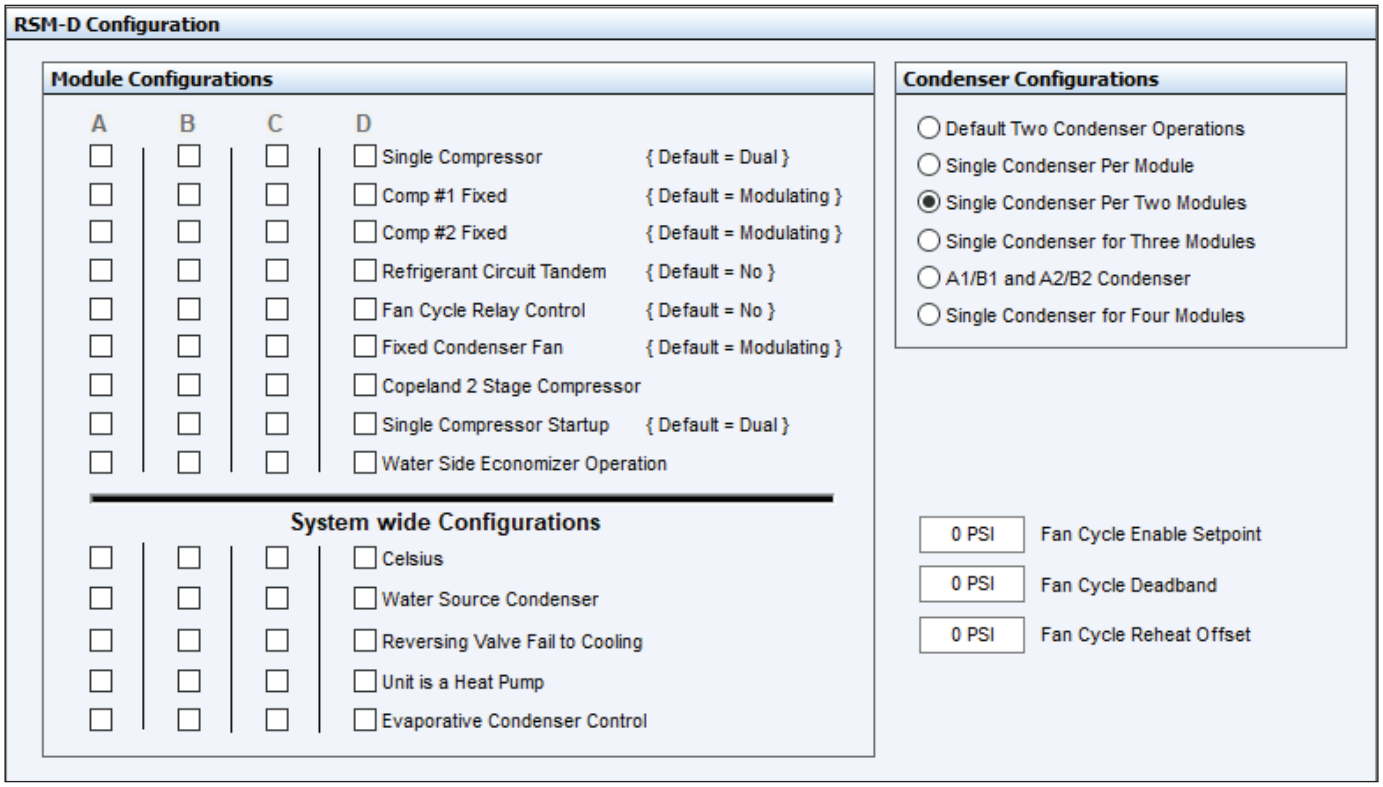


Figure 11: Prism 2 Condenser Configuration

RSMD Main Configuration Screen #2 - Condenser Options

```
RSMD CONFIGURATION
Condenser Options
1 Cond for 2 RSMDs
USE < or > TO CHANGE
```

Select the "1 Condenser for 2 RSMDs" option on the above Hand Held Service Tool Screen.

HVAC Unit Application

The One Condenser per Two RSMDs configuration is used with the following HVAC units:

- **RLA BOX**
- **RLB BOX**
- **RLE BOX**

Single Condenser For Three Modules

Single Condenser for 3 Modules

See **Figure 12, below** for Single Condenser for 3 Modules wiring. Refer to the figures on the following page for Prism2 configuration, Modular Service Tool Screen selection, and HVAC unit application.

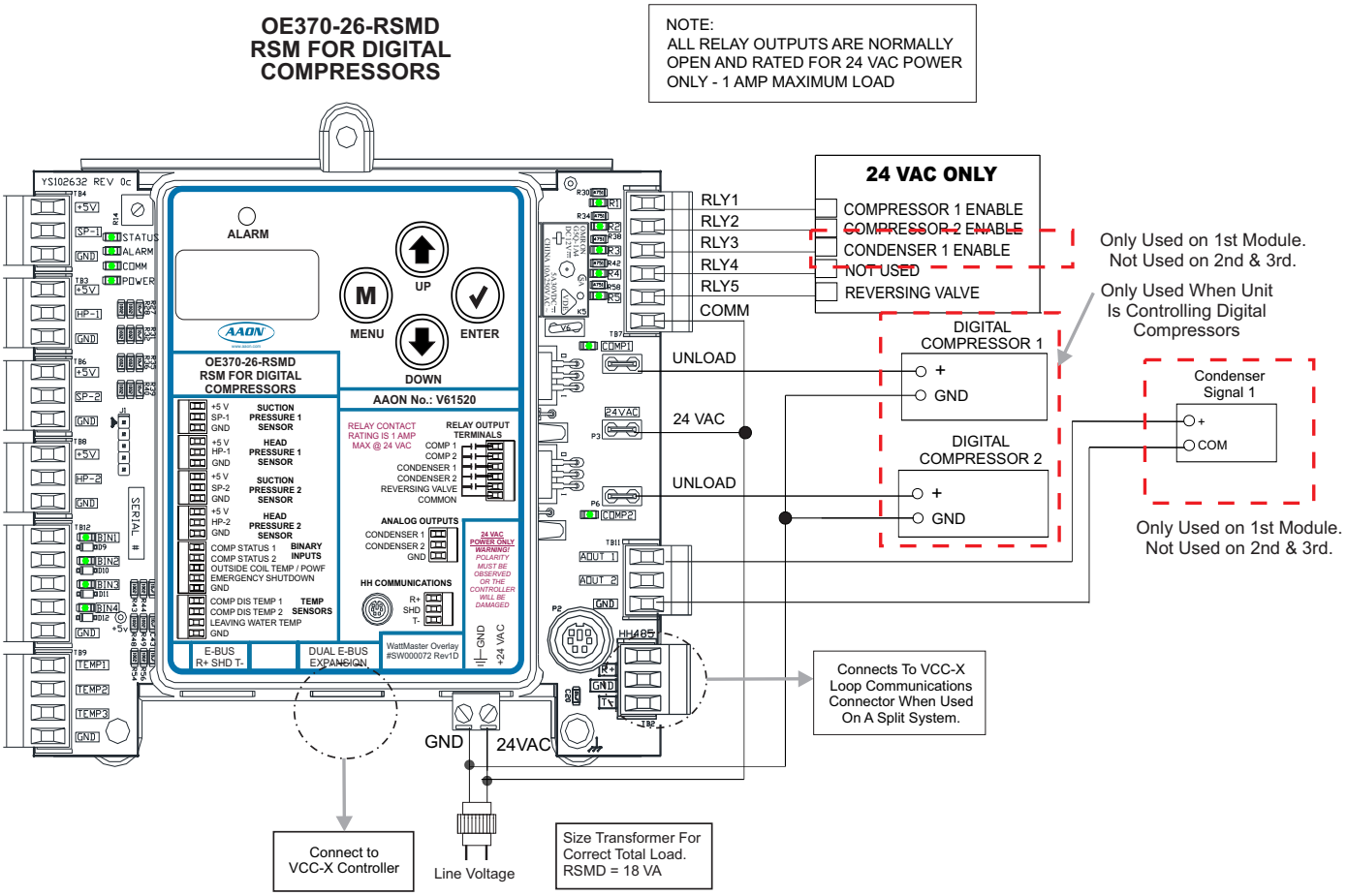


Figure 12: Single Condenser for 3 RSMD Modules Wiring

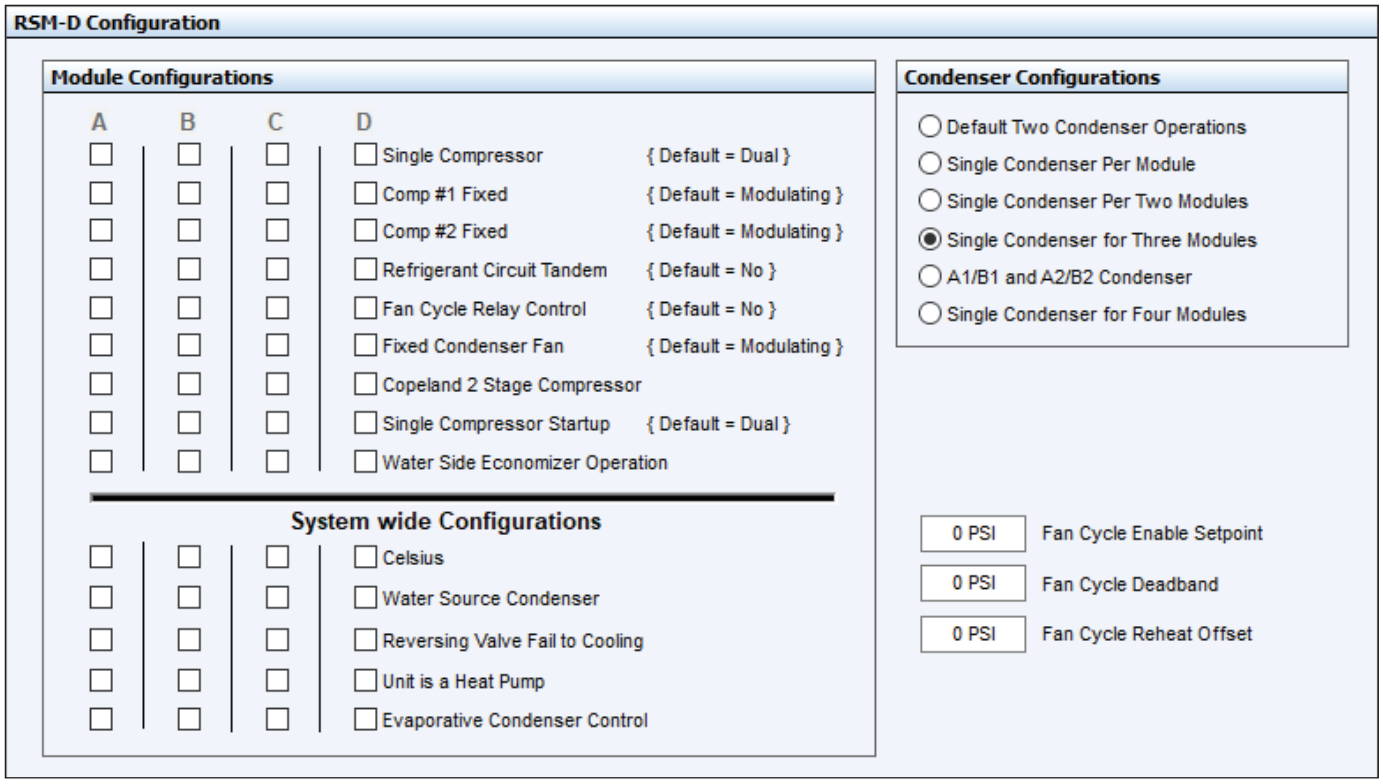


Figure 13: Prism 2 Condenser Configuration

RSMD Main Configuration Screen #2 - Condenser Options

```
RSMD CONFIGURATION
 Condenser Options
 1 Cond for 3 RSMDs
USE < or > TO CHANGE
```

Select the "1 Condenser for 3 RSMDs" option on the above Hand Held Service Tool Screen.

HVAC Unit Application

The One Condenser per Three RSMDs configuration is used with the following HVAC units:

- **RLC BOX**
- **RLD BOX**

Two Condensers Per Two Modules

A1/B1 and A2/B2 Condenser Fans

See **Figure 14, below** and **Figure 15** on the facing page for Two Condensers for 2 Modules wiring. Refer to the figures on **page 38** for Prism 2 configuration, Modular Service Tool Screen selection, and HVAC unit application.

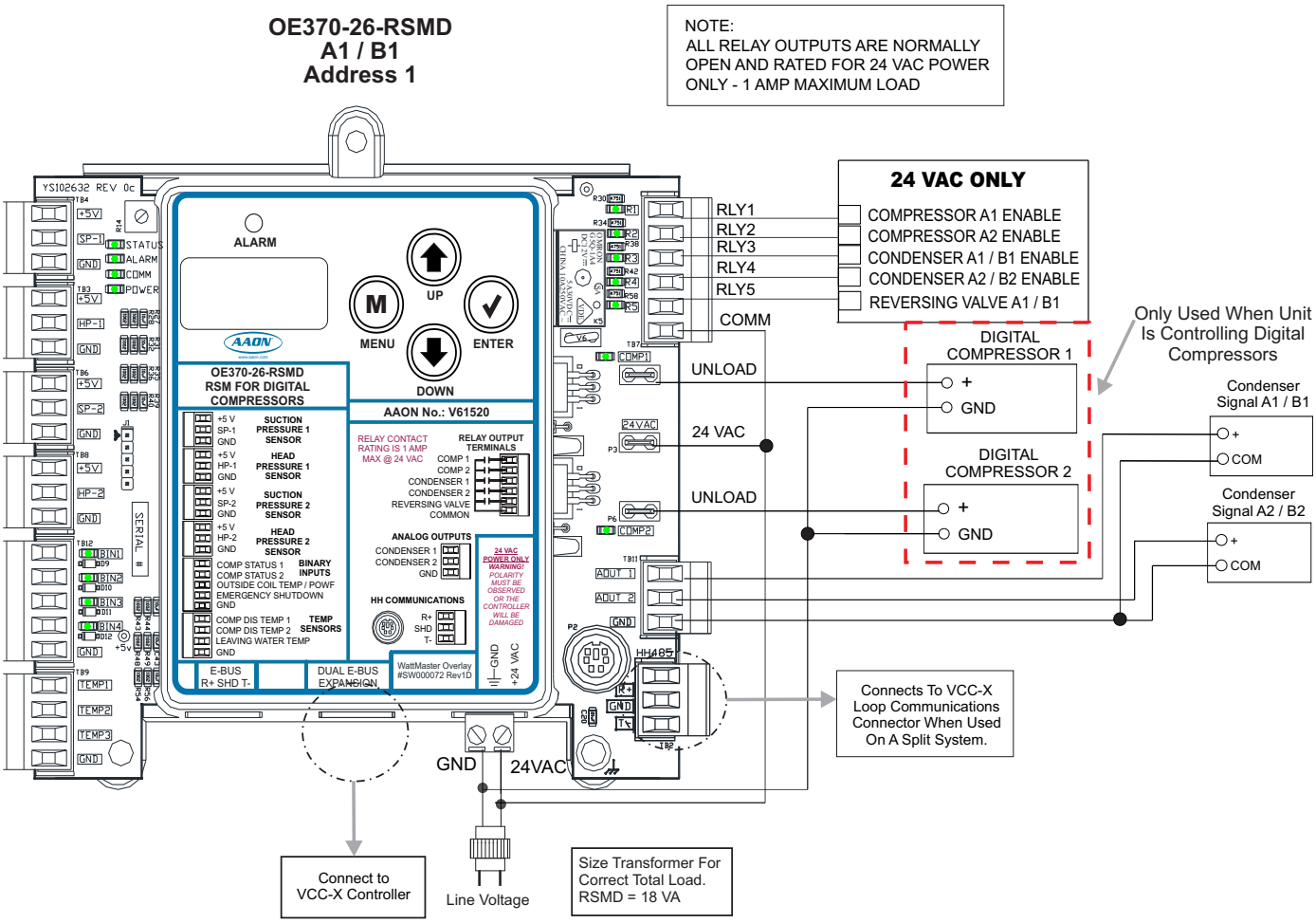


Figure 14: A1/ B1 Wiring

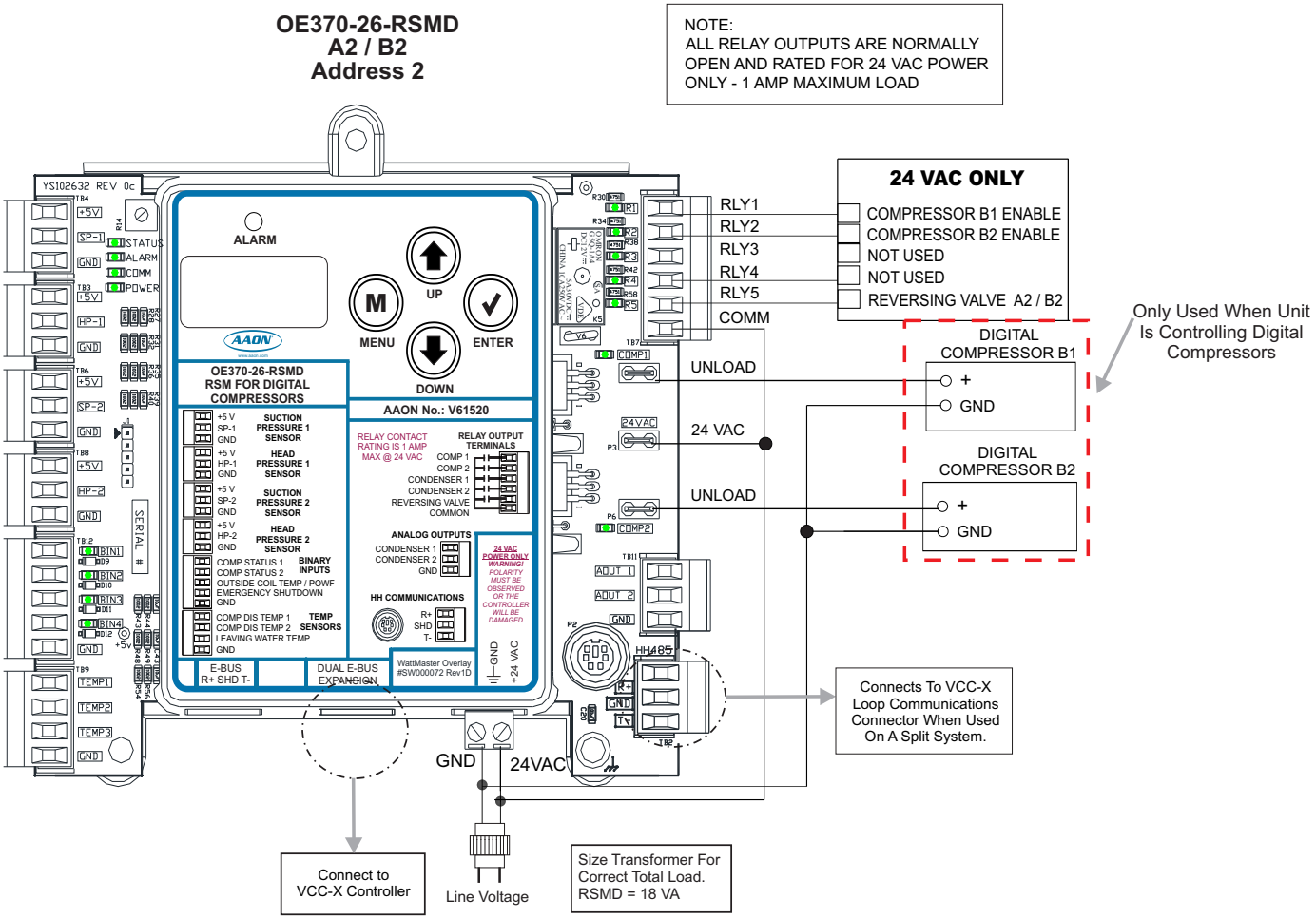


Figure 15: A2 / B2 Wiring

Two Condensers Per Two Modules

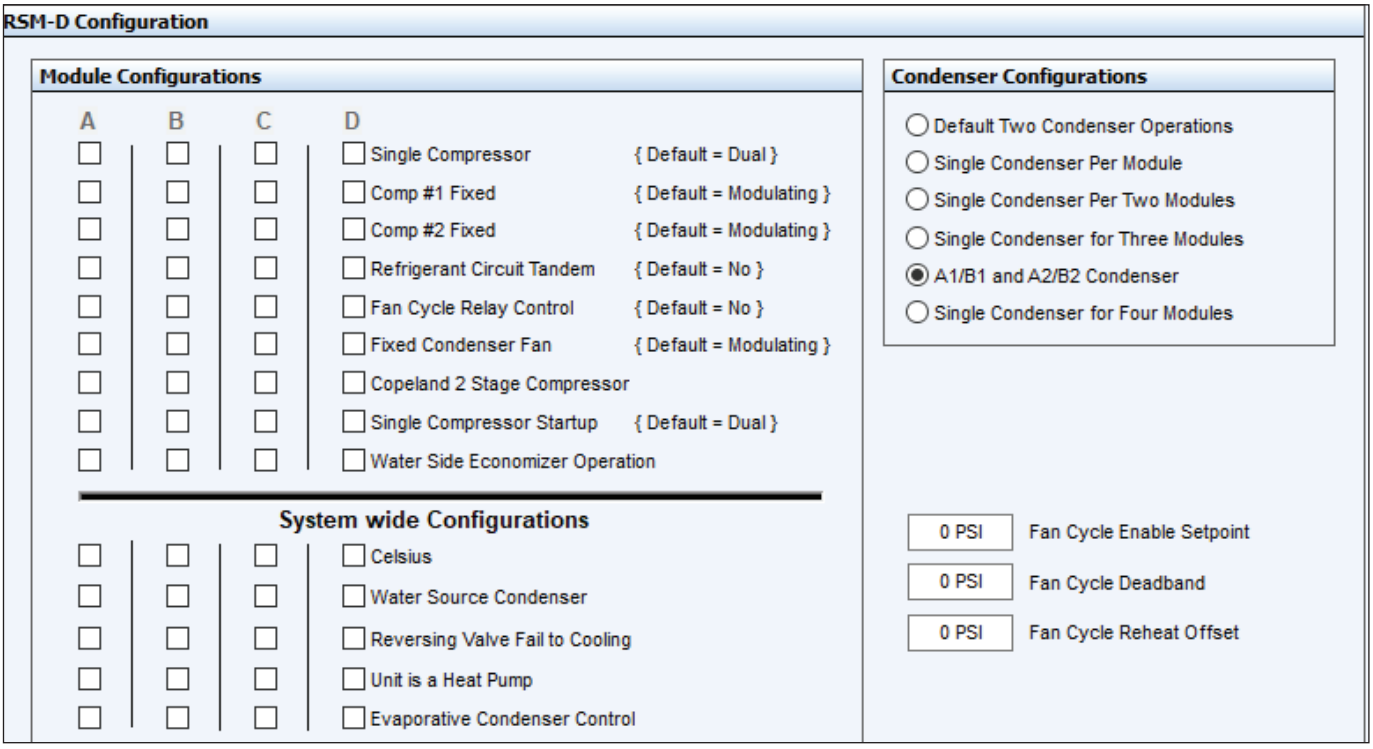


Figure 16: Prism 2 Condenser Configuration

RSMD Main Configuration Screen #2 - Condenser Options

```
RSMD CONFIGURATION
Condenser Options
2 Cond for 2 RSMDs
USE < or > TO CHANGE
```

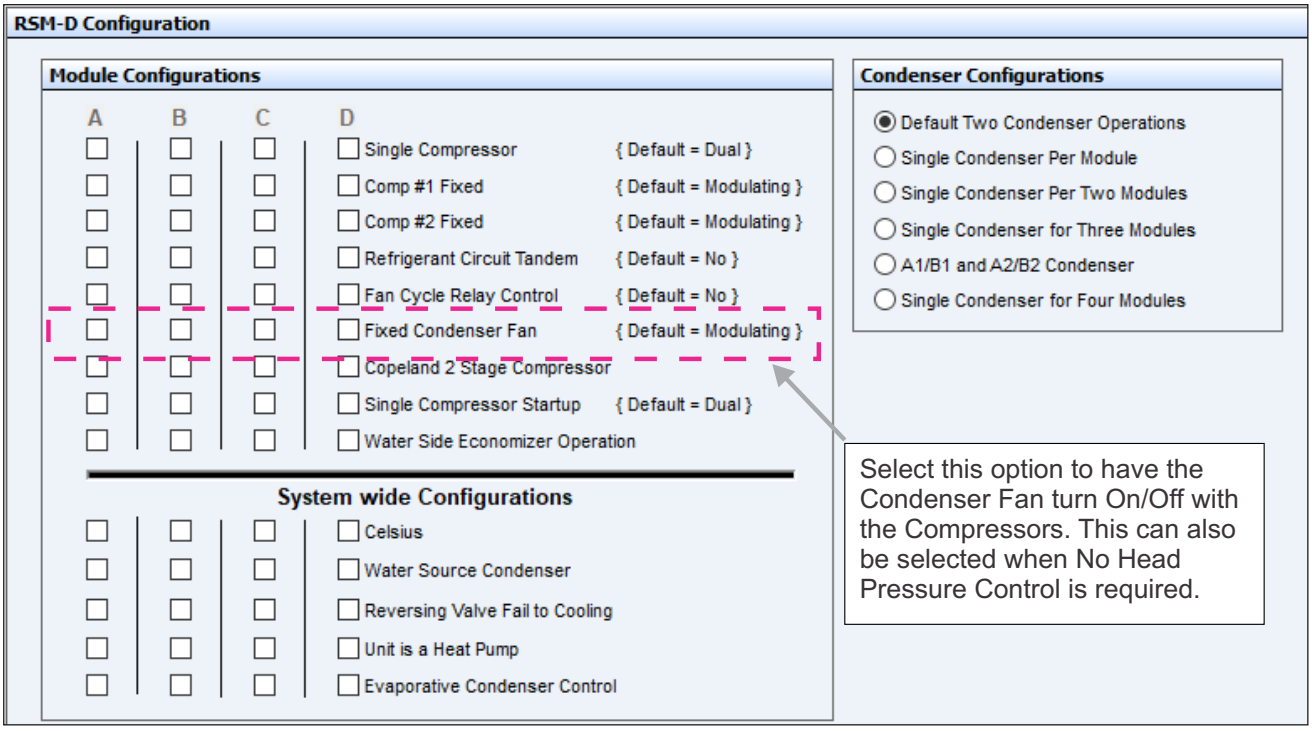
Select the “2 Condensers for 2 RSMDs” option on the above Hand Held Service Tool Screen.

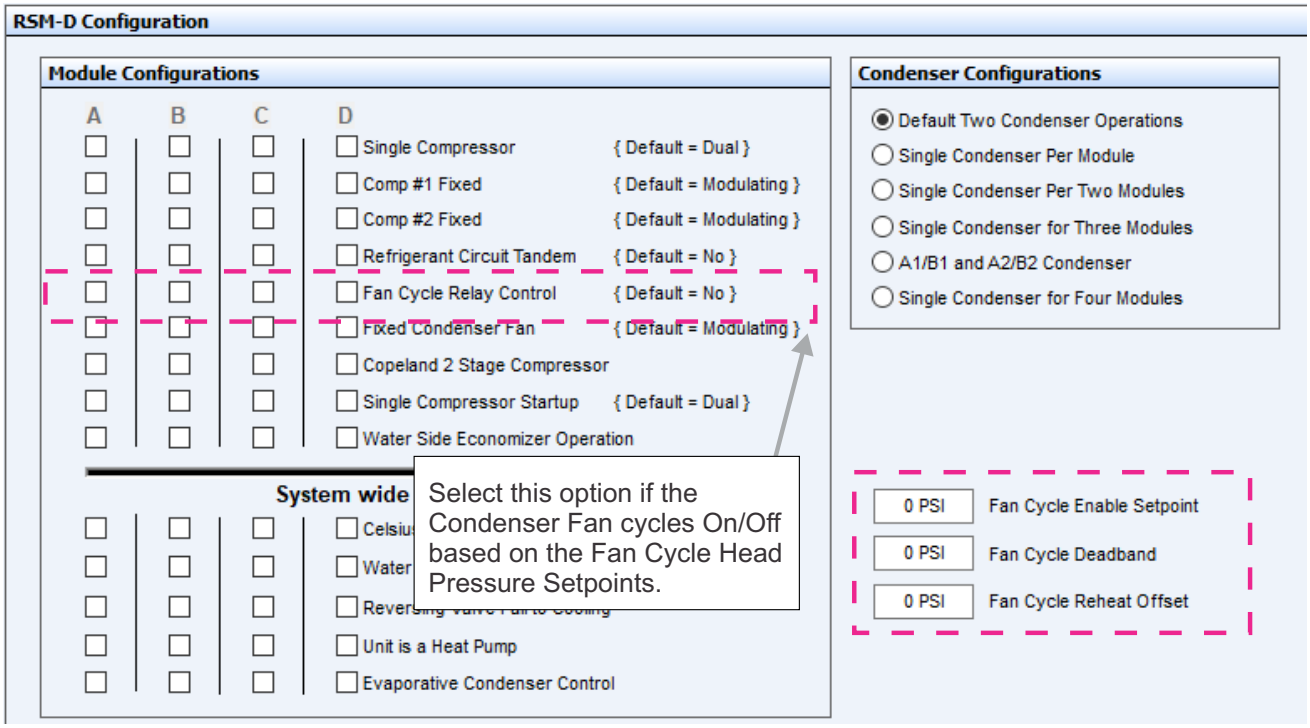
HVAC Unit Application

The Two Condensers per Two RSMDs configuration is used with the following HVAC units:

- **D-BOX 50-70 Ton**
- **D-BOX Air to Air Heat Pump**
- **D-BOX WSHP**

ON/OFF Condenser Options





2425 So. Yukon Ave • Tulsa, OK • 74107-2728
Ph: (918) 583-2266 • Fax: (918) 583-6094
AAON® Part No.: V87380
WM Form: AA-RSMD-TGD-01D

AAON/WattMaster Controls, Inc. • 8500 NW River Park Drive • Parkville, MO • 64152