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PART NUMBER CROSS REFERENCE TABLE

<table>
<thead>
<tr>
<th>PART DESCRIPTION</th>
<th>ORION</th>
<th>AAON COIL</th>
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<tr>
<td>VCM-X Dual Digital Module</td>
<td>OE370-23-DD-C</td>
<td>30311</td>
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<tr>
<td>VCM-X Controller</td>
<td>OE332-23-VMX-MOD-C</td>
<td>30553</td>
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<tr>
<td>VCM-X Modular E-BUS Controller</td>
<td>OE332-23E-VMX-C</td>
<td>TBA</td>
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<td>VCM-X E-BUS Distribution Module</td>
<td>OE365-23-EBD-C</td>
<td>30312</td>
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<td>VCM-X Expansion Module</td>
<td>OE333-23-EM</td>
<td>30308</td>
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<td>VCM-X 12 Relay Expansion Module</td>
<td>OE358-23-12R</td>
<td>30309</td>
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Overview

The Dual Digital Module (OE370-23-DD-C) is a device that enables and modulates two digital compressors on HVAC Units controlled by the VCM-X Modular Controller (OE332-23-VCMX-MOD-C) or VCM-X Modular E-BUS Controller (OE332-23E-VCMX-MOD-C). The Dual Digital Module will control the digital compressors to satisfy the cooling, dehumidification, and heat pump requirements of the VCM-X Modular series controller.

If the Dual Digital Module is in the Cooling Mode or Heat Pump Heating Mode, it will modulate the compressors to maintain the appropriate Supply Air Temperature Setpoint. If the module is in the Dehumidification Mode, it will modulate compressors to maintain the Coil Suction Temperature Setpoint. If the module is in the Heat Pump Heating Mode, the module can also monitor a signal for a Defrost Cycle from the VCM-X Modular series controller if a Two Condenser Head Pressure Module (OE370-23-HP2C) is also installed.

NOTE: Software versions 1.04 or above allow two modules per HVAC unit. If using two modules, set addresses accordingly—set 1st to address 1 and 2nd to address 2. Refer to wiring diagrams for address settings.

NOTE: The Dual Digital Module contains no user-serviceable parts. Contact qualified technical personnel if your module is not operating correctly.
Environmental Requirements

The Dual Digital Module needs to be installed in an environment which can maintain a temperature range between -30°F and 150°F and not exceed 90% RH levels (Non-Condensing).

Mounting

The Dual Digital Module is housed in a plastic enclosure. It is designed to be mounted by using the 3 mounting holes in the enclosure base. It is important to mount the module in a location that is free from extreme high or low temperatures, moisture, dust, and dirt. Be careful not to damage the electronic components when mounting the module.

See Figure 2 for Module dimensions (in inches).

Power Supply and Communications

The Dual Digital Module is connected to the E-BUS Distribution Module with a modular HSSC cable to provide communications from the VCM-X Modular Controller. The E-BUS Distribution Module uses WattMaster Control’s standard I2C modular cable to connect with the VCM-X Modular Controller, VCM-X Expansion Module, or 12-Relay Expansion Module.

The Dual Digital Module can also be directly connected to the VCM-X Modular E-BUS Controller, bypassing the use of the E-BUS Distribution Module.

The Dual Digital Module requires a 24 VAC power connection with an appropriate VA rating.

WARNING: Observe polarity! All boards must be wired GND-to-GND and 24 VAC-to-VAC. Failure to observe polarity could result in damage to the boards.

Note: Height is 1.49 inches.
Important Wiring Considerations

Please carefully read and apply the following information when wiring the Dual Digital Module:

1. The 1 to 5 VDC signals for the Copeland Compressor Speed need to use 18-gauge shielded twisted pair cable, and the Drain wire must be the GND signal.

2. All 24 V AC wiring must be connected so that all ground wires remain common. Failure to follow this procedure can result in damage to the module and connected devices.

3. All wiring is to be in accordance with local and national electrical codes and specifications.

4. Be sure that all wiring connections are properly inserted and tightened into the terminal blocks. Do not allow wire strands to stick out and touch adjoining terminals. This could potentially cause a short circuit.

5. Be sure all modular wiring harness connectors are seated firmly in their respective modular connectors on the circuit board.

NOTE: The Compressor Relays on the Dual Digital Module are used rather than the relay outputs on the VCM-X Modular series controller.

WARNING: Be sure all controllers and modules are powered down before connecting or disconnecting HSSC cables.
**VCM-X Modular E-BUS Controller to Dual Digital Module Wiring**

The Dual Digital Module directly connects to the VCM-X Modular E-BUS Controller using a modular HSSC cable. The Dual Digital Module requires a 24 V AC power connection with an appropriate VA rating. See Figure 4 below for wiring.

Any E-BUS Module can be connected to the E-BUS Controller’s E-BUS port or can be daisy-chained together using HSSC cables.

**NOTE:** Contact Factory for the correct HSSC cable length for your application. Cables are available in ½ and 3 meter lengths and 100 and 150 foot lengths.

---

**Figure 4: VCM-X Modular E-BUS Controller to Dual Digital Module Wiring Diagram**

Set address switches to OFF if using only one module. Software versions 1.04 or above allow two modules per HVAC unit. If using two modules, set the 1st to address 1 and the 2nd to address 2.

---

**WARNING!!** Observe Polarity! All boards must be wired with GND-to-GND and 24 VAC-to-24 VAC. Failure to observe polarity could result in damage to the boards.
WARNING: Be sure all controllers and modules are powered down before connecting or disconnecting HSSC cables.

For Stand Alone Applications, Connect To System Manager. For Network Applications Connect To Next Controller And/Or MiniLink PD On Local Loop.

OE332-23E-VCMX-MOD-C
VCM-X Modular E-BUS Controller

 OE271 Static Pressure Transducer

Connect FRP Tubing To High Pressure Port (Bottom Tube) and Route To Static Pressure Pickup Probe Located In Unit Discharge. Leave Port Marked “Lo” Open To Atmosphere

Connect To Digital Room Sensor And/Or Digital CO Sensor

Splice If Required

Size Transformer For Correct Total Load. VCM-X Controller = 8 VA

24 VAC
G - Fan ON/OFF Only

Warning: 24 VAC Must Be Connected So That All Ground Wires Remain Common. Failure To Do So Will Result In Damage To The Controllers.

Warning: 24 VAC Must Be Connected So That All Ground Wires Remain Common. Failure To Do So Will Result In Damage To The Controllers.

Figure 4, cont.: VCM-X E-BUS Controller to Dual Digital Module Wiring Diagram
General

In order to have a trouble free start-up, it is important to follow a few simple procedures. Before applying power for the first time, it is very important to run through a few simple checks.

One of the most important checks to make before powering up the system for the first time is to make sure that the VCM-X Modular or VCM-X Modular E-BUS Controller is configured properly for your application. Refer to the VCM-X Controller Technical Guide or VCM-X Modular E-BUS Controller Technical Guide for more information.

A handheld Modular Service Tool, Modular System Manager, or System Manager Touch Screen connected to the VCM-X Modular or VCM-X Modular E-BUS Controller will allow you to configure your application. Refer to the VCM-X Operator’s Interfaces Technical Guide or System Manager TS Technical Guide for more information.

Check all wiring leads at the terminal block for tightness. Be sure that wire strands do not stick out and touch adjacent terminals. Confirm that all sensors required for your system are mounted in the appropriate location and wired into the correct terminals.

**WARNING:** Observe polarity! All boards must be wired GND-to-GND and 24 VAC-to-VAC. Failure to observe polarity could result in damage to the boards.

### Table 1: Unit Configurations Chart

<table>
<thead>
<tr>
<th>PERMUTATION</th>
<th>CIRCUIT A</th>
<th>CIRCUIT B</th>
<th>HARDWARE</th>
<th>VCM-X WSHP CONFIGURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Comp A1</td>
<td>Comp A2</td>
<td>Comp B1</td>
<td>Comp B2</td>
</tr>
<tr>
<td></td>
<td>Relay 1</td>
<td>Relay 2</td>
<td>Relay 3</td>
<td>Relay 4</td>
</tr>
<tr>
<td>1</td>
<td>Fixed</td>
<td>N/A</td>
<td>Fixed</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>Digital</td>
<td>N/A</td>
<td>Fixed</td>
<td>N/A</td>
</tr>
<tr>
<td>3</td>
<td>Digital</td>
<td>N/A</td>
<td>Digital</td>
<td>N/A</td>
</tr>
<tr>
<td>4</td>
<td>Fixed</td>
<td>Fixed</td>
<td>Fixed</td>
<td>Fixed</td>
</tr>
<tr>
<td>5</td>
<td>Digital</td>
<td>Fixed</td>
<td>Fixed</td>
<td>Fixed</td>
</tr>
<tr>
<td>6</td>
<td>Digital</td>
<td>Fixed</td>
<td>Digital</td>
<td>Fixed</td>
</tr>
</tbody>
</table>
Sequence of Operation

**NOTE:** See Unit Configurations Chart on page 10 for more information about compressor staging.

**Off Mode**

The Dual Digital Module will be in the Off Mode when no signal is being received from the VCM-X Modular series controller to run the compressors.

**Cooling Mode**

When a Cool Signal is received, the Dual Digital Module will go into Cooling Mode. At this point, Compressor A1 will energize and modulate as necessary to maintain the Supply Air Temperature at the Active Supply Air Setpoint that is broadcast from the VCM-X Modular series controller.

When Compressor A1 reaches 100%, a stage up timer is started. If Compressor A1 stays at 100% for the stage up timer, Compressor B1 will energize and both compressors will go to 50% and begin to modulate together.

If there are additional fixed compressor stages and modulating Compressors A1 and B1 have modulated together up to 100%, then after a stage up delay, fixed Compressor A2 will stage on while A1/B1 go to 50% and begin to modulate from there. If A1/B1 again modulate up to 100%, then after a stage up delay, fixed compressor B2 will stage on while A1/B1 go to 50% and begin to modulate from there.

Staging down will happen in the reverse order as just described if the Supply Air Temperature falls below the Supply Air Temperature Setpoint by the Cooling Stage Window value and the stage down timer has elapsed. After the fixed compressors have staged off, or if there are no fixed compressors, then the staging down of the digital compressors A1 and B1 will continue as follows. If Compressors A1/B1 modulate together down to 30% and the stage down timer elapses, Compressor B1 will deactivate and Compressors A1 will go to 60%. Compressors A1 will stage down if it is at 0% for the duration of the stage down timer.

**Heat Pump Heating Mode (Air to Air)**

Heating Mode works the same as Cooling Mode except the Reversing Valve is switched and the sequence is opposite. Compressors modulate up when below the Heating Supply Air Setpoint and modulate down when above the setpoint.

**Dehumidification Mode**

In Dehumidification Mode, the compressor(s) will modulate to maintain the Suction Pressure Temperature Setpoint broadcast from the VCM-X Modular series controller. If there are two compressors, Compressor A1 will modulate up to 100% before Compressor B1 can be energized. If Compressor B1 is energized, Compressor A1 will be locked at 100%.

If there are additional fixed compressor stages and Compressor B1 has modulated up to 100%, then after a stage up delay, fixed Compressor A2 will stage on while B1 will again go to 50% and begin to modulate from there. If B1 again modulates up to 100%, then after a stage up delay, fixed compressor B2 will stage on while B1 will again go to 50% and begin to modulate from there.

Stage down will again be the reverse as just described with Compressor A1 being the last compressor to stage off.

**Defrost Mode**

In Defrost Mode, if only Circuit A is energized, it will go to 100% and the reversing valve will deactivate. If both Circuit A & Circuit B are energized, they will both go to 100% and the reversing valve will be deactivated. The duration for Defrost Mode is determined by the VCM-X Modular series controller.

**NOTE:** Defrost Mode is only available if a Two Condenser Head Pressure Module is installed.

**Staging Delays**

Staging Delays minimum run times and minimum off times are sent from the VCM-X Modular series controller.
Using LEDs to Verify Operation

The Dual Digital Module is equipped with LEDs that can be used to verify operation and perform troubleshooting. There are LEDs for communication, operation modes, and diagnostic codes. The module has seven LEDs—one used for power, one used for operation status, one used for alarms, and four used for the compressor relays. See Figure 5 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:

1. **Status LEDs**

   **“COMM”** - The COMM LED lights up to indicate Communications between the module and the VCM-X Modular series controller. If Communications are established, the COMM LED will blink.

   **“ALARM”** - This is the diagnostic blink code LED. It will light up and blink out diagnostic codes. See Table 2 for Diagnostic Blink Code descriptions. The blink code descriptions are also located on the module’s front cover.

   **“STAT”** - This is the status blink code LED. It will light up and every 10 seconds will blink the status mode that the module is currently operating under. See Table 3 for Status Blink Code code descriptions. The blink code descriptions are also located on the module’s front cover.

<table>
<thead>
<tr>
<th>No. of Blinks</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Problems</td>
</tr>
<tr>
<td>1</td>
<td>Low Suction Pressure Compressor A1</td>
</tr>
<tr>
<td>3</td>
<td>Low Suction Pressure Compressor B1</td>
</tr>
<tr>
<td>5</td>
<td>Pressure Sensor A1 Not Detected</td>
</tr>
<tr>
<td>7</td>
<td>Pressure Sensor B1 Not Detected</td>
</tr>
<tr>
<td>9</td>
<td>No Communication</td>
</tr>
</tbody>
</table>

   **Table 2: ALARM LED Blink Codes**

<table>
<thead>
<tr>
<th>No. of Blinks</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Off Mode</td>
</tr>
<tr>
<td>2</td>
<td>Cool Mode</td>
</tr>
<tr>
<td>3</td>
<td>Heat Mode</td>
</tr>
<tr>
<td>4</td>
<td>Dehumidify Mode</td>
</tr>
<tr>
<td>5</td>
<td>Defrost Mode</td>
</tr>
</tbody>
</table>

   **Table 3: STAT LED Blink Codes**
Compressor LEDs

“R1” - This LED will light up when Compressor A1 is enabled and will stay lit as long as Compressor A1 is active.

“R2” - This LED will light up when Compressor A2 is enabled and will stay lit as long as Compressor A2 is active.

“R3” - This LED will light up when Compressor B1 is enabled and will stay lit as long as Compressor B1 is active.

“R4” - This LED will light up when Compressor B2 is enabled and will stay lit as long as Compressor B2 is active.
LED Diagnostics

“PWR” LED: When the Dual Digital Module is powered up, the PWR LED (located below the address switches) should light up and stay on continuously. If it does not light up, check to be sure that the power wiring is connected to the board, the connections are tight, and the VCM-X Modular series controller is powered. If after making all these checks, the PWR LED does not light up, the module is probably defective.

“COMM” LED: The COMM LED lights up to indicate Communications between the module and the VCM-X Modular series controller. If the COMM LED does not blink, then communications have not been established. Check the connection between the VCM-X Modular Controller, the VCM-X Modular E-BUS Controller, the E-BUS Distribution Module, and the Dual Digital Module.

“STAT” LED: As previously described, this LED will blink out the operation mode that the Dual Digital Module is operating under. When the board is first powered up, the STAT LED will do the following:

- Light up
- Blink out status code every ten seconds to indicate controller status

“ALARM” LED: As previously described, this LED will blink on and off to indicate alarms and diagnostics.

Other Checks

NOTE: The Dual Digital Module contains no user-serviceable parts. Contact qualified technical personnel if your module is not operating correctly.

NOTE: The Dual Digital Module contains no user-serviceable parts. Contact qualified technical personnel if your module is not operating correctly.
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 Dual Digital Module. Read voltage with a meter set on DC volts. 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 (Table 4). The chart shows 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.

<table>
<thead>
<tr>
<th>Temperature°F</th>
<th>Pressure PSI</th>
<th>Signal DC Volts</th>
<th>Temperature°F</th>
<th>Pressure PSI</th>
<th>Signal DC Volts</th>
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<td>21.19</td>
<td>80.94</td>
<td>1.8</td>
<td>59.03</td>
<td>168.10</td>
<td>3.2</td>
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<td>24.49</td>
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<td>27.80</td>
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<td>33.89</td>
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<td>2.2</td>
<td>67.23</td>
<td>193.00</td>
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<td>112.07</td>
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<td>69.24</td>
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<td>54.50</td>
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<td>56.76</td>
<td>161.88</td>
<td>3.1</td>
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</table>

Table 4: Coil Pressure/Voltage/Temp for OE275-01 Suction Pressure Transducers - R410A Refrigerant
VCM-X Modular Controller to Dual Digital Module Wiring

When using the VCM-X Modular Controller, the E-BUS Distribution Module is required to connect to the Dual Digital Module. The Dual Digital Module connects to the E-BUS Distribution Module using a modular HSSC cable. The Dual Digital Module requires a 24 VAC power connection with an appropriate VA rating.

The E-BUS Distribution Module connects to the VCM-X Modular Controller, VCM-X Expansion Module, or 12 Relay Expansion Module using the FC port. See Figure 6 below for wiring.

Any E-BUS module can be connected to each of the four E-BUS Distribution Module’s output ports or can be daisy-chained together using HSSC cables.

If using a spliced terminal connection for longer runs, one module can be connected to the E-BUS Distribution Module and any additional modules would be daisy-chained to the first module. For more information, refer to the E-BUS Distribution Module Technical Guide.

Figure 6: VCM-X Modular Controller Connection to Dual Digital Module
NOTE: Contact Factory for the correct HSSC cable length for your application. Cables are available in ½ and 3 meter lengths and 100 and 150 foot lengths.

WARNING: Be sure all controllers and modules are powered down before connecting or disconnecting HSSC cables.

Figure 6: VCM-X Modular Controller Connection to Dual Digital Module