VCM-X E-BUS Component & System Wiring Technical Guide

Use For VCM-X E-BUS Controller Code: SS1030 and later
For VCM Wiring Information, See Component & System Wiring Technical Guide - Form: OR-VCMWIRE-TGD

RELAY CONTACT
RATING IS 1 AMP MAX @ 24 VAC

RS-485 COMMUNICATION LOOP. WIRE “R” TO “R”, “T” TO “T” “SHLD” TO “SHLD”

FAN
RELAY 2
RELAY 3
RELAY 4
RELAY 5
RELAY
COMMON

I C DIGITAL SENSOR
2
IC EXPANSION 2
STATIC PRESSURE ANALOG INPUT
JUMPER SETTINGS
MUST BE SET AS SHOWN FOR PROPER OPERATION

24 VAC POWER ONLY
WARNING!
POLARITY MUST BE OBSERVED OR THE CONTROLLER WILL BE DAMAGED

AI1
AI2
AI3
AI4
AI5
AI7
AI01
AI02
= SPC (SPACE TEMPERATURE SENSOR)
= SAT (SUPPLY AIR TEMPERATURE SENSOR)
= RAT (RETURN AIR TEMPERATURE SENSOR)
= OAT (OUTDOOR AIR TEMPERATURE SENSOR)
= SUCTION PRESSURE SENSOR (FROM EXP. MODULE)
= SPACE TEMPERATURE SENSOR SLIDE ADJUST OR VOLTAGE RESET SOURCE
= ECONOMIZER (2-10 VDC OUTPUT)
= SUPPLY FAN VFD (0-10 VDC OUTPUT)

4-20mA

4-20mA

4-20mA

4-20mA

4-20mA

4-20mA

4-20mA

0-10V

0-10V

0-10V

0-10V

0-10V

0-10V

0-5V

0-5V

0-5V

0-5V

0-5V

0-5V

THERM
THERM
THERM
THERM
THERM
THERM

ANALOG INPUT JUMPER SETTINGS

WattMaster Label
#LB102073-01-A
Rev.: 1A

www.aaon.com
www.orioncontrols.com

VCM-X MODULAR E-BUS CONTROLLER
Orion No.: OE332-23E-VCMX-MOD-A
AAON No.: V07150

AI1 = SPC (SPACE TEMPERATURE SENSOR)
AI2 = SAT (SUPPLY AIR TEMPERATURE SENSOR)
AI3 = RAT (RETURN AIR TEMPERATURE SENSOR)
AI4 = OAT (OUTDOOR AIR TEMPERATURE SENSOR)
AI5 = SUCTION PRESSURE SENSOR (FROM EXP. MODULE)
AI7 = SPACE TEMPERATURE SENSOR SLIDE ADJUST OR VOLTAGE RESET SOURCE
AI01 = ECONOMIZER (2-10 VDC OUTPUT)
AI02 = SUPPLY FAN VFD (0-10 VDC OUTPUT)

LED BLINK CODES

LED NAME

STATUS1

NORMAL OPERATION 0 1
SAT FAIL 1 2
OAT FAIL 2 2
SPC FAIL 3 2
MODULE ALARM 4 2
MECH COOL FAIL 1 3
MECH HEAT FAIL 2 3
FAN PROOF FAIL 3 3
DIRTY FILTER 4 3
EMERGENCY SHUTDOWN 5 3
LOW SAT 1 4
HIGH SAT 2 4
CONT. TEMP COOL FAIL 3 4
CONT. TEMP HEAT FAIL 4 4
PUSH BUTTON OVR 1 5
ZONE OVR 2 5
OUTPUT FORCE ACTIVE 0 6

E-BUS CONNECTOR
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System Overview, Installation & Commissioning
Overview

The Orion system components can be configured into several types of systems. It is a good idea to become familiar with the different types of systems and their architecture by reading the information in this section and looking at the configuration diagrams in the System Configurations section of this manual. The information below is designed to help you understand how the system components integrate with each other and the available configuration options.

System Types

Four different system configurations are available depending on the type and number of controllers that you have on your system.

1. **Stand Alone**
   (See Figure 3, page 22 for Connection Diagram)

2. **Interconnected**
   (See Figure 4, page 23 for Connection Diagram)

3. **Networked Single Loop**
   (See Figures 5-9, pages 24-28 for Connection Diagrams)

4. **Networked Multiple Loop**
   (See Figures 10-11, pages 29-30 for Connection Diagrams)

5. **Computer, CommLink 5, IP Module, USB-Link 2**
   (See Figures 54-58, pages 76-80 for Connection Diagrams)

System Type Definitions

**Stand Alone**

This system consists of a single VCM-X E-BUS Controller. Programming and status monitoring are accomplished by one or more of the following methods.

1. By using an operator interface. This can be a Modular System Manager, a System Manager TS II, a Modular Service Tool, or all 3 devices.
2. A computer interface can also be used in conjunction with the other operator interfaces listed above, or by itself. This requires a CommLink 5 or USB-Link 2 and a personal computer with the Prism 2 computer front end software installed.

**Interconnected**

This system consists of a group of VCM-X E-BUS Controllers interconnected with communication cable to allow programming from one central location. Broadcasting between controllers is not available. Programming and status monitoring are accomplished by one or more of the following methods.

1. By using an operator interface. This can be a Modular System Manager, a System Manager TS II, a Modular Service Tool, or all 3 devices.
2. A computer interface can also be used in conjunction with the other operator interfaces listed above, or by itself. This requires a CommLink 5 or USB-Link 2 and a personal computer with the Prism 2 computer front end software installed.

**Networked Single Loop**

The Networked Single Loop system, as its name implies, consists of a single communications loop. This loop utilizes a network device to share information that is broadcast from one controller to all controllers on the loop. The system can consist of the following devices.

1. A series of VCM-X E-BUS Controllers that utilizes a network device to share information that is broadcast from one controller to all controllers on the loop.
2. A single VCM-X E-BUS Controller and a series of VAV/Zone Controllers. These VAV/Zone Controllers can either be of the Modular type or Non-modular type. The Modular type use Power/Comm Boards and prefabricated cables and the Non-Modular type utilize terminals and 2 conductor twisted pair with shield wire. A network device is used to share information which is broadcast back and forth between all controllers on the loop.

These systems require a network device in the form of either a CommLink 5 communications interface or a MiniLink Polling Device. Both network devices may also be used together. Programming and status monitoring are accomplished by the following methods:

1. By using an operator interface. This can be a Modular System Manager, a System Manager TS II, a Modular Service Tool, or all 3 devices.
2. A computer interface can also be used in conjunction with the other operator interfaces listed above, or by itself. This requires a CommLink 5 or USB-Link 2 and a personal computer with the Prism 2 computer front end software installed.

When using the MiniLink Polling Device alone, only the System Manager, System Manager TS II, and Modular Service Tool can be used to program and monitor the system. With the addition of the CommLink 5, the Prism 2 computer front end software and a PC can be used to program and monitor the system in addition to the Modular Service Tool, Modular System Manager, and the System Manager TS II.
Networked Multiple Loop

The Networked Multiple Loop System consists of two or more loops, each being called a “Local Loop”, with one “Network Loop” that ties the “Local Loops” together. Each of these loops can consist of one of the following groups of controllers:

1. A series of VCM-X E-BUS Controllers.
2. A single VCM-X E-BUS Controller and a series of VAV/Zone Controllers. These VAV/Zone Controllers can either be of the Modular type or Non-modular type. The Modular type use Power/Comm Boards and prefabricated cables and the Non-Modular type utilize terminals and 2 conductor twisted pair with shield wire. A network device is used to share information which is broadcast back and forth between all controllers on the loop.

To form the Networked Multiple Loop System, the following network devices are required:

1. A MiniLink Polling Device is required per loop (Local Loop). This allows the controllers to share information that is broadcast from one controller to all controllers on that local loop.
2. One CommLink 5 is required for the entire system. It resides on the Network Loop and allows for communications between all the local loops and provides for global broadcasts to all controllers on the entire system.

Programming and status monitoring are accomplished by one or more of the following methods:

1. By using an operator interface. This can be a Modular System Manager, a System Manager TS II, a Modular Service Tool, or all 3 devices. The Modular System Manager, System Manager TS II, or Modular Service Tool connect to any “Local Loop” on the system.
2. A computer interface can also be used in conjunction with the other operator interfaces listed above, or by itself. This requires a personal computer with the Prism II computer front end software installed connected to the CommLink 5.

Network Communications Devices

MiniLink Polling Device

The MiniLink Polling device is used in the following applications:

1. This device is required on all Zoning applications. It is optional on single loop VAV systems.
2. This device is required on each local loop of all Networked Multiple Loop systems.
3. This device is responsible for local loop broadcasts only. It always resides on the local loop.

For a Networked Single Loop VCM-X E-BUS system, this device can be used for tenant logging and alarm reporting to a Modular System Manager or System Manager TS II. It can be used to broadcast information such as outside air temperature or outside air humidity to all devices on the local loop. It can also be used to broadcast space temperature from a GPC-X or GPC-XP Controller to any controllers on this loop that do not have their own Space Temperature Sensor.

For a Networked Single Loop VAV system, the MiniLink Polling Device can be used for tenant logging and alarm reporting to a Modular System Manager or System Manager TS II. It must be used to broadcast information such as, internal schedule, supply air temperature, fan and heat status, unoccupied calls for heating and cooling from the VAV/Zone Controllers, and forced modes of operation.

For a Networked Single Loop Zoning system, this device must be used for zone voting, because it calculates the heating and cooling totals on the loop and broadcasts cooling, venting, and heating modes to the VCM-X E-BUS Controller. It can also be used for tenant logging and alarm reporting to the Modular System Manager or System Manager TS II.

CommLink 5

The CommLink 5 device is used in the following applications.

1. A CommLink 5 is required on all Networked Multiple Loop Systems.
2. A CommLink 5 is optional on all Networked Single Loop Systems.
3. A CommLink 5 is required on any system when a permanent computer interface is desired. The USB-Link 2 can be used for temporary computer connection for setting up or servicing the system, but does not have the complete functionality that the CommLink 5 provides.

The CommLink 5 is responsible for local loop broadcasts on a Networked Single Loop system, and on this type of system, the Loop switch on the back of the CommLink must be set to “Single.” This device is responsible for network broadcasts on Networked Multiple Loop systems. On this type of system, the Loop switch on the back of the CommLink must be set to “Multiple.”

For a Networked Single Loop VCM-X E-BUS system, this device can be used for tenant logging and alarm reporting to a Modular System Manager or System Manager TS II. It can also be used to broadcast information like outside air temperature or outside air humidity to all local loops on the entire networked system. It may also be used to broadcast space temperature from a GPC-X or GPC-XP Controller to any controllers on the local loop that do not contain their own Space Temperature Sensor.

On a Networked Single Loop VAV/Zone system, the CommLink 5 can be used to broadcast information such as internal schedule, supply air temperature, fan and heat status, unoccupied calls for heating and cooling, and forced modes of operation to and from the VAV/Zone Controllers.
Wiring Considerations

Before beginning installation, please study the wiring diagrams for the controllers you are using with your particular application. These diagrams appear in this manual and can also be found in the technical guides supplied with your specific controllers. Wire and transformer sizing instructions and examples are found in Figures 1 & 2, pages 9-10 of this manual.

The Modular VAV/Zone Controllers are equipped with modular connections. Non-Modular VAV/Zone Controllers have wiring terminals instead of modular connectors. The VCM-X E-BUS Controller is supplied with modular connectors. The Power/Comm board is supplied with both terminals and a modular connector on the input side. All of its outputs use modular connectors. The MiniLink Poling Device is equipped with both modular and wiring terminal blocks. We recommend (when possible) using modular cables instead of hard wiring to wire terminal blocks to save installation time and eliminate wiring errors. In some cases, however, hard wiring is unavoidable. The table below lists the various Orion devices/controllers and their available termination type(s) for communications and power wiring.

### Communications and Power Terminations For Orion Products

<table>
<thead>
<tr>
<th>Orion Controller Or Device</th>
<th>Available Power And Communications Connections</th>
<th>Both Modular Connectors And Wire Terminals</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCM-X E-BUS</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>VAV/Zone</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Power/Comm Board</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>MiniLink PD</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>CommLink 5</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>*Modular System Manager</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>System Manager TS II</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>GPC-X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>GPC-XP</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Lighting Controller</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

* The System Manager is supplied with a pigtail connector that has a modular plug on one end and stripped wires on the other end. The pigtail is used to allow wiring connection to the HVAC unit controller wire terminals and to a 24 VAC power transformer on systems that do not use Power/Comm boards.

For detailed wiring diagrams, see the Power/Comm board wiring diagrams in the “Communication Devices Diagrams” section of this manual. For Power/Comm board transformer sizing, see Figures 1 & 2, pages 9-10 of this manual.

### Power/Comm Board Requirements

#### Standard Connection Configurations and Use

Power/Comm boards are typically used on Networked, Single, and Multiple Loop systems to transfer 24 VAC power and “Local Loop” communications to Modular VAV/Zone Controllers, Modular System Managers, or other Power/Comm boards.

The Power/Comm board must always be powered by its own dedicated 24 VAC transformer connected to its 2-wire, 24 VAC input terminals (TB1).

Local Loop communications can be transferred to the Power/Comm Board via a modular cable connected to its “Comm In” modular connector input terminal (P2). This modular cable connection can originate from the “Local Loop” modular connector of the MiniLink PD for this loop, another Power/Comm board output on the same loop, or a Modular VAV/Zone Controller or Modular System Manager output on the same loop. A Power/Comm board can also be connected if desired to the “Local Loop” by hard wiring a 2-wire shielded cable connected between its 3-wire communications input terminal (TB1) and a Power/Comm board, or the MiniLink PD “Local Loop”, 3-wire communications terminal.

For detailed wiring diagrams, see the Power/Comm board wiring diagrams in the “Communication Devices Diagrams” section of this manual. For Power/Comm board transformer sizing, see Figures 1 & 2, pages 9-10 of this manual.

#### Alternative Connection Configuration and Use

If desired, the Power/Comm board can also be used to transfer both 24 VAC power and “Network Loop” communications to multiple MiniLink PDs. Connection between the MiniLink PD(s) and Power/Comm board(s) is accomplished by using modular cables between the Power/Comm board’s modular output connectors and the MiniLink PD(s)’s “Network Loop” modular input connectors. When a Power/Comm board is used to connect power and communications to MiniLink PDs in this manner, that particular Power/Comm board cannot also be used to share communications and/or power with Modular VAV/Zone Controllers or Modular System Manager(s).

**Warning:** Do not ground the 24 VAC transformer that is to be used with the Power/Comm board. Grounding of the transformer will damage the Power/Comm board and all boards connected to it. A separate transformer must be used for each Power/Comm board. No exceptions. Do not connect any other devices to the transformer used for the Power/Comm board!

For detailed wiring diagrams, see the Power/Comm board wiring diagrams in the “Communication Devices Diagrams” section of this manual. For Power/Comm board transformer sizing, see Figures 1 & 2, pages 9-10 of this manual.
24 VAC Power - Transformer & Wire Sizing Considerations for Devices Without Modular Connectors

Some installers like to use one large 24 VAC transformer to power several devices. This is allowable as long as polarity is maintained to each device on the transformer circuit. **Warning:** If polarity is not maintained, severe damage to the devices may result. WattMaster Controls recommends using a separate transformer for each device in order to eliminate the potential for damaging controllers due to incorrect polarity. Using separate transformers also allows redundancy in case of a transformer failure. Instead of having 8 controllers inoperative because of a malfunctioning transformer you have only 1 controller offline. If the installer does decide to use a large transformer to supply power to several devices, the following transformer and wire sizing information is presented to help the installer correctly supply 24 VAC power to the devices.

Following is a typical example to help the installer to correctly evaluate transformer and wiring designs.

Each GPC-XP Controller requires 8 VA @ 24VAC power. In the examples below we have a total of 8 GPC-XP Controllers.

8 GPC-XP Controllers @ 8 VA each... 8 x 8 VA = 64 VA.

The above calculation determines that our transformer will need to be sized for a minimum of 64 VA if we are to use one transformer to power all the controllers.

Next we must determine the maximum length of run allowable for the wire gauge we wish to use in the installation. Each wire gauge below has a voltage drop per foot value we use to calculate total voltage drop.

- 18 ga wire: 0.00054 = voltage drop per 1' length of wire
- 16 ga wire: 0.00034 = voltage drop per 1' length of wire
- 14 ga wire: 0.00021 = voltage drop per 1' length of wire

For our example we will use 18 gauge wire. WattMaster recommends 18 gauge as a minimum wire size for all power wiring.

Next use the voltage drop per foot value for 18 gauge wire from the list above and multiply by the total VA load of the 8 controllers to be installed.

\[
\text{0.00054 (voltage drop per foot for 18 gauge wire) x 64 VA controller load} = \frac{2 \text{ Volts total allowable voltage drop}}{0.0346 (\text{V}olts/\text{Ft})} \]

\[
= 57.80 \text{ feet}
\]

Parallel circuiting of the wiring instead of wiring all 8 controllers in series allows for longer wire runs to be used with the same size wire (as shown in our examples below). It is often necessary for the installer to calculate and weigh the cost and installation advantages and disadvantages of wire size, transformer size, multiple transformers, circuiting, etc., when laying out an installation. No matter what layout scheme is decided upon, it is mandatory that the farthest controller on the circuit is supplied with a minimum of 22 Volts.
Transformer Sizing & Cabling For Devices With Modular Connectors

Modular devices include the VAV/Zone Controller, Modular System Manager & MiniLink Polling Device. When sizing transformers for the devices it is important to design your layout so that the fewest number of Power/Comm distribution boards and the least number of transformers can be used.

The polarity problem discussed in regards to other devices that do not have modular connections is not an issue with the modular devices as they cannot be connected with reversed polarity because of the modular board connectors and cable. Also the prefabricated cable is always 16 gauge. Wire size selection is therefore not an issue with the modular devices. However, the same minimum voltage rules apply to modular devices as with other non-modular devices. In order to simplify wiring design and layout with modular devices the following rules apply:

- **Power/Comm Board maximum transformer size = 100VA.** This is due to the board circuitry and fusing. Each modular device is to be calculated at 6VA. If more than 16 devices are required, multiple Power/Comm boards must be used.
- **No more than 6 modular devices allowed per branch circuit.** (The Power/Comm board has a total of 4 branch circuits)
- The longest total run per branch circuit is 240 Ft. This is due to voltage drop on the prefabricated cable.

Below are some examples of transformer sizing and branch circuit design.

**Warning!**
DO NOT GROUND THE 24V TRANSFORMER THAT IS TO BE USED WITH THE POWER/COMM BOARDS. GROUNDING OF THE TRANSFORMER WILL DAMAGE THE POWER/COMM BOARD AND ALL BOARDS CONNECTED TO IT. A SEPARATE TRANSFORMER MUST BE USED FOR EACH POWER/COMM BOARD. NO EXCEPTIONS. DO NOT CONNECT ANY OTHER DEVICES TO THE TRANSFORMER USED FOR THE POWER/COMM BOARD!

---

**Figure 2:** Transformer & Wire Sizing - Devices with Modular Connectors

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VCM-X Component & Systems Wiring
MiniLink Polling Device (MiniLink PD)

Standard Connection Configurations and Use

The MiniLink PD is used on Networked Single and Multiple Loop systems to provide two-way communication between all devices on its “Local Loop” and all the other “Network Loop” devices on the entire system. The MiniLink PD is equipped with both modular connectors and hard wiring terminal blocks for connection of 24 VAC power “Local Loop” and “Network Loop” communications.

Each MiniLink PD is normally hard wired to a 24 VAC power source connected to its 24 VAC input terminal (TB1). “Network Loop” communications are transferred between multiple MiniLink PDs by modular cables connected to their “Network Loop” modular connectors (P3 and P5). A CommLink 5 must be connected to one of the MiniLink PDs on the system by using a 2-wire shielded cable connected between its 3-wire “Network Loop” communications terminal block (TB4) and the CommLink’s “485 Loop” terminal block. Transfer of “Local Loop” communication from the MiniLink PD to a Power/Comm board is made by using a modular cable connected between the MiniLink PD “Local Loop” modular connector (P4) and the Power/Comm board modular “Comm In” connector (P2). If desired as an alternative, transfer of “Local Loop” communication from the MiniLink PD to a Power/Comm board can be made by hard wiring a 2-wire shielded cable connected between the MiniLink PD’s 3-wire communications terminal (TB1) and the 3-wire communications input (TB1) on the Power/Comm board.

Installation Procedures

The installation procedures that follow are based on recommended methods of wiring connection and controller installation. Installation procedures vary depending on the type of system you are installing. The system you are installing could be a Stand Alone, Interconnected, Networked Single Loop, or Networked Multiple Loop system. The Networked System also has installation variations based on the type of components you are installing for that system. The following information explains the procedures for all of these systems. Please find the system and components that closely match your system and follow the outlined procedures.

Stand Alone Systems

See Figure 3, page 22 of this manual for a detailed Stand Alone System wiring diagram. Also see pages 9-10 for wire and transformer sizing information. You should review these diagrams before attempting connections or powering up the controller or interface devices.

1. Install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from transformer to the controller using 18 gauge minimum, 2 conductor cable for power. Observe polarity on all power wiring.

2. The Modular Service Tool SD connects to the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Stand Alone.

3. The Modular System Manager SD comes supplied with a 12 foot modular cable with a modular connector on one end and stripped wires on the other. If the Modular System Manager is to be mounted in a remote location, run 18 gauge, 2 conductor shielded cable for communications from the controller’s 3 wire communications terminal to a junction box. Run 18 gauge minimum, 2-wire, power wires from a separate 24 VAC, 6 VA minimum transformer into the junction box. Splice the modular cable to the communications and power wire inside of the junction box by making solid connections, using wire nuts or butt splice connectors. The Communications setting must be set to Lo Speed Stand Alone.

4. The System Manager TS II utilizes a 3-wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2-wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum 2 conductor wire. In the Settings Menu, enter <0> for the System Manager Address.

5. If a CommLink 5 is used for a computer interface, connect communications using 18 gauge, 2 conductor with shield cable. Connect from the controller’s 3-wire communications connector to the CommLink’s 3-wire communications connector. For this type of system, the Loop switch located on the back of the CommLink 5 must be set to “Single”.

6. Use 18 gauge minimum, 2-wire cable for all 24 VAC power wiring. Be sure to maintain polarity on all boards. If a CommLink is connected, use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source.

7. Before powering up the controller, set the desired board address on the controller (usually 1).
Interconnected Systems

See Figure 4, page 23 for a detailed Interconnected System wiring diagram. Also see pages 9-10 for wire and transformer sizing information. You should review these diagrams before attempting connections or powering up the controller or interface devices.

1. Connect all VCM-X E-BUS Controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications. Install a separate 24 VAC, 8 VA minimum transformer for each VCM-X E-BUS Controller and wire the transformers to each controller using 18 gauge minimum, 2 conductor cable. Observe polarity on all boards.

2. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Stand Alone.

3. The Modular System Manager SD comes supplied with a 12 foot modular cable with a modular connector on one end and stripped wires on the other. If the Modular System Manager is to be mounted in a remote location, run 18 gauge, 2 conductor shielded cable for communications from the controller’s 3-wire communications terminal to a junction box. Run 18 gauge minimum, 2-wire power wires from a separate 24 VAC, 6 VA minimum transformer into the junction box. Splice the modular cable to the communications and power wire inside of the junction box by making solid connections, using wire nuts or butt splice connectors. The Communications setting must be set to Lo Speed Stand Alone.

4. The System Manager TS II utilizes a 3-wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2-wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum 2 conductor wire. In the Settings Menu, enter <0> for the System Manager Address and make sure One to One Unit Connection is not selected.

5. If a CommLink 5 is used to provide for connection to a computer interface, connect communications using 18 gauge, 2 conductor shielded cable. Connect from one of the controller’s 3-wire communications connectors to the CommLink’s 3-wire communications connector. For this type of system, the Loop switch on the back of the CommLink needs to be set to “Single”.

6. Use 18 gauge minimum, 2-wire cable for all 24 VAC power wiring. Be sure to maintain polarity on all boards. If a CommLink 5 is installed, use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source.

7. Before powering up the controllers, set each controller’s board address to a unique number from 1 through 60.

Networked Single Loop Systems

See Figures 5-9, pages 24-28 for detailed Networked Single Loop System wiring diagrams. Also see pages 9-10 for wire and transformer sizing information. You should review these diagrams before attempting connections or powering up the controller or interface devices.

Loop Containing VCM-X E-BUS Controllers Only (Using CommLink 5)

1. Connect all VCM-X E-BUS Controllers on the loop in a daisy chain format using 18 gauge, 2 conductor shielded cable wiring from each controller’s communication terminals to the next controller’s communication terminals. Install a separate 24 VAC, 8 VA minimum transformer for each controller and wire from controllers to the transformers using 18 gauge minimum, 2 wire cable. Be sure to observe polarity on all boards.

2. Connect 18 gauge minimum 2 conductor shielded cable from one of the VCM-X E-BUS Controller’s 3 wire communication terminals to the CommLink5’s 3 wire communications terminal. The Loop switch on the back of the CommLink must be set to “Single” for this installation. Use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source.

3. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.

4. The Modular System Manager SD comes supplied with a 12 foot long modular cable with a modular connector on one end and stripped wires on the other. If the System Manager is to be mounted in a remote location, run 18 gauge, 2 conductor shielded cable for communications from one of the controller’s 3 wire communications terminals to a junction box. Run 18 gauge, 2 wire, 24 VAC power wires supplied by a separate transformer into the junction box. Splice modular cable to the communications and power wire inside of the junction box using solid connections from wire nuts or butt splice connectors. The Modular System Manager MUST always be connected on the “Local Loop”; never the “Network Loop”. The Communications setting must be set to Lo Speed Network Mode.
5. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum, 2 conductor wire. In the Settings Menu, enter <63> for the System Manager Address.

6. Before powering up the controllers, set each controller’s board address to a unique number from 1 through 59.

Loop Containing VCM-X E-BUS Controller with Modular VAV/Zone Controllers and MiniLink PD Only

1. Connect all controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller. Using 18 gauge minimum, 2 wire cable for power, install a separate 24 VAC transformer sized for the required VA load for each Power/Comm board on the loop and wire from each transformer to its Power/Comm board. Observe polarity on all boards.

2. Connect 2 conductor shielded cable from the VCM-X E-BUS Controller’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Local Loop”. Use 18 gauge minimum, 2 wire cable for all power wiring and be sure to maintain polarity on all boards.

3. Using a modular cable, connect from the MiniLink PD’s modular connector marked “Local Loop” to a Power/Comm board’s modular input connector.

4. Using modular cables, connect from the Power/Comm board’s modular output connectors to the Modular VAV/Zone Controllers. The VAV/Zone Controllers connect together using modular cables from each VAV/Zone Controller to the next controller and/or to a Power/Comm board. A maximum of 16 VAV/Zone Controllers are allowed per Power/Comm board. If you have more than 16 VAV/Zone Controllers, you will need multiple Power/Comm boards. Each Power/Comm board must have its own 24 VAC transformer sized for the total number of VAV/Zone Controllers connected to it.

5. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.

6. The Modular System Manager SD can connect to any VAV/Zone Controller or directly to one of the Power/Comm board’s modular output connectors. The Communications setting must be set to Lo Speed Network Mode.

7. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. Since you are using Modular VAV/Zone Controllers, you can use a modular pigtail connector that has a modular connector on one end and stripped wires on the other to connect the System Manager TS II to the Power/Comm board or one of the Modular VAV/Zone Controllers. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter <63> for the System Manager Address.

8. Before powering up the controllers, set each VAV/Zone Controller’s board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59. Set MiniLink PD’s address at 1.

Note: Only communications, not power, are transferred from the MiniLink Polling Device to the Power/Comm board via the modular cable. A separate transformer is required for the MiniLink Polling Device. Both power and communications are transferred from the Power/Comm board to the VAV/Zone Controllers and the Modular System Manager.

Warning: Each Power/Comm board must have its own 24 VAC transformer for its power source. This transformer cannot be shared with any other board. Do not ground the transformer that is connected to the Power/Comm board. The transformer should be sized for the required VA by using the information found on pages 9-10 of this manual.
Loop Containing VCM-X E-BUS Controller with Non-Modular VAV/Zone Controllers and MiniLink PD Only

1. Connect 2 conductor shielded cable from the VCM-X E-BUS Controller’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Local Loop”. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller. Also connect a 24 VAC 6 VA minimum transformer to the MiniLink PD power terminals using 18 gauge minimum, 2 wire cable. Then wire from the VCM-X E-BUS Controller’s 3 wire communications connector or the MiniLink PD’s 3 wire communications connector marked “Local Loop” to the first VAV/Zone Controller’s 3 wire communications terminals. Using 18 gauge minimum, 2 wire cable, connect all of the associated Non-Modular VAV/Zone Controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 6 VA minimum, transformer for each Non-Modular VAV/Zone Controller and wire from each transformer to its VAV/Zone Controller. WattMaster recommends you use a separate transformer for each VAV/Zone Controller as stated. As an alternative, it is allowable to have several Non-Modular VAV/Zone Controllers share one properly sized transformer (6 VA per VAV/Zone Controller). Warning: Polarity must be observed on all of the VAV/Zone Controllers or damage to the controllers will result. Use 18 gauge minimum, 2 wire cable for all power wiring and be sure to maintain polarity on all boards.

2. The Modular System Manager can connect to any VAV/Zone Controller or to the VCM-X E-BUS Controller. Use the supplied pigtail cable which has a modular connector for connection to the back of the Modular System Manager and wire to any controller on the communications local loop with communication wire terminals. A separate transformer is required for the Modular System Manager. Connect the 2 power wires from the pigtail connector to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power. The Communications setting must be set to Lo Speed Network Mode.

3. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.

4. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter <63> for the System Manager Address.

5. Before powering up the controllers, set each VAV/Zone Controller’s board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59. Set MiniLink PD’s address at 1.

Loop Containing VCM-X E-BUS Controller with Modular VAV/Zone Controllers and CommLink 5 Only

1. Connect all controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from transformer to the VCM-X E-BUS Controller. Using 18 gauge minimum, 2 wire cable for power, install a separate 24 VAC transformer sized for the required VA load for each Power/Comm board on the loop and wire from each transformer to its Power/Comm board. Observe polarity on all boards.

2. Use 18 gauge minimum, 2 wire cable for all 24 VAC power wiring. Be sure to maintain polarity on all boards. Use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source.

3. Using 2 conductor shielded cable, connect from the CommLink 5’s 3 wire communications connector to the Power/Comm board’s or VCM-X E-BUS Controller’s 3 wire communications input connector. The Loop switch on the back of the CommLink 5 should be set to “Single”.

4. Using modular cables, connect from the Power/Comm board’s modular output connectors to the VAV/Zone Controllers. The VAV/Zone Controllers connect together using modular cables from each VAV/Zone Controller to the next controller and/or to a Power/Comm board. A maximum of 16 VAV/Zone Controllers are allowed per Power/Comm board. If you have more than 16 VAV/Zone Controllers, you will need multiple Power/Comm boards. Each Power/Comm board must have its own 24 VAC transformer sized for the total number of VAV/Zone Controllers connected to it.

5. The Modular System Manager can connect to any VAV/Zone Controller or directly to one of the Power/Comm board’s modular output connectors. The Communications setting must be set to Lo Speed Network Mode.
6. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.

7. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter <63> for the System Manager Address.

8. Before powering up the controllers, set each VAV/Zone Controller’s board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59.

Note: Both power and communications are transferred from the Power/Comm board to the VAV/Zone Controllers and the Modular System Manager. Only communications are transferred from Power/Comm board to Power/Comm board.

Warning: Each Power/Comm board must have its own 24 VAC transformer for its power source. This transformer cannot be shared with any other board. Do not ground the transformer that is connected to the Power/Comm board. The transformer should be sized for the required VA by using the information found on pages 9-10 of this manual.

Loop Containing VCM-X E-BUS Controller with Non-Modular VAV/Zone Controllers and CommLink 5 Only

1. Connect 2 conductor shielded cable from the VCM-X E-BUS Controller’s 3 wire communications connector to the CommLink 5’s 3 wire communications connector. Use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source. Be sure to maintain polarity on all boards. The Loop switch on the back of the CommLink 5 should be set to “Single”.

2. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller. Then wire from the VCM-X E-BUS Controller’s 3 wire communications connector or the CommLink 5’s 3 wire communications connector to the first VAV/Zone Controller’s 3 wire communications terminal. Connect all of the associated Non-Modular VAV/Zone Controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 6 VA minimum, transformer for each Non-Modular VAV/Zone Controller and wire from each transformer to its VAV/Zone Controller. WattMaster recommends you use a separate transformer for each VAV/Zone Controller as stated. As an alternative, it is allowable to have several Non-Modular VAV/Zone Controllers share one properly sized transformer (6 VA per VAV/Zone Controller). **Warning**: Polarity must be observed on all of the VAV/Zone Controllers or damage to the controllers will result. Use 18 gauge minimum, 2 wire cable for all 24 VAC power wiring. Be sure to maintain polarity on all boards.

3. The Modular System Manager can connect to any VAV/Zone Controller or to the VCM-X E-BUS Controller. Use the supplied pigtail cable which has a modular connector for connection to the back of the Modular System Manager and wire to any controller on the communications local loop with communication wire terminals. A separate transformer is required for the Modular System Manager. Connect the 2 power wires from the pigtail connector to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power. The Communications setting must be set to Lo Speed Network Mode.

4. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.

5. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter <63> for the System Manager Address.

6. Before powering up the controllers, set each VAV/Zone Controller’s board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59.
System Installation

Networked Single Loop

Loop Containing VCM-X E-BUS Controller with Modular VAV/Zone Controllers, MiniLink PD, and CommLink 5

1. Connect the CommLink 5 to the MiniLink PD by using 2 conductor shielded cable to connect from the CommLink 5’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Network Loop”. Use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source. Be sure to maintain polarity on all boards. The Loop switch on the back of the CommLink 5 should be set to “Multiple”. Also connect a 24 VAC 6 VA minimum transformer to the MiniLink PD power terminals using 18 gauge minimum, 2 wire cable.

2. Connect all controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum transformer for the VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller. Using 18 gauge minimum, 2 wire cable for power, install a separate 24 VAC transformer sized for the required VA load for each Power/Comm Board on the loop and wire from each transformer to its Power/Comm board. Observe polarity on all boards.

3. Using 2 conductor shielded cable, connect from the VCM-X E-BUS Controller’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Local Loop”. Use 18 gauge minimum wire for power and observe polarity on all boards.

4. Using a modular cable, connect from the MiniLink PD’s modular connector marked “Local Loop” to a Power/Comm board’s modular input connector.

5. Using modular cables, connect from the Power/Comm board’s modular output connectors to the VAV/Zone Controllers. The VAV/Zone Controllers connect together using modular cables from each VAV/Zone Controller to the next controller and/or to a Power/Comm board. A maximum of 16 VAV/Zone Controllers are allowed per Power/Comm board. If you have more than 16 VAV/Zone Controllers, you will need multiple Power/Comm boards. Each Power/Comm board must have its own 24 VAC transformer sized for the total number of VAV/Zone Controllers connected to it.

6. The Modular System Manager can connect to any VAV/Zone Controller or directly to one of the Power/Comm board’s modular output connectors. The Communications setting must be set to Lo Speed Network Mode.

7. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. Since you are using Modular VAV/Zone Controllers, you can use a modular pigtail connector that has a modular connector on one end and stripped wires on the other to connect the System Manager TS II to the Power/Comm board or one of the Modular VAV/Zone Controllers. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter <63> for the System Manager Address.

8. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.

9. Before powering up the controllers, set each VAV/Zone Controller’s board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59. Set MiniLink PD’s address at 1.

Note: Only communications, not power, is transferred from the MiniLink Polling Device to the Power/Comm board via the modular cable. Both power and communications are transferred from the Power/Comm board to the VAV/Zone Controllers and the Modular System Manager.

Warning: Each Power/Comm board must have its own 24 VAC transformer for its power source. This transformer cannot be shared with any other board. Do not ground the transformer that is connected to the Power/Comm board. The transformer should be sized for the required VA by using the information found on pages 9-10 of this manual.

Loop Containing VCM-X E-BUS Controller with Non-Modular VAV/Zone Controllers, MiniLink PD, and CommLink 5

1. Connect the CommLink 5 to the MiniLink PD by using 2 conductor shielded cable to connect from the CommLink’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Network Loop”. Use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source. Be sure to maintain polarity on all boards. The Loop switch on the back of the CommLink 5 should be set to “Multiple”. Also connect a 24 VAC 6 VA minimum transformer to the MiniLink PD power terminal using 18 gauge minimum, 2 wire cable.
2. Connect all controllers in a daisy chain format using 2 conductor shielded cable to connect from the controller’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Local Loop”. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for each VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller. Then wire from the VCM-X E-BUS Controller’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Local Loop”. From either the MiniLink PD connector marked “Local Loop” or the VCM-X E-BUS Controller’s 3 wire communications connector, wire to the first VAV/Zone Controller’s 3 wire communications terminal. Using 18 gauge minimum, 2 wire cable, connect all of the associated Non-Modular VAV/Zone Controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications.

3. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 6 VA minimum, transformer for each Non-Modular VAV/Zone Controller and wire from each transformer to its VAV/Zone Controller. WattMaster recommends you use a separate transformer for each VAV/Zone Controller as stated. As an alternative, it is allowable to have several Non-Modular VAV/Zone Controllers share one properly sized transformer (6 VA per VAV/Zone Controller). Warning: Polarity must be observed on all of the VAV/Zone Controllers or damage to the controllers will result. Use 18 gauge minimum, 2 wire cable for all power wiring and be sure to maintain polarity on all boards.

4. The Modular System Manager can connect to any VAV/Zone Controller or to the VCM-X E-BUS Controller. Use the supplied pigtail cable which has a modular connector for connection to the back of the Modular System Manager and wire to any controller on the communications local loop with communication wire terminals. A separate transformer is required for the Modular System Manager. Connect the 2 power wires from the pigtail connector to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter <63> for the System Manager Address.

5. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. Since you are using Modular VAV/Zone Controllers, you can use a modular pigtail connector that has a modular connector on one end and stripped wires on the other to connect the System Manager TS II to the Power/Comm board or one of the Modular VAV/Zone Controllers. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter <63> for the System Manager Address.

6. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.

7. Before powering up the controllers, set each VAV/Zone Controller’s board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59. Set MiniLink PD’s address at 1.

**Networked Multiple Loop Systems**

See Figures 10-11, pages 29-30 of this manual for detailed Networked Multiple Loop System wiring diagrams. Also see pages 9-10 for wire and transformer sizing information. You should review these diagrams before attempting connections or powering up the controller or interface devices.

**Local Loops containing VCM-X E-BUS Controllers with Modular VAV/Zone Controllers**

1. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller. Using 18 gauge minimum, 2 wire cable for power, install a separate 24 VAC, transformer sized for the required VA load for each Power/Comm board on the loop and wire from each transformer to its Power/Comm board. Observe polarity on all boards.

2. Using 2 conductor shielded cable, connect from the VCM-X E-BUS Controller’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Local Loop”. Use 18 gauge minimum wire for power and observe polarity on all boards.

3. Using a modular cable, connect from the MiniLink PD’S modular connector marked “Local Loop” to the Power/Comm board’s modular input connector.

4. Using modular cables, connect from the Power/Comm board’s modular output connectors to the VAV/Zone Controllers. The VAV/Zone Controllers connect together using modular cables from each VAV/Zone Controller to the next controller and/or to a Power/Comm board. A maximum of 16 VAV/Zone Controllers are allowed per Power/Comm board. If you have more than 16 VAV/Zone Controllers, you will need multiple Power/Comm boards. Each Power/Comm board must have its own 24 VAC transformer sized for the total number of VAV/Zone Controllers connected to it.
Networked Multiple Loop

5. Repeat the above steps for each local loop containing VCM-X E-BUS Controllers with VAV/Zone Controllers.

6. The Modular System Manager can connect to any VAV/Zone Controller on the entire system or directly to one of the Power/Comm board’s modular output connectors using modular cable. The Modular Service Tool will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controllers is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.

7. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. Since you are using Modular VAV/Zone Controllers, you can use a modular pigtail connector that has a modular connector on one end and stripped wires on the other to connect the System Manager TS II to the Power/Comm board or one of the Modular VAV/Zone Controllers. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire.

8. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.

9. Using 2 conductor shielded cable, connect from the CommLink 5’s 3 wire communications connector to one of the MiniLink PD’s 3 wire communications connector marked “Network Loop”. The Loop switch on the back of the CommLink 5 must be set to “Multiple”. The CommLink 5 only needs to be connected to one of the MiniLink PDs on the system.

10. Using a modular cable, connect from each MiniLink PD’s modular connector marked “Network Loop” to the next MiniLink PD’s “Network Loop” modular input connector using modular cable. Connect all the remaining MiniLink PD’s in the same manner using a daisy chain format.

11. Before powering up the controllers, set each VAV/Zone Controller’s board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59. Set MiniLink PD’s address from 1 to 60.

Warning: Each Power/Comm board must have its own 24 VAC transformer for its power source. This transformer cannot be shared with any other board. Do not ground the transformer that is connected to the Power/Comm board. The transformer should be sized for the required VA by using the information found on pages 9-10 of this manual.

Local Loops containing VCM-X E-BUS Controllers with Non-Modular VAV/Zone Controllers

1. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller.

2. Using 2 conductor shielded cable, connect from the VCM-X E-BUS Controller’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Local Loop”. Use 18 gauge minimum wire for power and observe polarity on all boards.

3. Using 2 conductor shielded cable, connect from the VCM-X E-BUS Controller’s 3 wire communications connector to the VAV/Zone Controllers. The VAV/Zone Controllers connect together using modular cables from each VAV/Zone Controller to the next controller and/or to a Power/Comm Board. A maximum of 16 VAV/Zone controllers are allowed per Power/Comm board. If you have more than 16 VAV/Zone controllers, you will need multiple Power/Comm boards. Each Power/Comm board must have its own 24 VAC transformer sized for the total number of VAV/Zone controllers connected to it.

4. Repeat the above steps for each local loop containing VCM-X E-BUS Controllers with VAV/Zone Controllers.

5. The Modular System Manager can connect to any VAV/Zone Controller on the entire system or directly to one of the Power/Comm board’s modular output connectors using modular cable. The Modular Service Tool will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controllers is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.

6. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide...
6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter <63> for the System Manager Address.

7. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.

8. Using 2 conductor shielded cable, connect from the CommLink 5’s 3 wire communications connector to one of the MiniLink PD’s 3 wire communications connector marked “Network Loop”. The Loop switch on the back of the CommLink 5 must be set to “Multiple”. The CommLink only needs to be connected to one of the MiniLink PDs on the system.

9. Using a modular cable, connect from each MiniLink PD’s modular connector marked “Network Loop” to the next MiniLink PD’s “Network Loop” modular input connector using modular cable. Connect all the remaining MiniLink PD’s in the same manner using a daisy chain format.

10. Before powering up the controllers, set each VAV/Zone Controller’s board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59. Set MiniLink PD’s address from 1 to 60.

Loops Containing VCM-X E-BUS Controllers without VAV/Zone Controllers

1. Connect all VCM-X E-BUS Controllers on the loop in a daisy chain format using 18 gauge minimum, 2 conductor shielded cable for communications. Install a separate 24 VAC, 8 VA minimum, transformer for each controller and wire to transformer using 18 gauge minimum, 2 wire cable for power. Observe polarity on all boards.

2. Connect 2 conductor shielded cable from one of the controller’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Local Loop”. Use 18 gauge wire for power and observe polarity on all boards.

3. Connect 2 wire shielded cable from the CommLink 5’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Network Loop”. The Loop switch on the back of the CommLink 5 must be set to “Multiple”. Use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source.

4. Only one MiniLink PD on the system should connect to the CommLink. Install a separate 24 VAC, 8 VA minimum, transformer for each MiniLink PD and wire to transformer using 18 gauge minimum, 2 wire cable for power. Observe polarity on all boards. Each MiniLink PD’s address switch should be set with a unique address between 1 and 60.

5. Using a modular cable, connect from the each MiniLink PD’s modular connector marked “Network Loop” to the next MiniLink PD’s “Network Loop” modular input connector using modular cable. Connect all the remaining MiniLink PD’s in the same manner using a daisy chain format.

6. The Modular Service Tool will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controllers is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.

7. The Modular System Manager is supplied with a 12 foot modular cable with a modular connector on one end and stripped wires on the other. If the Modular System Manager is to be mounted in remote location, run 18 gauge, 2 conductor shielded cable for communications from one controller’s 3 wire terminal connector to one of the MiniLink PD’s in the same manner using a daisy chain format. The Communications setting must be set to Lo Speed Network Mode.

8. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter <63> for the System Manager Address.

9. Address the VCM-X E-BUS Controllers from 1 to 59.
System Commissioning

Overview

The following information is a brief overview of the procedures required to commission a typical Orion System. Select the type of system that you have and follow the procedures listed for that system.

Stand Alone System

1. Be sure that the controller is set at address 1.
2. Apply power to the controller.
3. Verify diagnostics LED indicator for proper operation. See the technical guide for the specific controller in order to locate the diagnostic LED and controller start-up sequence.
4. Connect an operator’s interface device to the controller for programming the controller.

Interconnected System

1. Be sure that the controllers are addressed from 1 to 60.
2. Apply power to the controllers.
3. Verify diagnostics LED indicator for proper operation of all controllers. See the technical guide for the specific controller in order to locate the diagnostic LED and controller start-up sequence.
4. Connect an operator’s interface device to one of the controllers for programming all of the controllers.

Networked Systems

1. Address each MiniLink PD from 1 to 60.
2. On a loop of VCM-X E-BUS Controllers, address the controllers from 1 to 59.
3. On a VAV or Zoning system, address VAV/Zone Controllers from 1 to 58. Address the VCM-X E-BUS Controller at 59.
4. On a VAV or Zoning system, apply power in the following order:
   a. VCM-X E-BUS Controller
   b. MiniLink Polling Device
   c. CommLink 5
   d. Power/Comm boards
5. Verify diagnostics LED indicator for proper operation of all controllers. See the technical guide for the specific controller in order to locate the diagnostic LED and controller start-up sequence.
6. If a computer is used, connect it to the CommLink 5 to access all of the controllers on the entire system for programming.
7. If a computer is not used, and if a Modular System Manager is not already connected on the local loop, connect a Modular Service Tool or System Manager TS II to one of the controllers to perform programming of all controllers on the entire system.
System Configurations
Typical Stand Alone System

Either a Modular System Manager SD, System Manager TS II, Modular Service Tool SD or PC with Prism 2 Software Installed can be used to program and configure the Orion System. For computer connection information, see the Computer and Remote Connection Section of this manual.

For Stand Alone Applications:
Both Jumpers must be ON.

Connect Mini DIN ends to female connectors on Modular Service Tool and VCM-X Controller.

Typical terminal blocks. All wiring to be T, T, SHLD (G), H to SHLD (G), & R to R.

Figure 3: Stand Alone System Wiring
Figure 4: Interconnected System Wiring
Networked Single Loop System

Figure 5: Networked Single Loop System With CommLink Only Wiring
Figure 6: Networked Single Loop System With MiniLink PD And Modular VAV/Zone Controllers Wiring

Networked Single Loop System

Typical Single Loop Networked System

With MiniLink Polling Device & Modular VAV/Zone Controllers

Note: Enter A Modular System Manager SD, System Address DIP Switches, Power/Comm Board Serial #, And Remote Terminals As Required To Program And Configure The System. See The VAV/Zone Controller Wiring Diagram For Power/Comm Board Transformer Sizing And Circuit Design Information.

Figure 6: Networked Single Loop System With MiniLink PD And Modular VAV/Zone Controllers Wiring

VCM-X Component & Systems Wiring 25
Figure 7: Networked Single Loop System With MiniLink PD And Non Modular VAV/Zone Controllers Wiring
Figure 8: Networked Single Loop System With CommLink & MiniLink PD - Modular VAV/Zone Controllers

VCM-X Component & Systems Wiring
Networked Single Loop System

Typical Single Loop Networked System With MiniLink

Polling Device, CommLink & Non-Modular VAV/Zone Controllers

485 LOOP Typical Terminal Blocks. All Wiring To Be T To T, SHLD (G) To SHLD (G) & R To R

Note:

System Manager TS II, Modular Service Tool SD Or PC With Prism 2 Software Installed Can Be Used To Program And Configure The Orion System. For Computer And Remote Connection Information, See The Computer Connection Section Of This Manual.

Unit Controller

Note:

Manager TS II Wiring, See Figure 3.

CommLink Must Be Set For Multiple Loop Operation When Used With A MiniLink Whether It Is A Single Loop System Or Not. If it Doesn't Have A MiniLink Set It To Single Loop.

White (T)

DRAIN WIRE (SHLD)

Connect To Modular I/O Connectors Located On Back Of The System Manager

Black (R)

RED (24 VAC)

TB1

24 VAC

TB3

24 VAC

Black (R)

RED (24 VAC)

TB1

24 VAC

TB3

24 VAC

Note:

See Computer & Remote Connection Section Of This Manual For Optional Computer and Remote Connection Diagrams.

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P.I. VAV/ZONE PACKAGE

OE744-32-VAVZ

www.orioncontrols.com

P.I. VAV/ZONE PACKAGE

OE282

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P.I. VAV/ZONE PACKAGE

OE364-23-OR

Figure 9: Networked Single Loop System With CommLink & MLPD - Non-Modular VAV/Zone Controllers

VCM-X Component & Systems Wiring
Either a Modular System Manager SD, System Manager TS II, Modular Service Tool SD or PC with Prism 2 Software Installed can be used to program and configure the Orion System. For Computer & IP Module Connection information see the Computer Connection Section of this Manual.

Note:

For System Front View of CommLink 5 Manager TS II Wiring, see Figure 3.

Note:

OBSERVE POLARITY for Multiple Loop Operation

WARNING!

BE OBSERVED OR THE SYSTEM MUST BE SET UP TO THE VAV/ZONE CONTROLLERS.
Networked Multiple Loop System Connections & Wiring

Typ. Multiple Loop Networked System With Non-Modular VAV/Zone Controllers

- Wiring & Connection Diagram

Note:
- Either A Modular System Manager SD, Modular Service Tool SD Or PC With Prism 2 Software Installed Can Be Used To Program And Configure The Orion System. For Computer & IP Module Connection Information See The Computer Connection Section Of This Manual.
- Typical Terminal Blocks. All Wiring To Be T-To T, SHLD (G) To SHLD (G) & R To R Power Pack

Figure 11: Networked Multiple Loop System Wiring With Non Modular VAV/Zone Controllers
VCM-X E-BUS Controller Wiring
All Comm Loop Wiring Is Straight Thru
T to T, R to R & SHLD to SHLD

Note:
All Relay Outputs Are Normally Open
And Rated For 24 VAC Power Only.
1 Amp Maximum Load.

Relay Output Contacts
R2 Through R5 May Be User-Configured For The Following:
1 - Heating Stages
2 - Cooling Stages
3 - Warm-up Mode Command (VAV Boxes)
4 - Reversing Valve (Air To Air Heat Pumps)
5 - Reheat Control (Dehumidification)
6 - Exhaust Fan Interlock
7 - Preheater For Low Ambient Protection
8 - Alarm
9 - Override
10 - Occupied
11 - OA Damper
12 - Heat Wheel
13 - Emergency Heat
Note: A Total Of 20 Relays Are Available By Adding Relay Expansion Modules. All Expansion Module Relay Outputs Are User Configurable As Listed Above.

RS-485 COMMUNICATION LOOP. WIRE “R” TO “R”, “T” TO “T” “SHLD” TO “SHLD”

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

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

Figure 12: OE332-23E-VCM-X-MOD - VCM-X E-BUS Controller Wiring
Figure 13: VCM-X E-BUS Controller Addressing

Note: The Power To The Controller Must Be Removed And Reconnected After Changing The Address Switch Settings In Order For Any Changes To Take Effect.

Caution: Disconnect All Communication Loop Wiring From The Controller Before Removing Power From The Controller. Reconnect Power And Then Reconnect Communication Loop Wiring.

This Switch Should Be In The OFF Position As Shown

Address Switch Shown Is Set For Address 1
Address Switch Shown Is Set For Address 13

The Address For Each Controller Must Be Unique To The Other Controllers On The Local Loop And Be Between 1 and 59

Note:
The Power To The Controller Must Be Removed And Reconnected After Changing The Address Switch Settings In Order For Any Changes To Take Effect.

Caution:
Disconnect All Communication Loop Wiring From The Controller Before Removing Power From The Controller. Reconnect Power And Then Reconnect Communication Loop Wiring.

This Switch Should Be In The OFF Position As Shown

Address Switch Shown Is Set For Address 1
Address Switch Shown Is Set For Address 13

The Address For Each Controller Must Be Unique To The Other Controllers On The Local Loop And Be Between 1 and 59

Note:
The Power To The Controller Must Be Removed And Reconnected After Changing The Address Switch Settings In Order For Any Changes To Take Effect.

Caution:
Disconnect All Communication Loop Wiring From The Controller Before Removing Power From The Controller. Reconnect Power And Then Reconnect Communication Loop Wiring.

This Switch Should Be In The OFF Position As Shown

Address Switch Shown Is Set For Address 1
Address Switch Shown Is Set For Address 13

The Address For Each Controller Must Be Unique To The Other Controllers On The Local Loop And Be Between 1 and 59

Address Switch Shown Is Set For Address 1
Address Switch Shown Is Set For Address 13

The Address For Each Controller Must Be Unique To The Other Controllers On The Local Loop And Be Between 1 and 59
Note: When Only The Digital Room Sensor Is Used, It Connects Directly To The VCM-X E-BUS Controller Using A TSDRSC Cable Of The Appropriate Length. The Maximum Length Allowed Is 160 Feet. See Figure 19 For Connection When The Space CO Sensor Is Also Used.

Note: In This Configuration, Set The CO₂ Sensor To Address 1.

Note: When a Digital Room Sensor Is Used In Combination With The CO₂ Sensor, The CO₂ Sensor Always Connects To The VCM-X E-BUS Controller First Using a TSDRSC Cable Of The Required Length. The Digital Room Sensor Then Connects To The CO₂ Sensor With Another TSDRSC Cable. Mount Sensor(s) At Least 5 Feet Above Floor. See The CO₂ Sensor Technical Guide For Further Wiring Details.
Note:
1.) The CO₂ Sensor Always Connects To The VCM-X E-BUS Controller Using A TSDRSC Cable Of The Required Length. If Also Using a Digital Room Sensor, Connect the Digital Room Sensor to the CO₂ Sensor Using Another TSDRSC Cable Of The Required Length. The Total Length Of Cable For All Sensor Cables Combined Cannot Exceed 160 Feet.
2.) In This Configuration, Set The CO₂ Sensor To Address 1.
**VCM-X E-BUS Controller Wiring**

**Space Temperature Sensor & Remote Supply Air Reset Wiring**

---

**Note:**
Either The Slide Offset Option For The Space Temperature Sensor Or The Remote Supply Air Temperature Reset Signal Option (By Others) May Be Connected To An AI7 On The VCM-X E-BUS Controller. Only One Option Is Allowed, Not Both.

![Diagram of OE210, OE211, OE212, OE213 Space Temperature Sensor Wiring](Diagram)

**Figure 17:** OE210, OE211, OE212, OE213 Space Temperature Sensor Wiring

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**Remote Supply Air Temperature Reset Signal (By Others)**

![Diagram of Remote Supply Air Reset Wiring](Diagram)

**Figure 18:** Remote Supply Air Reset Wiring
Figure 19: OE231 Supply Air Temperature Sensor & OE231 Return Air Temperature Sensor Wiring

Be sure the jumper is set for THERM on AI2 & AI3 for supply & return air temperature sensors when used.

AI1
AI1 SET
AI2
AI2 SET
AI3
AI3 SET
AI4
AI4 SET
AI5
AI5 SET
AI7
AI7 SET
GND
GND

Figure 20: OE250 Outdoor Air Temperature Wiring

Be sure jumper is set for THERM on AI4 for outdoor air temperature sensor.

AI4
GND

For MUA applications with a heat wheel, mount sensor downstream of the heat wheel.

Mount sensor outdoors in shaded protected area & in upright position as shown.

Make splice connections inside sensor enclosure as shown. Seal all conduit fittings with silicone sealant.
Figure 21: Economizer Damper Actuator Wiring

NOTE: For Economizer Actuator Feedback Signal, See AI3 Wiring For The VCM-X Expansion Module.
**VCM-X E-BUS Controller Wiring**

**Supply Fan VFD & Bypass Damper Actuator**

**Caution:**
The VFD Unit Must Be Configured For 0-10 VDC Input.
The Input Resistance At The VFD Must Not Be Less Than 1000 Ohms When Measured At The VFD Terminals With All Input Wires Removed.

**Note:**
Wire To The VFD Using 18 GA Minimum 2 Conductor Twisted Pair With Shield Cable. Wire Shield To GND As Shown.

**Note:**
Either The Supply Fan VFD Or The Bypass Damper Actuator May Be Connected To AO2 On The VCM-X E-BUS Controller. Only One Option Is Allowed, Not Both.

**VCM-X E-BUS Controller Wiring**

**Figure 22: Supply Fan VFD & Bypass Damper Actuator Wiring**
VCM-X Expansion, 4 Binary Input & 12-Relay Expansion Module Wiring
**VCM-X Expansion Module Wiring**

**Input Wiring**

1. **Suction Pressure Transducer**
   - Connect PR OUT To AI5 & GND To GND On VCM-X Controller When Either Suction Pressure Transducer Is Used

2. **Building Pressure Transducer**
   - Connect Pressure Transducer Directly To VCM-X Expansion Module As Shown.

3. **Economizer Damper Actuator (Belt-type Actuator Shown)**
   - See Economizer Actuator Wiring: AO1 For VCM-X Controller

4. **Outdoor Air Humidity Sensor**
   - Connect PR OUT To GND TO GND On VCM-X Controller When Either Suction Pressure Transducer Is Used

5. **Indoor Air Humidity Sensor**
   - Connect PR OUT To GND TO GND On VCM-X Controller When Either Suction Pressure Transducer Is Used

**WARNING!!**

Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

**Figure 23: OE333-23-EM - VCM-X Expansion Module Input Wiring**
Output Wiring

**WARNING!!**
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

1. If Unit Has Dehumidification Option And Copeland Digital Compressor Is Used, Wire Suction Pressure Transducer To Copeland Digital Compressor As Shown.
2. The Modulating Cooling Output Voltage Must Be Configured For 1.5-5 VDC Operation When You Are Setting Up The VCM-X Controller Operating Parameters For The Copeland Digital Compressor.

**NOTE:**
- Modular Cable Connects To Next Expansion Board (When Used)
- Modular Cable Connects To VCM-X E-BUS Controller
- Suction Pressure Transducer
- Copeland Digital Compressor Wiring Detail
- Damper Actuator Wiring Shown, Consult Factory For Other Manufacturer Wiring Instructions

**Figure 24: OE333-23-EM - VCM-X Expansion Module Output Wiring**

**Parameters.**

- Setting Up The VCM-X Outputs Must Also Be Voltages. These Voltage Voltages. The Configurable For These Output Voltage Is User Modulating Cooling Accepting Either A 0-10 VDC, 2-10 VDC Or 1.5-5.5 VDC Input. The Modulating Cooling Output Voltage Is User-Configurable For These Voltages. The Modulating Heating Devices Used Must Be Capable Of Accepting Either A 0-10 VDC, 2-10 VDC Or 1.5-5.5 VDC Input. The Modulating Heating Output Voltage Is User-Configurable For These Voltages. These Voltage Outputs Must Also Be Configured When You Are Setting Up The VCM-X Controller(s) Operating Parameters.

- Each Modulating Heating Or Cooling Device Used On The VCM-X Controller Must Have (1) Relay Output Configured For Each Device Used. In Order To Enable The Modulating Heating And/OR Cooling Device’s Sequence. This Relay Output May Be Configured When Setting Up The VCM-X Controller Operating Parameters.
Suction Pressure Transducer Without Digital Compressor

10 VA Minimum Power Required For VCM-X Expansion Module

24 VAC

GND

Connect PR OUT To AI5 & GND To GND On VCM-X Controller When The Suction Pressure Transducer Is Used

Note:
1.) If Unit Has Dehumidification Option And Copeland Digital Compressor Is Not Used, Wire Suction Pressure Transducer Directly To VCM-X Expansion Module As Shown.

Suction Line To Prevent Refrigerant Oil Be Located In A Vertical Portion Of The Suction Pressure Transducer Should Be Located In A Vertical Portion Of The Suction Line To Prevent Refrigerant Oil From Accumulating In The Sensor.

Note:
1.) If Unit Has Dehumidification Option And Copeland Digital Compressor Is Used, Wire Suction Pressure Transducer To Copeland Controller As Shown On Following Page.

2.) AO3 Output Voltage Must Be Configured For 1.5 - 5 VDC Operation When You Are Setting Up The VCM-X Controller Operating Parameters For A Copeland Digital Compressor.

WARNING!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.
Suction Pressure Transducer With Digital Compressor

WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-
24VAC. Failure to observe polarity will result in damage to one or more of the
boards. Expansion Modules must be wired in such a way that the expansion
modules and the controller are always powered together. Loss of power to
the expansion module will cause the controller to become inoperative until
power is restored to the expansion module.

10 VA Minimum Power Required For
VCM-X Expansion Module

24 VAC

Connect P6 To A15
& P5 To GND On
VCM Controller
When The Suction
Pressure
Transducer Is
Used

Note:
1. If Unit Has Dehumidification Option And Copeland
Digital Compressor Is Used, Wire Suction Pressure
Transducer To
Copeland Controller As Shown.
2. Modulating Cooling Output Voltage Must Be
Configured For
1.5 - 5 VDC Operation When You Are Setting Up The
VCM-X Controller Operating Parameters For A Copeland
Digital Compressor.

Caution:
1) The Schraeder Port Used For Installation
Of The Suction Pressure Transducer Should
Be Located In A Vertical Portion Of The
Suction Line To Prevent Refrigerant Oil From
Accumulating In The Sensor.

Note:
1) If Unit Has Dehumidification Option And
Copeland Digital Compressor Is Not Used,
Wire Suction Pressure Transducer Directly
To VCM-X Expansion Module As Shown On
Previous Page.
WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

WARNING!

24 VAC

10 VA Minimum Power Required For VCM-X Expansion Module

EXPANSION Module Binary Inputs

Figure 27: VCM-X Expansion Module Binary Inputs Wiring

VCM-X Expansion Module

BI1
BI2
BI3
BI4
BI5
BI6
BI7
BI8

Emergency Shutdown - N.C. Contact
Dirty Filter - N.O. Contact
Proof Of Flow - N.O. Contact
Remote Forced Occupied - N.O. Contact
Remote Forced Heating - N.O. Contact
Remote Forced Cooling - N.O. Contact
Hood On - N.O. Contact
Remote Forced Dehumidification

N.O. Contact

Remote Forced Dehumidification - N.O. Contact
Remote Forcément Heated - N.O. Contact
Remote Forcément Occupied - N.O. Contact
Remote Forced Cooling - N.O. Contact

RATING IS 1 AMP

MAX @ 24 VAC

NOTE:
ALL BINARY INPUTS MUST BE 24 VAC ONLY.

Figure 27: VCM-X Expansion Module Binary Inputs Wiring

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VCM-X Component & Systems Wiring
WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

5 VA Minimum Power Required For 4 Binary Input Expansion Module

OE356-00-BI 4 Binary Input Expansion Module

Figure 28: OE356-00-BI 4 Binary Input Expansion Module Wiring
Figure 29: OE265-13 - Outdoor Air Humidity Sensor Wiring

WARNING!!

Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.
WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

1 of 1

Figure 30: OE265-11 - Indoor Wall Mounted Humidity Sensor Wiring

VCM-X Component & Systems Wiring

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Figure 31: OE265-14 - Indoor Return Air Humidity Sensor Wiring

WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

VCM-X Expansion Module Wiring

RA Humidity Sensor

Jumper Must Be Set as Shown For Normal Operation Of Sensor
1, 2, 5 & 6 Are Off
3 Is On

Jumpers Must Be Set as Shown For Correct 0-5 VDC Operation
1 & 3 Are Off
2 & 4 Are On

10 VA Minimum Power Required For VCM-X Expansion Module

24 VAC
GND

GND

Modular Cable Connect To VCM-X E-BUS Controller
Modular Cable Connect To Next Expansion Board (When Used)

Figure 31: OE265-14 - Indoor Return Air Humidity Sensor Wiring
Title 24 Economizer Actuator Feedback Wiring

WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

Economizer Damper Actuator (Belimo Actuator Shown)

Belimo Actuator Wiring Shown. Consult Factory For Other Manufacturer Wiring Instructions

NOTE: For Economizer Actuator Wiring. See AO1 Wiring For The VCM-X Controller.

Jumper Must Be Set To 0-10V As Shown

VCM-X Expansion Module Wiring

Figure 32: Title 24 Economizer Actuator Feedback Wiring

VCM-X Component & Systems Wiring
WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

10 VA Minimum Power Required For VCM-X Expansion Module

Note: Both Types Of Building Pressure Control Devices Are Shown Below. Only One Type Of Building Pressure Control Device (Not Both) May Be Used On Each HVAC Unit.

Wiring When Using Damper Actuator For Building Pressure Control
Building Pressure Control Damper Actuator
(By Others - Belimo Actuator Shown)

Wiring When Using Exhaust Fan VFD For Building Pressure Control

Caution: The VFD Unit Must Be Configured For 0-10VDC Input. The Input Resistance At The VFD Must Not Be Less Than 1000 Ohms When Measured At The VFD Terminals With All Input Wires Removed.

Note: Wire To The VFD Using 18 GA Minimum 2 Conductor Twisted Pair With Shield Cable. Wire Shield To GND As Shown.

Figure 33: OE258-01 - Building Pressure Sensor & Actuator & VFD Wiring
WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

WARNING!
OBSERVE JUMPER SETTINGS
GND
PR OUT
Provided above you are using in the relay outputs. Description of that you write the relay 2 = relay 4 = relay 1 = relay 3 =.

Note:
1.) The modulating heating device used on the VCM-X controller must have (1) relay output configured for it in order to enable the modulating heating device’s sequence. This relay output must be configured when setting up the VCM-X controller operating parameters. The modulating heating output’s voltage can also be configured for either 0 to 10 VDC or 2 to 10 VDC in the configuration menu.

![Diagram of VCM-X Expansion Module Wiring](image)

VCM-X Expansion Module Wiring

Figure 34: Modulating Heating Device Wiring

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**VCM-X Component & Systems Wiring**

Page 53
WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

Note:
1.) The Modulating Cooling Device Used Must Be Capable Of Accepting Either A 0-10 VDC, 2-10 VDC, Or 1.5-5.0 VDC Input. The Modulating Cooling Output Voltage Is User-Configurable For These Voltages. This Voltage Output Must Be Configured When You Are Setting Up The VCM-X Controller(s) Operating Parameters.

2.) The Modulating Cooling Device Used On The VCM-X Controller Must Have (1) Relay Output Configured In Order To Enable The Modulating Cooling Device's Sequence. This Relay Output Must Be Configured When Setting Up The VCM-X Controller Operating Parameters.

Figure 35: Modulating Cooling Device Wiring
WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

Figure 36: Return Air Bypass Wiring

VCM-X Expansion Module Wiring

Return Air Bypass

Belimo Actuator Wiring Shown. Consult Factory For Other Manufacturer Wiring Instructions.

Damper Actuator (0-10 VDC)

Return Air Bypass Damper Actuator (0-10 VDC)

VCM-X Expansion Module Wiring

Return Air Bypass

Belimo Actuator Wiring Shown. Consult Factory For Other Manufacturer Wiring Instructions.

Damper Actuator (0-10 VDC)

Return Air Bypass Damper Actuator (0-10 VDC)
WARNING!!
Observe Polarities! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarities will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

15 VA Minimum Power Required For 12 Relay Expansion Module

Set Jumper As Shown Below When Only The 12 Relay Expansion Module Is Used

Set Jumper As Shown Above When Both The 12 Relay & VCM-X Expansion Module Are Used

Relay Output Contacts R1 Thru R12 May Be User-Configured For The Following:
1 - Heating Stages
2 - Cooling Stages
3 - Warm-up Mode Command (VAV Boxes)
4 - Reversing Valve (Heat Pumps)
5 - Reheat Control (Dehumidification)
6 - Exhaust Fan Interlock
7 - Preheater For Low Ambient Protection
8 - Alarm
9 - Override
10 - Occupied
11 - OA Damper
12 - Heat Wheel
13 - Emergency Heat

Note: A Total Of 20 Relays Are Available By Adding Relay Expansion Modules. All Expansion Module Relay Outputs Are User-Configurable As Listed Above.

Note: All Relay Outputs Are Normally Open And Rated For 24 VAC Power Only. 1 Amp Maximum Load.

Figure 37: OE358-23-12R - 12 Relay Expansion Module Wiring
Modular & Non-Modular VAV/Zone Controller Diagrams
OE742-31 & OE744-31 VAV/Zone Controller Wiring Details

OE210-02, OE211-02, OE212-02 Or OE213-02 Modular Room Sensor Display

OE217-00 / OE217-01 Digital Room Sensor

Wiring When Using A Modular Sensor
OE210-02, OE211-02, OE212-02 Or OE213-02 Modular Room Sensor

FMRSC Cable

TSDRSC Or FMRSC Cable As Required. Select Cable Depending On Sensor(s) Used. See Notes Above For Details

Optional - Supply Air Temperature Sensor. Only Required When The Orion VCM-X Controller Is Not Installed On The HVAC Unit Connected To The Terminal Units. Locate In Ductwork Downstream Of The Terminal Unit

Power/Comm Cable To Next VAV/Zone Controller Actuator Package, System Manager Or Power/Comm Distribution Board

Power/Comm Cable From Previous VAV/Zone Controller Actuator Package, System Manager Or Power/Comm Distribution Board

Note: The Total Length Of Cable Cannot Exceed 160 Feet.

OE325-01 Fan & Reheat Expansion Module
(See Reheat Board Wiring For Detailed Wiring Connections)

This Expansion Module Is Only Required For Single Duct Terminal Units With Reheat And All Fan Terminal Units

Connect FRP Tubing (By Others) To Terminal Unit Air Flow Pickup Tube Hi & Lo Ports (P.I. VAV/Zone Controller Packages Only)

Modular Expansion Cable Supplied With OE325-01 Expansion Module

Connector Not Used With This Product

OE217-00 / OE217-01 Digital Room Sensor

Damper Actuator

Damper Actuator Cable

Figure 39: OE742-31 & OE744-31 - Modular Zone Controller Actuator Package - P.I. & P.D. Wiring

Job Name

FILENAME

Date: 01/16/13

Description:

Page

OE742-31 & OE744-31 VAV/Zone Controller

Actuator Package Wiring Details
Modular & Non-Modular VAV/Zone Controller Wiring

Non-Modular VAV/Zone Controller Actuator Package Wiring

Figure 40: OE742-32 & OE744-32 - Non-Modular Zone Controller Actuator Package - P.I. & P.D. Wiring

24 VAC Transformer. Size As Required For Number Of Controllers Connected. Each VAV/Zone Controller Actuator Package Requires 6 VA Minimum.
Expansion Module Wiring

WattMaster Part # BK000047
Snaptrack Supplied by WattMaster
Mounted by Others. Remove Control Board from Snaptrack & Mount Snaptrack on Box

WattMaster Part # OE325-01 Expansion Module
w/ Modular Cable Supplied by WattMaster
Mounted by Others

Typical Wiring for Single Duct Terminal

Note: 3 Stage Heating is attained by sizing all 3 heating elements for equal KW output. Each element should be sized for 1/3 of the total KW output required. To achieve 3 stage heating, the system would be configured to energize controller C1 for first stage heat. For 2nd stage heat the system would be configured to de-energize controller C1 and energize controller C2 & C3. For 3rd stage heat the system would be configured to leave controller C2 & C3 energized and also energize controller C1.

Typical Wiring for Fan Terminal Unit

Note: 3 Stage Heating is attained by sizing all 3 heating elements for equal KW output. Each element should be sized for 1/3 of the total KW output required. To achieve 3 stage heating, the system would be configured to energize controller C1 for first stage heat. For 2nd stage heat the system would be configured to de-energize controller C1 and energize controller C2 & C3. For 3rd stage heat the system would be configured to leave controller C2 & C3 energized and also energize controller C1.

Typical Wiring for Fan Terminal With Electric Heat

Note: 3 Stage Heating is attained by sizing all 3 heating elements for equal KW output. Each element should be sized for 1/3 of the total KW output required. To achieve 3 stage heating, the system would be configured to energize controller C1 for first stage heat. For 2nd stage heat the system would be configured to de-energize controller C1 and energize controller C2 & C3. For 3rd stage heat the system would be configured to leave controller C2 & C3 energized and also energize controller C1.

Figure 41: OE325-01 Expansion Module Wiring
**Figure 42: OE325-01 Expansion Module Wiring**

**Description:**
- **Typical Wiring For Single Duct Terminal With Modulating Hot Water Heat**
- **Typical Wiring For Fan Terminal With Modulating Hot Water Heat**

**Components:**
- 0-10 VDC Modulating Hot Water Valve Supplied & Wired By Others
- 0-10 VDC Signal
- 24VAC Fan Relay
- 24 VAC Transformer Supplied & Wired by Others. 1 Amp Max. Load.
- WattMaster Part #OE325-01 Relay Expansion Board
- 24VAC Fan Relay
- 24VAC Transformer Supplied & Wired by Others. Size For Required Fan Relay Load.

**Instructions:**
- Connect To Zone/VAV Controller With Modular Cable
- Remove Control Board from Snaptrack & Mount Snaptrack on Box

---

**Table:**

<table>
<thead>
<tr>
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<td>08/15/14</td>
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<td>B. Crews</td>
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<td><strong>DESCRIPTION:</strong></td>
<td>VAV/Zone Controller Actuator Packages OE325-01 Expansion Module Wiring Details</td>
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</table>
**Modular & Non-Modular VAV/Zone Controller Wiring**

**Expansion Module Wiring**

Figure 43: OE325-01 Expansion Module Wiring

- **24 VAC Transformer** Supplied & Wired by Others. Size For Required HW Valve Load.
- **24 VAC 2 Position HW Valve** Supplied & Wired by Others. 1 Amp Max Load.

---

**Typical Wiring for Single Duct Terminal With 2 Position HW Valve**

- **Connect To VAV/Zone Controller Using Modular Cable Supplied By WattMaster**
- **WattMaster Part # OE325-01 Expansion Module w/ Modular Cable Supplied by WattMaster Mounted by Others**

---

**Typical Wiring for Fan Terminal With 2 Position HW Valve**

- **Connect To VAV/Zone Controller Using Modular Cable Supplied By WattMaster**
- **WattMaster Part # BK030047 Snaprack Supplied by WattMaster Mounted by Others. Remove Control Board from Snaprack & Mount Snaprack on Box**
- **WattMaster Part # OE325-01 Expansion Module w/ Modular Cable Supplied by WattMaster Mounted by Others**
### Modular & Non-Modular VAV/Zone Controller Wiring

#### Expansion Module Wiring

**Typical Wiring For Single Duct Terminal With SCR Electric Heat**

- **Wiring Details**
  - OE325-01 Expansion Module
  - With Modular Cable
  - Supplied by WattMaster
  - Mounted by Others

**WattMaster Part # OE325-01**

**Expansion Module**

- **WattMaster Part # BK000047**
  - Snaptrack Supplied by WattMaster
  - Mounted by Others. Remove Control Board from Snaptrack & Mount Snaptrack on Box

**Typical Wiring For Fan Terminal With SCR Electric Heat**

- **Wiring Details**
  - 24 VAC Transformer Supplied & Wired by Others. Size for Required Fan Relay Load.
  - 24 VAC Fan Relay Supplied & Wired By Others. 1 Amp Max. Load.

**WattMaster Part # BK000047**

**Snaptrack Supplied by WattMaster**

- **Mounted by Others. Remove Control Board from Snaptrack & Mount Snaptrack on Box**

---

**Figure 44: OE325-01 Expansion Module Wiring**

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**Filename**: ZCAP-Exp-Mod-Wire-1A.CDR

**Date**: 01/16/13

**Drawn By**: B. Crews

**Page**: 4 of 6

**Description**: VAV/Zone Controller Actuator Packages

**Orion Control Systems**

**VCM-X Component & Systems Wiring**

65
Typical Wiring For
Single Duct Terminal
With Auxiliary
Electric Heat

WattMaster Part # OE325-01
Expansion Module
w/ Modular Cable
Supplied by WattMaster
Mounted by Others

WattMaster Part # BK000047
Snaptrack Supplied by WattMaster
Mounted by Others. Remove Control
Board from Snaptrack & Mount
Snaptrack on Box

Connect To VAV/Zone Controller
Using Modular Cable Supplied
By WattMaster

24 VAC Transformer Supplied
& Wired by Others. Size For
Required Auxiliary Electric Heat
Contacts Load.

Auxiliary Electric Heat Contactor

24 VAC Auxiliary Electric Heat
Contactor Supplied & Wired
By Others. 1 Amp Max. Load.

Typical Wiring For
Fan Terminal With
Auxiliary Electric Heat

WattMaster Part # OE325-01
Expansion Module
w/ Modular Cable
Supplied by WattMaster
Mounted by Others

WattMaster Part # BK000047
Snaptrack Supplied by WattMaster
Mounted by Others. Remove Control
Board from Snaptrack & Mount
Snaptrack on Box

Connect To VAV/Zone Controller
Using Modular Cable Supplied
By WattMaster

24 VAC Transformer Supplied
& Wired by Others. Size For
Required Fan Relay & Auxiliary
Electric Heat Contacts Load.

Fan Relay

24 VAC Fan Relay & Auxiliary
Electric Heat Contactor
Supplied & Wired By Others. 1
Amp Max. Load.

Typical Wiring For
Fan Terminal With
Auxiliary Electric Heat

Figure 45: OE325-01 Expansion Module Wiring
Figure 46: OE325-01 Expansion Module Wiring

- Connect To VAV/Zone Controller Using Modular Cable Supplied By WattMaster
- WattMaster Part # BK000047 Snaptrack Supplied by WattMaster Mounted by Others. Remove Control Board from Snaptrack & Mount Snaptrack on Box
- Typical Wiring For Single Duct Terminal With Two Position Auxiliary Hot Water Heat
- WattMaster Part # OE325-01 Relay Expansion Board w/ Modular Cable Supplied by WattMaster Mounted by Others
- 24 VAC 2 Position Auxiliary HW Valve Supplied & Wired By Others. 1 Amp Max. Load

- Connect To VAV/Zone Controller Using Modular Cable Supplied By WattMaster
- WattMaster Part # BK000047 Snaptrack Supplied by WattMaster Mounted by Others. Remove Control Board from Snaptrack & Mount Snaptrack on Box
- Typical Wiring For Fan Terminal With Two Position Auxiliary Hot Water Heat
- WattMaster Part # OE325-01 Relay Expansion Board w/ Modular Cable Supplied by WattMaster Mounted by Others
- 24 VAC 2 Position Auxiliary HW Valve Supplied & Wired By Others. 1 Amp Max. Load
Modular & Non-Modular VAV/Zone Controller Wiring

Slaved Zone Wiring

Figure 47: Slaved Zone Wiring
Communication Devices
Diagrams
Communication Devices

System Manager Stand-Alone Wiring

NOTE: If Desired A Power/Comm Board As Used With The Networked System Can Be Installed And Wired Instead Of Using The Pigtail Cable Wiring Shown Below. See The Networked System Wiring Diagram For Details.

NOTE: For Stand-Alone Installations (No CommLink or MiniLink), All TERM Jumpers Must Be ON. For All Applications With CommLink(s) or MiniLink(s), All Jumpers Must Be OFF.

Use Supplied Modular Cable With Stripped Ends For Connection To Terminal Block And Transformer

WHITE (T)
DRAIN WIRE (SHLD)
BLACK (R)
RED (24 VAC)
BROWN (GND)
GREEN (GND)

Class 2 Transformer Rated For 6 VA Minimum

Controller Board

Figure 48: OE392-12 Modular System Manager Stand-Alone Wiring
Notes:
1.) All wiring to be in accordance with local and national electrical codes and specifications.

2.) All modular power/comm cables are to be WattMaster part number PCC-xx or PCCE-xx cables.

System Manager Wiring Details For Using The Pigtail

---

Figure 49: OE392-12 Modular System Manager SD Cable Pigtail - Wiring Detail
Communication Devices

System Manager Networked Wiring

All Modular Power/Comm Cables Are To Be WattMaster Part Number PCC-xx Or PCCE-xx Cables.

Power/Comm Cables To Power/Comm Distribution Board, MiniLink Polling Device Or VAV/Zone Controllers On Local Loop.

NOTE: For Stand-Alone Installations (No CommLink or MiniLink), All TERM Jumpers Must Be ON. For All Applications With CommLink(s) Or MiniLink(s), All Jumpers Must Be OFF.

Figure 50: OE392-12 Modular System Manager SD Networked Wiring
The Modular Service Tool can be connected to a unit controller or VAV/Zone controller by plugging one end of the supplied cable into the Modular Service Tool DIN connector and the other end into the DIN connector on the controllers.

Be sure the Modular Service Tool is connected to the supplied power pack or has fresh batteries installed before attempting programming of the controller. Be sure the power is turned off on the Modular Service Tool before connecting the cable to the controller.

Figure 51: OE391-12 - Modular Service Tool SD Connections
System Manager TS II to VCM-X E-BUS Controller Wiring

Figure 52: OE392-10 System Manager TS II to VCM-X E-BUS Controller Wiring

Communication Devices

VCM-X Component & Systems Wiring
System Manager TS II to VAV/Zone Controller Wiring

Figure 53: OE392-10 System Manager TS II to VAV/Zone Controller Wiring

NOTE: Be sure all dip switches are off.

For stand-alone installations (no CommLink or MiniLink), both TERM jumpers must be ON. For all applications with CommLink(s) or MiniLink(s), both jumpers must be OFF.

VAV/Zone Controller Connections & Wiring

VCM-X Component & Systems Wiring
Communication Devices

CommLink 5 Connections & Wiring

**NOTE:** A CommLink is always required with a networked multiple loop system. It is used for alarm callout, remote computer connection, or direct computer connection to the system as desired. An IP module is only required if e-mail alarm notification or remote computer connection is required.

**WARNING:** If you are using the IP module with your CommLink, do not have your Ethernet connection and USB connection connected at the same time. This could cause unreliable communications.

When used with MiniLink, switch should be set to multiple.

**CommLink 5 Communications Interface**

- 24 VAC Power
- 18 Gauge 2 Conductor With Shield (Not Included)
  See Note 1
- Connect to controller as required by your specific system wiring instructions.
- USB Cable (Included), connect this cable to your computer USB port for direct connection to the CommLink 5.

**NOTES:**

1) For direct connection via USB, your computer must have an unused USB port available. Drivers for your USB port are provided on a CD supplied with the CommLink 5. Please follow the directions in the CommLink 5 technical guide to install and configure the USB drivers.

2) The CommLink 5 cannot communicate with the control system through its Ethernet port and USB port at the same time.

3) All wiring must conform to applicable federal, state & local electrical wiring codes.

**Optional Items**

Not required for CommLink-only installations.

- Optional - Prefabricated 10 ft. long CAT5 Ethernet cable (included with optional OE415-02 IP module kit). Connect to a 10/100 Base-T Ethernet router on your LAN. If a longer Ethernet cable is required, you will need to obtain (from others) and install an Ethernet cable of the required length for your installation.

- 120 to 24 VAC power pack (included) connect to 120/1/60 duplex receptacle (by others).

- If desired a 24 VAC transformer (not included) rated at 12 VA minimum may be used instead of the supplied power pack. Use 18 gauge minimum 2 conductor wire between the transformer & CommLink 5 terminals.

**WARNING!** If you are using the IP module with your CommLink, do not have your Ethernet connection and USB connection connected at the same time. This could cause unreliable communications.

Optional - Prefabricated ft. long CAT5 Ethernet cable (included with optional OE415-02 IP module kit). Connect to a 10/100 Base-T Ethernet router on your LAN. If a longer Ethernet cable is required, you will need to obtain (from others) and install an Ethernet cable of the required length for your installation.

If desired a 24 VAC transformer (not included) rated at 12 VA minimum may be used instead of the supplied power pack. Use 18 gauge minimum 2 conductor wire between the transformer & CommLink 5 terminals.

**Figure 54: OE361-13 CommLink 5 Computer Connection and Wiring**
Installing the OE415-02 IP Module into the CommLink 5

First Remove The Enclosure Screws That Hold The Top And Bottom Of The CommLink Enclosure Together. Remove The Top Half Of The Enclosure To Access The Circuit Board And IP Module Socket.


After Making Sure The IP Module Is Firmly Seated, Replace The CommLink Cover And Secure The Enclosure Halves Back Together With The Enclosure Screws That Were Previously Removed.

Follow The Instructions In This Guide For Installing The IP Module Software And Configuring The IP Module For Your Control System.

IP Module Installation Instructions:
First Remove The Enclosure Screws That Hold The Top And Bottom Of The CommLink Enclosure Together. Remove The Top Half Of The Enclosure To Access The Circuit Board And IP Module Socket.


After Making Sure The IP Module Is Firmly Seated, Replace The CommLink Cover And Secure The Enclosure Halves Back Together With The Enclosure Screws That Were Previously Removed.

Follow The Instructions In This Guide For Installing The IP Module Software And Configuring The IP Module For Your Control System.

Figure 55: OE415-02 IP Module Installation Instructions
Communication Devices

On-Site Computer Connections & Wiring

Optional Computer Connection Diagram

110 VAC to 24 VAC Power Pack (Supplied With CommLink 5)

Connect to MiniLink PD Network Terminals (When Used) Or Connect to VCM-X E-BUS Controller Communications Terminal

Type A USB Cable End

Type B USB Cable End

SHLD

T

R

Typical Terminal Blocks. All Wiring To Be T To T, SHLD (G) To SHLD (G) & R To R

485 LOOP

Connect Type A Cable End To USB Port On Desktop Or Laptop Personal Computer & Type B End To USB Port On CommLink 5.

USB Drivers Supplied With The CommLink 5 Must Be Installed On Your Computer Before The CommLink 5 Can Be Used

NOTE:

Set CommLink Internal Switch To "Multi" When MiniLink PD Is Used Otherwise Switch Must Be Set To "Single"

Optional Computer Connection Diagram

Figure 56: On-Site Computer Connection
Remote Job-Site Computer Connections & Wiring

Optional Computer Connection Diagram
Using IP-Module For Job-Site Location Connection

110 VAC To 24 VAC Power Pack (Supplied With CommLink IV)
Connect To MiniLink PD Network Terminals (When Used)
Otherwise Connect to VCM-X E-BUS Controller Communications Terminal

SHLD T R
Typical Terminal Blocks. All Wiring To Be T To T, SHLD (G) To SHLD(G) & R To R

485 LOOP

Optional Computer Connection Diagram
Using IP-Module For Job-Site Location Connection

FILENAME DESCRIPTION
O-VCMX-IP-Mod-Computer-1A.CDR VCM-X IP Module Job Site Computer Connections

DATE: 01/04/13

BY: Wiring & Connection Diagram

JOB NAME
1 of 1

Figure 57: Remote Job-Site Computer Connection
**USB-Link 2 Computer Connections & Wiring**

**Communication Devices**

---

**OPTIONAL USB-LINK 2 CONNECTION DIAGRAM**

**DESCRIPTION**

Use The PL-101905 Adapter To Plug Into A Terminal Socket And Connect The USB-Link On Boards That Don’t Have A Female Mini-DIN Plug Connection.

**NOTE:** This Only Allows Communications With The Board It Is Connected To.

**PL-101904**

**PL-101905**

**Mini-DIN Cable**

Use The Adapter To Plug In To A Terminal Socket And Connect The USB-Link On Boards That Don’t Have A Female Mini-DIN Plug Connection.

**NOTE:** This Only Allows Communications With The Board It Is Connected To.

**NOTE:** This Above Connection Is For All Controllers On The USB-Link 2 System.

---

**Computer Connections Using USB-Link 2**

**Figure 58:**

**USB-Link 2 Computer Connections & Wiring**

---

**SHLD**

**T**

**R**

**Computer (By Others) With Prism II Software Installed**

Notes:


---

**Line Voltage**

**VCM-X Unit Controller**

24 VAC (8 VA)

**WARNING**

**OBSERVE**

**POLARITY**
MiniLink Polling Device Wiring Using Modular Connectors

**Figure 59: OE364-22 MiniLink Polling Device Wiring Using Modular Connectors**

- **Controller Address Switch:**
  - Address Switch Shown Is Set For Address 1
  - Address Switch Shown Is Set For Address 13

- **Notes:**
  1. All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.
  2. All Modular Power/Comm Cables Are To Be WattMaster Part Number PCC-XX Or PCCE-XX Cables.
  3. Connection To The Power/Comm Board And/or Other MiniLink PDs Can Be Made By Using The Local Loop Modular Connector As Shown On Page 1 Or By Using 2 Conductor With Shield Communication Wires As Shown On Page 2. Connections To The HVAC Unit Controller Must Be Made By Using 2 Conductor With Shield Communication Wires Only.

- **Caution:**
  - Disconnect All Communication Loop Wiring From The MiniLink PD Before Removing Power From The MiniLink PD. Reconnect Power And Then Reconnect Communication Loop Wiring.
  - The Address For Each MiniLink PD Must Be Unique To The Other MiniLink PDs On The Network Loop And Be Between 1 and 60.
  - The Power To The MiniLink PD Must Be Removed And Reconnected After Changing The Address Switch Settings In Order For Any Changes To Take Effect.

- **Not Used:**
  - 24 VAC Transformer Rated For 6 VA Load Minimum
  - Not Used

- **Communication Devices:**
  - MiniLink Polling Device Wiring Using Power/Comm Cables
  - Wiring To Be Wired To T, SHLD (G) to SHLD (G) & R to R

- **Description:**
  - MiniLink Polling Device - Wiring Using Power/Comm Cables
  - All Communication Wiring Not Utilizing Modular Cable Assemblies Should Be Wired Using 18 Ga. Min. 2 Conductor Twisted Pair With Shield Belden #82760 Or Equivalent.
Communication Devices

MiniLink Polling Device Wiring Using Wire Terminals

Notes:
1.) All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.
2.) All Modular Power/Comm Cables Are To Be WattMaster Part Number PCC-XX Or PCCE-XX Cables.
3.) Connection To The Power/Comm Board And/OR Other MiniLink PDs Can Be Made By Using The Local Loop Modular Connector As Shown On Page 1 Or By Using 2 Conductor With Shield Communication Wires As Shown On Page 2. Connections To The HVAC Unit Controller Must Be Made By Using 2 Conductor With Shield Communication Wires Only.

Component Wiring Diagram

Figure 60: OE364-22 MiniLink Polling Device Wiring Using Wire Terminals
Communication Devices

Power/Comm Board Wiring For Local Loops

WARNING!
DO NOT GROUND THE 24V TRANSFORMER THAT IS TO BE USED WITH THE POWER/COMM BOARDS. GROUNDING OF THE TRANSFORMER WILL DAMAGE THE POWER/COMM BOARD AND ALL BOARDS CONNECTED TO IT. A SEPARATE TRANSFORMER MUST BE USED FOR EACH POWER/COMM BOARD. NO EXCEPTIONS. DO NOT CONNECT ANY OTHER DEVICES TO THE TRANSFORMER USED FOR THE POWER/COMM BOARD!

CAUTION!
No MiniLink PDs Can Be Connected To The Same Power/Comm Board(s) That Are Used To Supply Power And Communications For Modular VAV/Zone Controllers And System Manager On The Local Loop.

Note:
Diagram Shown Is For Wiring Of Power/Comm Board When Used For Connecting Local Loop Devices Such As Modular VAV/Zone Controllers, System Manager(s) and Other Power/Comm Boards. See Page 2 Of This Drawing For Wiring When Power/Comm Board Is Used For Connection Of MiniLink Polling Devices On The Network Loop.

Notes:
1.) All wiring to be in accordance with local and national electrical codes and specifications.
2.) All modular power/comm cables are to be WattMaster part number PCC-xx or PCCE-xx cables. All other communication wiring to be 2 conductor twisted pair with shield (Belden #82760 or equivalent).

Figure 61: OE365-01 Power/Comm Board Wiring When Used For Local Loop Devices

VCM-X Component & Systems Wiring
**Communication Devices**

**Power/Comm Board Wiring - When Used For Network Loop Devices**

**WARNING!**
DO NOT GROUND THE 24V TRANSFORMER THAT IS TO BE USED WITH THE POWER/COMM BOARDS. GROUNDING OF THE TRANSFORMER WILL DAMAGE THE POWER/COMM BOARD AND ALL BOARDS CONNECTED TO IT. A SEPARATE TRANSFORMER MUST BE USED FOR EACH POWER/COMM BOARD. NO EXCEPTIONS. DO NOT CONNECT ANY OTHER DEVICES TO THE TRANSFORMER USED FOR THE POWER/COMM BOARD!

**CAUTION!**
No Local Loop Devices (Modular VAV/Zone Controllers, System Manager(s) etc.) Can Be Connected To The Same Power/Comm Board(s) That Are Used To Supply Power And Communications For MinLink PDs On The Network Loop.

**Note:**
Diagram Shown Is For Wiring When Power/Comm Board Is Used For Connection Of MiniLink Polling Devices On The Network Loop. For Wiring Of Local Loop Devices Such As Modular VAV/Zone Controllers, System Manager(s) and Other Power/Comm Boards On The Local Loop See Page 1 Of This Drawing For Wiring.

**WARNING!**
DO NOT GROUND THE 24V TRANSFORMER THAT IS TO BE USED WITH THE POWER/COMM BOARDS. GROUNDING OF THE TRANSFORMER WILL DAMAGE THE POWER/COMM BOARD AND ALL BOARDS CONNECTED TO IT. A SEPARATE TRANSFORMER MUST BE USED FOR EACH POWER/COMM BOARD. NO EXCEPTIONS. DO NOT CONNECT ANY OTHER DEVICES TO THE TRANSFORMER USED FOR THE POWER/COMM BOARD!

**Use To Connect CommLink When This Is The First Power/Comm Board On The Network Loop. Otherwise No Connection Is Required. See Note 2.**

**CAUTION!**
No Local Loop Devices (Modular VAV/Zone Controllers, System Manager(s) etc.) Can Be Connected To The Same Power/Comm Board(s) That Are Used To Supply Power And Communications For MinLink PDs On The Network Loop.

**Note:**
Diagram Shown Is For Wiring When Power/Comm Board Is Used For Connection Of MiniLink Polling Devices On The Network Loop. For Wiring Of Local Loop Devices Such As Modular VAV/Zone Controllers, System Manager(s) and Other Power/Comm Boards On The Local Loop See Page 1 Of This Drawing For Wiring.

**WARNING!**
DO NOT GROUND THE 24V TRANSFORMER THAT IS TO BE USED WITH THE POWER/COMM BOARDS. GROUNDING OF THE TRANSFORMER WILL DAMAGE THE POWER/COMM BOARD AND ALL BOARDS CONNECTED TO IT. A SEPARATE TRANSFORMER MUST BE USED FOR EACH POWER/COMM BOARD. NO EXCEPTIONS. DO NOT CONNECT ANY OTHER DEVICES TO THE TRANSFORMER USED FOR THE POWER/COMM BOARD!

**Use To Connect CommLink When This Is The First Power/Comm Board On The Network Loop. Otherwise No Connection Is Required. See Note 2.**

**CAUTION!**
No Local Loop Devices (Modular VAV/Zone Controllers, System Manager(s) etc.) Can Be Connected To The Same Power/Comm Board(s) That Are Used To Supply Power And Communications For MinLink PDs On The Network Loop.

**Note:**
Diagram Shown Is For Wiring When Power/Comm Board Is Used For Connection Of MiniLink Polling Devices On The Network Loop. For Wiring Of Local Loop Devices Such As Modular VAV/Zone Controllers, System Manager(s) and Other Power/Comm Boards On The Local Loop See Page 1 Of This Drawing For Wiring.

**WARNING!**
DO NOT GROUND THE 24V TRANSFORMER THAT IS TO BE USED WITH THE POWER/COMM BOARDS. GROUNDING OF THE TRANSFORMER WILL DAMAGE THE POWER/COMM BOARD AND ALL BOARDS CONNECTED TO IT. A SEPARATE TRANSFORMER MUST BE USED FOR EACH POWER/COMM BOARD. NO EXCEPTIONS. DO NOT CONNECT ANY OTHER DEVICES TO THE TRANSFORMER USED FOR THE POWER/COMM BOARD!

**Use To Connect CommLink When This Is The First Power/Comm Board On The Network Loop. Otherwise No Connection Is Required. See Note 2.**

**CAUTION!**
No Local Loop Devices (Modular VAV/Zone Controllers, System Manager(s) etc.) Can Be Connected To The Same Power/Comm Board(s) That Are Used To Supply Power And Communications For MinLink PDs On The Network Loop.

**Note:**
Diagram Shown Is For Wiring When Power/Comm Board Is Used For Connection Of MiniLink Polling Devices On The Network Loop. For Wiring Of Local Loop Devices Such As Modular VAV/Zone Controllers, System Manager(s) and Other Power/Comm Boards On The Local Loop See Page 1 Of This Drawing For Wiring.

**WARNING!**
DO NOT GROUND THE 24V TRANSFORMER THAT IS TO BE USED WITH THE POWER/COMM BOARDS. GROUNDING OF THE TRANSFORMER WILL DAMAGE THE POWER/COMM BOARD AND ALL BOARDS CONNECTED TO IT. A SEPARATE TRANSFORMER MUST BE USED FOR EACH POWER/COMM BOARD. NO EXCEPTIONS. DO NOT CONNECT ANY OTHER DEVICES TO THE TRANSFORMER USED FOR THE POWER/COMM BOARD!

**Use To Connect CommLink When This Is The First Power/Comm Board On The Network Loop. Otherwise No Connection Is Required. See Note 2.**

**CAUTION!**
No Local Loop Devices (Modular VAV/Zone Controllers, System Manager(s) etc.) Can Be Connected To The Same Power/Comm Board(s) That Are Used To Supply Power And Communications For MinLink PDs On The Network Loop.

**Note:**
Diagram Shown Is For Wiring When Power/Comm Board Is Used For Connection Of MiniLink Polling Devices On The Network Loop. For Wiring Of Local Loop Devices Such As Modular VAV/Zone Controllers, System Manager(s) and Other Power/Comm Boards On The Local Loop See Page 1 Of This Drawing For Wiring.
Add-On Devices Diagrams
VCM-X Component & Systems Wiring

Add-On Devices

Lighting Panel Wiring For Standard Lighting Contactors

**Add-On Devices**

**Lighting Panel Wiring For Standard Lighting Contactors**

1. **24 VAC Must Be Connected So That All Ground Wires Remain Common.**
2. **All Wiring To Be In Accordance With Local And National Electrical Codes and Specifications.**
3. **All Communication Wiring To Be 18 Ga. Minimum, 2 Conductor Twisted Pair With Shield. Belden #82760 Or Equivalent.**
4. **It Is Recommended That All Controllers Address Switches Are Set Before Installation.**

---

**Figure 63: OE310-21-LP Lighting Panel Controller Wiring**

---

**Note:**
- All Circuit Board Contacts Are N.O.
- All Controllers Are Rated For 2 Amps @ 24VAC Pilot Duty Only
- Do Not Apply Any Voltage Greater Than 24VAC

---

**Caution:**
- If Lighting Contactor Coil Current Draw Is More Than 2 Amps And/OR Does Not Use A 24VAC Coil, A Pilot Duty Relay That Has A Current Draw Of Less Than 2 Amps @ 24VAC Must Be Used To Energize The Lighting Contactor. A Separate Transformer Rated For The Total Lighting Contactor(s) Or Pilot Relay Current Draw Must Always Be Used To Power The Circuit.
All Communication Loop Wiring Is Straight Through
T To T, R To R, SHLD To SHLD
Local Loop RS-485
9600 Baud

Mini DIN Connector For Connection Of Modular Service Tool
Jumpers - Typical

Analog Inputs AIN1 Thru AIN7 Can Be Used For 10kOhm Type III Thermistor, 0-5VDC Signal, 0-10 VDC Signal, 4-20mA Signal Or Dry Contact Closure Inputs. Jumpers Must Be Set Correctly For The Type Of Input You Require.

Analog Outputs AO1 & AO2 Provide (2) 0-10 VDC Outputs

Analog Input AIN5 Can Only Be Used For Connection Of A Static Pressure Transducer With Modular Connector

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

Connect 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

OE358-23-12R
12 Relay Output Expansion Module

24VAC Power For Relay Outputs
5 Relay Outputs Are Available On Board For On/Off Control Of Equipment. When Required 4 Additional Relay Outputs Are Available By Using The Optional OE357 4 Relay Output Expansion Board. See Below.

GND
24 VAC
24 VAC Transformer 8 VA Minimum


1.24 VAC Must Be Connected So That All Ground Wires Remain Common.
2. All Wiring To Be In Accordance With Local And National Electrical Codes and Specifications.
3. All Communication Wiring To Be 18 Ga, Minimum, 2 Conductor Twisted Pair With Shield, Belden #82760 Or Equivalent.
4. It is Recommended That All Controllers Address Switches Are Set Before Installation.

Figure 64: OE332-23-GPCX GPC-X Controller Wiring
Add-On Devices

GPC-X Controller - Address Switch Setting

**Note:**
The Power To The Controller Must Be Removed And Reconnected After Changing The Address Switch Settings In Order For Any Changes To Take Effect.

**Caution**
Disconnect All Communication Loop Wiring From The Controller Before Removing Power From The Controller. Reconnect Power And Then Reconnect Communication Loop Wiring.

Figure 65: OE332-23-GPCX GPC-X Controller Addressing

1. 24 VAC Must Be Connected So That All Ground Wires Remain Common.
2. All Wiring To Be In Accordance With Local And National Electrical Codes and Specifications.
3. All Communication Wiring To Be 18 Ga. Minimum, 2 Conductor Twisted Pair With Shield. Belden #82760 Or Equivalent.
4. It Is Recommended That All Controllers Address Switches Are Set Before Installation.

---

**JOB NAME**

**FILENAME**

G-GPCX-CNTRLR+1A.CDR

**DATE**

08/18/10

**DRAWN BY**

B. Crews

**PAGE**

2 of 2

**DESCRIPTION**

OE332-23-GPCX

GPC-X Controller
GPC-XP Controller Wiring

All Communication Loop Wiring Is Straight Through
T To T, R To R, SHLD To SHLD
Local Loop RS-485 9600 Baud

Connect To Next Device On The Local Loop

CommLink Jumpers Both On = Use On Board CommLink Both Off - Use External CommLink

Binary Inputs BIN1 Through BIN8 Configured For The Following:
1. Not Used
2. Normally Closed Operation
3. Normally Open Operation
4. Read Global Binary
5. Push-Button Override
6. Follow Relay

Analog Inputs A11Through A18 Configured For The Following:
1. Thermistor 10K Ohm Type III
2. Thermistor 10K Ohm Type III
3. 4 - 20mA User Scaled
4. 0 - 5 vdc User Scaled
5. Wall Sensor Slide Offset
6. Read Global Analog Broadcast from another Controller
7. Communicating Temperature Sensor
8. Communicating Humidity Sensor
9. Communicating Carbon Dioxide

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

Notes:
1.)24 VAC Must Be Connected So That All Ground Wires Remain Common.
2.)All Wiring To Be In Accordance With Local And National Electrical Codes and Specifications.
3.)All Communication Wiring To Be 18 Ga. Minimum, 2 Conductor Twisted Pair With Shield. Belden #22760 Or Equivalent.
4.)It Is Recommended That The Address Switch Is Set Before Installation.

Figure 66: OE338-23-GPCXP GPC-XP Controller Wiring

GPC-XP Controller Wiring

Add-On Devices
Add-On Devices

GPC-XP Controller Addressing & Baud Rate Selection

Note:
The Power To The Controller Must Be Removed And Reconnected After Changing The Address Switch Settings In Order For Any Changes To Take Effect.

Caution:
Disconnect All Communication Loop Wiring From The Controller Before Removing Power From The Controller. Reconnect Power And Then Reconnect Communication Loop Wiring.

Figure 67: OE338-23-GPC-XP GPC-XP Controller Addressing & Baud Rate Selection

BAUD RATE SELECTION

<table>
<thead>
<tr>
<th>Baud</th>
<th>Switch 7</th>
<th>Switch 8</th>
<th>Communication Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>9600</td>
<td>OFF</td>
<td>OFF</td>
<td>CommLink IV</td>
</tr>
<tr>
<td>57600</td>
<td>OFF</td>
<td>ON</td>
<td>CommLink 5 &amp; Stand Alone</td>
</tr>
</tbody>
</table>

Address 1 @ 9600 Baud
Address Switch Shown Is Set For Address 1

Address 5 @ 57,600 Baud
Address Switch Shown Is Set For Address 13

The Address For Each Controller Must Be Unique To The Other Controllers On The Local Loop And Be Between 1 and 59
Caution:
Disconnect All Communication Loop Wiring From The Controller Before Removing Power From The Controller. Reconnect Power And Then Reconnect Communication Loop Wiring.

Note:
The Power To The Controller Must Be Removed And Reconnected After Changing The Address Switch Settings In Order For Any Changes To Take Effect.

**ON-BOARD COMMLINK SETTING**

<table>
<thead>
<tr>
<th>Jumper 1</th>
<th>Jumper 2</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON</td>
<td>ON</td>
<td>Use On-Board CommLink</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
<td>Use External CommLink</td>
</tr>
</tbody>
</table>

Both Jumpers ON

![ON BOARD COMMLINK CONNECT](image)

Both Jumpers OFF

![ON BOARD COMMLINK CONNECT](image)
Connection:
- Connect the GBD-X to the same local communications loop as the controller that will receive the GBD-X broadcast.

Communications Wire:
- Must be 2 conductor twisted pair with shield, Belden #82760 or equivalent.
- All wiring must be straight through, R to R, T to T and SHLD to SHLD.

Available Inputs:
- For connection of CO₂ sensor 4-20mA signal, see page 2 for detailed CO₂ sensor wiring.
- Available 0-10 VDC proportional output signal.
- Available 10 VDC fixed output signal.

Notes:
1. The GBD-X can either be used with CO₂ sensors or space temperature sensors but not both on the same GBD-X controller. Up to 2 GBD controllers can be located on each local loop.
2. 24 VAC must be connected so that all ground wires remain common.
3. Set-up, programming, and monitoring of the GBD-X controller requires the use of a personal computer and Prism software.
4. All wiring to be in accordance with local and national electrical codes and specifications.

Figure 69: OE332-23-GBDX  GBD-X Controller Wiring CO₂ Applications
Add-On Devices

GBD-X Controller - CO₂ Applications Wiring (Cont’d)

The Jumper For The Analog Input That Each CO₂ Sensor Is Connected To Must Be Set For 4-20mA As Shown For Proper Operation Of The GBD-X Controller.

Up to (6) CO₂ Sensors Can Be Used On The GBD-X. They Can Be Wired To AIN1, AIN2, AIN3, AIN4, AINS And AIN7 As Desired. Only 4-20mA CO₂ Sensor(s) May Be Used.

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

Typical Wiring Shown For Input A11. Wiring For Other Inputs Is Identical.

OE255 or OE256 CO₂ Sensor (4-20mA Signal)

Notes:
1.) The GBD-X Can Either Be Used With CO₂ Sensors Or Space Temperature Sensors But Not Both On The Same GBD-X Controller. Up to 2 GBD Controllers Can Be Located On Each Local Loop.
2.) 24 VAC Must Be Connected So That All Ground Wires Remain Common.
3.) Set-up, Programming And Monitoring Of The GBD-X Controller Requires The Use Of A Personal Computer And Prism Software.
4.) All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.

Figure 70: OE332-23-GBDX GBD-X Device Wiring When Used For CO₂ Applications
Add-On Devices

GBD-X Controller - Space Temp. Sensor Averaging Wiring

Connect the GBD-X to the same local communications loop as the controller that will be receiving the GBD-X broadcast.

Communications wiring must be 2 conductor twisted pair with shield, Belden #82760 or equivalent. All wiring must be straight through, R to R, T to T and SHLD to SHLD.

Available Inputs for connection of space temperature sensors. See page 4 for detailed space temperature sensor wiring.

OE332-23-GBDX GBD-X Controller Wiring

When used for space temperature sensor applications

Notes:
1) The GBD-X can either be used with CO2 sensors or space temperature sensors but not both on the same GBD-X controller. Up to 2 GBD controllers can be located on each local loop.
2) 24 VAC must be connected so that all ground wires remain common.
3) Set-up, Programming and Monitoring of the GBD-X controller requires the use of a personal computer and Prism software.
4) All wiring to be in accordance with local and national electrical codes and specifications.

Figure 71: OE332-23-GBDX GBD-X Controller Wiring - Space Temperature Sensor Averaging
Add-On Devices

GBD-X Controller - Space Temp. Sensor Averaging Wiring (Cont’d)

The Jumper For The Analog Input That Each Space Temperature Sensor Is Connected To Must Be Set For Thermistor As Shown For Proper Operation Of The GBD-X Controller.

Typical Wiring Shown For Input A11. Wiring For Other Inputs Is Identical.

Figure 72: OE332-23-GBDX GBD-X Controller Wiring - Space Temperature Sensor Averaging

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

OE210 Space Temperature Sensor

Up to (6) Space Temperature Sensors Can Be Used On The GBD-X. They Can Be Wired To AIN1, AIN2, AIN3, AIN4, AINS And AIN7 As Desired.

OE331-21-AVG
GBD Device Wiring
When Used For Space Temperature Sensor Averaging Applications

Notes:

2.) 24 VAC Must Be Connected So That All Ground Wires Remain Common.

3.) Set-up, Programming And Monitoring Of The GBD-X Controller Requires The Use Of A Personal Computer And Prism Software.

4.) All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.

Figure 72: OE332-23-GBDX GBD-X Controller Wiring - Space Temperature Sensor Averaging

VCM-X Component & Systems Wiring
Add-On Devices

GBD-X Controller Address Switch Setting

Figure 73: OE332-23-GBDX GBD-X Controller Addressing

Notes:

1.) The GBD-X can either be used with CO2 sensors or space temperature sensors but not both on the same GBD-X controller. Up to 2 GBD controllers can be located on each local loop.

2.) 24 VAC must be connected so that all ground wires remain common.

3.) Set-up, Programming and Monitoring of the GBD-X controller requires the use of a personal computer and C-PRISM software.

4.) All wiring to be in accordance with local and national electrical codes and specifications.

Caution

Disconnect all communication loop wiring from the controller before removing power from the controller. Reconnect power and then reconnect communication loop wiring.

Note:

The power to the controller must be removed and reconnected after changing the address switch settings in order for any changes to take effect.

OE331-21-AVG

GBD Device Wiring

Address Switch Setting Information

Job Name

File Name: OE332-23-GBDX-Wr1A.CDR

Date: 06/10/10

Drawn By: B. CREWS

Page: 5 of 5

Description: OE332-23- GBDX Controller

GBD-X Wiring
Module Wiring & Connections
HP1C Module Wiring When Used With The VCM-X E-BUS

**OE370-23-HP1C**

One Condenser Head Pressure Module

- **WARNING!!** Observe Polarity! All boards must be wired with GND-to-GND and 24 VAC-to-24 VAC.
- Set ADDRESS Dip Switch 1 to ON for Water Cooled or to OFF for Air Cooled. Currently showing OFF for Air Cooled.
- Set ADDRESS Dip Switch 2 to OFF on all communicating applications unless it is intended to be the Second Head Pressure Module on a system. If set to ON, it will not communicate. Currently showing OFF.
- Connect To Other WattMaster-Approved E-BUS Expansion Module(s)
- Set ADDRESS Dip Switch 4 to OFF to make reversing valve "ON to Heat / OFF to Cool" Set to ON to make reversing valve "ON to Cool / OFF to Heat. Currently showing OFF.
- **NOTE:** ALL RELAY OUTPUTS ARE NORMALLY OPEN AND RATED FOR 24 VAC POWER ONLY - 1 AMP MAXIMUM LOAD
- **24 VAC ONLY**
  - CONDENSER A ENABLE
  - REVERSING VALVE A ENABLE
  - HVAC UNIT CONNECTION

**Wiring For One Condenser Head Pressure Module When Used With Orion VCM-X E-BUS Controller**

- **24 VAC Transformer**
  - 3 VA Minimum
- **HSSC Cable**
  - Connect To VCM-X E-BUS Controller or VCM-X WSHP E-BUS Controller
- **Set ADDRESS Dip Switch Setting**
  - Not Required When Connected To VCM-X Modular E-BUS or VCM-X WSHP E-BUS Controller
  - Water Cooled or to OFF for Air Cooled.
  - Currently showing OFF for Air Cooled.
  - Set ADDRESS Dip Switch 2 to OFF on all communicating applications unless it is intended to be the Second Head Pressure Module on a system. If set to ON, it will not communicate. Currently showing OFF.
  - Set ADDRESS Dip Switch 4 to OFF to make reversing valve "ON to Heat / OFF to Cool" Set to ON to make reversing valve "ON to Cool / OFF to Heat. Currently showing OFF.

---

Figure 74: OE370-23-HP1C One Condenser Head Pressure Module to VCM-X E-BUS Controller Wiring

---

**HP1C-1A.CDR**

**DATE:** 06/04/15

**DRAWN BY:** S. Olson

**DESCRIPTION:** AAON One Condenser Head Pressure Wiring When Used With Orion VCM-X E-BUS Controller

---

**JOB NAME**

**FILENAME**

**DATE:** 06/04/15

**DRAWN BY:** S. Olson

**PAGE**

**DESCRIPTION:** AAON One Condenser Head Pressure Wiring When Used With Orion VCM-X E-BUS Controller

---

**VCM-X Component & Systems Wiring**
Module Wiring & Connections

HP2C2 Controller Wiring When Used With The VCM-X E-BUS

Figure 75: OE370-23-HP2C2 Two Condenser Head Pressure Module to VCM-X E-BUS Controller Wiring

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

WARNING!! Observe Polarity! All boards must be wired with GND-to-GND and 24 VAC-to-24 VAC.

NOTE: NORMALLY OPEN AND RATED FOR 24 VAC POWER ONLY - 1 AMP MAXIMUM LOAD

ALL RELAY OUTPUTS ARE

HEAD PRESSURE TRANSDUCER #1
HEAD PRESSURE TRANSDUCER #2
HEAD PRESSURE TRANSDUCER #3
HEAD PRESSURE TRANSDUCER #4

CONDENSER A ENABLE
CONDENSER B ENABLE
REV. VLV. A ENABLE
REV. VLV. B ENABLE

CONDENSER A SIGNAL
CONDENSER B SIGNAL

PWM1-
PWM1+
PWM2-
PWM2+

CONND. FAN A
COND. FAN B
COND. A SIGNAL
COND. B SIGNAL

LINE VOLTAGE 24 VAC

3 VA MINIMUM

CONNECT TO OTHER WATTMASTER-APPROVED E-BUS EXPANSION MODULE(S)

HEAD PRESSURE TRANSDUCERS

CONNECT TO VCM-X E-BUS

HSSC CABLE

HEAD PRESSURE TRANSDUCER #1
HEAD PRESSURE TRANSDUCER #2
HEAD PRESSURE TRANSDUCER #3
HEAD PRESSURE TRANSDUCER #4

CONDENSER A ENABLE INPUT
CONDENSER B ENABLE INPUT

CONDENSER A SIGNAL
CONDENSER B SIGNAL

PWM1-
PWM1+
PWM2-
PWM2+

CONNECT TO VCM-X E-BUS

HSSC CABLE

24 VAC TRANSFORMER

3 VA MINIMUM

WARNING!! Observe Polarity! All boards must be wired with GND-to-GND and 24 VAC-to-24 VAC.

Set ADDRESS Dip Switch 1 to ON for Water Cooled or to OFF for Air Cooled. Currently showing OFF. Setting ADDRESS Dip Switch 1 to ON for Water Cooled or to OFF for Air Cooled. Currently showing OFF.

Set ADDRESS Dip Switch 2 to OFF on all communicating applications unless it is intended to be the Second Head Pressure Module on a system. If set to ON, it will not communicate. Currently showing OFF. Setting ADDRESS Dip Switch 2 to OFF on all communicating applications unless it is intended to be the Second Head Pressure Module on a system. If set to ON, it will not communicate. Currently showing OFF.

Set ADDRESS Dip Switch 3 to ON to disable Circuit B alarms when only one Condenser is Used. Currently showing OFF. Setting ADDRESS Dip Switch 3 to ON to disable Circuit B alarms when only one Condenser is Used. Currently showing OFF.

Set ADDRESS Dip Switch 4 to OFF to make reversing valve "ON to Heat / OFF to Cool." Setting ADDRESS Dip Switch 4 to OFF to make reversing valve "ON to Heat / OFF to Cool." Currently showing OFF. Setting ADDRESS Dip Switch 4 to OFF to make reversing valve "ON to Heat / OFF to Cool." Currently showing OFF.

Connect To Other WattMaster-Approved E-BUS Expansion Module(s)

When Used With Orion VCM-X E-BUS Controller

JOB NAME

FILENAME

DATE: 06/05/15

DRAWN BY: S. Olson

PAGE DESCRIPTION:

1 Two Condenser Head Pressure Module Wiring

When Used With Orion VCM-X E-BUS Controller

Figure 75: OE370-23-HP2C2 Two Condenser Head Pressure Module to VCM-X E-BUS Controller Wiring

VCM-X Component & Systems Wiring 99
Wiring For Full Digital Module When Used With Orion VCM-X E-BUS Controller

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.

Figure 76: OE370-23-FD-A Full Digital Module to VCM-X E-BUS Controller Wiring
Dual Digital Module Wiring

When Used With Orion VCM-X E-BUS Controller

Connect To Other WattMaster-Approved E-BUS Expansion Module(s)

HSSC Cable

Connect To VCM-X E-BUS

24 VAC Transformer

Wiring For Dual Digital Module When Used With Orion VCM-X E-BUS Controller

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.

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.

Figure 77: OE370-23-DD-A Dual Digital Module to VCM-X E-BUS Controller Wiring
Wiring For MODGAS-X When Used With Orion VCM-X E-BUS Controller

1. Connect Supply Air Temperature Sensor to AI2 & GND on Main Controller.

The SAT OPTIONS Jumper Setting Should Be Set to 1. Only One Supply Air Temperature Sensor Can Be Used Per Application.

124 VAC Must Be Connected So That All Ground Wires Remain Common.
2. All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.

### MODGAS-X CONTROLLER

**OE377-26-00058**

**INPUT TERMINALS (TYPE)**

- AI1: Supply Air Temperature
- AI2: Modulating Valve
- AI3: Gas Valve
- AI4: Fan Enable
- AI5: Stage 1 Heat (Mod)
- AI6: FSD
- AI7: PAN
- AI8: CR1-A
- AI9: CR1-B
- AI10: CR2-A
- AI11: CR2-B
- AI12: L1
- AI13: L2
- AI14: GND
- AI15: 24VAC
- AI16: IC Cable

**CONNECTORS:**

- 10-pin Molex
- 5-pin Molex

**I/O TERMINALS:**

- 5-pin Molex

**CONTACT TYPES:**

- N.O.
- N.C.
- N.C.

**CURRENT RATING: 18 VA**

**MAX. POWER CONSUMPTION:**

- 1 Gas Valve: 18 VA
- 2 Gas Valves: 33 VA

### Diagram Notes:

- **24 VAC Power Input Terminals:**
  - Max. Power Consumption
  - 1 Gas Valve: 18 VA
  - 2 Gas Valves: 33 VA

- **IC Cable Connects To:**
  - IC Port On VCM-X E-BUS Controller or Expansion Module

- **Motor:**
  - Induced Air Blower

- **Job Name:**
  - O-MODGASX-VCMX-Wr1.CDR
  - AAON MODGAS-X Wiring

**Figure 78:** OE377-26-00058 MODGAS-X Controller Single Modulating Valve - No Staging to VCM-X E-BUS Controller Wiring
Figure 79: OE377-26-00058 MODGAS-X Controller Two Modulating Staged Valves to VCM-X E-BUS Wiring
Module Wiring & Connections

MODGAS-XWR Controller Wiring When Used With The VCM-X E-BUS

Connect Supply Air Temperature Sensor to AI2 & GND On Main Controller
Mount In Supply Air Duct

Supply Air Temperature Sensor

The SAT OPTIONS Jumper Setting Should Be Set to 1. Only One Supply Air Temperature Sensor Can Be Used Per Application.

1) 24 VAC Must Be Connected So That All Ground Wires Remain Common.
2) All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.

Wiring For MODGAS-XWR When Used With Orion VCM-X E-BUS Controller

Modular Cable Connects To VCM-X E-BUS Controller's Expansion Port

Check Your Fan Relay Wiring (RLY1) Schematic For Proper Wiring.

Figure 80: MODGAS-XWR Controller Single Modulating Valve No Staging to VCM-X E-BUS Wiring
Module Wiring & Connections

MODGAS-XWR Controller Wiring When Used With The VCM-X E-BUS

Figure 81: MODGAS-XWR Controller Single Modulating Valve & 1 Fixed Stage to VCM-X E-BUS Wiring

The SAT OPTIONS Jumper Setting Should Be Set to 1. Only One Supply Air Temperature Sensor Can Be Used Per Application.

1. 24 VAC Must Be Connected So That All Ground Wires Remain Common.
2. All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.

Wiring For MODGAS-XWR When Used With Orion VCM-X E-BUS Controller

Check Your Fan Relay Wiring (RLY1) Schematic For Proper Wiring.

Connecting Supply Air Temperature Sensor to A2 & GND On Main Controller.

Mount In Supply Air Duct

Supply Air Temperature Sensor

The SAT OPTIONS Jumper Setting Should Be Set to 1.

Only One Supply Air Temperature Sensor Can Be Used Per Application.

1,24 VAC Must Be Connected So That All Ground Wires Remain Common.
2. All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.

Wiring For MODGAS-XWR When Used With Orion VCM-X E-BUS Controller

Check Your Fan Relay Wiring (RLY1) Schematic For Proper Wiring.

Connecting Supply Air Temperature Sensor to A2 & GND On Main Controller.

Mount In Supply Air Duct

Supply Air Temperature Sensor

The SAT OPTIONS Jumper Setting Should Be Set to 1.

Only One Supply Air Temperature Sensor Can Be Used Per Application.

1,24 VAC Must Be Connected So That All Ground Wires Remain Common.
2. All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.
**Module Wiring & Connections**

**MODGAS-XWR Controller Wiring When Used With The VCM-X E-BUS**

**When Used With Orion VCM-X E-BUS Controller**

1. 24 VAC Must Be Connected So That All Ground Wires Remain Common.
2. All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.

**Wiring For MODGAS-XWR When Used With Orion VCM-X E-BUS Controller**

**Figure 82: MODGAS-XWR Controller Two Modulating Valves Staged to VCM-X E-BUS Wiring**
MHGRV-X Controller Wiring When Used With Orion VCM-X E-BUS Controller

Wiring For MHGRV-X When Used With Orion VCM-X E-BUS Controller

Notes:
1.) All Wiring To Be In Accordance With Local And National Electrical Codes and Specifications.

Figure 83: OE377-26-00059 MHGRV-X Controller to VCM-X E-BUS Controller Wiring
Module Wiring & Connections

WSHP-X2 Controller Wiring When Used With The VCM-X E-BUS

Figure 84: OE334-26-WSHP-X2 WSHP-X2 Module AAON NO. V48820

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.

Connect To Other WattMaster-Approved E-BUS Expansion Module(s)

LEAVING WATER TEMPERATURE SENSOR

VCM-X Component & Systems Wiring

Figure 84: OE334-26-WSHP-X2 WSHP-X2 Controller Single Circuit Wiring to VCM-X E-BUS Controller
WSHP-X2 Controller Wiring When Used With The VCM-X E-BUS

Figure 85: OE334-26-WSHP-X2  WSHP-X2 Controller Dual Circuit Wiring to VCM-X E-BUS Controller

NOTE: ALL RELAY OUTPUTS ARE NORMALLY OPEN AND RATED FOR 24 VAC POWER ONLY

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.

- COMP A1
- COMP A2
- COMP B1
- COMP B2
- ALARM OUTPUT

NOTE: DIGITAL COMPRESSORS = 1.5-5VDC
VFD COMPRESSORS = 0-10VDC

Connect To Other WattMaster-Approved E-BUS Expansion Module(s)

Connect To VCM-X E-BUS

LEAVING WATER TEMPERATURE FOR SYSTEM A

LEAVING WATER TEMPERATURE FOR SYSTEM B

NOTE: HVAC 24 VAC ONLY

NOTE: WATER SOURCE HEAT PUMP X2 MODULE

NOTE: WATER POF A BIN6

NOTE: WATER POF B BIN7

NOTE: DIGITAL/VFD COMPRESSORS A1, A2, B1, B2

NOTE: NON-DIGITAL COMPRESSORS

NOTE: +5 NOT USED, PRES TO P6 & GND TO P5

NOTE: +5 TO RED, PRES TO WHT & GND TO BLK

NOTE: PRESSURE TRANSDUCERS

NOTE: SUCT. PR. SENSOR

NOTE: PRES 1=A1, PRES 2=A2

NOTE: PRES 3=B1, PRES 4=B2

NOTE: PRES 1=A1, PRES 2=A2

NOTE: PRES 3=B1, PRES 4=B2

NOTE: +5 NOT USED, PRES TO P6 & GND TO P5

NOTE: +5 TO RED, PRES TO WHT & GND TO BLK

NOTE: DIGITAL COMRESSORS

NOTE: NON-DIGITAL COMPRESSORS

NOTE: AOUT1

NOTE: AOUT2

NOTE: AOUT3

NOTE: AOUT4

NOTE: COMP A1

NOTE: COMP A2

NOTE: COMP B1

NOTE: COMP B2

NOTE: SEE NOTE BELOW

NOTE: JOB NAME

NOTE: FILENAME

NOTE: ** Orion Control Systems

NOTE: DATE: 06/05/15

NOTE: DRAWN BY: S. Olson

NOTE: PAGE

NOTE: DESCRIPTION:

When Used With Orion VCM-X E-BUS Controller

Figure 85: OE334-26-WSHP-X2  WSHP-X2 Controller Dual Circuit Wiring to VCM-X E-BUS Controller
Wiring For PREHEAT-X When Used With Orion VCM-X E-BUS Controller

**NOTE:** All Relay Outputs Are Normally Open And Rated For 24 VAC Power Only. 1 Amp Maximum Load.
Note:
1.) When the MODGAS II Controller is used with the VCM-X Controller it must have (1) Relay Output On The VCM-X Controller configured for the MODGAS II Controller in order to function correctly. This Relay Output must be configured when setting-up the Controller(s) operating parameters. See the VCM-X Controller Operator Interfaces Technical Guide for complete Controller Programming and Configuration Information.

Caution: The supply air temperature sensor always connects to the VCM-X controller and the supply air temperature is broadcast to the MODGAS II controller, MHGRVII and the MHGRVIII controller from it.

Wiring for MODGAS II When Used with Orion VCM-X E-BUS Controller

1.) 24 VAC must be connected so that all ground wires remain common.
2.) All wiring to be in accordance with local and national electrical codes and specifications.

Figure 87: OE377-00-00041 MODGAS II Controller to VCM-X E-BUS Controller Wiring
Caution: The Supply Air Temperature Sensor Always Connects To The VCM-X E-BUS Controller And The Supply Air Temperature Is Broadcast To The MODGAS II Controller, MHGRVII, And The MHGRVIII Controller From It.

Wiring For MHGRV II When Used With Orion VCM-X E-BUS Controller

Notes:
1.) All Wiring To Be In Accordance With Local And National Electrical Codes and Specifications.

Figure 88: OE377-00-00042 MHGRV II Controller to VCM-X E-BUS Controller Wiring
MHGRV III Controller Wiring When Used With VCM-X E-BUS

Figure 89: OE377-00-00054 MHGRV III Controller to VCM-X E-BUS Controller Wiring

MHGRV III Controller

Condenser Valve #1
- GRN
- RED
- WHT
- BLK

HGR Valve #1
- GRN
- RED
- WHT
- BLK

Condenser Valve #2
- GRN
- RED
- WHT
- BLK

HGR Valve #2
- GRN
- RED
- WHT
- BLK

Supplementary Diagrams and Technical Information

MHGRV III Controller Wiring When Used With VCM-X E-BUS

Figure 89: OE377-00-00054 MHGRV III Controller to VCM-X E-BUS Controller Wiring

VCM-X Component & Systems Wiring
Miscellaneous Diagrams & Technical Information
**Temperature Sensor Resistance/Voltage Chart**

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<th>Resistance* Ohms</th>
<th>Voltage @ Input*</th>
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*Chart Notes:*

1. Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered). Connect as shown below.

2. Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the sensor leads as shown in the illustration below. If the voltage is above 5.08 VDC, then the sensor or wiring is “open.” If the voltage is less than 0.05 VDC, the sensor or wiring is shorted.
Warning!
Use extreme caution when removing any chips to avoid damaging any circuit board traces which are under the chip.

Be sure that any small screwdriver or other sharp object used to remove the chip does not come into contact with the printed circuit board.

A small screwdriver may be inserted between the chip and the socket to aid in removal of the chip.

Be very careful not to insert the screwdriver under the socket! Damage to the board is not covered by warranty.

Figure 91: EPROM Chip Locations for VCM-X E-BUS & VAV/Zone Controller Actuator Package
Warning!
Use Extreme Caution When Removing Any Chips To Avoid Damaging Any Circuit Board Traces Which Are Under The Chip.

Be Sure That Any Small Screwdriver Or Other Sharp Object Used To Remove The Chip Does Not Come Into Contact With The Printed Circuit Board.

A Small Screwdriver May Be Inserted Between The Chip And The Socket To Aid In Removal Of The Chip.

Be Very Careful Not To Insert The Screwdriver Under The Socket!! Damage To The Board Is Not Covered By Warranty.

Figure 92: EPROM Chip Locations for VAV/Zone Controller & MiniLink Polling Device
Warning!
Use Extreme Caution When Removing Any Chips To Avoid Damaging Any Circuit Board Trace Which Are Under The Chip.

Be Sure That Any Small Screwdriver Or Other Sharp Object Used To Remove The Chip Does Not Come Into Contact With The Printed Circuit Board.

A Small Screwdriver May Be Inserted Between The Chip And The Socket To Aid In Removal Of The Chip.

Be Very Careful Not To Insert The Screwdriver Under The Socket!! Damage To The Board Is Not Covered By Warranty.

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<th>BY:  S. OLSON</th>
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<td><strong>Orion</strong></td>
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<td>DESCRIPTION: Orion Components VCM-X</td>
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<tr>
<td></td>
<td>Product Chip Replacement Information</td>
</tr>
</tbody>
</table>

Figure 93: EPROM Chip Locations for GPC Plus, GBD, and GPC-17 Controller
**WARNING!**

Be sure the chip you have selected to replace is a socketed chip. Not all driver chips on the boards are field replaceable. Only socketed chips may be removed and replaced in the field. All other chips that are not socketed will require sending the board to the WattMaster factory for repair. **If you try to remove a chip that is not socketed, it will destroy the circuit board.** Once you have determined that the chip needing replacement is indeed a socketed chip, please proceed in the following manner:

Remove the communications loop connector and then the 24VAC power connector on the controller before attempting to change any components. **DAMAGE will occur if components are removed or installed with power applied.**

If you are unsure how to safely remove the chip or have questions about correct pin placement, please consult the factory before proceeding.

Damage to the board caused by failure to correctly remove or install the chip is not covered by the WattMaster warranty.

Use extreme care to avoid inserting the screwdriver or I.C. Puller under the socket. You must insert the tip of the screwdriver or ends of the I.C. Puller between the body of the chip and the chip socket. Each chip must be installed with Pin 1 in the correct location. Installing the chip “backwards” will in most cases destroy the device when power is reapplied.

Pin 1 can be located by looking for the notch in the end of the chip. Pin 1 on “some” chips is identified with a dot. Be certain that ALL pins are lined up in the socket before pressing the chip in. Failure to properly line up the pins will result in damage to the chip. This is a VERY common error - BE CAREFUL.

Only after confirming that the chip has been correctly installed with Pin 1 in the proper position and that the pins are lined up and none are bent or out of the socket, should communication or power wiring be reconnected to the board. To prevent possible damage, always reconnect the power wiring first and then the communication wiring.

**Figure 94: EPROM Chip Installation Instructions**
### Updating The SD Memory Card

You may need to update the SD memory card from time to time, either for a new release or to add data for another Controller. Follow the instructions below to download the update file from our tech support webpage:

1. Insert the SD memory card in your computer’s SD drive and open the drive’s window.
2. Open your browser and type in the address: http://wattmaster.com/techsupport.
3. On the Tech Support webpage, locate the file Modular_HH_Screens.zip and double-click on it.
4. Click <Save File> when asked to save or open the file and then click <OK>. This option will save the file to the “Downloads” folder on your PC.
5. Open the “Downloads” folder in Windows Explorer. You will find a folder labeled, “Modular_HH_Screens.zip” Right-click on the folder and choose “Extract All” from the options list. **NOTE:** Any compression software can be used to extract the zip folder’s contents, for example, Winzip.
6. Once you unzip the file, you will see a window similar to the one below.

![Image of unzipping file]

7. Press <CTRL> <A> to highlight the folders in the window—App, Manuals & Scr. Press <CTRL> <C> to copy the folders.
8. Paste the folders into the SD memory card drive’s window by pressing <CTRL> <V>.
9. Remove the SD Memory Card from your computer and reinsert it in the Modular Hand Held Service Tool or Modular System Manager.
To update the software for various WattMaster E-BUS modules, follow these simple steps.

1. Update your SD memory card with the new software file for the controller or module you need to update. Follow the steps on page 121 for Updating the SD memory card.

2. Connect the Modular Service Tool to the device you wish to update using the mini DIN communication cable or EBC E-BUS cable provided.

3. Power up the controller or E-BUS module you wish to update.

4. Apply power to the Modular Service Tool SD and press the <ON> button.

5. After initialization of the Modular Service Tool SD, press <NEXT> at the first Setup Screen and <4> at the second Setup Screen shown below.

6. The Update Software Screen will appear as shown below:

7. Follow the instructions for WattMaster E-BUS Modules.

E-BUS Modules

1. Press <2> to update an E-BUS Module. The following screen will appear:

2. Enter the address of the E-BUS module you are updating and then press <ENTER>. The following is the list of Module addresses:
   - WSHP-X2 - address 17
   - MHGRV-X - address 132
   - MODGAS-X - address 138
   - PREHEAT-X - address 157
   - RSM #1 - address 152
   - RSM #2 - address 153
   - RSM #3 - address 154
   - RSM #4 - address 155

3. The Software Version Screen will appear as shown below. Enter <0> for the latest software version or enter the number of an older version if given to you by Technical Support. Then press <ENTER>.

4. The screen will display the following messages:
   - “Resetting Unit”
   - “Load Sys Info”

5. If communications are successful, the screen will display, the name of the HEX file on the top line, “Flash Memory Erased” on the second line, and the progress percentage on the third line.

   NOTE: If communications are not successful, the screen will display, “Press Any Key to Continue. Cannot Load Sys Info.” Make sure you have the right address and the right software version on your SD card. If these two items are correct and you still experience a problem, contact Technical Support.

6. When updating is complete, the screen will display, “Finish Download.”
Sensor Checks

The following sensor voltage and resistance tables are 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 below each chart when checking sensors.

**Temperature – Resistance – Voltage For Type III 10 K Ohm Thermistor Sensors**

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<thead>
<tr>
<th>Temp (°F)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
<th>Temp (°F)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
<th>Temp (°F)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
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<td>8514</td>
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**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.

**Notes:**

*If the voltage is above 5.08 VDC, then the sensor or wiring is “open.”
If the voltage is less than 0.05 VDC, the sensor or wiring is shorted.*
### OE265-11, 13 & 14 Relative Humidity Transmitters – Humidity vs. Voltage For 0-5 VDC Sensors

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<th>Voltage @ Input (VDC)</th>
<th>Humidity Percentage (RH)</th>
<th>Voltage @ Input (VDC)</th>
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<td>4.20</td>
</tr>
<tr>
<td>8%</td>
<td>0.40</td>
<td>34%</td>
<td>1.70</td>
<td>60%</td>
<td>3.00</td>
<td>86%</td>
<td>4.30</td>
</tr>
<tr>
<td>10%</td>
<td>0.50</td>
<td>36%</td>
<td>1.80</td>
<td>62%</td>
<td>3.10</td>
<td>88%</td>
<td>4.40</td>
</tr>
<tr>
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<td>1.90</td>
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<td>90%</td>
<td>4.50</td>
</tr>
<tr>
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<td>0.70</td>
<td>40%</td>
<td>2.00</td>
<td>66%</td>
<td>3.30</td>
<td>92%</td>
<td>4.60</td>
</tr>
<tr>
<td>16%</td>
<td>0.80</td>
<td>42%</td>
<td>2.10</td>
<td>68%</td>
<td>3.40</td>
<td>94%</td>
<td>4.70</td>
</tr>
<tr>
<td>18%</td>
<td>0.90</td>
<td>44%</td>
<td>2.20</td>
<td>70%</td>
<td>3.50</td>
<td>96%</td>
<td>4.80</td>
</tr>
<tr>
<td>20%</td>
<td>1.00</td>
<td>46%</td>
<td>2.30</td>
<td>72%</td>
<td>3.60</td>
<td>98%</td>
<td>4.90</td>
</tr>
<tr>
<td>22%</td>
<td>1.10</td>
<td>48%</td>
<td>2.40</td>
<td>74%</td>
<td>3.70</td>
<td>100%</td>
<td>5.00</td>
</tr>
<tr>
<td>24%</td>
<td>1.20</td>
<td>50%</td>
<td>2.50</td>
<td>76%</td>
<td>3.80</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### OE265-11, ·13, and ·14 Relative Humidity Sensor Testing Instructions:

Use the voltage column to check the Humidity Sensor while connected to a powered expansion board. Read voltage with meter set on DC volts. Place the “-” (minus) lead on terminal labeled GND and the “+” lead on terminal AIN4 on the Analog Input/Output Expansion Board.
OE271 Duct Static Pressure Sensor

This sensor is used to sense duct static pressure for the Orion system controllers. The OE271 sensor is a 0-5" W.C. pressure range, 0-5 VDC voltage range sensor. Use the table and testing information below to check for proper sensor operation.

<table>
<thead>
<tr>
<th>Pressure @ Sensor (&quot; W.C.)</th>
<th>Voltage @ Input (VDC)</th>
<th>Pressure @ Sensor (&quot; W.C.)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>0.25</td>
<td>2.60</td>
<td>2.33</td>
</tr>
<tr>
<td>0.10</td>
<td>0.33</td>
<td>2.70</td>
<td>2.41</td>
</tr>
<tr>
<td>0.20</td>
<td>0.41</td>
<td>2.80</td>
<td>2.49</td>
</tr>
<tr>
<td>0.30</td>
<td>0.49</td>
<td>2.90</td>
<td>2.57</td>
</tr>
<tr>
<td>0.40</td>
<td>0.57</td>
<td>3.00</td>
<td>2.65</td>
</tr>
<tr>
<td>0.50</td>
<td>0.65</td>
<td>3.10</td>
<td>2.73</td>
</tr>
<tr>
<td>0.60</td>
<td>0.73</td>
<td>3.20</td>
<td>2.81</td>
</tr>
<tr>
<td>0.70</td>
<td>0.81</td>
<td>3.30</td>
<td>2.89</td>
</tr>
<tr>
<td>0.80</td>
<td>0.89</td>
<td>3.40</td>
<td>2.97</td>
</tr>
<tr>
<td>0.90</td>
<td>0.97</td>
<td>3.50</td>
<td>3.05</td>
</tr>
<tr>
<td>1.00</td>
<td>1.05</td>
<td>3.60</td>
<td>3.13</td>
</tr>
<tr>
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<td>1.13</td>
<td>3.70</td>
<td>3.21</td>
</tr>
<tr>
<td>1.20</td>
<td>1.21</td>
<td>3.80</td>
<td>3.29</td>
</tr>
<tr>
<td>1.30</td>
<td>1.29</td>
<td>3.90</td>
<td>3.37</td>
</tr>
<tr>
<td>1.40</td>
<td>1.37</td>
<td>4.00</td>
<td>3.45</td>
</tr>
<tr>
<td>1.50</td>
<td>1.45</td>
<td>4.10</td>
<td>3.53</td>
</tr>
<tr>
<td>1.60</td>
<td>1.53</td>
<td>4.20</td>
<td>3.61</td>
</tr>
<tr>
<td>1.70</td>
<td>1.61</td>
<td>4.30</td>
<td>3.69</td>
</tr>
<tr>
<td>1.80</td>
<td>1.69</td>
<td>4.40</td>
<td>3.77</td>
</tr>
<tr>
<td>1.90</td>
<td>1.77</td>
<td>4.50</td>
<td>3.85</td>
</tr>
<tr>
<td>2.00</td>
<td>1.85</td>
<td>4.60</td>
<td>3.93</td>
</tr>
<tr>
<td>2.10</td>
<td>1.93</td>
<td>4.70</td>
<td>4.01</td>
</tr>
<tr>
<td>2.20</td>
<td>2.01</td>
<td>4.80</td>
<td>4.09</td>
</tr>
<tr>
<td>2.30</td>
<td>2.09</td>
<td>4.90</td>
<td>4.17</td>
</tr>
<tr>
<td>2.40</td>
<td>2.17</td>
<td>5.00</td>
<td>4.25</td>
</tr>
<tr>
<td>2.50</td>
<td>2.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OE258-01 Building Pressure Sensor

This sensor is used to sense building pressure for the Orion system controllers. The OE258-01 sensor is a -0.25" to +0.25" W.C. pressure range, 0-5 VDC voltage range sensor. Use the table and testing information below to check for proper sensor operation.

<table>
<thead>
<tr>
<th>Pressure @ Sensor (&quot; W.C.)</th>
<th>Voltage @ Input (VDC)</th>
<th>Pressure @ Sensor (&quot; W.C.)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.25</td>
<td>0.00</td>
<td>0.01</td>
<td>2.60</td>
</tr>
<tr>
<td>-0.24</td>
<td>0.10</td>
<td>0.02</td>
<td>2.70</td>
</tr>
<tr>
<td>-0.23</td>
<td>0.20</td>
<td>0.03</td>
<td>2.80</td>
</tr>
<tr>
<td>-0.22</td>
<td>0.30</td>
<td>0.04</td>
<td>2.90</td>
</tr>
<tr>
<td>-0.21</td>
<td>0.40</td>
<td>0.05</td>
<td>3.00</td>
</tr>
<tr>
<td>-0.20</td>
<td>0.50</td>
<td>0.06</td>
<td>3.10</td>
</tr>
<tr>
<td>-0.19</td>
<td>0.60</td>
<td>0.07</td>
<td>3.20</td>
</tr>
<tr>
<td>-0.18</td>
<td>0.70</td>
<td>0.08</td>
<td>3.30</td>
</tr>
<tr>
<td>-0.17</td>
<td>0.80</td>
<td>0.09</td>
<td>3.40</td>
</tr>
<tr>
<td>-0.16</td>
<td>0.90</td>
<td>0.10</td>
<td>3.50</td>
</tr>
<tr>
<td>-0.15</td>
<td>1.00</td>
<td>0.11</td>
<td>3.60</td>
</tr>
<tr>
<td>-0.14</td>
<td>1.10</td>
<td>0.12</td>
<td>3.70</td>
</tr>
<tr>
<td>-0.13</td>
<td>1.20</td>
<td>0.13</td>
<td>3.80</td>
</tr>
<tr>
<td>-0.12</td>
<td>1.30</td>
<td>0.14</td>
<td>3.90</td>
</tr>
<tr>
<td>-0.11</td>
<td>1.40</td>
<td>0.15</td>
<td>4.00</td>
</tr>
<tr>
<td>-0.10</td>
<td>1.50</td>
<td>0.16</td>
<td>4.10</td>
</tr>
<tr>
<td>-0.09</td>
<td>1.60</td>
<td>0.17</td>
<td>4.20</td>
</tr>
<tr>
<td>-0.08</td>
<td>1.70</td>
<td>0.18</td>
<td>4.30</td>
</tr>
<tr>
<td>-0.07</td>
<td>1.80</td>
<td>0.19</td>
<td>4.40</td>
</tr>
<tr>
<td>-0.06</td>
<td>1.90</td>
<td>0.20</td>
<td>4.50</td>
</tr>
<tr>
<td>-0.05</td>
<td>2.00</td>
<td>0.21</td>
<td>4.60</td>
</tr>
<tr>
<td>-0.04</td>
<td>2.10</td>
<td>0.22</td>
<td>4.70</td>
</tr>
<tr>
<td>-0.03</td>
<td>2.20</td>
<td>0.23</td>
<td>4.80</td>
</tr>
<tr>
<td>-0.02</td>
<td>2.30</td>
<td>0.24</td>
<td>4.90</td>
</tr>
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<td>-0.01</td>
<td>2.40</td>
<td>0.25</td>
<td>5.00</td>
</tr>
<tr>
<td>0.00</td>
<td>2.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OE271 Pressure Sensor Testing Instructions

Use the voltage column to check the Duct Static Pressure Sensor while connected to powered controllers. Read voltage with meter set on DC volts. Place the “-” (minus) lead on the GND terminal and the “+” (plus) lead on the 0-5 pin terminal on (TP) with the jumper removed. Be sure to replace the jumper after checking.

OE258-01 Building Pressure Sensor Testing Instructions

Use the voltage column to check the Building Static Pressure Sensor while connected to a powered expansion board. Read voltage with meter set on DC volts. Place the “-”(minus) lead on terminal labeled GND and the “+” lead on terminal AIN4 on the Analog Input/Output Expansion Board.
OE275-01 Suction Pressure Transducer Testing for R22 and 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 VCM-X Expansion Module. The VCM-X and the VCM-X Expansion Module must be powered for this test. Read voltage with a meter set on DC volts. Place the positive lead from the meter on the PR OUT terminal located on the VCM-X Expansion Module terminal block. Place the negative lead from the meter on the ground (GND) terminal located adjacent to the PR OUT terminal on the VCM-X Expansion Module terminal block. Use a refrigerant gauge set and/or an accurate electronic thermometer to measure the temperature or suction line pressure near where the Suction Pressure Transducer is connected to the suction line. Measure the Voltage at the terminals PR OUT and GND terminals and compare it to the appropriate chart depending on the refrigerant you are using. If the temperature/voltage or pressure/voltage readings do not align closely with the chart, your Suction Pressure Transducer is probably defective and will need to be replaced.

See the OE275-01 Suction Pressure Transducer, Pressure, Temperature, and Voltage Chart for R22 and R410A Refrigerant testing (Tables 8 and 9). 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.