VCCX2 Component & System Wiring Technical Guide

VCCX2 Controller Code: SS1088 version 1.0 and up
VCC-X Controller Code: SS1079
VAV/Zone Controller Code: SS8011
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System Overview, Installation & Commissioning
**SYSTEM OVERVIEW**

**System Types**

### 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 1, page 16 for Connection Diagram)

2. **Interconnected**
   (See Figure 2, page 17 for Connection Diagram)

3. **Networked Single Loop**
   (See Figures 3-5, pages 18-20 for Connection Diagrams)

4. **Networked Multiple Loop**
   (See Figure 6, page 21 for Connection Diagrams)

5. **System Managers, Service Tool, Computer, CommLink 5, IP Module, USB-Link 2**
   (See Figures starting on page 66)

### System Type Definitions

#### Stand Alone

This system consists of a single VCCX2 Controller. Configuration and status monitoring are accomplished by one or more of the following methods.

1. By using an operator interface. This can be a Modular Service Tool, a Modular System Manager, a System Manager TS-L (Limited Access), 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 multiple VCCX2 Controllers interconnected with communication cable to allow configuration and monitoring from one central location. Broadcasting between controllers is not available. Configuration and status monitoring are accomplished by one or more of the following methods.

1. By using an operator interface. This can be a Modular Service Tool, a Modular System Manager, a System Manager TS-L (Limited Access), 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. Multiple VCCX2 Controllers that utilize a network device to broadcast information between controllers on the loop.

2. A single VCCX2 Controller and a series VAV/Zone Controllers that utilize a network device to broadcast information between 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 5 (MLPD5). Both network devices may also be used together. Configuration and status monitoring are accomplished by the following methods:

1. By using an operator interface. This can be a Modular Service Tool, a Modular System Manager, a System Manager TS-L (Limited Access), 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 MLPD5 alone, only the System Manager, System Manager TS-L, and Modular Service Tool can be used to configure 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 configure and monitor the system in addition to the Modular Service Tool, Modular System Manager, and the System Manager TS-L (Limited Access).
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. Multiple VCCX2 Controllers.
2. A single VCCX2 Controller and a series of VAV/Zone Controllers that utilize a network device to broadcast information between all controllers on the local loop.

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

1. A MiniLink Polling Device 5 (MLPD5) is required per loop (Local Loop). The MLPD5 broadcasts information from one controller to all controllers on the 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.

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

1. By using an operator interface. This can be a Modular Service Tool, a Modular System Manager, a System Manager TS-L (Limited Access), or all 3 devices. The Modular System Manager, System Manager TS-L, 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 2 computer front-end software installed connected to the CommLink 5.

Network Communications Devices

MiniLink Polling Device 5 (MLPD5)

The MLPD5 is used in the following applications:

1. This device is required on all Zoning applications and is typically required 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, but on multiple loop systems, the MLPD5s are daisy-chained together back to the CommLink 5 to form the Network loop.

For a Networked Single Loop VCCX2 system, this device can be used for tenant logging and alarm reporting to a Modular System Manager or System Manager TS-L. 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 certain sensor values from a GPC-XP Controller to any controllers on this loop that do not have their own sensors.

For a Networked Single Loop VAV system, the MLPD5 can be used for tenant logging and alarm reporting to a Modular System Manager or System Manager TS-L. 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 VCCX2 Controller. It can also be used for tenant logging and alarm reporting to the Modular System Manager or System Manager TS-L.

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 at an RTU 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 VCCX2 system, this device can be used for tenant logging and alarm reporting to a Modular System Manager or System Manager TS-L. It can also 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.

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 & Installation

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 Figure 7, page 22 of this manual.

Installation Procedures

The installation procedures that follow are based on recommended methods of wiring connections 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 1, page 16 of this manual for a detailed Stand Alone System wiring diagram. Also see page 22 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, 15 VA minimum, transformer for the VCCX2 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 Hi 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 Hi Speed Stand Alone.

4. The System Manager TS-L 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-L. 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. The OPT1 Dipswitch should be set to ON for high speed.

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” and the Baud rate switch set to “High”.

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 2, page 17 for a detailed Interconnected System wiring diagram. Also see page 22 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 VCCX2 Controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications. Install a separate 24 VAC, 15 VA minimum transformer for each 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 Hi Speed Stand Alone.

3. The Modular System Manager SD connects to any controller using 18 gauge, 2 conductor shielded cable. 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. The Communications setting must be set to Hi Speed Stand Alone.

4. The System Manager TS-L 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-L. 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. OPT1 Dipswitch should be set to ON for high speed.

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” and the Baud rate switch set to “High.”

6. Use 18 gauge minimum, 2-wire cable for all 24 V AC 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 3-5, pages 18-20 for detailed Networked Single Loop System wiring diagrams. Also see page 22 for wire and transformer sizing information. You should review these diagrams before attempting connections or powering up the controller or interface devices.

Loop Containing VCCX2 Controllers Only
(Using CommLink 5)

1. Connect all VCCX2 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, 15 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 VCCX2 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” and the Baud rate switch set to “High” 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 Hi Speed Network Mode.

4. The Modular System Manager SD connects to any controller using 18 gauge, 2 conductor shielded cable. 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. The Communications setting must be set to Hi Speed Stand Alone. The Modular System Manager MUST always be connected on the “Local Loop”, never the “Network Loop”. The Communications setting must be set to Hi Speed Network Mode.

5. The System Manager TS-L 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-L. 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. The OPT1 Dipswitch should be set to ON for high speed.

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

Loop Containing VCCX2 Controller with VAV/Zone Controllers and MiniLink PD Only

1. Connect 2 conductor shielded cable from the VCCX2 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, 15 VA minimum, transformer for the VCCX2 Controller and wire from the transformer to the 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 VCCX2 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 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 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 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 VCCX2 Controller using 18 gauge, 2 conductor shielded cable. 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 Hi 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 Hi Speed Network Mode.

4. The System Manager TS-L 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-L. 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. The OPT1 Dipswitch should be set to ON for high speed.

5. Before powering up the controllers, set each VAV/Zone Controller’s board address to a unique number from 1 through 58. Address the VCCX2 Controller at 59. Set MiniLink PD’s address at 1.

**Loop Containing VCCX2 Controller with VAV/Zone Controllers and CommLink 5 Only**

1. Connect 2 conductor shielded cable from the VCCX2 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” and the Baud rate switch set to “High.”

2. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 15 VA minimum, transformer for the VCCX2 Controller and wire from the transformer to the VCCX2 Controller. Then wire from the 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 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 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 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 VCCX2 Controller using 18 gauge, 2 conductor shielded cable. 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 Hi 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 Hi Speed Network Mode.

5. The System Manager TS-L 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-L. 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. The OPT1 Dipswitch should be set to ON for high speed.

6. Before powering up the controllers, set each VAV/Zone Controller’s board address to a unique number from 1 through 58. Address the VCCX2 Controller at 59.

**Loop Containing VCCX2 Controller with 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” and the Baud rate switch set to “High.” 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, 15 VA minimum, transformer for the VCCX2 Controller and wire from the transformer to the VCCX2 Controller. Then wire from the VCCX2 Controller’s 3 wire communications connector to the MiniLink PD’s 3 wire communications con-
SYSTEM INSTALLATION

Networked Single Loop

Connect the VCCX2 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 VCCX2 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 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 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 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 VCCX2 Controller using 18 gauge, 2 conductor shielded cable. 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 Hi Speed Network Mode.

5. The System Manager TS-L 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-L. 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. The OPT1 Dipswitch should be set to ON for high speed.

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 Hi 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 VCCX2 Controller at 59. Set MiniLink PD’s address at 1.

Networked Multiple Loop Systems

See Figure 6, page 21 of this manual for detailed Networked Multiple Loop System wiring diagrams. Also see page 22 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 VCCX2 Controllers with VAV/Zone Controllers

1. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 15 VA minimum, transformer for the VCCX2 Controller and wire from the transformer to the controller.

2. Using 2 conductor shielded cable, connect from the VCCX2 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 VCCX2 Controller’s 3 wire communications connector to the VAV/Zone Controllers. Using 18 gauge minimum, 2 wire cable, connect all of the associated VAV/Zone Controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications.

4. Repeat the above steps for each local loop containing VCCX2 Controllers with VAV/Zone Controllers.

5. The Modular System Manager can connect to any VAV/Zone Controller on the entire system. 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 Hi Speed Network Mode.

6. The System Manager TS-L 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-L. 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. The OPT1 Dipswitch should be set to ON for high speed.

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 Hi 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” and the Baud rate switch must be set to “High.” The CommLink only needs to be connected to one of the MiniLink PDs on the system.

9. 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 VCCX2 Controller at 59. Set MiniLink PD’s address from 1 to 60.

Loops Containing VCCX2 Controllers without VAV/Zone Controllers

1. Connect all VCCX2 Controllers on the loop in a daisy chain format using 18 gauge minimum, 2 conductor shielded cable for communications. Install a separate 24 V AC, 15 VA minimum, transformer for each controller and wire to its 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” and the Baud rate switch set to “High”. Use the 110 V AC/24 V AC 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 V AC, 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 18 gauge, 2 conductor shielded cable, connect from the each MiniLink PD’s terminal connector marked “Network Loop” to the next MiniLink PD’s “Network Loop” terminal connector. 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 Hi Speed Network Mode.

7. 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 Hi Speed Network Mode.

8. The System Manager TS-L 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-L. It has a 2 wire 24 V AC terminal block for connection to a 24 V AC 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. The OPT1 Dipswitch should be set to ON for high speed.

9. Address the VCCX2 Controllers from 1 to 59.
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 configuration 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 configuration all of the controllers.

**Networked Systems**

1. Address each MiniLink PD from 1 to 60.
2. On a loop of VCCX2 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 VCCX2 Controller at 59.
4. On a VAV or Zoning system, apply power in the following order:
   a. VCCX2 Controller
   b. MiniLink Polling Device
   c. CommLink 5
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 configuration.
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-L to one of the controllers to perform configuration of all controllers on the entire system.
System Configurations
Typical Stand Alone System

Note: Either A Modular System Manager SD, Modular Service Tool SD, Or Computer 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.

Note: The SMTS-L Is An End-User Interface Only. It Cannot Be Used To Configure The Controllers.

Note: A Modular System Manager SD, A Modular Service Tool SD Or A PC With Prism 2 Software Installed Can Be Used To Configure And Maintain The Orion Controls System.

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

Figure 1: Stand Alone System Wiring
**Typical Interconnected System**

Note: A Modular System Manager SD, A Modular Service Tool SD, Or A PC With Prism 2 Software Installed Can Be Used To Configure And Maintain The Orion Controls System.

1. All wiring to be in accordance with local and national electrical codes and specifications.
**Figure 3: Networked Single Loop System With CommLink Only Wiring**
Figure 5: Networked Single Loop System With CommLink & MLPD - VAV/Zone Controllers
Figure 6: Networked Multiple Loop System Wiring With VAV/Zone Controllers
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 off line. If the installer does decide to use a large transformer to supply power to several devices, the following transformer and wiring 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.

18ga wire.................................0.00054 = voltage drop per 1' length of wire
16ga wire.................................0.00034 = voltage drop per 1' length of wire
14ga 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.

0.00054 (Voltage drop per foot for 18 gauge wire) x 64VA controller load = 0.346 Volts/Ft.

WattMaster controllers will operate efficiently with a voltage drop no greater than 2 Volts. Divide the total allowable voltage drop of 2 Volts by the number you arrived at above and you have the maximum number of feet you can run the 18 gauge wire with an 75 VA transformer with no more than a 2 Volt drop at the farthest controller from the transformer.

\[
\frac{2 \text{ (Volts total allowable voltage drop)}}{0.0346 \text{ (Voltage drop per 1 ft. @ 64VA load)}} = 57.80 \text{ feet}
\]

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.

---

**Component Power Requirements**

<table>
<thead>
<tr>
<th>Component</th>
<th>Power Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCCX2 Controller</td>
<td>15 VA</td>
</tr>
<tr>
<td>GPC-XP Controller</td>
<td>8 VA</td>
</tr>
<tr>
<td>VAV/Zone Controller</td>
<td>6 VA</td>
</tr>
<tr>
<td>MiniLink Polling Device</td>
<td>8 VA</td>
</tr>
</tbody>
</table>

**Transformer Sizing & Wiring**

Figure 7: Transformer & Wire Sizing
VCCX2 Controller Wiring
**Main Controller Wiring**

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

All Comm Loop Wiring Is Straight Through T to T, R to R & SHLD to SHLD

VCCX2 CONTROLLER

- **Local Loop RS-485 9600 Baud**
- **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**

OE271 Duct Static Pressure Transducer

**Size Transformer For Correct Total Load. VCCX2 Controller = 15 VA**

**See Individual Component Wiring Diagrams For Detailed Wiring Of Binary Inputs**

**See Individual Component Wiring Diagrams For Detailed Wiring Of Analog Inputs**

VCCX2 CONTROLLER

- **Connect To E-BUS Digital Room Sensor And/Or E-BUS Digital CO Sensor or Expansion Module(s) (When Used)**
- **24 VAC Must Be Connected So That All Ground Wires Remain Common. Failure To Do So Will Result In Damage To The Controllers.**

**NOTE:**
- **RELAY CONTACTS R2-R8 MAY BE CONFIGURED FOR:**
  1. COOLING STAGES
  2. HEATING STAGES
  3. AUX HEAT
  4. EMERGENCY HEAT
  5. MOD HEAT ENABLE
  6. MOD COOL ENABLE
  7. MORNING WARM-UP
  8. MORNING COOL-DOWN
  9. PREHEAT
  10. LOW AMBIENT
  11. EXHAUST
  12. ECONOMIZER
  13. HEAT WHEEL
  14. OCCUPIED
  15. OVERRIDE
  16. ALARM
  17. SPACE TEMPERATURE
  18. SPACE SLIDE OFFSET
  19. SUPPLY AIR TEMPERATURE
  20. RETURN AIR TEMPERATURE
  21. BUILDING PRESSURE
  22. SUPPLY AIR TEMP RESET
  23. OUTDOOR AIR TEMPERATURE
  24. NOT CONNECTED USE DUCT STATIC CONNECTOR

**Warning:** 24 VAC Power Only

- **Supply Fan**
- **Configurable Relay Output #2**
- **Configurable Relay Output #3**
- **Configurable Relay Output #4**
- **Configurable Relay Output #5**
- **Configurable Relay Output #6**
- **Configurable Relay Output #7**
- **Configurable Relay Output #8**

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

**Figure 8: OE338-26B-VCCX2 - VCCX2 Controller Wiring**
Figure 9: VCCX2 Binary Inputs Wiring
Figure 10: OE210, OE211, OE212, OE213 Space Temperature Sensor Wiring

Note: When Only The E-BUS Digital Room Sensor Is Used, It Connects Directly To The VCCX2 Controller Using An EBC E-BUS Cable Of The Appropriate Length. Mount At Least 5 Feet Above Floor. See Figure 13 For Connection When A Wall Mounted E-BUS CO₂ Sensor Is Also Used.

Figure 11: OE217-02 / OE217-03 / OE217-04 E-BUS Digital Room Sensor
OE256-05 E-BUS Wall-Mounted CO₂ Sensor

Note: Mount both sensors at least 5 feet above floor. The E-BUS Digital Room Sensor connects to the E-BUS CO₂ Sensor.

OE217-02, OE217-03, or OE217-04 E-BUS Digital Room Sensor

E-BUS Cable (EBC Cable)

Figure 12: OE256-05 Wall-Mounted E-BUS CO₂ Sensor

Note:
1. The Duct Mounted E-BUS CO₂ Sensor connects to the VCCX2 Controller using an EBC E-BUS Cable of the required length or the provided 10 foot EBC Cable.

OE256-07 Duct Mounted E-BUS CO₂ Sensor

EBC E-BUS Cable with Jack Connection

Figure 13: OE256-07 Duct-Mounted E-BUS CO₂ Sensor
Figure 14: OE231 Supply Air Temperature Sensor Wiring

Figure 15: OE231 Return Air Temperature Sensor Wiring
VCCX2 CONTROLLER WIRING

Building Pressure Sensor & Remote SAT Reset

Figure 16: OE258-01 Building Pressure Sensor Wiring

![Diagram of OE258-01 Building Static Pressure Sensor](image)

NOTE:
Either The Slide Offset Option For The Space Temperature Sensor May Be Used Or The Remote Supply Air Temperature Reset Signal Option (By Others) May Be Connected To AI6 On The VCCX2 Controller. Only One Option Is Allowed, Not Both.

Figure 17: Remote Supply Air Temperature Reset Wiring

![Diagram of Remote Supply Air Temperature Reset Wiring](image)
Figure 18: OE250 Outdoor Air Temperature Wiring

- Make Splice Connections Inside Sensor Enclosure As Shown. Seal All Conduit Fittings With Silicone Sealant.
- Mount Sensor Outdoors In Shaded Protected Area & In Upright Position As Shown.

Figure 19: OE265-15-A or OE265-16-A – E-BUS Outdoor Air Temperature & Humidity Sensor Wiring

- Connect the Sensor to the VCCX2 Controller Using an EBC E-BUS Cable.
- EBC E-BUS Cable with Jack Connection
- 10 Foot EBC E-BUS Cable (Provided)
**Figure 20: OE265-17-A – E-BUS Return Air Temperature & Humidity Sensor Wiring**

**Figure 21: OE271 Static Pressure Transducer Wiring**
VCCX2 CONTROLLER WIRING

Supply Fan VFD & Bypass Damper Actuator Wiring

Figure 22: Supply Fan VFD & Bypass Damper Actuator Wiring

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.

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

Size Transformer For Correct Total Load. VCCX2 Controller = 15 VA
Figure 23: Economizer Damper Actuator or Water-Side Economizer Actuator Wiring

VCCX2 Component & Systems Wiring
Modulating Heating Wiring

**Figure 24: Modulating Heating Device Wiring**

Note:
1. If the Modulating Heating Device Needs a Relay Signal to Activate, This Can Be Configured When Setting Up the VCCX2 Controller.
Figure 25: Building Pressure Control Output Wiring Diagram
Airflow Monitoring


NOTE: Set Airflow Monitoring Station’s Baud Rate To 19,200 In Order To Communicate With The VCCX2.

WARNING!! Observe Polarity! All boards must be wired with GND-to-GND and 24 V AC-to-24 V AC. Failure To observe polarity could result in damage to the boards.

WARNING!! Size Transformer For Correct Total Load. VCCX2 Controller = 15 VA

E-BUS Cable (EBC Cable)

OE365-15-EBA E-BUS Adapter Board

Airflow Measurement Digital Transmitter Terminals For Exhaust Air CFM (Set Address Switch To 12)

Airflow Measurement Digital Transmitter Terminals For Supply Air CFM (Set Address Switch To 11)

Airflow Measurement Digital Transmitter Terminals For Return Air CFM (Set Address Switch To 10)

Airflow Measurement Digital Transmitter Terminals For Outdoor Air CFM (Set Address Switch To 9)

VCCX2 Controller

Line Voltage

24VAC

GND

Size Transformer For Correct Total Load. VCCX2 Controller = 15 VA

E-BUS Cable (EBC Cable)

WARNING!! Observe Polarity! All boards must be wired with GND-to-GND and 24 V AC-to-24 V AC. Failure To observe polarity could result in damage to the boards.

NOTE: Set Airflow Monitoring Station’s Baud Rate To 19,200 In Order To Communicate With The VCCX2.

WARNING!! Observe Polarity! All boards must be wired with GND-to-GND and 24 V AC-to-24 V AC. Failure To observe polarity could result in damage to the boards.

VCCX2 Controller = 15 VA

E-BUS Cable (EBC Cable)

OE365-15-EBA E-BUS Adapter Board
Wiring Notes:
1.) All wiring to be in accordance with local and national electrical codes and specifications.

2.) All communication wiring to be 18 gauge minimum, 2 conductor twisted pair with shield. Use Belden #82760 or equivalent.
VCC-X EM1 & 12-Relay E-BUS Expansion Module 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 28: OE233 – Entering Water Temperature Sensor Wiring

Entering Water Temperature Sensor (Strap On)

Connect To VCCX2 Controller

Connect To Expansion Module(s) (When Used)

Size Transformer
For Correct Total Load, VCC-X EM1 Module = 5 VA
VCCX2 EXPANSION MODULE WIRING

VCC-X EM1 Entering Water Temperature Sensor Wiring

Butt Splice Or Wire Nut Wire Leads And Extend Wire To Controller Terminals. Connect One Wire Lead To Entering Water Temperature Terminal (T1) At The EM1 Expansion Module. Secure Other Wire Lead To Ground Terminal At The Controller. See Note 3.

Secure Sensor Element And Thermal Mastic Strip To Pipe With Supplied Wire Tie. Be Sure To Tighten Wire Tie Snugly To Ensure Good Thermal Contact.

Thermal Mastic Strip (Supplied)

Enter Water Pipe

See Note 1 & 2.

Notes:

1.) Sensor Should Be Mounted At Location Along Pipe Length That Best Represents Desired Temperature Reading.

2.) Sensing Element Shown Mounted To Top Of Pipe. The Sensor Element May Be Located At Any Location Around Pipe.

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

Caution: For Accurate Temperature Readings It Is Necessary To Place Insulation Over The Sensor After Installation. This Prevents The Ambient Temperature From Affecting The Sensor. Insulation Should Cover The Sensor And Extend 6" to 12" Beyond Each End Of The Sensor.

Figure 29: OE233 – Entering Water Temperature Sensor Installation

Entering Water Temperature Sensor

VCCX2 Component & Systems Wiring 41
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.

Connect FRP Tubing To Low Pressure Port (Top Tube) and Route To Static Pressure Pickup Probe Located In Exhaust Duct. Leave The High Pressure Port Open To Atmosphere.


OE271
Static Pressure Transducer

- See Economizer Actuator Wiring AO2 For VCCX2 Controller

Title 24 Economizer Actuator Feedback Signal 2-10VDC (By Others) Set Jumper To 0-10V

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

Connect To VCCX2 Controller

Connect To Expansion Module(s) (When Used)

Size Transformer For Correct Total Load. VCC-X EM1 Module = 5 VA

Figure 30: VCC-X EM1 Exhaust Duct Static Pressure & Economizer Actuator Feedback Wiring
VCC-X EM1 Output Wiring

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

CONFIGURABLE RELAY OUTPUT #1
CONFIGURABLE RELAY OUTPUT #2
CONFIGURABLE RELAY OUTPUT #3
CONFIGURABLE RELAY OUTPUT #4
CONFIGURABLE RELAY OUTPUT #5

24 VAC ONLY

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

CHILLED WATER VALVE ACTUATOR

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

RETURN AIR DAMPER ACTUATOR

RETURN AIR BYPASS DAMPER ACTUATOR

24 VAC POWER

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.

VCC-X EM1 Module = 5 VA

Size Transformer For Correct Total Load.

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.

---

Figure 32: Chilled Water Valve Actuator Wiring Diagram

---

Size Transformer For Correct Total Load. VCC-X EM1 Module = 5 VA

---

VCCX2 EXPANSION MODULE WIRING

Chilled Water Valve Actuator Wiring

---

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VCCX2 Component & Systems Wiring
Figure 33: Return Air Bypass 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.

Size Transformer For Correct Total Load. VCC-X EM1 Module = 5 VA

Belimo Actuator Wiring Shown. Consult Factory For Other Manufacturer Wiring Instructions.
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:
All Relay Outputs Are Normally Open And Rated For 24 VAC Power Only. 1 Amp Maximum Load.

NOTE: RELAY CONTACTS R1-R12 MAY BE CONFIGURED FOR:
1.) COOLING STAGES
2.) HEATING STAGES
3.) AUX HEAT
4.) EMERGENCY HEAT
5.) MOD HEAT ENABLE
6.) MOD COOL ENABLE
7.) MORNING WARMUP
8.) MORNING COOL-DOWN
9.) REHEAT
10.) PREHEAT
11.) LOW AMBIENT
12.) EXHAUST
13.) ECONOMIZER
14.) HEAT WHEEL
15.) OCCUPIED
16.) OVERRIDE
17.) ALARM
18.) LIQUID LINE 1 SOLENOID - EXV 1
19.) LIQUID LINE 2 SOLENOID - EXV 2
20.) LIQUID LINE 3 SOLENOID - EXV 3
21.) LIQUID LINE 4 SOLENOID - EXV 4
22.) CONDENSER PUMP
23.) SUMP HEATER
24.) SUMP PUMP DRAIN

Figure 34: OE358-23E-12R - 12 Relay E-BUS Expansion Module Wiring
Refrigeration System Module Wiring
NOTE:
IF THERE ARE TWO COMPRESSORS ON A SINGLE CIRCUIT (A TANDEM CIRCUIT), SUCTION PRESSURE 2 AND HEAD PRESSURE 2 WOULD NOT BE USED.

Figure 35: RSMD Inputs Wiring
**NOTE:**

IF THERE ARE TWO COMPRESSORS ON A SINGLE CIRCUIT (A TANDEM CIRCUIT), CONDENSER SIGNAL 2 WOULD NOT BE USED.

---

**NOTE:**

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

---

**FILE NAME**

RSMD-OUTPUTS-01C.CDR

**DATE:** 12/04/17  
**BY:** Sonya Olson

**PAGE**

1 of 1

**DESCRIPTION:**

VCCX2 Controller  
RSMD Outputs Wiring

---

**Figure 36: RSMD Outputs Wiring**
Figure 37: RSMSD Inputs Wiring

RSMSD Module Input Wiring

OE370-23-RSMSD
RSM FOR SINGLE
DIGITAL COMPRESSOR

Size Transformer For Correct Total Load.
RSMSD = 18 VA

24VAC
Line Voltage

FILENAME
RSMSD-INPUTS-1A.CDR
DATE: 09/19/17
BY: Sonya Olson

DESCRIPTION:
VCCX2 Controller
RSMSD Input Wiring
Figure 38: RSMSD Outputs Wiring

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

RSMSD = 18 VA

Connect to VCCX2 Controller

Size Transformer For Correct Total Load, RSMSD = 18 VA

Connect to VCCX2 Controller

Status Transformer Connects To VCCX2 Loop Communications Connector When Used On A Split System.

FileName: OE370-23-RSMSD RSM For Single Digital Compressor

Date: 12/04/17

By: Sonya Olson

VCCX2 Component & Systems Wiring
REFRIGERANT SYSTEM MODULE FOR VFD COMPRESSORS (RSMV)

SUCTION PRESSURE SENSOR

HEAD PRESSURE SENSOR (BY OTHERS)

COIL (SUCTION LINE) TEMP. 1 SENSOR

COIL (SUCTION LINE) TEMP. 2 SENSOR

COMPRESSOR STATUS 1

COMPRESSOR STATUS 2

ALARM

MENU

ENTER

UP

DOWN

RELAY CONTACT

RATING IS 1 AMP @ 24 VAC

CONDENSER

COMP 1

COMP 2

EXPANSION VALVE 1

SUCTION PRESSURE SENSOR

HEAD PRESSURE SENSOR

PRESSURE SENSOR

PRESSURE SENSOR

COIL TEMP SENSORS

BINARY INPUTS

EXPANSION VALVE 2

ANALOG OUTPUTS

BLACK

+5 V

+5 V

COIL TEMP 1

COMP STATUS 1

WHITE

MOD COMP SIG

CONDENSER FAN SIG

RED

RED

GND

GREEN

GREEN

NOT USED

COMMON

RELAY OUTPUT TERMINALS

Size Transformer For Correct Total Load. RSMV = 18 VA

Line Voltage

24VAC

GND

Line Voltage

24VAC

GND

**FILENAME**

RSMV-INPUTS-01B.CDR

**DATE:** 09/18/17

**DESCRIPTION:**

VCCX2 Controller

RSMV Input Wiring

**PAGE:**

1 of 1

**FILE:**

RSMV-INPUTS-01B.CDR

**DATE:** 09/18/17

**DESCRIPTION:**

VCCX2 Controller

RSMV Input Wiring

Figure 39: RSMV Inputs Wiring
Figure 40: RSMV Outputs Wiring

REFRIGERANT SYSTEM MODULE FOR VFD COMPRESSORS (RSMV)

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

CONNECTIONS:
- **24 VAC ONLY**
  - RLY1: COMPRESSOR 1 ENABLE
  - RLY2: COMPRESSOR 2 ENABLE
  - RLY3: CONDENSER ENABLE

**Expansion Valves:**
- Expansion Valve 1
- Expansion Valve 2

**Modulating Compressor**
- Connect to VCCX2 Controller

**Condenser Fan Signal**
- Size Transformer For Correct Total Load. RSMV = 18 VA
RSMV-HP Module Input Wiring

Figure 41: RSMV-HP Inputs Wiring

REFRIGERANT SYSTEM MODULES

RSMV-HP = 18 VA

Size Transformer For Correct Total Load.
Figure 42: RSMV-HP Outputs Wiring
VAV/Zone Controller Diagrams
VAV/ZONE CONTROLLER WIRING

VAV/Zone Controller Package Wiring

NOTE: The Optional E-BUS Digital Room Temperature Sensor Can Be Connected To The VAV/Zone Controller With E-BUS Cable(s) Of The Required Length Or They Can Be Hand Wired From The Terminals On The VAV/Zone Controller To The Terminals On The E-BUS Sensor.

NOTE: Mount Sensor At Least 5 Feet Above Floor.

Optional - Discharge Air Temperature Sensor. Only Required When The Main Controller Is Not Installed On The HVAC Unit Connected To The Terminal Units. Locate In Ductwork Downstream Of The Terminal Unit Or Upstream If Using Stand-Alone Damper.

Wire To Previous And/OR Next VAV/Zone Controller Actuator Package Or Device On The Local Communications Loop. All Communication Wiring Must Be Plenum-rated, Minimum 18-gauge, 2-conductor, Twisted Pair With Shield Wire. Watstaker Can Supply Communication Wire That Meets This Specification And Is Color Coded For Local Loop. The Local Loop Wire Part Number Is WR-L-WG-18. Is Color Coded With Green Candy Stripping And Comes On A 1000 Ft. Spool. If Desired, 18-Gauge Minimum Beldon #02760 Or Equivalent Communications Wire May Also Be Used For The Local Loop Wiring.

WARNING: When Multiple VAV/Zone Controller Actuator Packages Are Powered From A Single Transformer, Polarity Must Be Observed Or Damage To The Controllers Will Result.

CAUTION: Disconnect All Communication Loop Wiring From The VAV/Zone Controller Actuator Before Removing Power, Reconnect Power And Then Reconnect Communication Loop Wiring.

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

Address Switch Shown Is Set For Address 21

Address Switch Shown Is Set For Address 1

Loop Baud Switch 1 Should Be Set To Off And Loop Baud Switch 2 Should Be Set To On As Shown For VAV/Zone Controllers Using High Speed Connection.

The Address For Each VAV/Zone Controller Must Be Unique To The Other Zone Controllers On The Local Loop And Be Between 1 and 58.

Figure 43: VAV/Zone Controller Package with Terminal Blocks Wiring
Figure 45: OE325-01 Expansion Module Wiring
Figure 46: OE325-01 Expansion Module Wiring

VCCX2 Component & Systems Wiring
Typical Wiring For
Single Duct Terminal With Modulating Hot
Water Heat

Remove Control Board from Snaptrack & Mount
Snaptrack on Box

E-BUS EBC Cable

Typical Wiring For
Fan Terminal With Modulating Hot
Water Heat

Remove Control Board from Snaptrack & Mount
Snaptrack on Box

E-BUS EBC Cable

24 VAC Transformer Supplied & Wired by Others. Size For Required HW Valve Load.

24 VAC Transformer Supplied & Wired by Others. Size For Required Fan Relay Load.

WattMaster Part #OE325-03
Zone Controller Expansion Module

WattMaster Part #OE325-03
Zone Controller Expansion Module

24 VAC Fan
Relay Supplied & Wired By Others. 1 Amp Max. Load

24 VAC Fan
Relay Supplied & Wired By Others. 1 Amp Max. Load

0-10 VDC Modulating
Hot Water Valve
Supplied & Wired
By Others

0-10 VDC Modulating
Hot Water Valve
Supplied & Wired
By Others

40 VDC
HWV

40 VDC
HWV

0-10 VDC

0-10 VDC

GND

GND

AOUT

AOUT

COM

COM

R1

R1

RC

RC

24 VAC

24 VAC

COM

COM

Typical Wiring For
Single Duct Terminal With Modulating Hot
Water Heat

Connect to VAV/Zone
Controller E-BUS
Female Connector

Connect to VAV/Zone
Controller E-BUS
Female Connector

24 VAC Transformer Supplied & Wired by
Others. Size For Required Fan Relay Load.

24 VAC Transformer Supplied & Wired by Others. Size For Required HW Valve Load.
VAV/ZONE CONTROLLER WIRING

Slaved Zone Wiring

Figure 48: Slaved Zone Wiring

MT ONE BYPASS & SLAVE INTERFACE CARD WITHIN 1 FOOT OF ZONE CONTROLLER & ACTUATOR. CONNECT TO ZONE CONTROLLER AND ACTUATOR WITH SUPPLIED CABLES. WIRE TO SECOND (AND THIRD WHEN USED) SLAVE INTERFACE CARD WITH 24 GAUGE MINIMUM WIRE.

SLAVED ZONE DAMPER ASSEMBLY #1

(PL101824) BYPASS AND SLAVE INTERFACE CARD

SECOND SLAVE INTERFACE CARD NOT USED IN THIS APPLICATION

(PL101824) BYPASS AND SLAVE INTERFACE CARD

APPLIES TO WIRING THE OE520-XX-PT PRESSURE DEPENDENT ROUND ZONE DAMPER, THE OE736-03-PT PRESSURE DEPENDENT RECTANGULAR ZONE DAMPER AND THE OE742-01P-VAVZ ZONE CONTROLLER ACTUATOR PACKAGE.
Addressing and Baud Rate

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.

BAUD RATE SELECTION

Baud | Switch 1 | Switch 2 | Communication Setting
--- | --- | --- | ---
9600 | OFF | OFF | CommLink IV
9600 | OFF | OFF | CommLink 5 Set at Low Speed*
57600 | OFF | ON | CommLink 5 Set at High Speed* or VAV/Zone Controller is Stand Alone

* The CommLink 5 must be set to Low Speed if it is being used on a system that includes the VCM-X Controller or older generation of Orion Controllers.
** The CommLink 5 can be set to High Speed if it is being used on a system that only includes VCC-X, VCB-X, or GPC-XP Controllers.

The Address For Each Controller Must Be Between 1 And 58 And Be Unique To The Other Controllers On The Local Loop.

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 49: Address and Baud Rate Switch Setting
Communication Devices
Diagrams
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.

All Comm Loop Wiring Is Straight Through

Figure 50: OE392-12 Modular System Manager SD Wiring & Jumper Setting
Be Sure The Modular Service Tool Is Connected To A Unit Controller. Plugging One End Of 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 SD 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.
System Manager TS-L to VCCX2 Controller Wiring

Figure 52: OE392-11 System Manager TS-L to VCCX2 Controller Wiring

**NOTE:** 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.

**NOTE:** Dip Switch OPT1 Should Be Set To ON For High Speed And OPT2 & OPT3 Should Be Set To OFF. OPT4 Should Be Set To ON By Default. If Your Screen Is Not Centered Correctly, Switch OPT4 To The Opposite Position.

**NOTE:** Run 2 Conductor Twisted Pair W/Shield Cable. WattMaster WR-LL-WG-18 Cable Or Equivalent From System Manager TS To VCC-X Controller.

Run 2 Conductor 20 Ga. Minimum Cable From System Manager TS Terminals To 24 VAC Transformer.

System Manager TS-L - Back View

VCCX2 Controller - Front View

24 VAC Transformer 5 VA Minimum

Line Voltage

NOTE: Transformer - To (24 VAC)
Transformer + To (24 VAC)
Figure 53: OE392-11 System Manager TS-L to VAV/Zone Controller Wiring

**System Manager TS-L to VAV/Zone Controller Wiring**

1. **Run 2 Conductor Twisted Pair W/Shield Cable.** WattMaster WR-LL/WG-18 Cable Or Equivalent From System Manager TS To VAV/Zone Controller.
2. **24 VAC Transformer** To (24 VAC) Terminals To 24 VAC Transformer
3. **NOTE:** Dip Switch OPT1 Should Be Set To ON For High Speed And OPT2 & OPT3 Should Be Set To OFF. OPT4 Should Be Set To ON By Default. If Your Screen Is Not Centered Correctly, Switch OPT4 To The Opposite Position.
4. **NOTE:** 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 - Front View**

**System Manager TS-L - Back View**

---

**VCCX2 Component & Systems Wiring**

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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, if 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.

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, and local electrical wiring codes.

Optional Items
Not required for CommLink-only installations.

USB cable (included). Connect this cable to your computer USB port for direct connection to the CommLink 5.

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.

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

IP Module (Part Of OE415-02 IP Module Kit). Used When TCP/IP LAN Or Internet Communications With The Control System Is Desired.

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.
COMMUNICATION DEVICES

On-Site Computer Connections & Wiring

Figure 56: On-Site Computer Connection
**COMMUNICATION DEVICES**

Remote Job-Site Computer Connections & Wiring

Figure 57: Remote Job-Site Computer Connection

VCCX2 Component & Systems Wiring

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Optional USB-Link 2 Connection Diagram

- **Mini-DIN Cable** Supplied With USB-Link
- **PL101904** Adapter
- **PL101905** Adapter
- **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. This Only Allows Communications With The Board It Is Connected To PL101904
- **NOTE:** Use The Adapter And Wire To A Terminal Block To Connect The USB-Link To The Local Communications Loop All Controllers That Are Connected To The System PL101905L
- **Mini-DIN Cable** Use The USB-Link Mini D Cable To The - IN Connector On Controllers That Are Supplied With Them. All Controllers That Are Connected To The System - IN Female Mini D Plug This Allows Communications With . See Note 1.

**NOTE:**

USB-Link 2 Computer Connections & Wiring

**Controller With Mini-DIN Plug**

**Unit Controller**

**VCCX2 Unit Controller**

**VCCX2 Controller**

**Orion No.: OE338-26B-VCCX2 AAON No.: V87900**

**BINARY INPUTS**

<table>
<thead>
<tr>
<th>BI1</th>
<th>BI2</th>
<th>BI3</th>
<th>BI4</th>
<th>BI5</th>
<th>BI6</th>
<th>AI1</th>
<th>AI2</th>
<th>AI3</th>
<th>AI4</th>
<th>AI5</th>
<th>AI6</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROOF OF AIRFLOW</td>
<td>DIRTY FILTER</td>
<td>HOOD ON/OFF</td>
<td>REMOTE OCCUPIED</td>
<td>REMOTE COOLING</td>
<td>REMOTE HEATING</td>
<td>REMOTE DEHUMIDIFICATION</td>
<td>SPACE TEMPERATURE</td>
<td>SPACE SLIDE OFFSET</td>
<td>SUPPLY AIR TEMPERATURE</td>
<td>RETURN AIR TEMPERATURE</td>
<td>BUILDING PRESSURE</td>
</tr>
</tbody>
</table>

**ANALOG INPUTS**

<table>
<thead>
<tr>
<th>BI7</th>
<th>BI8</th>
<th>AI7</th>
<th>AI8</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATIC CONNECTOR</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Communication Switch** Must Be Set To Stand Alone Or Network Depending On Your Installation.

**Communication Speed Switch** Must Be Set To Low or High Speed Depending On Your Controller's Baud Rate.

**WattMaster**

**Overlay**

| #S 000079 | Rev.: 1A |

**USB-Link 2**

**DUAL E-BUS**

**24 VAC POWER ONLY**

**WARNING! POLARITY MUST BE OBSERVED OR THE CONTROLLER WILL BE DAMAGED**

**Computer (By Others) With Prism 2 Software Installed**

**STAND ALONE NETWORK**

**Communication Speed Switch** Must Be Set To Low or High Speed Depending On Your Controller's Baud Rate.

**RS-485 COMM LOOP. WIRE "R" TO "R", "T" TO "T", "SHLD" TO "SHLD"**

**24 VAC POWER ONLY**

**Communication Speed Switch** Must Be Set To Low or High Speed Depending On Your Controller's Baud Rate.

**Figure 58: Computer Connections Using USB-Link 2**

**COMMUNICATION DEVICES**

**USB-Link 2 Computer Connections & Wiring**
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 recommends using a separate transformer for each device in order to eliminate the potential for damaging devices due to incorrect polarity.

Using separate transformers also allows redundancy in case of a transformer failure. Instead of having 8 devices inoperative because of a malfunctioning transformer, you have only 1 device off line.

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 recommends using a separate transformer for each device in order to eliminate the potential for damaging devices due to incorrect polarity.

Using separate transformers also allows redundancy in case of a transformer failure. Instead of having 8 devices inoperative because of a malfunctioning transformer, you have only 1 device off line.

**NOTE:** All communication wiring must be plenum-rated, minimum 18-gauge, 2-conductor, twisted pair with shield wire. WattMaster can supply communication wire that meets this specification and is color coded for the network or local loop. The local loop wire part number is WR-LL-WG-18, is color coded with green candy striping and comes on a 1000 ft. spool. The network loop wire part number is WR-NL-WR-18, is color coded with red candy striping and comes on a 500 ft. spool. If desired, 18 gauge minimum Belden #82760 or equivalent communications wire may also be used for network or local loop wiring.
Add-On Devices
Diagrams
ADD-ON DEVICES

GPC-XP Controller Wiring

Figure 60: OE332-23-GPCXP GPC-XP Controller Wiring

NOTES:
1.) 24 VAC Must Be Connected So That All Ground Wires Remain Common. Failure To Do So Will Result In Damage To The Controller
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 The Address Switch Is Set Before Installation.

1. Not Configured
2. Direct Acting Floating Point
3. Reverse Acting Floating Point
4. Direct Acting PID
5. Reverse Acting PID
6. Follow Active Binary Input
7. Follow Inactive Binary Input
8. Follow Relay Output
9. Follow Schedule
10. Ventilation Control
11. Lead Relay For Lead/Lag Control
12. Lag Relay For Lead/Lag Control

ADB Control Systems

FILENAME
GDPX-Wire-1A.CDR

DATE: 01/05/17
DRAWN BY: Sonya Olson

PAGE
1 of 1
DESCRIPTION:
OE332-23-GPCXP
GPC-XP Controller

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

USE ON-BOARD COMMLINK

Both Jumper OFF

USE EXTERNAL COMMLINK
**GPC-XP Controller Addressing & Baud Rate Selection**

**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.

---

### 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>9600</td>
<td>OFF</td>
<td>OFF</td>
<td>CommLink 5 Set at Low Speed*</td>
</tr>
<tr>
<td>57600</td>
<td>OFF</td>
<td>ON</td>
<td>CommLink 5 Set at High Speed* or GPC-XP is Stand Alone</td>
</tr>
</tbody>
</table>

* The CommLink 5 must be set to Low Speed if it is being used on a system that includes the VCM-X Controller or older generation of Orion Controllers.

** The CommLink 5 can be set to High Speed if it is being used on a system that only includes VCC-X or VCC-X Controllers that are set to High Speed along with this GPC-XP Controller.

---

**Address Switch Shown Is Set For Address 1**

- Address 1 @ 9600 Baud
  - ADD
    - 1
    - 2
    - 4
    - 8
    - 16
    - 32
    - Baud 0
    - Baud 1

**Address Switch Shown Is Set For Address 13**

- Address 5 @ 57,600 Baud
  - ADD
    - 1
    - 2
    - 4
    - 8
    - 16
    - 32
    - Baud 0
    - Baud 1

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

---

**WattMaster Controls**

**YS102432 REV 3**

**MADE IN USA**

**1 of 1**

---

**Figure 62: OE332-23-GPCXP GPC-XP Controller Addressing & Baud Rate Selection**
Additional Module Wiring & Connections
NOTE: For additional configurations, please see the MODGAS-X Controller Field Technical Guide.

Connect Supply Air Temperature Sensor To AI3 & GND On VCCX2 Controller.

Mount In Supply Air Duct

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-X Controller Wiring When Used With The VCCX2

Figure 63: OE377-26-00058 - Single Modulating Valve No Staging Communicating
VCCX2 Component & Systems Wiring

Figure 64: OE377-26-00060-1 One Modulating Valve, One Ignitor, One Stage Communicating Wiring

NOTE: For additional configurations, please see the MODGAS-XWR-1 Controller Technical Guide.

Connect Supply Air Temperature Sensor to A13 & GND On VCCX2 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.
MHGRV-X Controller Wiring When Used With The VCCX2

Figure 65: OE377-26-00059  MHGRV-X Controller to VCCX2 Controller Wiring

Connect Supply Air Temperature Sensor To AIS & GND On VCCX2 Controller

Mount In Supply Air Duct

SAT OPTIONS
Jumper Setting.
Only One Supply Air Temperature Sensor Can Be Used Per Application.

EBC E-BUS Cable
Connects To VCCX2 Expansion Port When Used With VCCX2 Controller

EBC E-BUS Cable
Connects To Reheat Expansion Module

40 VA Transformer Minimum

Fan

Compressor

HGR Solenoid Valve

2 Position HGR Valve (Optional)

Condenser Valve #1

HGR Valve #1

FILENAME
DATE:
DESCRIPTION:
DRAWN BY:
MHGRV-X Controller
1 of 1
JOB NAME

MHGRVX-Wiring-1A.CDR
OE377-26-00059
Sonya Olson12/05/17
Figure 66: PREHEAT-X & PREHEAT-X-EXT Controller Wiring to VCCX2 Controller

Note:
All Relay Outputs Are Normally Open And Rated For 24 VAC Power Only. 1 Amp Maximum Load.
Miscellaneous Technical Information
### Temperature Sensor Resistance/Voltage Chart

<table>
<thead>
<tr>
<th>Temp [°F]</th>
<th>Resistance [Ohms @ Input]</th>
<th>Voltage [V]</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10</td>
<td>93333</td>
<td>4.620</td>
</tr>
<tr>
<td>-6</td>
<td>80531</td>
<td>4.550</td>
</tr>
<tr>
<td>0</td>
<td>69822</td>
<td>4.474</td>
</tr>
<tr>
<td>5</td>
<td>60552</td>
<td>4.380</td>
</tr>
<tr>
<td>10</td>
<td>52500</td>
<td>4.297</td>
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<td>15</td>
<td>45902</td>
<td>4.200</td>
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<td>4.095</td>
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<td>3.982</td>
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<td>30805</td>
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<td>35</td>
<td>27140</td>
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</tr>
<tr>
<td>40</td>
<td>23874</td>
<td>3.605</td>
</tr>
</tbody>
</table>

*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.

---

**Figure 67: OE210-02, OE211-02, OE212-02, OE213-02 Modular Room Sensor Wiring**
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.

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.
Updating E-BUS Module Software

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 96 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.

   1) Set Time & Date
   2) Communications
   NEXT) More Options
   ESC) Exit Menu

   3) Energy Saving
   4) Update Software
   NEXT) More Options
   ESC) Exit Menu

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

   Select Communication
   1) WattMaster Comm
   2) E-BUS Module
   ESC) Exit Menu

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:

   Enter Board Address
   0
   Esc) Exit Menu

2. Enter the address of the E-BUS module you are updating and then press <ENTER>. The following is the list of Module addresses:

   MHGRV-X - address 132
   MODGAS-X - address 138
   MODGAS-XWR - address 138 & 139 (#2 board)
   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>.

   Software Version
   Enter 0 for Latest
   0
   Esc) Exit Menu

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.”
Space, Supply Air, Outdoor Air or Return Air Temperature Sensor Testing

The following sensor voltage and resistance table is provided to aid in checking sensors that appear to be operating incorrectly. Many system operating problems can be traced to incorrect sensor wiring. Be sure all sensors are wired per the wiring diagrams in this manual.

If the sensors still do not appear to be operating or reading correctly, check voltage and/or resistance to confirm that the sensor is operating correctly per the tables. Please follow the notes and instructions that appear after the chart when checking sensors.

<table>
<thead>
<tr>
<th>Temp (ºF)</th>
<th>Temp (ºC)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10</td>
<td>-23.33</td>
<td>93333</td>
<td>4.51</td>
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<tr>
<td>-5</td>
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<td>69822</td>
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<td>-15</td>
<td>60552</td>
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<td>52500</td>
<td>4.2</td>
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<td>-9.44</td>
<td>45902</td>
<td>4.1</td>
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<td>-6.66</td>
<td>40147</td>
<td>4.002</td>
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<td>35165</td>
<td>3.891</td>
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<td>30805</td>
<td>3.773</td>
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<td>27140</td>
<td>3.651</td>
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<tr>
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<td>23874</td>
<td>3.522</td>
</tr>
<tr>
<td>45</td>
<td>7.22</td>
<td>21094</td>
<td>3.39</td>
</tr>
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<td>10</td>
<td>18655</td>
<td>3.252</td>
</tr>
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<td>17799</td>
<td>3.199</td>
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<td>11652</td>
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</tr>
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<td>11379</td>
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<tr>
<td>72</td>
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<td>11136</td>
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<tr>
<td>73</td>
<td>22.77</td>
<td>10878</td>
<td>2.605</td>
</tr>
</tbody>
</table>

Table 1: Temperature/Resistance for Type III 10K Ohm Thermistor Sensors

Thermistor Sensor Testing Instructions

Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered).

Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the “-” (minus) lead on GND terminal and the “+” (plus) lead on the sensor input terminal being investigated.

If the voltage is above 4.88 VDC, then the sensor or wiring is “open.” If the voltage is less than 0.05 VDC, then the sensor or wiring is shorted.
APPENDIX A: MISCELLANEOUS TECHNICAL INFORMATION

OE271 Duct Static & OE258-01 Building Pressure Sensor Testing

OE271 Pressure Sensor Testing

The table below is used to troubleshoot the OE271 Duct Static Pressure Sensors.

<table>
<thead>
<tr>
<th>Pressure @ Sensor (&quot;W.C.&quot;)</th>
<th>Voltage @ Input (VDC)</th>
<th>Pressure @ Sensor (&quot;W.C.&quot;)</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>
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<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>
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<td>0.73</td>
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<td>2.81</td>
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<tr>
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<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>
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<td>0.97</td>
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<td>3.05</td>
</tr>
<tr>
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<td>1.05</td>
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<td>3.13</td>
</tr>
<tr>
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<td>1.13</td>
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<td>3.21</td>
</tr>
<tr>
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<td>1.21</td>
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<td>3.29</td>
</tr>
<tr>
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<td>1.29</td>
<td>3.90</td>
<td>3.37</td>
</tr>
<tr>
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<td>1.37</td>
<td>4.00</td>
<td>3.45</td>
</tr>
<tr>
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<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>
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<tr>
<td>2.20</td>
<td>2.01</td>
<td>4.80</td>
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<tr>
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<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>
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</tr>
<tr>
<td>2.50</td>
<td>2.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Duct Static Pressure/Voltage for OE271 Duct Static Pressure Sensors

OE258-01 Building Pressure Sensor Testing

The table below is used to troubleshoot the OE258-01 Building Pressure Sensors.

<table>
<thead>
<tr>
<th>Pressure @ Sensor (&quot;W.C.&quot;)</th>
<th>Voltage @ Input (VDC)</th>
<th>Pressure @ Sensor (&quot;W.C.&quot;)</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>
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<tr>
<td>-0.21</td>
<td>0.40</td>
<td>0.05</td>
<td>3.00</td>
</tr>
<tr>
<td>-0.20</td>
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<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>
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<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>
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<td>3.70</td>
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<tr>
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<td>3.80</td>
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<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>
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<tr>
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<td>0.23</td>
<td>4.80</td>
</tr>
<tr>
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<td>4.90</td>
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</tr>
<tr>
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<td>2.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Building Static Pressure/Voltage for OE258-01 Building Pressure Sensors

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 right side of the resistor labeled R85. 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 module. Read voltage with meter set on DC volts. Place the “−” (minus) lead on terminal labeled GND and the “+” lead on terminal A15 on the VCCX2 Controller.
OE275-01 Suction Pressure Transducer Testing for R410A Refrigerant

The Evaporator Coil Temperature is calculated by converting the Suction Pressure to Temperature. The Suction Pressure is obtained by using the OE275-01 Suction Pressure Transducer, which is connected into the Suction Line of the Compressor.

Use the voltage column to check the Suction Pressure Transducer while connected to the RSMV/RSMD Module(s). The VCCX2 and the RSMV/RSMD Module(s) must be powered for this test. Read voltage with a meter set on DC volts. Place the positive lead from the meter on the PR OUT terminal located on the RSMV/RSMD Module(s) terminal block. Place the negative lead from the meter on the ground (GND) terminal located adjacent to the PR OUT terminal on the RSMV/RSMD Module(s) terminal block. Use a refrigerant gauge set and/or an accurate electronic thermometer to measure the temperature or suction line pressure near where the Suction Pressure Transducer is connected to the suction line. Measure the Voltage at the terminals PR OUT and GND terminals and compare it to the appropriate chart depending on the refrigerant you are using. If the temperature/voltage or pressure/voltage readings do not align closely with the chart, your Suction Pressure Transducer is probably defective and will need to be replaced.

The OE275-01 Suction Pressure Transducer, Pressure, Temperature, and Voltage Chart for R410A Refrigerant testing chart shows a temperature range from 20°F to 80°F. For troubleshooting purposes, the DC Voltage readings are also listed with their corresponding temperatures and pressures.

### OE275-01 Suction Pressure Transducer
<table>
<thead>
<tr>
<th>Temperature °F</th>
<th>Pressure PSI</th>
<th>Signal DC Volts</th>
<th>Temperature °F</th>
<th>Pressure PSI</th>
<th>Signal DC Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.19</td>
<td>80.94</td>
<td>1.8</td>
<td>59.03</td>
<td>168.10</td>
<td>3.2</td>
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<td>24.49</td>
<td>87.16</td>
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<td>61.17</td>
<td>174.32</td>
<td>3.3</td>
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<td>63.19</td>
<td>180.55</td>
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<td>71.15</td>
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<td>72.95</td>
<td>211.68</td>
<td>3.9</td>
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<td>217.91</td>
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<td>76.57</td>
<td>224.14</td>
<td>4.1</td>
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<td>78.37</td>
<td>230.36</td>
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<td>80.18</td>
<td>236.59</td>
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</table>

Table 4: Coil Pressure/Voltage/Temp for OE275-01 Suction Pressure Transducers - R410A Refrigerant
**Copeland® Discharge Thermistor Temperature Sensor Testing**

The following sensor voltage and resistance table is provided to aid in checking sensors that appear to be operating incorrectly. Many system operating problems can be traced to incorrect sensor wiring. Be sure all sensors are wired per the wiring diagrams in this manual.

If the sensors still do not appear to be operating or reading correctly, check voltage and/or resistance to confirm that the sensor is operating correctly per the table. Please follow the notes and instructions the appear after the chart when checking sensors.

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>Temp (°C)</th>
<th>Resistance (K Ohms)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40</td>
<td>-40</td>
<td>2889.60</td>
<td>4.98</td>
</tr>
<tr>
<td>-31</td>
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<tr>
<td>95</td>
<td>35</td>
<td>56.16</td>
<td>4.24</td>
</tr>
<tr>
<td>104</td>
<td>40</td>
<td>45.81</td>
<td>4.10</td>
</tr>
<tr>
<td>113</td>
<td>45</td>
<td>37.58</td>
<td>3.94</td>
</tr>
<tr>
<td>122</td>
<td>50</td>
<td>30.99</td>
<td>3.77</td>
</tr>
<tr>
<td>131</td>
<td>55</td>
<td>25.68</td>
<td>3.59</td>
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<tr>
<td>140</td>
<td>60</td>
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<td>3.40</td>
</tr>
<tr>
<td>149</td>
<td>65</td>
<td>17.91</td>
<td>3.20</td>
</tr>
<tr>
<td>158</td>
<td>70</td>
<td>15.07</td>
<td>3.00</td>
</tr>
<tr>
<td>167</td>
<td>75</td>
<td>12.73</td>
<td>2.80</td>
</tr>
<tr>
<td>176</td>
<td>80</td>
<td>10.79</td>
<td>2.59</td>
</tr>
<tr>
<td>185</td>
<td>85</td>
<td>9.20</td>
<td>2.39</td>
</tr>
</tbody>
</table>

**Thermistor Sensor Testing Instructions**

Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered).

Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the “-” (minus) lead on GND terminal and the “+” (plus) lead on the sensor input terminal being investigated.

If the voltage is above 4.98 VDC, then the sensor or wiring is “open.” If the voltage is less than 0.38 VDC, then the sensor or wiring is shorted.
Leaving Water Temperature Sensor Testing

The following sensor voltage and resistance table is provided to aid in checking sensors that appear to be operating incorrectly. Many system operating problems can be traced to incorrect sensor wiring. Be sure all sensors are wired per the wiring diagrams in this manual.

If the sensors still do not appear to be operating or reading correctly, check voltage and/or resistance to confirm that the sensor is operating correctly per the tables. Please follow the notes and instructions that appear after the chart when checking sensors.

| Temperature – Resistance – Voltage for Type III 10 K Ohm Thermistor Sensors |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Temp (°F) | Temp (°C) | Resistance (Ohms) | Voltage @ Input (VDC) |
| -10 | -23.33 | 93333 | 4.51 |
| -5 | -20.55 | 80531 | 4.45 |
| 0 | -17.77 | 69822 | 4.37 |
| 5 | -15 | 60552 | 4.29 |
| 10 | -12.22 | 52500 | 4.2 |
| 15 | -9.44 | 45902 | 4.1 |
| 20 | -6.66 | 40147 | 4.002 |
| 25 | -3.88 | 35165 | 3.891 |
| 30 | -1.11 | 30805 | 3.773 |
| 35 | 1.66 | 27140 | 3.651 |
| 40 | 4.44 | 23874 | 3.522 |
| 45 | 7.22 | 21094 | 3.39 |
| 50 | 10 | 18655 | 3.252 |
| 55 | 11.11 | 17799 | 3.199 |
| 60 | 12.22 | 16956 | 3.143 |
| 65 | 13.33 | 16164 | 3.087 |
| 70 | 14.44 | 15385 | 3.029 |
| 75 | 15.55 | 14681 | 2.972 |
| 80 | 16.66 | 14014 | 2.916 |
| 85 | 17.77 | 13382 | 2.861 |
| 90 | 18.88 | 12758 | 2.802 |
| 95 | 20 | 12191 | 2.746 |
| 100 | 20.55 | 11906 | 2.717 |
| 105 | 21.11 | 11652 | 2.691 |
| 110 | 21.66 | 11379 | 2.661 |
| 115 | 22.22 | 11136 | 2.635 |
| 120 | 22.77 | 10878 | 2.605 |

Table 6: Temperature/Resistance for Type III 10K Ohm Thermistor Sensors

Thermistor Sensor Testing Instructions

Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered).

Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the “-” (minus) lead on GND terminal and the “+” (plus) lead on the sensor input terminal being investigated.

If the voltage is above 4.88 VDC, then the sensor or wiring is “open.” If the voltage is less than 0.05 VDC, then the sensor or wiring is shorted.
Coil Temperature Sensor Testing

The following sensor voltage and resistance table is provided to aid in checking sensors that appear to be operating incorrectly. Many system operating problems can be traced to incorrect sensor wiring. Be sure all sensors are wired per the wiring diagrams in this manual.

If the sensors still do not appear to be operating or reading correctly, check voltage and/or resistance to confirm that the sensor is operating correctly per the tables. Please follow the notes and instructions that appear after the chart when checking sensors.

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>Temp (°C)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10</td>
<td>-23.33</td>
<td>93333</td>
<td>4.51</td>
</tr>
<tr>
<td>-5</td>
<td>-20.55</td>
<td>80531</td>
<td>4.45</td>
</tr>
<tr>
<td>0</td>
<td>-17.77</td>
<td>69822</td>
<td>4.37</td>
</tr>
<tr>
<td>5</td>
<td>-15</td>
<td>60552</td>
<td>4.29</td>
</tr>
<tr>
<td>10</td>
<td>-12.22</td>
<td>52500</td>
<td>4.2</td>
</tr>
<tr>
<td>15</td>
<td>-9.44</td>
<td>45902</td>
<td>4.1</td>
</tr>
<tr>
<td>20</td>
<td>-6.66</td>
<td>40147</td>
<td>4.002</td>
</tr>
<tr>
<td>25</td>
<td>-3.88</td>
<td>35165</td>
<td>3.891</td>
</tr>
<tr>
<td>30</td>
<td>-1.11</td>
<td>30805</td>
<td>3.773</td>
</tr>
<tr>
<td>35</td>
<td>1.66</td>
<td>27140</td>
<td>3.651</td>
</tr>
<tr>
<td>40</td>
<td>4.44</td>
<td>23874</td>
<td>3.522</td>
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<tr>
<td>45</td>
<td>7.22</td>
<td>21094</td>
<td>3.39</td>
</tr>
<tr>
<td>50</td>
<td>10</td>
<td>18655</td>
<td>3.252</td>
</tr>
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<td>52</td>
<td>11.11</td>
<td>17799</td>
<td>3.199</td>
</tr>
<tr>
<td>54</td>
<td>12.22</td>
<td>16956</td>
<td>3.143</td>
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<td>56</td>
<td>13.33</td>
<td>16164</td>
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<tr>
<td>58</td>
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<td>3.029</td>
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<td>60</td>
<td>15.55</td>
<td>14681</td>
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<tr>
<td>62</td>
<td>16.66</td>
<td>14014</td>
<td>2.916</td>
</tr>
<tr>
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<td>17.77</td>
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<td>66</td>
<td>18.88</td>
<td>12758</td>
<td>2.802</td>
</tr>
<tr>
<td>68</td>
<td>20</td>
<td>12191</td>
<td>2.746</td>
</tr>
<tr>
<td>69</td>
<td>20.55</td>
<td>11906</td>
<td>2.717</td>
</tr>
<tr>
<td>70</td>
<td>21.11</td>
<td>11652</td>
<td>2.691</td>
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<td>2.661</td>
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<td>72</td>
<td>22.22</td>
<td>11136</td>
<td>2.635</td>
</tr>
<tr>
<td>73</td>
<td>22.77</td>
<td>10878</td>
<td>2.605</td>
</tr>
</tbody>
</table>

Table 7: Temperature/Resistance for Type III 10K Ohm Thermistor Sensors

**Thermistor Sensor Testing Instructions**

Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered).

Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the “-” (minus) lead on GND terminal and the “+” (plus) lead on the sensor input terminal being investigated.

If the voltage is above 4.88 VDC, then the sensor or wiring is “open.” If the voltage is less than 0.05 VDC, then the sensor or wiring is shorted.
Head Pressure Transducer Troubleshooting

If you suspect there is a problem related to head pressure transducer measurements, reference the table, below.

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

Table 8: Head Pressure Transducer Chart
Modular Wiring
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.

The VAV/Zone Controllers can have a modular adapter installed that provides modular connections. See Figure 69, page 102 for adapter installation instructions. The Power/Comm board is supplied with both terminals and a modular connector on the input side. All of the Power/Comm board outputs use modular connectors. The MiniLink Polling Device is equipped with both modular and wiring terminal blocks.

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.

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!

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 to all the other “Network Loop” devices on the entire system. The MiniLink PD is equipped with 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 to 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.
APPENDIX B: MODULAR WIRING

MiniLink Polling Device 5 Modular Wiring

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


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 Recommends Using A Separate Transformer For Each Device In Order To Eliminate The Potential For Damaging Devices Due To Incorrect Polarity. Using Separate Transformers Also Allows Redundancy In Case Of A Transformer Failure. Instead Of Having 6 Devices Inoperative Because Of A Malfunctioning Transformer, You Have Only 1 Device Off Line.


For Address And Baud Rate Settings, See The MiniLink PD 5 Technical Guide.

Connect Local Loop Comm Cable To Power Comm Board (If Used).

24 VAC Transformer Size For 6 VA Min. Load

On Multiple Loop Systems, Connect Modular Cable To Next MiniLink’s Network Comm Connector And So On.

Figure 68: OE364-23 MiniLink Polling Device 5 Modular Wiring

VCCX2 Component & Systems Wiring

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The PL102681 VAV/Zone Controller Modular Adapter provides two Modular PCC (Power and Comm) connections to the OE326-23I-OR and OE326-23D-OR VAV/Zone Controllers. It plugs into the 3 pin Comm connector and the 2 pin 24VAC power connector on the VAV/Zone Controller. The PCC modular cabling is not included.

**Installation Instructions**

1. Insert the two terminal pin headers of the VAV/Zone Controller Modular Adapter into the 24VAC and Comm terminal blocks that are located on the VAV/Zone Controller.

2. Tighten the two right angle brackets on the VAV/Zone Modular Adapter down to secure the mounting of the VAV/Zone Controller Modular Adapter circuit board with two of the three screws that were originally provided with the VAV/Zone Controller.

3. Tighten the terminal block screws on the 3 pin - Comm and 2 pin - 24VAC power connectors that are on the VAV/Zone Controller.

4. Plug in the power and comm cables to the VAV/Zone Controller Modular Adapter Board.

Figure 69: VAV/Zone Controller with Modular Adapter PL102681 Installed - OE326-23D-OR Shown
Figure 70: Networked Single Loop System With MiniLink PD And Modular VAV/Zone Controllers Wiring

VCCX2 Component & Systems Wiring

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Figure 71: Networked Single Loop System With CommLink & MiniLink PD - Modular VAV/Zone Controllers

1 of 1

Wiring & Connection Diagrams

For Required VA Load
Connect To Other VAV/Zone Controllers On Loop

WARNING! POLARITY MUST BE OBSERVED OR THE BOARD WILL BE DAMAGED

Connecting To Next VAV/Zone Controller On Branch Circuit

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.

Either A Modular System Manager SD, Note:
VCCX-Net-SingleLoop1B-4.CDR

For SMTS-L Wiring, See Figure 1, Page 16,
Wiring To Be T To T, SHLD (G) To SHLD (G) & R To R

Either A Modular System Manager SD,
Figure 72: Networked Multiple Loop System Wiring With Modular VAV/Zone Controllers
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

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 73: OE392-12 Modular System Manager SD Pigtail Cable Wiring
System Manager Modular Cable Pigtail Wiring Detail

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.

FILENAME: SysMsgPigtail1D.CDR
DATE: 01/09/18
By: Sonya Olson

Figure 74: OE392-12 Modular System Manager SD Cable Pigtail - Wiring Detail
APPENDIX B: MODULAR WIRING

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 MinLink 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 MinLink 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 75: OE365-01 Power/Comm Board Wiring When Used For Local 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!

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.

Connect Power/Comm Cables To Other Power/Comm Distribution Board Or MiniLink PDs On The Network Loop Only.

Figure 76: OE365-01 Power/Comm Board Wiring When Used For Network Loop Devices
24VAC Power - Transformer & Cabling Considerations 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. This allows for a maximum of 16 devices per Power/Comm board. 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!

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**Figure 77:** Transformer & Wire Sizing - Devices with Modular Connectors

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**APPENDIX B: MODULAR WIRING**

Transformer Sizing & Cabling For Devices With Modular Connectors