Use For VCM Controller Code: SS1016 & Newer Wiring
For VAV/CAV & MUA II Wiring Information, See Component & System Wiring Technical Guide - Form: OR-WIRE-TGD-01B
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System Configurations
Installation & Commissioning
Stand Alone System Wiring

Typical Stand Alone System

Notes:
1.) All wiring to be in accordance with local and national electrical codes and specifications.

For Optional CommLink, Remote Link And Computer Connections, See Page 2 Of This Drawing.
Optional Computer Connection Diagram
Using Remote Link For Remote Connection

Note: CommLink Is Only Required If
Alarm Callout, Remote Computer
Connection Or Direct Computer
Connection To System Is Desired.
Remote Link Is Only Required If
Alarm Callout Or Remote Computer
Connection Is Required.

Connect To HVAC Unit Controller
See Page 1 Of This Drawing For Wiring

110 VAC To
24 VAC
Power Pack

25 Pin
Female
Connector
(IF Req'd)

9 Pin
Female
Connector

Back View of CommLink

Front View of CommLink

9 Pin Female End

Connect To Computer
Serial Port

9 Pin Female Connector

Molded
Cable Assembly

8 Conductor
Modular Cable
Assembly

Personal Computer
(By Others)

110 VAC To
9 VDC
Power Pack

Dedicated Telephone
Outlet (By Others)

Telephone
Cable Assembly

Back View of Remote Link

Remote Link

Front View of Remote Link
Remote Link
(Optional)

CommLink

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

110 VAC To
9V D C
Power Pack

Remote Link
(Optional)

SHLD
T
R

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

Notes:
1.) All wiring to be in accordance with local and national electrical codes
and specifications.
Optional Computer Connection Diagram
Using IP-Link For Remote Connection

Note: CommLink Is Only Required If Alarm Callout, Remote Computer Connection Or Direct Computer Connection To System Is Desired. IP-Link Is Only Required If E-mail Alarm Notification Or Remote Computer Connection Is Required.

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

Connect To HVAC Unit Controller
See Page 1 Of This Drawing For Wiring

Notes:
1. Set CommLink Internal Switch To “Single”.
2. Replace CommLink EPROM With IP-Link EPROM Supplied With IP-Link Kit
Typical Interconnected System

Note: Either a Modular System Manager, a Modular Service Tool, or a PC with Prism software installed can be used to program and configure the Orion System.

Connect to Modular I/O Connectors located on back of the System Manager.

White (T) Drain Wire (SHLD)
Black (R)
Red (24 VAC)
Clear (GND)
Green (GND)

24 VAC (6 VA)

Line Voltage

HVAC Unit Controller

24 VAC (8 VA)

Line Voltage

HVAC Unit Controller

24 VAC (8 VA)

Line Voltage

HVAC Unit Controller

24 VAC (8 VA)

Line Voltage

To Next HVAC Unit Controller on Loop up to 60 controllers can be interconnected.

For Optional CommLink, remote link and computer connections, see page 2 of this drawing.

Notes:
1.) All wiring to be in accordance with local and national electrical codes and specifications.
Optional Computer Connection Diagram
Using Remote Link For Remote Connection

Connect To HVAC Unit Controller
See Page 1 Of This Drawing For Wiring

CommLink
Front View of CommLink
Note: Set CommLink Internal Switch To "Single"

Back View of CommLink

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

Dedicated Telephone Outlet (By Others)

9 Pin Female End

Telephone Cable Assembly

Molded Modular Cable Assembly

25 Pin Male End

Back View of Remote Link

Front View of Remote Link
Remote Link (Optional)

Personal Computer (By Others)

110 VAC To 24 VAC Power Pack

25 Pin Female Connector (If Req'd)

9 Pin Female Connector

Connect To Computer Serial Port

8 Conductor Modular Cable Assembly

9 Pin Female Connector

Optional Computer Connection Diagram
Using Remote Link For Remote Connection

Notes:
1.) All wiring to be in accordance with local and national electrical codes and specifications.
Interconnected - Computer Connection With IP-Link

Optional Computer Connection Diagram
Using IP-Link For Remote Connection

Note: CommLink Is Only Required If Alarm Callout, Remote Computer Connection Or Direct Computer Connection To System Is Desired. IP-Link Is Only Required If E-mail Alarm Notification Or Remote Computer Connection Is Required.

- Connect To HVAC Unit Controller
- See Page 1 Of This Drawing For Wiring

9 Pin Female End
Connect Ethernet RJ45 Cable Assembly
(If Req'd)
To 10BaseT Port On IP-Link

Assembly
To 10BaseT Port On IP-Link

Back View of CommLink

9 Pin Female Connector
Connect To Serial Port On IP-Link

25 Pin Female Connector (If Req'd)

Back View of CommLink

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

Connect To Computer Serial Port

110 VAC To 24 VAC Power Pack

Molded Cable Assembly Supplied With IP-Link Kit

8 Conductor Modular Cable Assembly

110 VAC To 9 VDC Power Pack

9 Pin Male End
Connect To Serial Port On IP-Link

9 Pin Female Connector

9VDC

Connect Ethernet RJ45 Cable Assembly (By Others)
To 10 BaseT Connection On Ethernet Router Or Modem (By Others)

Connect To Computer Serial Port

Personal Computer (By Others)

Notes:
1.) All wiring to be in accordance with local and national electrical codes and specifications.

Notes:
1. Set CommLink Internal Switch To "Single".
2. Replace CommLink EPROM With IP-Link EPROM Supplied With IP-Link Kit

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

Connect To Serial Port On IP-Link

110 VAC To 9 VDC Power Pack

Molded Cable Assembly Supplied With IP-Link Kit

8 Conductor Modular Cable Assembly

Connect To Computer Serial Port

Front View of CommLink

Connect To HVAC Unit Controller
See Page 1 Of This Drawing For Wiring

Back View of CommLink

Front View of CommLink

9 Pin Female Connector
Connect To Computer Serial Port

Notes:
1.) All wiring to be in accordance with local and national electrical codes and specifications.
Networked Single Loop System With CommLink Only

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

Note: CommLink Must Be Set For Single Loop Operation When Used In This Application.

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

To Next HVAC Unit Controller Up To 60 Controllers Can Be Interconnected.

Components & System Wiring
Networked Single Loop System With CommLink & MiniLink PD

Typical Single Loop Networked System With MiniLink Polling Device And CommLink

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

Diagram showing wiring and connection details for the networked single loop system including CommLink and MiniLink PD devices.
Optional Computer Connection Diagram
Using Remote Link For Remote Connection

Note: If Direct Computer Connection Is Required, Connect To PC As Shown.
Remote Link Is Only Required If Alarm Callout Or Remote Computer Connection Is Required.

CommLink
Front View of CommLink
Note: Set CommLink Internal Switch To "Multi" When MiniLink PD Is Used
Otherwise Switch Must Be Set To "Single"

Connect To MiniLink PD Network Terminals (When Used)
Otherwise Connect to VAV/CAV or MUA II Controller Communications Terminals

Back View of CommLink

Dedicated Telephone Outlet (By Others)

Optional Computer Connection Diagram
Using Remote Link For Remote Connection

Connecting Diagram: By Others

Front View of Remote Link
Remote Link (Optional)

Back View of Remote Link

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

Molded Modular Cable Assembly

Telephone Cable Assembly

Back View of Remote Link

Telephone Cable Assembly

9 Pin Female End

9 Pin Female Connector

25 Pin Male End

Connect To Computer Serial Port

Connect To Computer Serial Port

25 Pin Female Connector (If Req'd)

9 Pin Female Connector

8 Conductor Modular Cable Assembly

Personal Computer (By Others)

Back View of Remote Link

Remote Link

Front View of Remote Link

110 VAC To 24 VAC Power Pack

110 VAC To 9 VDC Power Pack

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

FILENAME: O-Network-SingleLoop1B.CDR
DATE: 06/20/03
DRAWN BY: B. Crews

JOB NAME: Orion Control Systems

DESCRIPTION: Networked System - Single Loop

Wiring & Connection Diagram
Optional Computer Connection Diagram
Using Remote Link For Remote Connection

Note: If Direct Computer Connection Is Required, Connect To PC As Shown. If Remote Link Is Required, Connect To MiniLink PD.

Networked Multiple Loop - Computer Connection With Remote Link

110 VAC To 24 VAC Power Pack

110 VAC To 9 VDC Power Pack

Remote Link (Optional)

Connect To MiniLink PD Network Terminals (When Used) Otherwise Connect To VAV/CAV or MUA II Controller Communications Terminals

Connect To Remote Link (Optional)

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

FILENAME: O-Network-MultipleLoop1B.CDR
DATE: 10/30/03
DRAWN BY: B. Crews
DESCRIPTION: Networked System - Multiple Loop Wiring & Connection Diagram
PAGE: 2 of 3
Networked Multiple Loop - Computer Connection With IP-Link

Optional Computer Connection Diagram Using IP-Link For Remote Connection

Note: If Direct Computer Connection is Required, IP-Link is Only Required if E-mail Alert Notification or Remote Computer Connection is Required. All Wires To Be T To T, SHLD (G) To SHLD (G) & RT To T, T G R

Front View of CommLink

Back View of CommLink

Personal Computer (By Others)

Optional Computer Connection Diagram Using IP-Link For Remote Connection

Note: CommLink Internal Switch To "Multi" When MiniLink PD is Used. Otherwise Set To "Single".

2. Replace CommLink EPROM With IP-Link EPROM Supplied With IP-Link Kit.

Connect Ethernet RJ45 Cable Assembly To 10BaseT Port On IP-Link

Connect To MiniLink PD Network Terminals (When Used) Otherwise Connect to VAV/CAV or MUA II Controller Communications Terminals

10/30/03

Networked Multiple Loop - Computer Connection With IP-Link
General Information

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 Installation & Commissioning 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 Pages 6 Through 8 For Connection Diagrams)
2. **Interconnected**
   (See Pages 9 Through 11 For Connection Diagrams)
3. **Networked Single Loop**
   (See Pages 12 Through 16 For Connection Diagrams)
4. **Networked Multiple Loop**
   (See Pages 17 Through 19 For Connection Diagrams)

System Type Definitions

Stand Alone

This system consists of a single VCM controller. Programming and status monitoring are accomplished by one or more of the following methods.

1. By using an operator interface. This can be either a Modular System Manager, a Modular Service Tool or both devices.
2. A computer interface can also be used in conjunction with the other operators interfaces listed above, or by itself. This requires a CommLink and a personal computer with the Prism computer front end software installed.

Interconnected

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

1. By using an operator interface. This can be either a Modular System Manager, a Modular Service Tool or both devices.
2. A computer interface can also be used in conjunction with the other operators interfaces listed above, or by itself. This requires a CommLink and a personal computer with the Prism computer front end software installed.

Networked Single Loop

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

1. **A series of VCM Controllers that utilizes a network device to share information that is broadcast from one controller to all controllers on the loop.**
2. **A single VCM controller and a series of VAV/Zone controllers. A network device is used to share information which is broadcast back and forth between all controllers on the loop.**

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

1. By using an operator interface. This can be either a Modular System Manager, a Modular Service Tool or both devices.
2. A computer interface can also be used in conjunction with the other operators interfaces listed above, or by itself. This requires a CommLink and a personal computer with the Prism computer front end software installed.

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

Networked Multiple Loop

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

1. A series of VCM controllers.
2. A single VCM controller and a series of VAV/Zone controllers.

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

1. A MiniLink Polling Device is required per loop (Local Loop). This allows the controllers to share information that is broadcast from one controller to all controllers on that local loop.
2. One CommLink is required for the entire system. It resides on the Network Loop and allows for communications between all the local loops and provides for global broadcasts to all controllers on the entire system.
Programming and status monitoring are accomplished by one or more of the following methods.

1. By using an operator interface. This can be either a Modular System Manager, a Modular Service Tool or both devices. The System Manager 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 operators interfaces listed above, or by itself. This requires a personal computer with the Prism computer front end software installed.

**Network Communications Devices**

**MiniLink Polling Device**
The MiniLink Polling device is used in the following applications.

1. This device is required on all Zoning applications. It is optional on single loop VAV systems.
2. This device is required on each local loop of all Networked Multiple Loop systems

This device is responsible for local loop broadcasts only. It always resides on the local loop.

For a Networked Single Loop VCM system, this device can be used for tenant logging and alarm reporting to a Modular System Manager. It can 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 VAV system, the MiniLink Polling Device can be used for tenant logging and alarm reporting to a Modular System Manager. 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 VAV controller. It can also be used for tenant logging and alarm reporting to the Modular System Manager.

**CommLink**
The CommLink device is used in the following applications.

1. A CommLink is required on all Networked Multiple Loop Systems
2. A CommLink is optional on all Networked Single Loop Systems
3. A CommLink is required on any system when a computer interface is desired

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

For a Networked Single Loop VCM system, this device can be used for tenant logging and alarm reporting to a Modular System Manager. It can also be used to broadcast information like outside air temperature or outside air humidity to all local loops on the entire networked system. It may also be used to broadcast space temperature from a GPC Plus or GPC-17 controller to any controllers on the local loop that do not contain their own space temperature sensor.

On a Networked Single Loop VAV/Zone system, the CommLink 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.

**System 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 Component & System Wiring Technical Guide and can also be found in the technical guide supplied with your specific controllers. Wire and transformer sizing instructions and examples are located on page 28 through 29 of this manual.

Most of the Orion controllers are equipped with modular connections, and in some cases are equipped with both modular and wiring terminal blocks. We recommend (when possible) using modular cables instead of hard wiring to wiring terminal blocks, to save installation time and eliminate wiring errors. In some cases, however, hard wiring is unavoidable. The table below lists the various Orion devices/controllers and their available termination type(s) for communications and power wiring.

<table>
<thead>
<tr>
<th>Orion Controller Or Device</th>
<th>Communications And Power Wiring</th>
<th>Power And Communications Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Available Power And Communications Connections</td>
<td>Both Modular Connectors And Wire Terminals</td>
</tr>
<tr>
<td>VCM</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>VAV/Zone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power/Comm Board</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>MiniLink PD</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>CommLink II</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>*System Manager</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>GPC Plus</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>GPC-17</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Lighting Controller</td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

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

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 VAV/Zone controllers, System Managers or other Power/Comm boards.

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

Local Loop communications are 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 VAV/Zone controller or System Manager output on the same loop. If desired a Power/Comm board can be connected to the “Local Loop” by hard wiring a 2-wire shielded cable connected between it’s 3-wire communications input terminal (TB1) and a VCM controller, a Power/Comm board or the MiniLink PD “Local Loop”, 3-wire communications terminal.

For detailed wiring diagrams, see the Power/Comm board wiring diagrams in the “Communication Devices Diagrams” section of this manual.

For Power/Comm board transformer sizing see the last 2 pages of the “Systems Configurations Installation & Commissioning” section of this manual.

Alternative Connection Configuration and Use

If desired, the Power/Comm board can also be used to transfer both 24 VAC power and “Network Loop” communications to multiple MiniLink PDs. Connection between the MiniLink PD(s) and Power/Comm board(s) is accomplished by using modular cables between the Power/Comm boards modular output connectors and the MiniLink PD(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 VAV/Zone controllers or System Manager(s).

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

For detailed wiring diagrams, see the Power/Comm board wiring diagrams in the “Communication Devices Diagrams” section of this manual.

For Power/Comm board transformer sizing see the last 2 pages of the “Systems Configurations Installation & Commissioning” section of this manual.

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 communications between all devices on it’s “Local Loop” and to all the other “Network Loop” devices on the entire system. The MiniLink PD is equipped with both modular connectors and hard wiring terminal blocks for connection of 24 VAC power, “Local Loop” and “Network Loop” communications.

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

Installation Procedures

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

Stand Alone Systems

See the “Stand Alone System Wiring” on pages 6 through 8 of this manual for detailed wiring diagrams. Also see pages 28 and 29 for wire and transformer sizing information. You should review these diagrams before attempting connections or powering up the controller or interface devices.

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

2. 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 controller is located near the communications connector.
3. The Modular System Manager comes supplied with a 12 foot modular cable with a modular connector on one end and stripped wires on the other. 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 wires inside of the junction box by making solid connections, using wire nuts or butt splice connectors. See the wiring diagram in this section for correct wiring color coding and connection.

4. If a CommLink is used for a computer interface, connect communications using 18 gauge, 2 conductor shielded cable. Connect from the controller’s 3 wire communications connector to the CommLink’s 3 wire communications connector. For this type of system, the CommLink needs to have its internal jumper set to “Single”.

5. 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.

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

**Interconnected Systems**

See the “Interconnected System Wiring” on pages 9 and 11 of this manual for detailed wiring diagrams. Also see pages 28 and 29 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 controllers in a daisy chain or star ring format using 18 gauge, 2 conductor shielded cable for communications. Install separate 24 VAC, 8 VA minimum transformer for each controller and wire to transformers using 18 gauge minimum, 2 wire cable for power. Observe polarity on all boards.

2. The Modular Service Tool will connect to any of the devices.

3. The Modular System Manager comes supplied with a 12 foot modular cable with a modular connector on one end.

4. If a CommLink 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 connectors. For this type of system, the CommLink needs to have its internal jumper set to “Single”.

5. 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 installed, use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source.

6. Before powering up the controllers, set the board addresses from 1-60.

**Networked Single Loop Systems**

See the “Networked System - Single Loop Wiring” on pages 12 through 16 of this manual for detailed wiring. Also see pages 28 and 29 for wire and transformer sizing information. You should review these diagrams before attempting connections or powering up the controller or interface devices.

**Loop Containing VCM Controllers Only**

1. Connect all controllers in a daisy chain or star ring format using 18 gauge, 2 conductor shielded cable for communications. Install separate 24 VAC, 8 VA minimum transformer for each controller and wire to transformers 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. If only a CommLink II is used, connect 2 conductor shielded cable from one of the controller’s 3 wire communications connector to the CommLink’s 3 wire communications connector. If only the CommLink II is used, the CommLink’s internal jumper must be set to “Single”. Use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source.

4. If both the MiniLink Polling Device and the CommLink II are used, 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”. Connect 2 wire shielded cable from the CommLink’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Network Loop”. When a MiniLink PD and a CommLink are used, the CommLink’s internal jumper must be set to “Multi”. Install a separate 24 VAC, 8 VA minimum transformer for the MiniLink PD and wire to transformer using 18 gauge minimum, 2 wire cable for power. Observe polarity on all boards.
System Installation

5. 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 controller is located near the communications connector.

6. The Modular System Manager comes supplied with a 12-foot modular cable with a modular connector on one end and stripped wires on the other. If the System Manager is to be mounted in remote location, run 18 gauge, 2 conductor shielded cable for communications from one of the controller’s 3 wire communications terminals to a junction box. Run 18 gauge, 2 wire, 24 VAC power wires supplied by a separate transformer into the junction box. Splice modular cable to the communications and power wire inside of the junction box using solid connections from wire nuts or butt-spike connectors. The Modular System Manager MUST always be connected on the “Local Loop”, never the “Network Loop”.

Loops Containing VCM controllers with VAV/Zone Controllers and MiniLink PD Only

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

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

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

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

5. The Modular System Manager can connect to any VAV/Zone controller or directly to one of the Power/Comm board’s modular output connectors.

VCM with VAV/Zone Controllers and CommLink Only

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

2. Connect 2 conductor shielded cable from the VCM controller’s 3 wire communications connector to the CommLink’s 3 wire communications connector. The CommLink’s on-board jumper should be set to “Single”.

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

4. Using 2 conductor shielded cable, connect from the CommLink’s 3 wire communications connector to the Power/Comm board’s or VCM controller’s 3 wire communications input connector.

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

6. The Modular System Manager can connect to any VAV/Zone controller or directly to one of the Power/Comm board’s modular output connectors.

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

Warning: Each Power/Comm board must have its own 24 VAC transformer for its power source. This transformer cannot be shared with any other board. Do not ground the transformer that is connected to the Power/Comm board. The transformer should be sized for the required VA by using the information found on page 29 of this manual.
Notes: Both power and communications are transferred from the Power/Comm board to the VAV/Zone controllers and the Modular System Manager. Only communications is transferred from Power/Comm board to Power/Comm board.

Warning: Each Power/Comm board must have its own 24 VAC transformer for its power source. This transformer cannot be shared with any other board. Do not ground the transformer that is connected to the Power/Comm board. The transformer should be sized for the required VA by using the information found on page 29 of this manual.

VCM with VAV/Zone Controllers MiniLink PD and CommLink
1. Connect all controllers in a daisy chain or star ring format using 18 gauge, 2 conductor shielded cable for communications. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM controller and wire from transformer to the VCM controller. Using 18 gauge minimum, 2 wire cable for power, install a separate 24 VAC transformer sized for the required VA load for each Power/Comm Board on the loop and wire from each transformer to its Power/Comm board. Observe polarity on all boards.
2. Using 2 conductor shielded cable, connect from the VCM controller’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Local Loop”. Use 18 gauge minimum wire for power and observe polarity on all boards.
3. Using a modular cable, connect from the MiniLink PD’s modular connector marked “Local Loop” to a Power/Comm board’s modular input connector.
4. Using modular cables, connect from the Power/Comm board’s modular output connectors to the VAV/Zone controllers. The VAV/Zone controllers connect together using modular cables from each VAV/Zone controller to the next controller and/or to a Power/Comm Board. A maximum of 16 VAV/Zone controllers are allowed per Power/Comm board. If you have more than 16 VAV/Zone controllers, you will need multiple Power/Comm boards. Each Power/Comm board must have its own 24 VAC transformer sized for the total number of VAV/Zone controllers connected to it.
5. The System Manager can connect to any VAV/Zone controller or directly to one of the Power/Comm board’s modular output connectors.
6. Using 2 conductor shielded cable, connect from the CommLink’s 3 wire communications connector to the MiniLink’s 3 wire communications connector marked “Network Loop”. When a MiniLink PD and a CommLink are used together, the CommLink’s internal jumper must be set to “Multi”.

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

Warning: Each Power/Comm board must have its own 24 VAC transformer for its power source. This transformer cannot be shared with any other board. Do not ground the transformer that is connected to the Power/Comm board. The transformer should be sized for the required VA by using the information found on page 29 of this manual.

Networked Multiple Loop Systems
See the “Networked System - Multiple Loop Wiring” on pages 17 through 19 of this manual for detailed wiring diagrams. Also see pages 28 and 29 for wire and transformer sizing information. You should review these diagrams before attempting connections or powering up the controller or interface devices.

Local Loops containing VCM Controllers with VAV/Zone Controllers
1. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM controller and wire from the transformer to the VCM controller. Using 18 gauge minimum, 2 wire cable for power, install a separate 24 VAC, transformer sized for the required VA load for each Power/Comm Board on the loop and wire from each transformer to its Power/Comm board. Observe polarity on all boards.
2. Using 2 conductor shielded cable, connect from the VCM controller’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Local Loop”. Use 18 gauge minimum wire for power and observe polarity on all boards.
3. Using a modular cable, connect from the MiniLink PD’s modular connector marked “Local Loop” to the Power/Comm board’s modular input connector.
4. Using modular cables, connect from the Power/Comm board’s modular output connectors to the VAV/Zone controllers. The VAV/Zone controllers connect together using modular cables from each VAV/Zone controller to the next controller and/or to a Power/Comm Board. A maximum of 16 VAV/Zone controllers are allowed per Power/Comm board. If you have more than 16 VAV/Zone controllers, you will need multiple Power/Comm boards. Each Power/Comm board must have its own 24 VAC transformer sized for the total number of VAV/Zone controllers connected to it.
5. Repeat the above steps for each local loop containing VCM Controllers with VAV/Zone Controllers.
6. The Modular System Manager can connect to any VAV/Zone controller on the entire system or directly to one of the Power/Comm board’s modular output connectors using modular cable. The Modular Service Tool will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controllers is located near the communications connector.

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

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

**Notes:** Both power and communications are transferred from the Power/Comm board to the VAV/Zone controllers and the Modular System Manager.

**Warning:** Each Power/Comm board must have its own 24 VAC transformer for its power source. This transformer cannot be shared with any other board. Do not ground the transformer that is connected to the Power/Comm board. The transformer should be sized for the required VA by using the information found on page 29 of this manual.

**Loops Containing VCM Controllers without VAV/Zone Controllers**

1. Connect all VCM controllers on the loop in a daisy chain or star ring format using 18 gauge minimum, 2 conductor shielded cable for communications. Install a separate 24 VAC, 8 VA minimum, transformer for each controller and wire to 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’s 3 wire communications connector to the MiniLink PD’s 3 wire communications connector marked “Network Loop”. The CommLink’s internal jumper must be set to “Multi”. Use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source. Only one MiniLink PD on the system should connect to the CommLink. Install a separate 24 VAC, 8 VA minimum, transformer for each MiniLink PD and wire to transformer using 18 gauge minimum, 2 wire cable for power. Observe polarity on all boards. Each MiniLink PD’s address switch should be set with a unique address between 1 and 60.

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

5. 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.

6. If your system has other loops that have VAV/Zone controllers, the Modular System Manager can connect to any VAV/Zone controller on the entire system or directly to one of the Power/Comm board’s modular output connectors using modular cable. If you do not have any loops with VAV/Zone controllers, the Modular System Manager also is supplied with a 12 foot modular cable with a modular connector on one end and stripped wires on the other. If the Modular System Manager is to be mounted in remote location, run 18 gauge, 2 conductor shielded cable for communications from one controller’s 3 wire MiniLink PD’s in the same manner using a daisy chain or star ring format.
System Commissioning

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 technical guide for the specific controller, the location of the diagnostic LED, and controller start-up sequence.
4. Connect an operators interface device for programming the controller.

Interconnected System

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

Networked Systems

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

Transformer & Wire Sizing - Devices Without Modular Connectors

24VAC Power - Transformer & Wire Sizing Considerations for Devices Without Modular Connectors

Some installers like to use one large 24VAC 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 wire sizing information is presented to help the installer correctly supply 24VAC power to the devices.

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

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

8 GPC Plus Controllers @ 8VA each............. 8 x 8VA = 64VA.

The above calculation determines that our transformer will need to be sized for a minimum of 64VA 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 = 0.0346 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</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCM Controller</td>
<td>8VA</td>
</tr>
<tr>
<td>GPC Plus Controller</td>
<td>8VA</td>
</tr>
<tr>
<td>GPC-17 Controller</td>
<td>10VA</td>
</tr>
<tr>
<td>Lighting Panel Controller</td>
<td>10VA</td>
</tr>
<tr>
<td>GBD Controller</td>
<td>6VA</td>
</tr>
<tr>
<td>MiniLink Polling Device</td>
<td>6VA</td>
</tr>
</tbody>
</table>

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**JOB NAME**

Orion VCM System

**FILENAME**

O-VCMSWRSIZ1A.CDR

**DATE:** 03/09/06

**DRAWN BY:** B. CREWS

**PAGE**

1 of 2

**DESCRIPTION:**

Wire & Transformer Sizing
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.

**Example 1:**
- 16 Devices At 6 VA = 96 VA
  - Use 100 VA Transformer
  - Total length of all modular cables used on each branch (A to B) cannot exceed 240 Ft.

**Example 2:**
- 12 Devices At 6 VA = 72 VA
  - Use 75 VA Transformer

**Example 3:**
- 13 Devices At 6 VA = 78 VA
  - Use 80 VA Transformer

**Example 4:**
- 6 Devices At 6 VA = 36 VA
  - Use 40 VA Transformer

**Example 5:**
- 16 Devices At 6 VA = 96 VA
  - Use 100 VA Transformer

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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Component & System Wiring
VCM Controller Wiring
VCM Controller Wiring

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

Local Loop RS-485 9600 Baud

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

See Individual Component Wiring Diagrams For Detailed Wiring Of Analog Inputs And Outputs

Notes:
1.) Connect FRP Tubing To The High Pressure Port (Bottom Tube) Of The Static Pressure Transducer And Route The Tubing To The Static Pressure Pickup Probe Location. Leave The Port Marked “LO” Open To Atmosphere.

2.) The Static Pressure Pickup Probe Should Ideally Be Mounted With The Probe Pointing At A 90 Degree Angle To The Supply Air Flow Direction. It Should Be Located In A Straight Section Of The Supply Air Duct At A Distance From The Unit Discharge That Is Approximately Equal To 2/3 The Length Of The Longest Supply Air Duct Run. Also Ideally The Probe Should Be Located Not Less Than 3 Duct Diameters Downstream And 2 Duct Diameters Upstream Of Any Elbow Or Takeoff In The Ductwork.

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

Note:
All Relay Outputs Are Normally Open And Rated For 24 VAC Power Only, 2 Amp Maximum Load.

Size Transformer For Correct Total Load. VCM Controller = 8 VA Power Consumption. If Economizer Option Is Used The Economizer Actuator VA load Must Also Be Considered When Sizing The Transformer.

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

Notes:
1.) Connect FRP Tubing To The High Pressure Port (Bottom Tube) Of The Static Pressure Transducer And Route The Tubing To The Static Pressure Pickup Probe Location. Leave The Port Marked “LO” Open To Atmosphere.

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

Notes:
1.) Connect FRP Tubing To The High Pressure Port (Bottom Tube) Of The Static Pressure Transducer And Route The Tubing To The Static Pressure Pickup Probe Location. Leave The Port Marked “LO” Open To Atmosphere.

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

Notes:
1.) Connect FRP Tubing To The High Pressure Port (Bottom Tube) Of The Static Pressure Transducer And Route The Tubing To The Static Pressure Pickup Probe Location. Leave The Port Marked “LO” Open To Atmosphere.

2.) The Static Pressure Pickup Probe Should Ideally Be Mounted With The Probe Pointing At A 90 Degree Angle To The Supply Air Flow Direction. It Should Be Located In A Straight Section Of The Supply Air Duct At A Distance From The Unit Discharge That Is Approximately Equal To 2/3 The Length Of The Longest Supply Air Duct Run. Also Ideally The Probe Should Be Located Not Less Than 3 Duct Diameters Downstream And 2 Duct Diameters Upstream Of Any Elbow Or Takeoff In The Ductwork.

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

Notes:
1.) Connect FRP Tubing To The High Pressure Port (Bottom Tube) Of The Static Pressure Transducer And Route The Tubing To The Static Pressure Pickup Probe Location. Leave The Port Marked “LO” Open To Atmosphere.

2.) The Static Pressure Pickup Probe Should Ideally Be Mounted With The Probe Pointing At A 90 Degree Angle To The Supply Air Flow Direction. It Should Be Located In A Straight Section Of The Supply Air Duct At A Distance From The Unit Discharge That Is Approximately Equal To 2/3 The Length Of The Longest Supply Air Duct Run. Also Ideally The Probe Should Be Located Not Less Than 3 Duct Diameters Downstream And 2 Duct Diameters Upstream Of Any Elbow Or Takeoff In The Ductwork.

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

Notes:
1.) Connect FRP Tubing To The High Pressure Port (Bottom Tube) Of The Static Pressure Transducer And Route The Tubing To The Static Pressure Pickup Probe Location. Leave The Port Marked “LO” Open To Atmosphere.

2.) The Static Pressure Pickup Probe Should Ideally Be Mounted With The Probe Pointing At A 90 Degree Angle To The Supply Air Flow Direction. It Should Be Located In A Straight Section Of The Supply Air Duct At A Distance From The Unit Discharge That Is Approximately Equal To 2/3 The Length Of The Longest Supply Air Duct Run. Also Ideally The Probe Should Be Located Not Less Than 3 Duct Diameters Downstream And 2 Duct Diameters Upstream Of Any Elbow Or Takeoff In The Ductwork.

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

Address Switch Shown Is Set For Address 1

Address Switch Shown Is Set For Address 13

The Address For Each Controller Must Be Unique To The Other Controllers On The Local Loop And Be Between 1 and 60

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.
**Outdoor Air, Return Air & Supply Air Temperature Sensor Wiring**

### Caution:
If your HVAC unit is supplied with the MODGAS II controller with or without an MHGRV II controller, the Supply Air Temperature Sensor must always be wired to the MODGAS II controller. If your HVAC unit is supplied with only the MHGRV II controller, the Supply Air Temperature Sensor must be connected to the MHGRV II controller. See the Miscellaneous Diagrams & Technical Information section in the back of this manual for detailed connection diagrams when using MODGAS II or MHGRV II controllers.

If you have either of these controllers on your HVAC unit and connect a Supply Air Temperature Sensor to the VCM controller, your controls will not function correctly. Only one Supply Air Temperature Sensor can be used on each HVAC unit.

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**JOB NAME**

**FILENAME**
DVCM-OA-SA-RASnsr-Wr-1A.CDR

**DATE:** 02/28/06  **DRAWN BY:** B. Crews

**PAGE**  **DESCRIPTION:**
1 of 2  VCM Controller Wiring Detail

**OA, SA and RA Temperature Sensors**
Economizer Actuator Wiring

Note:
When Return Air Bypass Control Is Used This Actuator Will Control Only The Outdoor Air Damper Actuator. The Return Air Damper Is Controlled By A Separate Actuator. For All Other Units The Return Air And Outdoor Air Dampers Use The Same Actuator With The Dampers Linked Together.

Economizers Damper Actuator
(Belimo Actuator Shown)

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

OE331-21-VCM
VCM Controller Board

24 VAC Power Source Sized For Actuator VA Load

INPUTS
+VDC
AIN1
AIN2
AIN3
AIN4
AIN5
GND
GND
AOUT1
AOUT2
AIN7
GND

PRESSURE SENSOR

OE331-21-VCM
VCM Controller Board

Note:
When Return Air Bypass Control Is Used This Actuator Will Control Only The Outdoor Air Damper Actuator. The Return Air Damper Is Controlled By A Separate Actuator. For All Other Units The Return Air And Outdoor Air Dampers Use The Same Actuator With The Dampers Linked Together.
Space Temperature Sensor & Remote Supply Air Reset Wiring

OE210, OE211, OE212 or OE213
Space Temperature Sensor

Remote Supply Air Temperature Reset Signal (By Others)

0-5 VDC or 0-10 VDC Signal
GND

Note:
When Using 0-10 VDC For The Remote Signal Source Must Have (2) 10kOhm Resistors Wired As Shown. When Using 0-5 VDC For The Remote Signal These Resistors are Not Required And The Signal Can Be Wired Directly To AIN7 and GND.

Note:
Either The Slide Offset Option For The Space Temperature Sensor Or The Remote Supply Air Temperature Reset Signal Option (by Others) May Be Connected To AIN7 On The VCM Controller. Only One Option Is Allowed, Not Both.

Note:
When Using 0-10 VDC For The Remote Signal Source Must Have (2) 10kOhm Resistors Wired As Shown. When Using 0-5 VDC For The Remote Signal These Resistors are Not Required And The Signal Can Be Wired Directly To AIN7 and GND.

Pullup Resistor PU7 Must Be Removed When Using The Remote Supply Air Temperature Reset Signal Input.
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.

Supply Fan Variable Frequency Drive
(By Others)

VFD 0-10VDC Input

GND

Bypass Damper Actuator
(Belimo Actuator Shown)

COM - 1
+ 2
Y1 3

GND
24 VAC
0-10 VDC

Note:
Either The Supply Fan Variable Frequency Drive Option Or The Bypass Damper Actuator Option May Be Connected To AOUT2 On The VCM Controller. Only One Option Is Allowed, Not Both.

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

OE331-21-VCM
VCM Controller Board

INPUTS
+VDC
AIN1
AIN2
AIN3
AIN4
AIN5
GND
GND
AOUT1
AOUT2
AIN7
GND

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:
Either The Supply Fan Variable Frequency Drive Option Or The Bypass Damper Actuator Option May Be Connected To AOUT2 On The VCM Controller. Only One Option Is Allowed, Not Both.
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 Boards must be wired in such a way that power to both the expansion boards and the controller are always powered together. Loss of power to the expansion board will cause the controller to become inoperative until power is restored to the expansion board.

Note:
Use This Diagram Only For Applications Without Copeland Digital Scroll Compressors. For Applications With Copeland Digital Scroll Compressors See The Wiring Detail For Suction Pressure Transducers With Copeland Digital Scroll Compressors.

OE275-01-NDC
Suction Pressure Transducer With Signal Conditioner (250 PSIG)

OE331-21-VCM
VCM Controller Board

Pullup Resistor PU5 Must Be Removed
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 Boards must be wired in such a way that power to both the expansion boards and the controller are always powered together. Loss of power to the expansion board will cause the controller to become inoperative until power is restored to the expansion board.

Note:
Use This Diagram Only For Applications With Copeland Digital Scroll Compressors. For Applications Without Copeland Digital Scroll Compressors See The Wiring Detail For Suction Pressure Transducers Without Copeland Digital Scroll Compressors.
Expansion Board Jumper Settings

- OE356 - 4 BINARY INPUT BOARD #1
- OE356 - 4 BINARY INPUT BOARD #2

- OE354 - 4 ANALOG INPUT 1 ANALOG OUTPUT BOARD
- OE355 - 4 ANALOG OUTPUT BOARD

VOLTAGE JUMPER J03 MUST BE IN PLACE
VOLTAGE JUMPER J01, J02 & J04 MUST BE REMOVED
PULLUP RESISTORS PU1, PU2, PU3 & PU4 MUST BE REMOVED

- OE357 - 4 RELAY OUTPUT BOARD #1
- OE357 - 4 RELAY OUTPUT BOARD #2
- OE357 - 4 RELAY OUTPUT BOARD #3
- OE357 - 4 RELAY OUTPUT BOARD #4

**Job Name:**

**Filename:** OVCM-EXP-JMPR-1A.CDR

**Date:** 03/06/06

**Drawn By:** B. Crews

**Description:**
VCM Controller Wiring Detail
Expansion Board Address & Jumper Settings
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 Boards must be wired in such a way that power to both the expansion boards and the controller are always powered together. Loss of power to the expansion board will cause the controller to become inoperative until power is restored to the expansion board.

10 VA Minimum Power Required For Each OE352 - 2 Slot Expansion Base Board. 20 VA Minimum Power Required For Each OE353 - 4 Slot Expansion Base Board.

OE352 2 Slot Or OE353 - 4 Slot Expansion Board As Required

Remote Forced Heating - N.O. Contact
- Dirty Filter - N.O. Contact
- Proof Of Flow - N.O. Contact
- Remote Forced Occupied - N.O. Contact
- Remote Forced Cooling - N.O. Contact
- Smoke Detector - N.C. Contact
- Remote Forced Dehumidification - N.O. Contact

As Required
Outdoor Humidity Sensor Wiring

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

10 VA Minimum Power Required For Each 2 Slot Expansion Base Board.
20 VA Minimum Power Required For Each 4 Slot Expansion Base Board

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

Pullup Resistor PU1 Must Be Removed As Shown

Jumper J01 Must Be Removed As Shown

Connect To VCM Controller

Connect To Next Expansion Base Board (When Used)

OE265-13
OA Humidity Sensor

OE352 or OE353 Expansion Base Board

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 Boards must be wired in such a way that power to both the expansion boards and the controller are always powered together. Loss of power to the expansion board will cause the controller to become inoperative until power is restored to the expansion board.

10 VA Minimum Power Required For Each 2 Slot Expansion Base Board.
20 VA Minimum Power Required For Each 4 Slot Expansion Base Board

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

Pullup Resistor PU1 Must Be Removed As Shown

Jumper J01 Must Be Removed As Shown

Connect To VCM Controller

Connect To Next Expansion Base Board (When Used)

OE352 or OE353 Expansion Base Board
### Return Air Humidity Sensor Wiring

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

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

10 VA Minimum Power Required For Each 2 Slot Expansion Base Board.
20 VA Minimum Power Required For Each 4 Slot Expansion Base Board

- **24 VAC**
- **GND**

Connect To VCM Controller

Connect To Next Expansion Base Board (When Used)

OE265-14 RA Humidity Sensor

JO1 JO2 JO3 JO4 JO5 JO6

OE352 or OE353 Expansion Base Board

Jumper J02 Must Be Removed As Shown

Pullup Resistor PU2 Must Be Removed As Shown

0-5 VDC Input

<table>
<thead>
<tr>
<th>JGB NAME</th>
</tr>
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</table>

#### Orion Control Systems

**FILENAME**
OVCM-RA-HumSensor-Ht-1A.CDR

**DATE:** 03/06/06
**DRAWN BY:** B. Crews

**PAGE**
**DESCRIPTION:**
1 of 1
- VCM Controller Wiring Detail
- Return Air Humidity Sensor
Indoor Air Humidity Sensor Wiring

**WARNING!!**
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Boards must be wired in such a way that power to both the expansion boards and the controller are always connected.

10 VA Minimum Power Required For Each 2 Slot Expansion Base Board.
20 VA Minimum Power Required For Each 4 Slot Expansion Base Board

**OE265-11**
Space Humidity Sensor

Connect To VCM Controller

Connect To Next Expansion Base Board (When Used)

Connect To Next Expansion Base Board

**OE352 or OE353 Expansion Base Board**

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

Pullup Resistor PU2 Must Be Removed As Shown

Jumpers Must Be Set as Shown For Normal

**NOTE:**

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 Boards must be wired in such a way that power to both the expansion boards and the controller are always connected.

10 VA Minimum Power Required For Each 2 Slot Expansion Base Board.
20 VA Minimum Power Required For Each 4 Slot Expansion Base Board

**Connect To VCM Controller**

Connect To Next Expansion Base Board

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

Pullup Resistor PU2 Must Be Removed As Shown

Jumpers Must Be Set as Shown For Normal

**NOTE:**

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 Boards must be wired in such a way that power to both the expansion boards and the controller are always connected.

10 VA Minimum Power Required For Each 2 Slot Expansion Base Board.
20 VA Minimum Power Required For Each 4 Slot Expansion Base Board

**Connect To VCM Controller**

Connect To Next Expansion Base Board

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

Pullup Resistor PU2 Must Be Removed As Shown

Jumpers Must Be Set as Shown For Normal

**NOTE:**

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 Boards must be wired in such a way that power to both the expansion boards and the controller are always connected.

10 VA Minimum Power Required For Each 2 Slot Expansion Base Board.
20 VA Minimum Power Required For Each 4 Slot Expansion Base Board

**Connect To VCM Controller**

Connect To Next Expansion Base Board

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

Pullup Resistor PU2 Must Be Removed As Shown

Jumpers Must Be Set as Shown For Normal

**NOTE:**

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 Boards must be wired in such a way that power to both the expansion boards and the controller are always connected.

10 VA Minimum Power Required For Each 2 Slot Expansion Base Board.
20 VA Minimum Power Required For Each 4 Slot Expansion Base Board

**Connect To VCM Controller**

Connect To Next Expansion Base Board

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

Pullup Resistor PU2 Must Be Removed As Shown

Jumpers Must Be Set as Shown For Normal

**NOTE:**

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 Boards must be wired in such a way that power to both the expansion boards and the controller are always connected.

10 VA Minimum Power Required For Each 2 Slot Expansion Base Board.
20 VA Minimum Power Required For Each 4 Slot Expansion Base Board

**Connect To VCM Controller**

Connect To Next Expansion Base Board

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

Pullup Resistor PU2 Must Be Removed As Shown

Jumpers Must Be Set as Shown For Normal

**NOTE:**

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 Boards must be wired in such a way that power to both the expansion boards and the controller are always connected.

10 VA Minimum Power Required For Each 2 Slot Expansion Base Board.
20 VA Minimum Power Required For Each 4 Slot Expansion Base Board

**Connect To VCM Controller**

Connect To Next Expansion Base Board

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

Pullup Resistor PU2 Must Be Removed As Shown

Jumpers Must Be Set as Shown For Normal

**NOTE:**
**Building Pressure Sensor, Actuator & VFD Wiring**

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

10 VA Minimum Power Required For
Each OE352 - 2 Slot Expansion Base Board.
20 VA Minimum Power Required For
Each OE353 - 4 Slot Expansion Base Board

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

Building Pressure Control
Damper Actuator
(0-10 VDC)

Building Pressure
Relief FAN VFD
(0-10 VDC)

Orion - OE258 Building Pressure
Transducer

Either The Building Pressure
Control Damper Actuator (Used for
Reverse Building Pressure Control
Applications) Or The Building
Pressure Relief Fan VFD Control
Can Be Used, Not Both.

Plastic Tubing To Building
Pressure Sensing Locations

OE352 2 Slot Or OE353 - 4 Slot Expansion Board
As Required - OE353 Is Shown

---

**VCM Controller Wiring Detail**

Building Pressure Sensor, Actuator & VFD Wiring
CO2 Sensor Wiring

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

10 VA Minimum Power Required For Each 2 Slot Expansion Base Board. 20 VA Minimum Power Required For Each 4 Slot Expansion Base Board

Connect To VCM Controller

Connect To Nex Expansion Base Board (When Used)

OE255 or OE256 CO Sensor (0-10VDC Signal)

Pullup Resistor PU3 Must Be Removed As Shown

Jumper J03 Must Be In Place As Shown

OE352 or OE353 Expansion Base Board
**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 Boards must be wired in such a way that power to both the expansion boards and the controller are always powered together. Loss of power to the expansion board will cause the controller to become inoperative until power is restored to the expansion board.

---

**24 Relay Output Expansion Board Wiring**

10 VA Minimum Power Required For Each OE352 - 2 Slot Expansion Base Board.
20 VA Minimum Power Required For Each OE353 - 4 Slot Expansion Base Board

---

OE352 2 Slot Or OE353 - 4 Slot Expansion Board

As Required - OE353 Is Shown

Note:
All Relay Outputs Are Normally Open And Rated For 24 VAC Power Only. 2 Amp Maximum 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 Boards must be wired in such a way that power to both the expansion boards and the controller are always powered together. Loss of power to the expansion board will cause the controller to become inoperative until power is restored to the expansion board.

The Cooling Device Used Can Be A Modulating Chilled Water Valve or A Digital Scroll Compressor. If Using A Digital Scroll Compressor Please See Digital Scroll Detailed Wiring Information In This Manual.

**Modulating Heating Device**
(By Others)

- 0-10 VDC or 2-10 VDC (Configurable)
- GND

The Heating Device Used Can Be A Modulating Hot Water Valve, Modulating Steam Valve or SCR Controlled Electric Heating Coil.

**Modulating Cooling Device**
(By Others)

- 0-10 VDC, 2-10 VDC or 1.5-5.0 VDC (Configurable)
- GND

The Cooling Device Used Can Be A Modulating Chilled Water Valve or A Digital Scroll Compressor. If Using A Digital Scroll Compressor Please See Digital Scroll Detailed Wiring Information In This Manual.

**Note:**
1.) The Modulating Cooling Device Used Must Be Capable Of Accepting Either A 0-10 VDC, 2-10 VDC Or 1.5-5.0 VDC Input. The AOUT2 Output Voltage Is User Configurable For These Voltages. The Modulating Heating Devices Used Must Be Capable Of Accepting Either A 0-10 VDC Or 2-10 VDC Input. The AOUT1 Output Voltage Is User Configurable For These Voltages. These Voltage Outputs Must Be Configured When You are Setting-up The VCM Controller(s) Operating Parameters. See the VCM Controller Operator Interfaces Technical Guide For Complete Controller Programming and Configuration Information.

2.) Each Modulating Heating Or Cooling Device Used On The VCM Controller Must Have (1) Relay Output Configured For Each Device Used, In Order To Enable The Modulating Heating And/Or Cooling Device’s Sequence. This Relay Output Must Be Configured When Setting-up The VCM Controller Operating Parameters. See the VCM Controller Operator Interfaces Technical Guide For Complete Controller Programming and Configuration Information.
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 Boards must be wired in such a way that power to both the expansion boards and the controller are always powered together. Loss of power to the expansion board will cause the controller to become inoperative until power is restored to the expansion board.

10 VA Minimum Power Required For Each 2 Slot Expansion Base Board.
20 VA Minimum Power Required For Each 4 Slot Expansion Base Board

Connect To VCM Controller
Connect To Next Expansion Board (When Used)

Connect To Next Expansion Board (When Used)

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

Return Air Damper Actuator (2-10 VDC)

Return Air Bypass Damper Actuator (2-10 VDC)

Connect To VCM Controller

Return Air Bypass Wiring
VAV/Zone Controller Diagrams
Notes:
1.) All wiring to be in accordance with local and national electrical codes and specifications.
2.) All communication wiring to be 2 conductor twisted pair with shield. Use Belden #82760 or equivalent.
3.) The Supply Air Sensor is not required when the VAV/Zone Controller is connected to an Orion VAV/CAV or VCM Unit Controller board. A global supply air temperature is broadcast by the VAV/CAV or VCM Unit Controller. The Supply Air Sensor is only required if the VAV/Zone Controller is required to operate as a "Stand Alone" controller.
Note:

1.) A Slave Wiring Adapter (OE267) consisting of a bypass & slave interface card and modular cable is supplied with the OE523 Round Slaved-Zone Damper, OE738 Rectangular Slaved-Zone Damper Kit and the OE282-03 Slaved Zone Package. It is required when attaching slave actuator(s) to the master zone damper. The bypass & slave interface card should be mounted in the control enclosure of the master zone damper. It is mounted by fastening the plastic snap-track to the control enclosure with sheet metal screws. Connect modular cables to the bypass and slave interface card and the master zone actuator as shown.
3 Relay Output Expansion Board Wiring

Notes:
1.) All Wiring to be in Accordance With Local & National Electrical Codes & Specifications.

1st Stage Heat Contactor
2nd Stage Heat Contactor
3rd Stage Heat Contactor

Typical Wiring for Single Duct Terminal with Electric Heat

Typical Wiring for Fan Terminal Unit with Cooling Only

Typical Wiring for Fan Terminal Unit with Electric Heat

Component Wiring Diagram

FILENAME: 0-OE322-3RELAY1OUTBD.CDR
DATE: 09/26/06
DRAWN BY: B. Crews
PAGE: 1 of 3
DESCRIPTION: OE322 - 3 Relay - 1 Analog Output Board
Notes:
1.) All Wiring to be in Accordance With Local & National Electrical Codes & Specifications.

Typical Wiring For Single Duct Terminal With Modulating Hot Water Heat

WattMaster Part # OE322
Relay Expansion Board w/ Modular Cable
Supplied by WattMaster
Mounted & Wired by Others

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

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

0-10 VDC Modulating
Hot Water Valve Supplied & Installed by Others

Supply Power
Of Required Voltage
To Valve Motor
(By Others)
24 VDC Power Only
(12 Watts Max.)
Is Available From TB3
Terminals (+V & GND)

Typical Wiring For
Fan Terminal Unit
With Modulating
Hot Water Heat

WattMaster Part # OE322
Relay Expansion Board w/ Modular Cable
Supplied by WattMaster
Mounted & Wired by Others

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

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

24 VAC Fan Relay Supplied and
Installed by Others. 2 Amp Max. Load For Fan Relay.
3 Relay Output Expansion Board Wiring (Cont’d)

Notes:
1.) All Wiring to be in Accordance With Local & National Electrical Codes & Specifications.

WattMaster Part #OE322 Relais Expansion Board w/ Modular Cable Supplied by WattMaster Mounted & Wired by Others

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

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

WattMaster Part #OE322 Relais Expansion Board w/ Modular Cable Supplied by WattMaster Mounted & Wired by Others

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

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

24 VAC - Transformer Supplied and Installed by Others. Size For Required HW Valve Load.

HWV

24 VAC HW Valve Supplied and Installed by Others. 2 Amp Max. Load.

Typical Wiring for Single Duct Terminal With 2 Position HW Valve

24 VAC - Transformer Supplied and Installed by Others. Size For Required Fan Relay and HW Valve Load.

Fan Relay

HWV

24 VAC Fan Relay and HW Valve Supplied and Installed by Others. 2 Amp Max. Load Each For HW Valve and Fan Relay.

Typical Wiring for Fan Terminal With 2 Position HW Valve
Communication Devices
Diagrams
Notes:
1.) All wiring to be in accordance with local and national electrical codes and specifications.
2.) All modular power/comm cables are to be WattMaster part number PCC-xx or PCCE-xx cables.

System Manager Wiring Using Modular Cables
See Page 2 and 3 of this Diagram for Alternate Hard Wiring Information
Notes:
1.) All wiring to be in accordance with local and national electrical codes and specifications.

See Page 1 of this Diagram for Modular Cable Connection Information
See Page 3 of this Diagram for Additional Pigtail Wiring Details

System Manager Wiring Schematic For Using The Pigtail

Class 2 Transformer Rated For 6 VA Minimum
System Manager Modular Cable Pigtail - Wiring Detail

Notes:
1.) All wiring to be in accordance with local and national electrical codes and specifications.

System Manager Wiring Details For Using The Pigtail
See Page 1 of this Diagram for Modular Cable Connection Information
See Page 2 of this Diagram for Pigtail Wiring Schematic
Optional Connection For Controllers Without DIN Connector

PL101904 Adapter Board

Terminal Block Base
(Remove Terminal Block)

Female DIN Connector

Male DIN Connector

Connector Cable

Typical Controller Board

The Modular Service Tool Can Be Connected To Most Controllers By Plugging One End Of The Supplied Cable Into the Modular Service Tool DIN Connector And The Other End Into The DIN Connector On The Controllers.

Some Controllers Without DIN Connectors Require Use Of The Supplied PL101904 Adapter Board Shown Above. To Connect With Adapter Board, First Unplug COMM Terminal Block From Controller Board. Plug PL101904 Adapter Board Terminal End Into Terminal Block Base On Controller. Plug DIN Connector Cable Into DIN Connector On PL101904 Adapter Board. See Optional Connection For Controllers Without DIN Connector Above For Illustration Of This Connection.

Be Sure The Modular Service Tool Is Connected To The Supplied Power Pack Or Has Fresh Batteries Installed Before Attempting Programming Of The Controller. Be Sure The Power Is Turned Off On The Modular Service Tool Before Connecting The Cable To The Controller.

Power On Button

Modular Service Tool

Component & System Wiring
**CommLink II Wiring & Cabling Connections**

**CommLink II Communications Interface**

*Jumper Set For Multiple Loop*

Part #OE361-04

- **Remote Link (DTE)**
- **Computer (DCE)**
- **POWER**
- **LINE VOLTAGE**

**Notes:**

1. 24 VAC Must Be Connected So That All Ground Wires Remain Common.
2. All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.
3. All Communication Wiring To Be 2 Conductor Twisted Pair With Shield. Use Belden #82760 Or Equivalent.

**CommLink Jumper Switch Settings**

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<tr>
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<td>CommLink II Wiring</td>
</tr>
</tbody>
</table>

**Date:** 02/11/04 **Drawn By:** B. CREWS

**Page:** 1

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**Remote Link**

**Part # OE419-04**

Connect To Remote Link Only. Remote Link Is Part # OE419-04

**Cautions:**

- Do Not Use The “Molded Cable” To Connect To The Computer (DCE) Connector. This Cable Is Only To Be Used To Connect From The CommLink (DTE) Connection To The Remote Link (When Used).
- Use 25 Pin Or 9 Pin Connector As Required By Available Serial (COM) Port On Computer.
- Do Not Use The “25 Pin Or 9 Pin Cable” To Connect To The Computer (DCE) Connector. This Cable Is Only To Be Used To Connect From The CommLink (DTE) Connection To The Remote Link (When Used).
- Do Not Use The Molded Cable” To Connect To The Computer (DCE) Connector. This Cable Is Only To Be Used To Connect From The CommLink (DTE) Connection To The Remote Link (When Used).

**System Application Documentation**

- Connect To First Device On Loop. See System Application Documentation For Your Specific Systems Controller Connection & Wiring Information
- All Communication Loop Wiring Is Straight Through

** Transformer**

Part # PX000015

- 120/24 Vac Transformer
- Part # PX000015

**CommLink**

- COMM DRIVER CHIP
- EPROM CHIP

**Notes:**

- Place Jumper Between Pins 1 & 2 for Multiple Loop Applications & Between Pins 2 & 3 for Single Loop Applications See Note 4.

---

**Notes:**

- 1.) 24 VAC Must Be Connected So That All Ground Wires Remain Common.
- 2.) All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.
- 3.) All Communication Wiring To Be 2 Conductor Twisted Pair With Shield. Use Belden #82760 Or Equivalent.
- 4.) CommLink Is Usually Shipped With The Jumper In The Multiple Loop Configuration. Check The Application Documentation For Your Specific System For Correct Jumper Position Setting.
MiniLink Polling Device Wiring Using Modular Connectors

- The Power To The MiniLink PD Must Be Removed And Reconnected After Changing The Address Switch Settings In Order For Any Changes To Take Effect.
- Disconnect All Communication Loop Wiring From The MiniLink PD Before Removing Power From The MiniLink PD. Reconnect Power And Then Reconnect Communication Loop Wiring.
- All Modular Power/Comm Cables Are To Be WattMaster Part Number PCC-XX Or PCCE-XX Cables.
- Connections To The Power/Comm Board And/Or Other MiniLink PDs Can Be Made By Using The Local Loop Modular Connector As Shown On Page 1 Or By Using 2 Conductor With Shield Communication Wires Only.

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

- All Communication Wiring Not Utilizing Modular Cable Assemblies Should Be Wired Using 18 Ga. Min. 2 Conductor Twisted Pair With Shield Belden #82760 Or Equivalent.

Notes:
- This Switch Should Be In The OFF Position As Shown.
- The Address Switch Shown Is Set For Address 1.
- The Address Switch Shown Is Set For Address 13.
- The Address For Each MiniLink PD Must Be Unique To The Other MiniLink PDs On The Network Loop And Be Between 1 and 60.
MiniLink Polling Device Wiring Using Wire Terminals

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

Component & System Wiring
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 MinLink PDs Can Be Connected To The Same Power/Comm Board(s) That Are Used To Supply Power And Communications For VAV/Zone Controllers And System Manager On The Local 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).

---

**FILENAMES**
OE365-01 Orion Power/Comm Board
Component Wiring Diagram
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 (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 MiniLink 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 VAV/Zone Controllers, System Manager(s) and Other Power/Comm Boards On The Local Loop See Page 1 Of This Drawing For Wiring.

Notes:
1.) All wiring to be in accordance with local and national electrical codes and specifications.
2.) All modular power/comm cables are to be WattMaster part number PCC-xx or PCCE-xx cables. All other communication wiring to be 2 conductor twisted pair with shield (Belden #82760 or equivalent).
RS-232 Serial Port To USB Port Converter

**Features & Specifications:**
Converts a USB port into a 9-pin male RS-232 serial port capable of speeds up to 115 Kbps.
The USB Serial Adapter is designed to make serial port expansion quick and simple.
Installs as a standard Windows COM port,
Full RS-232 modem control signals,
RS-232 data signals; TxD, RxD, RTS, CTS, DSR, DTR, DCD, RI, GND
Self Powered by USB port
Supports Windows 98/SE, ME & 2000 and XP

**Packages Includes:**
USB-232 Converter cable with short 12inch USB Type A end
Installation Instructions
USB Driver CD for win98/ME/2K/XP

**Installing the USB adapter**
Follow the instructions provided inside the USB Serial Adapter package for installation and driver setup of the USB Serial Adapter.
A CD-ROM is included that contains the correct drivers.

**Changing the COM ports:**
To change the COM port to a different COM port is accomplished by changing the COM port I/O range in the Windows Device Manager.

Right-click on "My Computer"
Click the "Device Manager" tab.
Click the "+" by "Ports"
Select "USB to Serial Port (COM5)"
Click the "Properties" button
Click the "Resources" Tab.
Uncheck the box that says "Use automatic settings".
Select the "Input/Output range"
Click the "Change Settings " button.
Click the little arrows until you find an appropriate setting.
"02E8-02EF" should give you a COM4 setting after you restart the computer.
Make sure to click "OK" on all screens.
Use the following settings to get the following COM ports:
COM1 - 3F8h-03FFh
COM2 - 2F8h-02FFh
COM3 - 3E8h-03EFh
COM4 - 2E8h-02EFh
Add-On Devices Diagrams
1. 24 VAC must be connected so that all ground wires remain common.
2. All wiring to be in accordance with local and national electrical codes and specifications.
3. All communication wiring to be 18 Ga. minimum, 2 conductor twisted pair with shield. Belden #82760 or equivalent.
4. It is recommended that all controllers address switches are set before installation.

Note:
- All circuit board contacts are N.O.
- All contacts are rated for 2 amps @ 24VAC pilot duty only.
- Do not apply any voltage greater than 24VAC.

Controller must have address switch set between 1 and 60.
Using GE Latching Relays

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

Caution:
- If Lighting Contactor Coil Current Draw Is More Than 2 Amps And/Or Does Not Use A 24VAC Coil, A Pilot Duty Relay That Has A Current Draw Of Less Than 2 Amps @ 24VAC Must Be Used To Energize The Lighting Contactor. A Separate Transformer Rated For The Total Lighting Contactor(s) Or Pilot Relay Current Draw Must Always Be Used To Power The Circuit.

Caution!:
- Controller Must Have Address Switch Set Between 1 And 60

Typical Wiring Shown For Circuit #1
All Other Circuits Are To Be Wired Identically. Up To 7 Lighting Circuits May Be Wired To Each Lighting Panel Controller.

Note:
- Set-up, Programming And Monitoring Of The Lighting Panel Controller Requires The Use Of A Personal Computer And PrismSoftware.

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

Typical Wiring Shown For Circuit #1
All Other Circuits Are To Be Wired Identically. Up To 7 Lighting Circuits May Be Wired To Each Lighting Panel Controller.

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

Caution:
- If Lighting Contactor Coil Current Draw Is More Than 2 Amps And/Or Does Not Use A 24VAC Coil, A Pilot Duty Relay That Has A Current Draw Of Less Than 2 Amps @ 24VAC Must Be Used To Energize The Lighting Contactor. A Separate Transformer Rated For The Total Lighting Contactor(s) Or Pilot Relay Current Draw Must Always Be Used To Power The Circuit.

Caution!:
- Controller Must Have Address Switch Set Between 1 And 60

Typical Wiring Shown For Circuit #1
All Other Circuits Are To Be Wired Identically. Up To 7 Lighting Circuits May Be Wired To Each Lighting Panel Controller.

Note:
- Set-up, Programming And Monitoring Of The Lighting Panel Controller Requires The Use Of A Personal Computer And PrismSoftware.

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

Typical Wiring Shown For Circuit #1
All Other Circuits Are To Be Wired Identically. Up To 7 Lighting Circuits May Be Wired To Each Lighting Panel Controller.

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

Caution:
- If Lighting Contactor Coil Current Draw Is More Than 2 Amps And/Or Does Not Use A 24VAC Coil, A Pilot Duty Relay That Has A Current Draw Of Less Than 2 Amps @ 24VAC Must Be Used To Energize The Lighting Contactor. A Separate Transformer Rated For The Total Lighting Contactor(s) Or Pilot Relay Current Draw Must Always Be Used To Power The Circuit.

Caution!:
- Controller Must Have Address Switch Set Between 1 And 60

Typical Wiring Shown For Circuit #1
All Other Circuits Are To Be Wired Identically. Up To 7 Lighting Circuits May Be Wired To Each Lighting Panel Controller.

Note:
- Set-up, Programming And Monitoring Of The Lighting Panel Controller Requires The Use Of A Personal Computer And PrismSoftware.

1.) 24 VAC Must Be Connected So That All Ground Wires Remain Common.
2.) All Wiring To Be In Accordance With Local And National Electrical Codes and Specifications.
3.) All Communication Wiring To Be 18 Ga. Minimum, 2 Conductor Twisted Pair With Shield. Belden #82760 Or Equivalent.
4.) It Is Recommended That All Controllers Address Switches Are Set Before Installation.
GPC-17 Controller Wiring

1.) 24 VAC Must Be Connected So That All Ground Wires Remain Common.

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

3.) All Communication Wiring To Be 18 Ga. Minimum, 2 Conductor Twisted Pair With Shield, Belden #82760 Or Equivalent.

4.) It Is Recommended That All Controllers Address Switches Are Set Before Installation.

Note: All Circuit Board Contacts Are N.O. All Contacts Are Rated For 2 Amps @ 24VAC Pilot Duty Only. Do Not Apply Any Voltage Greater Than 24VAC.
All Communication Loop Wiring Is Straight Through

T To T, R To R, SHLD To SHLD

Local Loop RS-485 9600 Baud

Connect To Next Device On The Local Loop

Mini DIN Connector For Connection Of Modular Service Tool

Pull-up Resistor- Typical

Analog Inputs AIN1 thru AIN7 Can Be Used For 10kOhm Type III Thermistor, 0-5VDC Signal, 4-20mA Signal Or Dry Contact Closure Inputs. As Required.

Note: When Using Sensors or Transducers With 4-20 mA Input Signal, The Pull-up Resistor For The Input Being Used Must Be Removed From The Controller Board And A 250 Ohm Resistor Must Be Wired Between The Input Terminal And The Ground Terminal On The Controller Board

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

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

Analog Input AIN6 Can Only Be Used For Connection Of A Static Pressure Transducer With Modular Connector

Splice If Required

4 Additional Relay Outputs Are Available By Using The OE357 4 Relay Output Expansion Board. The OE352 2 Slot Expansion Base Board Is also Required To Mount The OE357 Board.

24VAC Power For Relay Outputs

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

Connecting Expansion Board Base (When Used)

4) All Communication Wiring To Be 18 Ga. Minimum, 2 Conductor Twisted Pair With Shield. Belden #82760 Or Equivalent.

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

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.

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

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

Analog Input AIN6 Can Only Be Used For Connection Of A Static Pressure Transducer With Modular Connector

Splice If Required

4 Additional Relay Outputs Are Available By Using The OE357 4 Relay Output Expansion Board. The OE352 2 Slot Expansion Base Board Is also Required To Mount The OE357 Board.

24VAC Power For Relay Outputs

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

Connecting Expansion Board Base (When Used)
GPC Plus Controller - Address Switch Setting

1.) 24 VAC Must Be Connected So That All Ground Wires Remain Common.

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

3.) All Communication Wiring To Be 18 Ga. Minimum, 2 Conductor Twisted Pair With Shield. Belden #82760 Or Equivalent.

4.) It Is Recommended That All Controllers Address Switches Are Set Before Installation.

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.

The Address For Each Controller Must Be Unique To The Other Controllers On The Local Loop. For Auto-Zone Systems The Address Must Be Set Between 18 to 30. For All Other Systems The Address Can Be Set Between 1 to 59.
GBD Controller - CO₂ Applications Wiring

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

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

Available Inputs for connection of CO₂ sensor 4-20mA signal. See Page 2 for detailed CO₂ sensor wiring.

Available 0-10 VDC proportional output signal

Available 10 VDC fixed output signal

Notes:
1.) The GBD can either be used with CO₂ sensors or space temperature sensors but not both on the same GBD device. Up to 2 GBD devices can be located on each local loop.

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

3.) Set-up, Programming and Monitoring of the GBD device requires the use of a personal computer and Prism software.

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

Available Relay #1
24 VAC output closes on rise above minimum CO₂ setpoint

Available Relay #2
24 VAC output closes on rise above maximum CO₂ setpoint

24 VAC Transformer 20VA minimum

GBD Device Wiring
When Used For CO₂ Applications
GBD Controller - CO2 Applications Wiring (Cont’d)

Up to (6) CO₂ Sensors Can Be Used On The GBD. They Can Be Wired To AIN1, AIN2, AIN3, AIN4, AIN5 And AIN7 As Desired. Only 4-20mA CO₂ Sensor(s) May Be Used.

250 Ohm-1% Resistor Supplied With CO₂ Sensor(s) Must Be Wired As Shown For Each Sensor Used.

The Pullup Resistor For The Analog Input That Each CO₂ Sensor Is Connected To Must Be Removed For Proper Operation Of The GBD Device.

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

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

Communications Wire Must Be 2 Conductor Twisted Pair With Shield, Belden #82760 Or Equivalent. All Wiring Must Be Straight Through, R To R, T To T And SHLD To SHLD.

Available Inputs For Connection of Space Temperature Sensors. See Page 4 For Detailed Space Temperature Sensor Wiring.

GBD Device Wiring

When Used For Space Temperature Sensor Averaging Applications

Notes:
1.) The GBD Can Either Be Used With CO2 Sensors Or Space Temperature Sensors But Not Both On The Same GBD Device. Up to 2 GBD Devices Can Be Located On Each Local Loop.
2.) 24 VAC Must Be Connected So That All Ground Wires Remain Common.
3.) Set-up, Programming And Monitoring Of The GBD Device Requires The Use Of A Personal Computer And Prism Software.
4.) All Wiring To Be In Accordance With Local And National Electrical Codes And Specifications.
Up to (6) Temperature Sensors Can Be Used On The GBD. They Can Be Wired To AIN1, AIN2, AIN3, AIN4, AIN5 And AIN7 As Desired.

Typical Wiring Shown For Input AIN3. Wiring For Other Inputs Is Identical.

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

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

Address Switch Shown Is Set For Address 1

Address Switch Shown Is Set For Address 13

The Address For Each Controller Must Be Unique To The Other Controllers On The Local Loop And Be Between 1 and 60

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.

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

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

This Switch Should Be In The OFF Position As Shown

The Address Switch Shown Is Set For Address 1

The Address Switch Shown Is Set For Address 13

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

1.) The GBD Can Either Be Used With CO2 Sensors Or Space Temperature Sensors But Not Both On The Same GBD Device. Up to 2 GBD Devices Can Be Located On Each Local Loop.

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.

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

GBD Device Wiring
Miscellaneous Diagrams & Technical Information
Modular Room Sensor Wiring

**Room Sensor Typical Dimensions**

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**Temperature Sensor Resistance/Voltage Chart**

<table>
<thead>
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<th>Temp (°F)</th>
<th>Resistance (Ohms)</th>
<th>Voltage (V)</th>
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<td>9333</td>
<td>4.620</td>
</tr>
<tr>
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<td>80531</td>
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</tr>
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<td>69522</td>
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</table>

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*Chart Notes:*

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

2. Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the sensor leads as shown in the illustration below. If the voltage is above 5.08 VDC, then the sensor or wiring is "open." If the voltage is less than 0.05 VDC, the sensor or wiring is shorted.

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**OEMODRMSENS1.CDR**

**DATE: B. CREWS**

**DESCRIPTION: PAGE DRAWN BY: B. CREWS**

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**JOB NAME**
OE-268 Over Voltage Board

**NOTE:** This board goes between the supply transformers low voltage output and the controllers low voltage input. WattMaster Controllers do not like to see more than 28 VAC on their input side. When the line voltage to the transformer is too high, generally the output side of the transformer (low voltage) is too high, thus requiring this Over Voltage Board.

This output is DC voltage. Our controllers will accept DC voltage if the voltage is above 28 VDC.

**Warning**
This board is designed to power one controller with expansion boards only.

To the 24 VAC input side of WattMaster Controller
Caution:

If your HVAC unit is supplied with the MODGAS II controller with or without an MHGRV II controller, the Supply Air Temperature Sensor must always be wired to the MODGAS II controller. If your HVAC unit is supplied with only the MHGRV II controller, the Supply Air Temperature Sensor must be connected to the MHGRV II controller. If you have either of these controllers on your HVAC unit and have a Supply Air Temperature Sensor connected to the VCM controller, your controls will not function correctly. Only one Supply Air Temperature Sensor can be used on an HVAC unit.

Wiring For MODGAS II When Used With Orion VCM Controller

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

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

Caution:
If your HVAC unit is supplied with the MODGAS II controller with or without an MHGRV II controller, the Supply Air Temperature Sensor must always be wired to the MODGAS II controller. If your HVAC unit is supplied with only the MHGRV II controller, the Supply Air Temperature Sensor must be connected to the MHGRV II controller. If you have either of these controllers on your HVAC unit and have a Supply Air Temperature Sensor connected to the VCM controller, your controls will not function correctly. Only one Supply Air Temperature Sensor can be used on an HVAC unit.

Wiring For MHGRVII When Used With Orion VCM Controller
Notes:

1) All Wiring To Be In Accordance With Local And National Electrical Codes and Specifications.
Supply Air Sensor Location & Wiring

Caution:
If your HVAC unit is supplied with the MODGAS II controller with or without an MHGRV II controller, the Supply Air Temperature Sensor must always be wired to the MODGAS II controller. If your HVAC unit is supplied with only the MHGRV II controller, the Supply Air Temperature Sensor must be connected to the MHGRV II controller. If you have either of these controllers on your HVAC unit and have a Supply Air Temperature Sensor connected to the VCM controller, your controls will not function correctly. Only one Supply Air Temperature Sensor can be used on an HVAC unit. If expansion boards are used they can be connected via modular cable to any 7C connector on the loop.
Caution:
If your HVAC unit is supplied with the MODGAS II controller with or without an MHGRV II controller, the Supply Air Temperature Sensor must always be wired to the MODGAS II controller. If your HVAC unit is supplied with only the MHGRV II controller, the Supply Air Temperature Sensor must be connected to the MHGRV II controller. If you have either of these controllers on your HVAC unit and have a Supply Air Temperature Sensor connected to the VCM controller, your controls will not function correctly. Only one Supply Air Temperature Sensor can be used on an HVAC unit. If expansion boards are used they can be connected via modular cable to any I2C connector on the loop.
Supply Air Sensor Location & Wiring (Cont’d)

SA Sensor Wiring Location
HVAC Unit Control By Others and MODGAS II Only

SA Sensor Wiring Location
HVAC Unit Controls By Others and both MODGAS II & MHGRV II Controller

Pullup Resistor “PU1” Must Be Removed From The MODGAS II Board For This Configuration

Supply Air Temperature Sensor

SA Sensor Wiring
HVAC Unit Control By Others and both MODGAS II & MHGRV II Controller

Supply Air Temperature Sensor

SA Sensor Wiring Location
HVAC Unit Control By Others and MODGAS II Only

Supply Air Temperature Sensor

SA Sensor Wiring Location
HVAC Unit Controls By Others and both MODGAS II & MHGRV II Controller

Supplied by Robert B. Crews
Chip Locations

Warning!
Use Extreme Caution When Removing Any Chips
To Avoid Damaging Any Circuit Board Traces Which
Are Under The Chip.

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

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

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

**WARNING!**

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

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

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

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

Use extreme care to avoid inserting the screwdriver or I.C. Puller under the socket. You must insert the tip of the screwdriver or ends of the I.C. Puller between the body of the chip and the chip socket.

Each chip MUST be installed with Pin 1 in the correct location. Installing the chip "backwards" will in most cases destroy the device when power is reapplied.

Pin 1 can be located by looking for the notch in the end of the chip. Pin 1 on "some" chips is identified with a dot.

Be certain that ALL pins are lined up in the socket before pressing the chip in. Failure to properly line up the pins will result in damage to the chip. This is a **VERY common error - BE CAREFUL.**

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

---

**Using I.C. Puller To Remove Socketed Chip**

Gently Lift The Chip On One End And Rock Chip Back And Forth With Screwdriver As Shown. Repeat This Process On The Other End Of Chip. Alternate This Process On Both Ends Of Chip Until The Chip Is Free From The Chip Socket.

**Using Screwdriver To Remove Socketed Chip**

Gently Rock Chip Side To Side And Then Lift Straight Up To Remove Chip From Chip Socket.

---

**典型 RS-485 通讯**

**Driver Chip Detail**

**Socket**

**Dot**

**Pin 1**

**Printed Circuit Board**

---

**JOB NAME**

**FILENAME**

O-DRCHPREP.CDR

**DATE:** 03/09/06

**DRAWN BY:** B. CREWS

**DESCRIPTION:** Orion Components

**Page:** 3 of 3

---

Component & System Wiring
**Sensor Checks**

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

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

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

<table>
<thead>
<tr>
<th>Temp (°F)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
<th>Temp (°F)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
<th>Temp (°F)</th>
<th>Resistance (Ohms)</th>
<th>Voltage @ Input (VDC)</th>
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<td>60</td>
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<td>80531</td>
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<td>62</td>
<td>14014</td>
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<td>2.242</td>
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<td>13382</td>
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<td>60552</td>
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<td>2.867</td>
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<td>52500</td>
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<td>1.927</td>
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</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 5.08 VDC, then the sensor or wiring is “open.”
- If the voltage is less than 0.05 VDC, the sensor or wiring is shorted.

### OE265-03 Relative Humidity Transmitter – Humidity vs. Voltage

<table>
<thead>
<tr>
<th>Humidity Percentage (RH)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>1.00</td>
</tr>
<tr>
<td>2%</td>
<td>1.08</td>
</tr>
<tr>
<td>4%</td>
<td>1.16</td>
</tr>
<tr>
<td>6%</td>
<td>1.24</td>
</tr>
<tr>
<td>8%</td>
<td>1.32</td>
</tr>
<tr>
<td>10%</td>
<td>1.40</td>
</tr>
<tr>
<td>12%</td>
<td>1.48</td>
</tr>
<tr>
<td>14%</td>
<td>1.56</td>
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<tr>
<td>16%</td>
<td>1.64</td>
</tr>
<tr>
<td>18%</td>
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<td>22%</td>
<td>1.88</td>
</tr>
<tr>
<td>24%</td>
<td>1.96</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Humidity Percentage (RH)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26%</td>
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</tr>
<tr>
<td>28%</td>
<td>2.12</td>
</tr>
<tr>
<td>30%</td>
<td>2.20</td>
</tr>
<tr>
<td>32%</td>
<td>2.28</td>
</tr>
<tr>
<td>34%</td>
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<td>36%</td>
<td>2.44</td>
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<td>38%</td>
<td>2.52</td>
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<td>40%</td>
<td>2.60</td>
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<tr>
<td>42%</td>
<td>2.68</td>
</tr>
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<td>44%</td>
<td>2.76</td>
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<td>46%</td>
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<tr>
<td>48%</td>
<td>2.92</td>
</tr>
<tr>
<td>50%</td>
<td>3.00</td>
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</table>

<table>
<thead>
<tr>
<th>Humidity Percentage (RH)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>52%</td>
<td>3.08</td>
</tr>
<tr>
<td>54%</td>
<td>3.16</td>
</tr>
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<td>56%</td>
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<td>58%</td>
<td>3.32</td>
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<td>60%</td>
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<td>62%</td>
<td>3.48</td>
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<td>64%</td>
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<td>66%</td>
<td>3.64</td>
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<td>68%</td>
<td>3.72</td>
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<td>70%</td>
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<td>72%</td>
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<tr>
<td>74%</td>
<td>3.96</td>
</tr>
<tr>
<td>76%</td>
<td>4.04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Humidity Percentage (RH)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
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<td>78%</td>
<td>4.12</td>
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<tr>
<td>80%</td>
<td>4.20</td>
</tr>
<tr>
<td>82%</td>
<td>4.28</td>
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<td>84%</td>
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<tr>
<td>86%</td>
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<td>4.68</td>
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<td>94%</td>
<td>4.76</td>
</tr>
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<td>96%</td>
<td>4.84</td>
</tr>
<tr>
<td>98%</td>
<td>4.92</td>
</tr>
<tr>
<td>100%</td>
<td>5.00</td>
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</tbody>
</table>

**OE265-03 Relative Humidity Sensor Testing Instructions:**

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

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

<table>
<thead>
<tr>
<th>Pressure @ Sensor (&quot; W.C.)</th>
<th>Voltage @ Input (VDC)</th>
<th>Pressure @ Sensor (&quot; W.C.)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
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<td>2.20</td>
</tr>
<tr>
<td>0.10</td>
<td>0.33</td>
<td>2.70</td>
<td>2.28</td>
</tr>
<tr>
<td>0.20</td>
<td>0.40</td>
<td>2.80</td>
<td>2.35</td>
</tr>
<tr>
<td>0.30</td>
<td>0.48</td>
<td>2.90</td>
<td>2.43</td>
</tr>
<tr>
<td>0.40</td>
<td>0.55</td>
<td>3.00</td>
<td>2.50</td>
</tr>
<tr>
<td>0.50</td>
<td>0.63</td>
<td>3.10</td>
<td>2.58</td>
</tr>
<tr>
<td>0.60</td>
<td>0.70</td>
<td>3.20</td>
<td>2.65</td>
</tr>
<tr>
<td>0.70</td>
<td>0.78</td>
<td>3.30</td>
<td>2.73</td>
</tr>
<tr>
<td>0.80</td>
<td>0.85</td>
<td>3.40</td>
<td>2.80</td>
</tr>
<tr>
<td>0.90</td>
<td>0.93</td>
<td>3.50</td>
<td>2.88</td>
</tr>
<tr>
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<td>1.00</td>
<td>3.60</td>
<td>2.95</td>
</tr>
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<td>1.08</td>
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<td>3.03</td>
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<td>3.18</td>
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<td>3.93</td>
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<td>4.00</td>
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<td>2.13</td>
<td>5.10</td>
<td>4.10</td>
</tr>
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</table>

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

<table>
<thead>
<tr>
<th>Pressure @ Sensor (&quot; W.C.)</th>
<th>Voltage @ Input (VDC)</th>
<th>Pressure @ Sensor (&quot; W.C.)</th>
<th>Voltage @ Input (VDC)</th>
</tr>
</thead>
<tbody>
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<tr>
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<td>0.03</td>
<td>2.80</td>
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<td>3.80</td>
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<td>3.90</td>
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<tr>
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<td>1.50</td>
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<td>4.10</td>
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<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>
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<td>4.40</td>
</tr>
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<td>1.90</td>
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<td>4.50</td>
</tr>
<tr>
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<td>2.00</td>
<td>0.21</td>
<td>4.60</td>
</tr>
<tr>
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<td>4.70</td>
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<tr>
<td>-0.03</td>
<td>2.20</td>
<td>0.23</td>
<td>4.80</td>
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<tr>
<td>-0.02</td>
<td>2.30</td>
<td>0.24</td>
<td>4.90</td>
</tr>
<tr>
<td>-0.01</td>
<td>2.40</td>
<td>0.25</td>
<td>5.00</td>
</tr>
<tr>
<td>0.00</td>
<td>2.50</td>
<td>5.10</td>
<td>5.10</td>
</tr>
</tbody>
</table>

**OE271 Pressure Sensor Testing Instructions**
Use the voltage column to check the Duct Static Pressure Sensor while connected to powered controllers. Read voltage with meter set on DC volts. Place the “-” (minus) lead on GND terminal and the “+” (plus) lead on the 0-5 pin terminal on (JP1) with the jumper removed. Be sure to replace the jumper after checking.

**OE258 Building Pressure Sensor Testing Instructions**
Use the voltage column to check the Building Static Pressure Sensor while connected to a powered expansion board. Read voltage with meter set on DC volts. Place the “-” (minus) lead on terminal labeled GND and the “+” lead on terminal AIN4 on the Analog Input/Output Expansion Board.