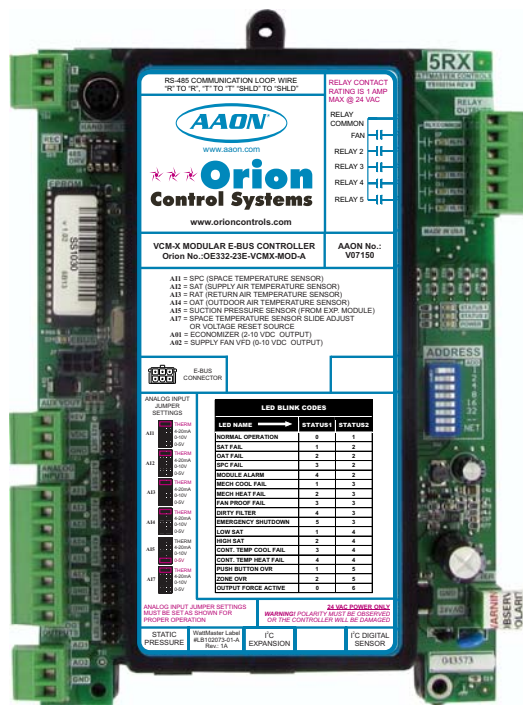




Use For VCM-X E-BUS Controller Code: SS1030 and later
For VCM Wiring Information, See Component & System Wiring
Technical Guide - Form: OR-VCMWIRE-TGD



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System Overview, Installation & Commissioning

System Types

Overview

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

System Types

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

1. **Stand Alone**
(See **Figure 3, page 22** for Connection Diagram)
2. **Interconnected**
(See **Figure 4, page 23** for Connection Diagram)
3. **Networked Single Loop**
(See **Figures 5-9, pages 24-28** for Connection Diagrams)
4. **Networked Multiple Loop**
(See **Figures 10-11, pages 29-30** for Connection Diagrams)
5. **Computer, CommLink 5, IP Module, USB-Link 2**
(See **Figures 54-58, pages 76-80** for Connection Diagrams)

System Type Definitions

Stand Alone

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

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

Interconnected

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

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

Networked Single Loop

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

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

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

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

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

Networked Multiple Loop

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

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

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

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

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

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

Network Communications Devices

MiniLink Polling Device

The MiniLink Polling device is used in the following applications:

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

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

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

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

CommLink 5

The CommLink 5 device is used in the following applications.

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

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

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

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

Wiring Considerations

Wiring Considerations

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

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

Communications And Power Wiring Terminations For Orion Products			
Orion Controller Or Device	Available Power And Communications Connections		
	Modular Connectors Only	Wire Terminals Only	Both Modular Connectors And Wire Terminals
VCM-X E-BUS	X		
VAV/Zone			X
Power/Comm Board			X
MiniLink PD			X
CommLink 5		X	
*Modular System Manager	X		
System Manager TS II		X	
GPC-X		X	
GPC-XP	X		
Lighting Controller		X	

* 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.

Table 1: Communications and Power Terminations

Power/Comm Board Requirements

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

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

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

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

Alternative Connection Configuration and Use

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

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

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

For Power/Comm board transformer sizing, see **Figures 1 & 2, pages 9-10** of this manual.

Transformer Sizing & Wiring For Devices W/Out Modular Connectors

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

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

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

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

8 GPC-XP Controllers @ 8 VA each..... $8 \times 8 \text{ VA} = 64 \text{ VA}$.

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

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

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

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

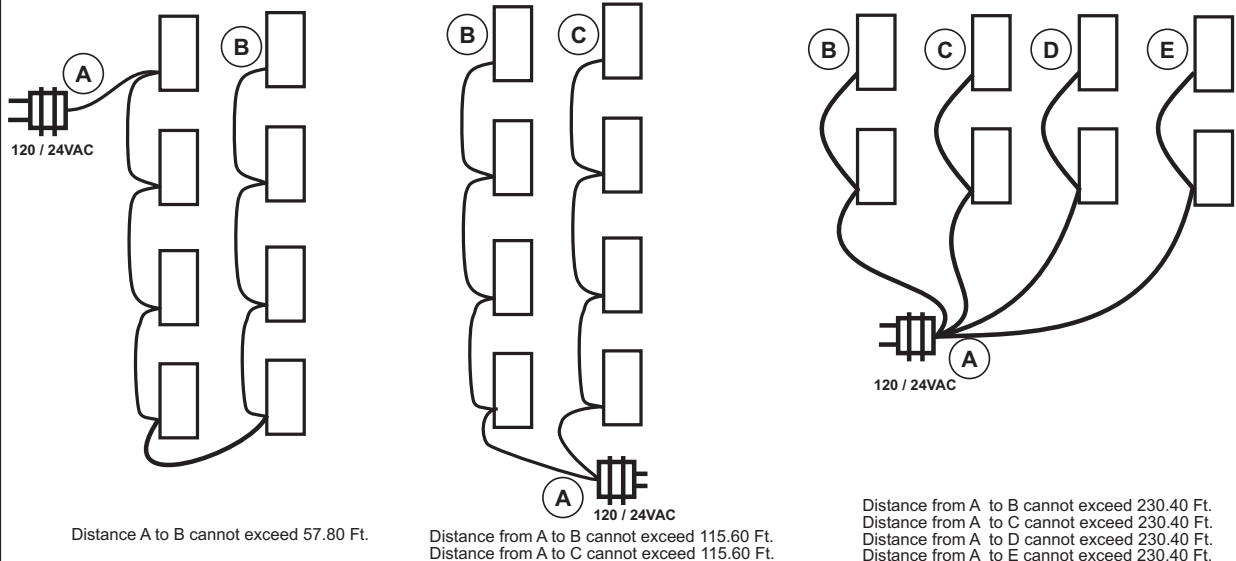
Next use the voltage drop per foot value for 18 gauge wire from the list above and multiply by the total VA load of the 8 controllers to be installed.

$0.00054 \text{ (Voltage drop per foot for 18 gauge wire)} \times 64 \text{ VA controller load} = 0.0346 \text{ Volts/Ft.}$

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

VCM-X E-BUS Controller8 VA	Lighting Panel Controller10 VA
VAV/Zone Controller.....6 VA	MiniLink Polling Device.....6 VA
GPC-X Controller8 VA	
GPC-XP Controller8 VA	

JOB NAME

FILENAME

*****Orion**
Control Systems

O-VCMXWRSIZ1A.CDR

DATE: 01/07/13

PAGE

DESCRIPTION:

1 of 2

Orion VCM-X System

Wire & Transformer Sizing

Figure 1: Transformer & Wire Sizing - Devices without Modular Connectors

Transformer Sizing & Cabling For Devices With Modular Connectors

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.

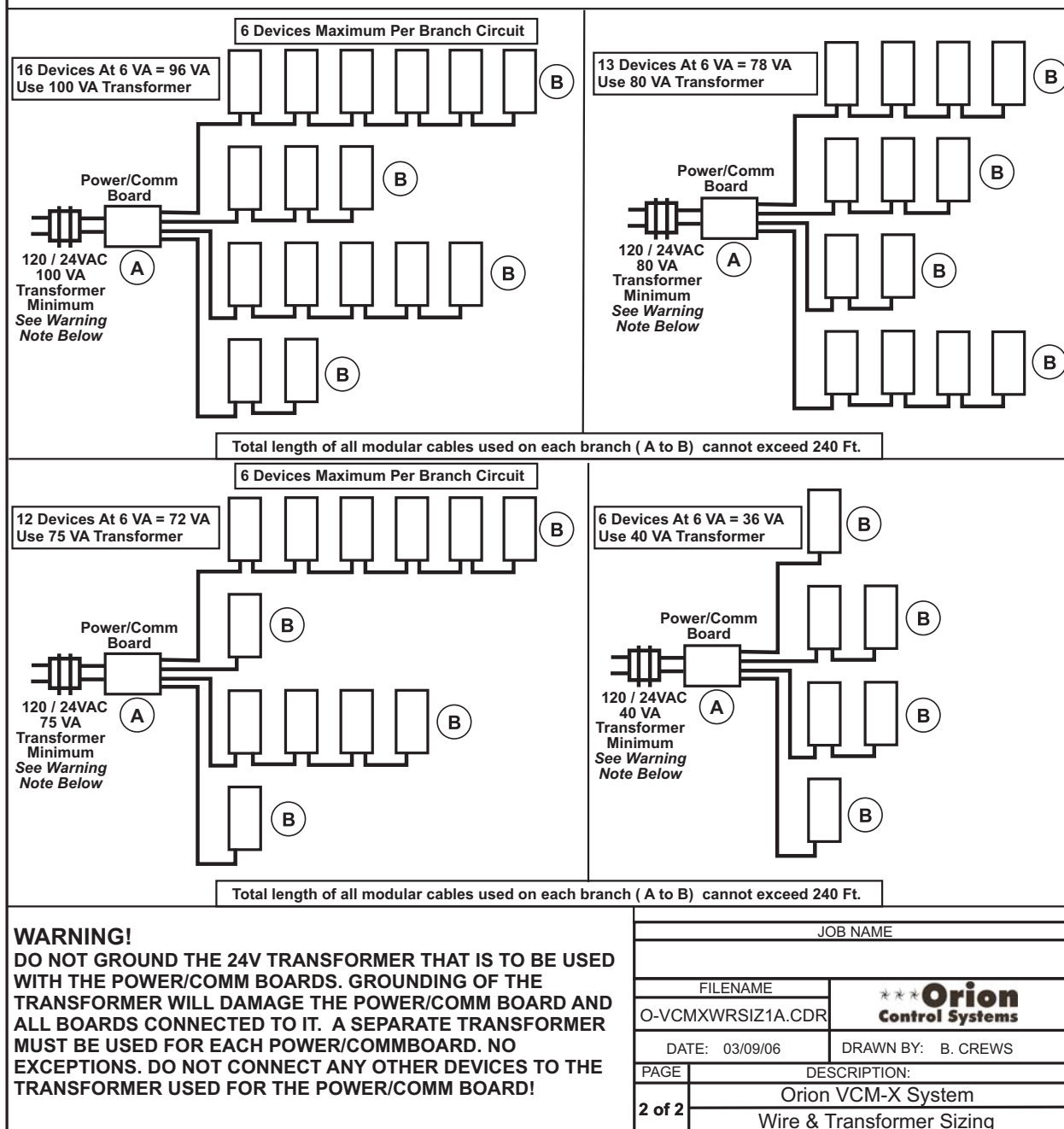


Figure 2: Transformer & Wire Sizing - Devices with Modular Connectors

MiniLink Polling Device (MiniLink PD)

Standard Connection Configurations and Use

The MiniLink PD is used on Networked Single and Multiple Loop systems to provide two-way communication between all devices on 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 5 must be connected to one of the MiniLink PDs on the system by using a 2-wire shielded cable connected between its 3-wire "Network Loop" communications terminal block (TB4) and to the CommLink's "485 Loop" terminal block. Transfer of "Local Loop" communication from the MiniLink PD to a Power/Comm board is made by using a modular cable connected between the MiniLink PD "Local Loop" modular connector (P4) and the Power/Comm board modular "Comm In" connector (P2). If desired as an alternative, transfer of "Local Loop" communication from the MiniLink PD to a Power/Comm board can be made by hard wiring a 2-wire shielded cable connected between the MiniLink PD's 3-wire communications terminal (TB1) and the 3-wire communications input (TB1) on the Power/Comm board.

Installation Procedures

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

Stand Alone Systems

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

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

2. The Modular Service Tool SD connects to the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Stand Alone.
3. The Modular System Manager SD comes supplied with a 12 foot modular cable with a modular connector on one end and stripped wires on the other. If the Modular System Manager is to be mounted in a remote location, run 18 gauge, 2 conductor shielded cable for communications from the controller's 3 wire communications terminal to a junction box. Run 18 gauge minimum, 2-wire, power wires from a separate 24 VAC, 6 VA minimum transformer into the junction box. Splice the modular cable to the communications and power wire inside of the junction box by making solid connections, using wire nuts or butt splice connectors. The Communications setting must be set to Lo Speed Stand Alone.
4. The System Manager TS II utilizes a 3-wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2-wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum 2 conductor wire. In the Settings Menu, *enter <0>* for the System Manager Address.
5. If a CommLink 5 is used for a computer interface, connect communications using 18 gauge, 2 conductor with shield cable. Connect from the controller's 3-wire communications connector to the CommLink's 3-wire communications connector. For this type of system, the Loop switch located on the back of the CommLink 5 must be set to "Single".
6. Use 18 gauge minimum, 2-wire cable for all 24 VAC power wiring. Be sure to maintain polarity on all boards. If a CommLink is connected, use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source.
7. Before powering up the controller, set the desired board address on the controller (usually 1).

Interconnected & Networked Single Loop

Interconnected Systems

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

1. Connect all VCM-X E-BUS Controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications. Install a separate 24 VAC, 8 VA minimum transformer for each VCM-X E-BUS Controller and wire the transformers to each controller using 18 gauge minimum, 2 conductor cable. Observe polarity on all boards.
2. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Stand Alone.
3. The Modular System Manager SD comes supplied with a 12 foot modular cable with a modular connector on one end and stripped wires on the other. If the Modular System Manager is to be mounted in a remote location, run 18 gauge, 2 conductor shielded cable for communications from the controller's 3-wire communications terminal to a junction box. Run 18 gauge minimum, 2-wire power wires from a separate 24 VAC, 6 VA minimum transformer into the junction box. Splice the modular cable to the communications and power wire inside of the junction box by making solid connections, using wire nuts or butt splice connectors. The Communications setting must be set to Lo Speed Stand Alone. .
4. The System Manager TS II utilizes a 3-wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2-wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum 2 conductor wire. In the Settings Menu, enter **<0>** for the System Manager Address and make sure One to One Unit Connection is not selected.
5. If a CommLink 5 is used to provide for connection to a computer interface, connect communications using 18 gauge, 2 conductor shielded cable. Connect from one of the controller's 3-wire communications connectors to the CommLink's 3-wire communications connector. For this type of system, the Loop switch on the back of the CommLink needs to be set to "Single".

6. Use 18 gauge minimum, 2-wire cable for all 24 VAC power wiring. Be sure to maintain polarity on all boards. If a CommLink 5 is installed, use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source.
7. Before powering up the controllers, set each controller's board address to a unique number from 1 through 60.

Networked Single Loop Systems

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

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

1. Connect all VCM-X E-BUS Controllers on the loop in a daisy chain format using 18 gauge, 2 conductor shielded cable wiring from each controller's communication terminals to the next controller's communication terminals. Install a separate 24 VAC, 8 VA minimum transformer for each controller and wire from controllers to the transformers using 18 gauge minimum, 2 wire cable. Be sure to observe polarity on all boards.
2. Connect 18 gauge minimum 2 conductor shielded cable from one of the VCM-X E-BUS Controller's 3 wire communication terminals to the CommLink5's 3 wire communications terminal. The Loop switch on the back of the CommLink must be set to "Single" for this installation. Use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source.
3. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.
4. The Modular System Manager SD comes supplied with a 12 foot long modular cable with a modular connector on one end and stripped wires on the other. If the System Manager is to be mounted in a remote location, run 18 gauge, 2 conductor shielded cable for communications from one of the controller's 3 wire communications terminals to a junction box. Run 18 gauge, 2 wire, 24 VAC power wires supplied by a separate transformer into the junction box. Splice modular cable to the communications and power wire inside of the junction box using solid connections from wire nuts or butt-splice connectors. The Modular System Manager **MUST** always be connected on the "Local Loop", never the "Network Loop". The Communications setting must be set to Lo Speed Network Mode.

5. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum, 2 conductor wire. In the Settings Menu, enter **<63>** for the System Manager Address.
6. Before powering up the controllers, set each controller's board address to a unique number from 1 through 59.

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

1. Connect all controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller. Using 18 gauge minimum, 2 wire cable for power, install a separate 24 VAC transformer sized for the required VA load for each Power/Comm board on the loop and wire from each transformer to its Power/Comm board. Observe polarity on all boards.
2. Connect 2 conductor shielded cable from the VCM-X E-BUS Controller's 3 wire communications connector to the MiniLink PD's 3 wire communications connector marked "Local Loop". Use 18 gauge minimum, 2 wire cable for all power wiring and be sure to maintain polarity on all boards.
3. Using a modular cable, connect from the MiniLink PD's modular connector marked "Local Loop" to a Power/Comm board's modular input connector.
4. Using modular cables, connect from the Power/Comm board's modular output connectors to the Modular VAV/Zone Controllers. The VAV/Zone Controllers connect together using modular cables from each VAV/Zone Controller to the next controller and/or to a Power/Comm board. A maximum of 16 VAV/Zone Controllers are allowed per Power/Comm board. If you have more than 16 VAV/Zone Controllers, you will need multiple Power/Comm boards. Each Power/Comm board must have its own 24 VAC transformer sized for the total number of VAV/Zone Controllers connected to it.
5. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.
6. The Modular System Manager SD can connect to any VAV/Zone Controller or directly to one of the Power/Comm board's modular output connectors. The Communications setting must be set to Lo Speed Network Mode.
7. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. Since you are using Modular VAV/Zone Controllers, you can use a modular pigtail connector that has a modular connector on one end and stripped wires on the other to connect the System Manager TS II to the Power/Comm board or one of the Modular VAV/Zone Controllers. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter **<63>** for the System Manager Address.
8. Before powering up the controllers, set each VAV/Zone Controller's board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59. Set MiniLink PD's address at 1.

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

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

Networked Single Loop

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

1. Connect 2 conductor shielded cable from the VCM-X E-BUS Controller's 3 wire communications connector to the MiniLink PD's 3 wire communications connector marked "Local Loop". Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller. Also connect a 24 VAC 6 VA minimum transformer to the MiniLink PD power terminals using 18 gauge minimum, 2 wire cable. Then wire from the VCM-X E-BUS Controller's 3 wire communications connector or the MiniLink PD's 3 wire communications connector marked "Local Loop" to the first VAV/Zone Controller's 3 wire communications terminals. Using 18 gauge minimum, 2 wire cable, connect all of the associated Non-Modular VAV/Zone Controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 6 VA minimum, transformer for each Non-Modular VAV/Zone Controller and wire from each transformer to its VAV/Zone Controller. WattMaster recommends you use a separate transformer for each VAV/Zone Controller as stated. As an alternative, it is allowable to have several Non-Modular VAV/Zone Controllers share one properly sized transformer (6 VA per VAV/Zone Controller). **Warning:** *Polarity must be observed on all of the VAV/Zone Controllers or damage to the controllers will result.* Use 18 gauge minimum, 2 wire cable for all power wiring and be sure to maintain polarity on all boards.
2. The Modular System Manager can connect to any VAV/Zone Controller or to the VCM-X E-BUS Controller. Use the supplied pigtail cable which has a modular connector for connection to the back of the Modular System Manager and wire to any controller on the communications local loop with communication wire terminals. A separate transformer is required for the Modular System Manager. Connect the 2 power wires from the pigtail connector to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power. The Communications setting must be set to Lo Speed Network Mode.
3. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.

4. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter **<63>** for the System Manager Address.
5. Before powering up the controllers, set each VAV/Zone Controller's board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59. Set MiniLink PD's address at 1.

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

1. Connect all controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from transformer to the VCM-X E-BUS Controller. Using 18 gauge minimum, 2 wire cable for power, install a separate 24 VAC, transformer sized for the required VA load for each Power/Comm board on the loop and wire from each transformer to its Power/Comm board. Observe polarity on all boards.
2. Use 18 gauge minimum, 2 wire cable for all 24 VAC power wiring. Be sure to maintain polarity on all boards. Use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source.
3. Using 2 conductor shielded cable, connect from the CommLink 5's 3 wire communications connector to the Power/Comm board's or VCM-X E-BUS Controller's 3 wire communications input connector. The Loop switch on the back of the CommLink 5 should be set to "Single".
4. Using modular cables, connect from the Power/Comm board's modular output connectors to the VAV/Zone Controllers. The VAV/Zone Controllers connect together using modular cables from each VAV/Zone Controller to the next controller and/or to a Power/Comm board. A maximum of 16 VAV/Zone Controllers are allowed per Power/Comm board. If you have more than 16 VAV/Zone Controllers, you will need multiple Power/Comm boards. Each Power/Comm board must have its own 24 VAC transformer sized for the total number of VAV/Zone Controllers connected to it.
5. The Modular System Manager can connect to any VAV/Zone Controller or directly to one of the Power/Comm board's modular output connectors. The Communications setting must be set to Lo Speed Network Mode.

6. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.
7. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter **<63>** for the System Manager Address.
8. Before powering up the controllers, set each VAV/Zone Controller's board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59.

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

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

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

1. Connect 2 conductor shielded cable from the VCM-X E-BUS Controller's 3 wire communications connector to the CommLink 5's 3 wire communications connector. Use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source. Be sure to maintain polarity on all boards. The Loop switch on the back of the CommLink 5 should be set to "Single".
2. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller. Then wire from the VCM-X E-BUS Controller's 3 wire communications connector or the CommLink 5's 3 wire communications connector to

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

3. The Modular System Manager can connect to any VAV/Zone Controller or to the VCM-X E-BUS Controller. Use the supplied pigtail cable which has a modular connector for connection to the back of the Modular System Manager and wire to any controller on the communications local loop with communication wire terminals. A separate transformer is required for the Modular System Manager. Connect the 2 power wires from the pigtail connector to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power. The Communications setting must be set to Lo Speed Network Mode.
4. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.
5. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter **<63>** for the System Manager Address.
6. Before powering up the controllers, set each VAV/Zone Controller's board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59.

Networked Single Loop

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

1. Connect the CommLink 5 to the MiniLink PD by using 2 conductor shielded cable to connect from the CommLink 5's 3 wire communications connector to the MiniLink PD's 3 wire communications connector marked "Network Loop". Use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source. Be sure to maintain polarity on all boards. The Loop switch on the back of the CommLink 5 should be set to "Multiple". Also connect a 24 VAC 6 VA minimum transformer to the MiniLink PD power terminals using 18 gauge minimum, 2 wire cable.
2. Connect all controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller. Using 18 gauge minimum, 2 wire cable for power, install a separate 24 VAC transformer sized for the required VA load for each Power/Comm Board on the loop and wire from each transformer to its Power/Comm board. Observe polarity on all boards.
3. Using 2 conductor shielded cable, connect from the VCM-X E-BUS Controller's 3 wire communications connector to the MiniLink PD's 3 wire communications connector marked "Local Loop". Use 18 gauge minimum wire for power and observe polarity on all boards.
4. Using a modular cable, connect from the MiniLink PD's modular connector marked "Local Loop" to a Power/Comm board's modular input connector.
5. Using modular cables, connect from the Power/Comm board's modular output connectors to the VAV/Zone Controllers. The VAV/Zone Controllers connect together using modular cables from each VAV/Zone Controller to the next controller and/or to a Power/Comm board. A maximum of 16 VAV/Zone Controllers are allowed per Power/Comm board. If you have more than 16 VAV/Zone Controllers, you will need multiple Power/Comm boards. Each Power/Comm board must have its own 24 VAC transformer sized for the total number of VAV/Zone Controllers connected to it.
6. The Modular System Manager can connect to any VAV/Zone Controller or directly to one of the Power/Comm board's modular output connectors. The Communications setting must be set to Lo Speed Network Mode.
7. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. Since you are using

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

8. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.
9. Before powering up the controllers, set each VAV/Zone Controller's board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59. Set MiniLink PD's address at 1.

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

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

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

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

Networked Multiple Loop

2. Connect all controllers in a daisy chain format using 2 conductor shielded cable to connect from the controller's 3 wire communications connector to the MiniLink PD's 3 wire communications connector marked "Local Loop". Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller. Then wire from the VCM-X E-BUS Controller's 3 wire communications connector to the MiniLink PD's 3 wire communications connector marked "Local Loop". From either the MiniLink PD connector marked "Local Loop" or the VCM-X E-BUS Controller's 3 wire communications connector, wire to the first VAV/Zone Controller's 3 wire communications terminal. Using 18 gauge minimum, 2 wire cable, connect all of the associated Non-Modular VAV/Zone Controllers in a daisy chain format using 18 gauge, 2 conductor shielded cable for communications.
3. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 6 VA minimum, transformer for each Non-Modular VAV/Zone Controller and wire from each transformer to its VAV/Zone Controller. WattMaster recommends you use a separate transformer for each VAV/Zone Controller as stated. As an alternative, it is allowable to have several Non-Modular VAV/Zone Controllers share one properly sized transformer (6 VA per VAV/Zone Controller). **Warning:** *Polarity must be observed on all of the VAV/Zone Controllers or damage to the controllers will result.* Use 18 gauge minimum, 2 wire cable for all power wiring and be sure to maintain polarity on all boards.
4. The Modular System Manager can connect to any VAV/Zone Controller or to the VCM-X E-BUS Controller. Use the supplied pigtail cable which has a modular connector for connection to the back of the Modular System Manager and wire to any controller on the communications local loop with communication wire terminals. A separate transformer is required for the Modular System Manager. Connect the 2 power wires from the pigtail connector to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power. The Communications setting must be set to Lo Speed Network Mode.
5. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. Since you are using Modular VAV/Zone Controllers, you can use a modular pigtail connector that has a modular connector on one end and stripped wires on the other to connect the System Manager TS II to the Power/Comm board or one of the Modular VAV/Zone Controllers. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, enter **<63>** for the System Manager Address.
6. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.
7. Before powering up the controllers, set each VAV/Zone Controller's board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59. Set MiniLink PD's address at 1.

Networked Multiple Loop Systems

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

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

1. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller. Using 18 gauge minimum, 2 wire cable for power, install a separate 24 VAC, transformer sized for the required VA load for each Power/Comm board on the loop and wire from each transformer to its Power/Comm board. Observe polarity on all boards.
2. Using 2 conductor shielded cable, connect from the VCM-X E-BUS Controller's 3 wire communications connector to the MiniLink PD's 3 wire communications connector marked "Local Loop". Use 18 gauge minimum wire for power and observe polarity on all boards.
3. Using a modular cable, connect from the MiniLink PD's modular connector marked "Local Loop" to the Power/Comm board's modular input connector.
4. Using modular cables, connect from the Power/Comm board's modular output connectors to the VAV/Zone Controllers. The VAV/Zone Controllers connect together using modular cables from each VAV/Zone Controller to the next controller and/or to a Power/Comm board. A maximum of 16 VAV/Zone Controllers are allowed per Power/Comm board. If you have more than 16 VAV/Zone Controllers, you will need multiple Power/Comm boards. Each Power/Comm board must have its own 24 VAC transformer sized for the total number of VAV/Zone Controllers connected to it.

Networked Multiple Loop

5. Repeat the above steps for each local loop containing VCM-X E-BUS Controllers with VAV/Zone Controllers.
6. The Modular System Manager can connect to any VAV/Zone Controller on the entire system or directly to one of the Power/Comm board's modular output connectors using modular cable. The Modular Service Tool will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controllers is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.
7. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. Since you are using Modular VAV/Zone Controllers, you can use a modular pigtail connector that has a modular connector on one end and stripped wires on the other to connect the System Manager TS II to the Power/Comm board or one of the Modular VAV/Zone Controllers. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire.
8. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.
9. Using 2 conductor shielded cable, connect from the CommLink 5's 3 wire communications connector to one of the MiniLink PD's 3 wire communications connector marked "Network Loop". The Loop switch on the back of the CommLink 5 must be set to "Multiple". The CommLink 5 only needs to be connected to one of the MiniLink PDs on the system.
10. Using a modular cable, connect from each MiniLink PD's modular connector marked "Network Loop" to the next MiniLink PD's "Network Loop" modular input connector using modular cable. Connect all the remaining MiniLink PD's in the same manner using a daisy chain format.
11. Before powering up the controllers, set each VAV/Zone Controller's board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59. Set MiniLink PD's address from 1 to 60.

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

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

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

1. Using 18 gauge minimum, 2 wire cable for power, install a 24 VAC, 8 VA minimum, transformer for the VCM-X E-BUS Controller and wire from the transformer to the VCM-X E-BUS Controller.
2. Using 2 conductor shielded cable, connect from the VCM-X E-BUS Controller's 3 wire communications connector to the MiniLink PD's 3 wire communications connector marked "Local Loop". Use 18 gauge minimum wire for power and observe polarity on all boards.
3. Using 2 conductor shielded cable, connect from the VCM-X E-BUS Controller's 3 wire communications connector to the VAV/Zone Controllers. The VAV/Zone Controllers connect together using modular cables from each VAV/Zone Controller to the next controller and/or to a Power/Comm Board. A maximum of 16 VAV/Zone controllers are allowed per Power/Comm board. If you have more than 16 VAV/Zone controllers, you will need multiple Power/Comm boards. Each Power/Comm board must have its own 24 VAC transformer sized for the total number of VAV/Zone controllers connected to it.
4. Repeat the above steps for each local loop containing VCM-X E-BUS Controllers with VAV/Zone Controllers.
5. The Modular System Manager can connect to any VAV/Zone Controller on the entire system or directly to one of the Power/Comm board's modular output connectors using modular cable. The Modular Service Tool will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controllers is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.
6. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide

- 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, *enter* **<63>** for the System Manager Address.
7. The Modular Service Tool SD will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controller is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.
 8. Using 2 conductor shielded cable, connect from the CommLink 5's 3 wire communications connector to one of the MiniLink PD's 3 wire communications connector marked "Network Loop". The Loop switch on the back of the CommLink 5 must be set to "Multiple". The CommLink only needs to be connected to one of the MiniLink PDs on the system.
 9. Using a modular cable, connect from each MiniLink PD's modular connector marked "Network Loop" to the next MiniLink PD's "Network Loop" modular input connector using modular cable. Connect all the remaining MiniLink PD's in the same manner using a daisy chain format.
 10. Before powering up the controllers, set each VAV/ Zone Controller's board address to a unique number from 1 through 58. Address the VCM-X E-BUS Controller at 59. Set MiniLink PD's address from 1 to 60.
 4. Only one MiniLink PD on the system should connect to the CommLink. Install a separate 24 VAC, 8 VA minimum, transformer for each MiniLink PD and wire to transformer using 18 gauge minimum, 2 wire cable for power. Observe polarity on all boards. Each MiniLink PD's address switch should be set with a unique address between 1 and 60.
 5. Using a modular cable, connect from the each MiniLink PD's modular connector marked "Network Loop" to the next MiniLink PD's "Network Loop" modular input connector using modular cable. Connect all the remaining MiniLink PD's in the same manner using a daisy chain format.
 6. The Modular Service Tool will connect to any of the controllers using the supplied cable with DIN connectors on both ends. The connection point on the controllers is located near the communications connector. The Communications setting must be set to Lo Speed Network Mode.
 - 7.. The Modular System Manager is supplied with a 12 foot modular cable with a modular connector on one end and stripped wires on the other. If the Modular System Manager is to be mounted in remote location, run 18 gauge, 2 conductor shielded cable for communications from one controller's 3 wire terminal connector to one of the MiniLink PD's in the same manner using a daisy chain format. The Communications setting must be set to Lo Speed Network Mode.

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

1. Connect all VCM-X E-BUS Controllers on the loop in a daisy chain format using 18 gauge minimum, 2 conductor shielded cable for communications. Install a separate 24 VAC, 8 VA minimum, transformer for each controller and wire to its transformer using 18 gauge minimum, 2 wire cable for power. Observe polarity on all boards.
2. Connect 2 conductor shielded cable from one of the controller's 3 wire communications connector to the MiniLink PD's 3 wire communications connector marked "Local Loop". Use 18 gauge wire for power and observe polarity on all boards.
3. Connect 2 wire shielded cable from the CommLink 5's 3 wire communications connector to the MiniLink PD's 3 wire communications connector marked "Network Loop". The Loop switch on the back of the CommLink 5 must be set to "Multiple". Use the 110 VAC/24 VAC power supply furnished with the CommLink for its power source.
8. The System Manager TS II utilizes a 3 wire communication terminal block for connection to any controller on the communications local loop that has communication wire terminals. A separate transformer is required for the System Manager TS II. It has a 2 wire 24 VAC terminal block for connection to a 24 VAC transformer. The transformer should be sized to provide 6 VA minimum power and should be connected using 18 gauge minimum wire. In the Settings Menu, *enter* **<63>** for the System Manager Address.
9. Address the VCM-X E-BUS Controllers from 1 to 59.

Overview

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

Stand Alone System

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

Interconnected System

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

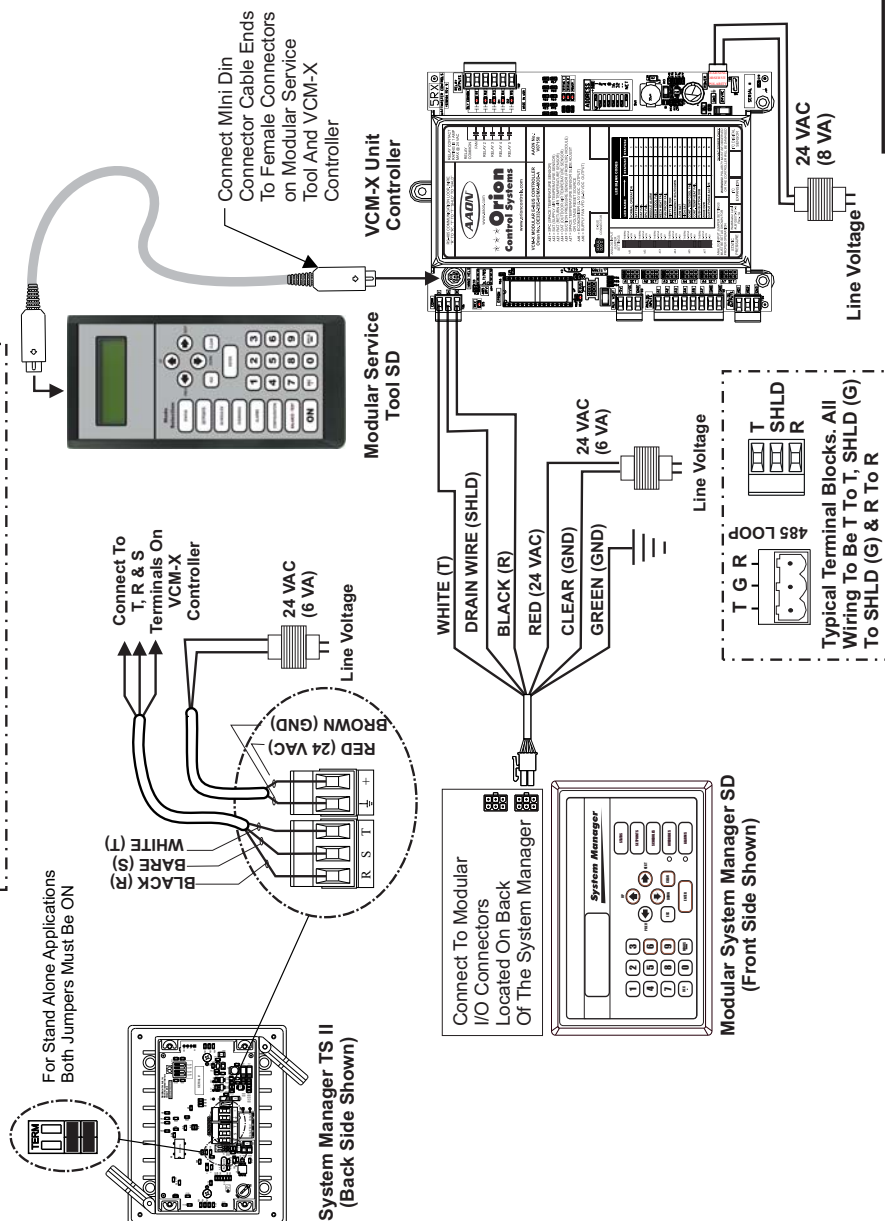
Networked Systems

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

System Configurations

Typical Stand Alone System

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



JOB NAME

FILENAME

Orion
Control Systems

O-VCMX-Sys-Stand-Alone-1A.CDR

DATE: 05/12/15 BY: S. Olson

DESCRIPTION:

VCMX E-BUS Stand Alone System

PAGE

1 of 1
Wiring & Connection Diagram

Figure 3: Stand Alone System Wiring

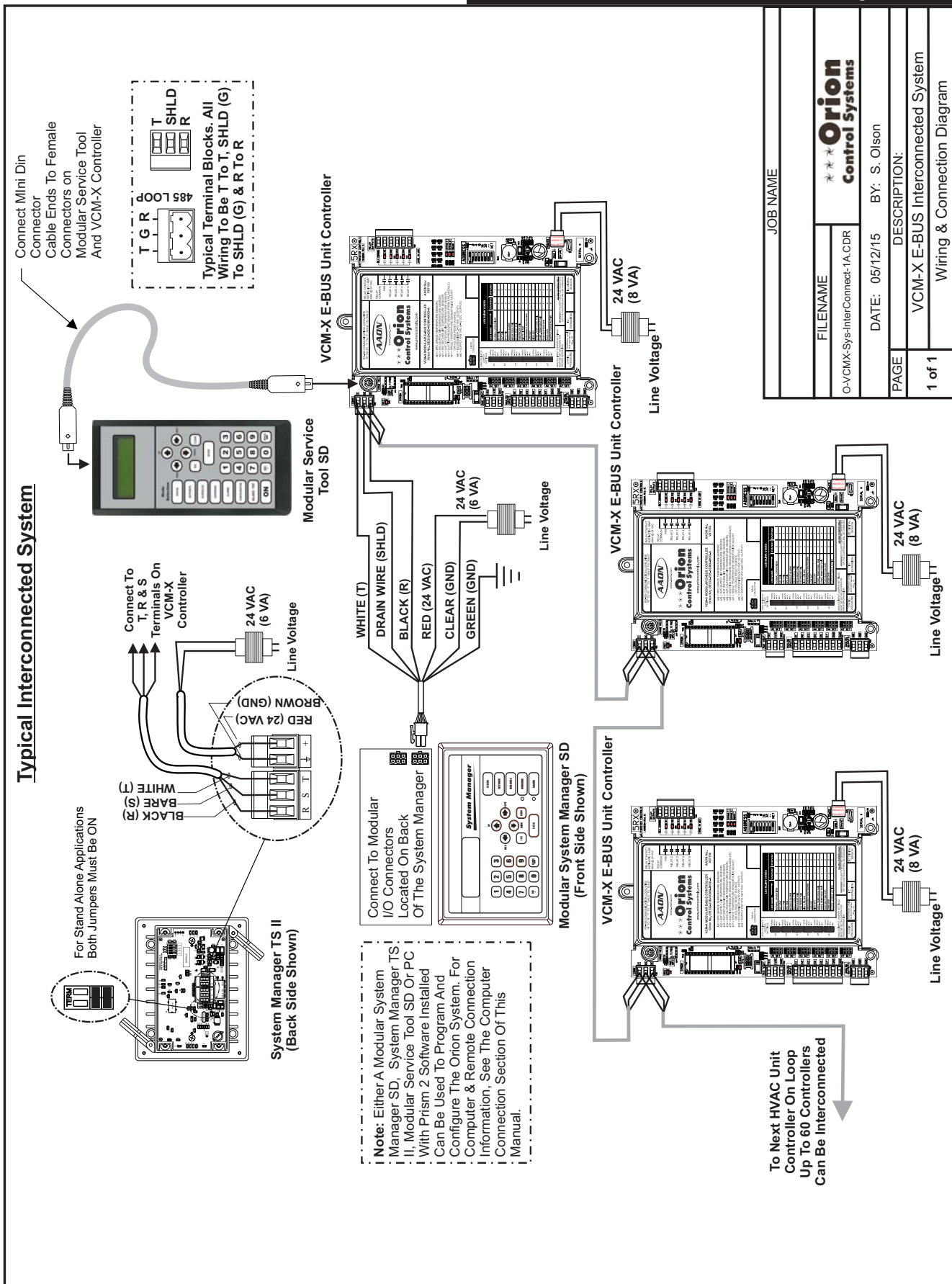


Figure 4: Interconnected System Wiring

Typical Single Loop Networked System With CommLink 5 Only

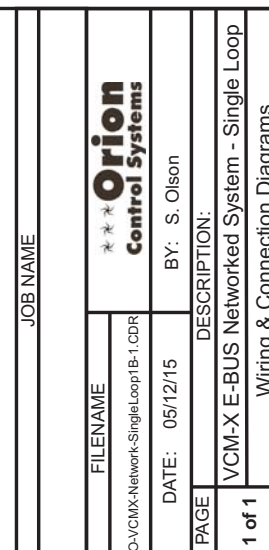


Figure 5: Networked Single Loop System With CommLink Only Wiring

Networked Single Loop System

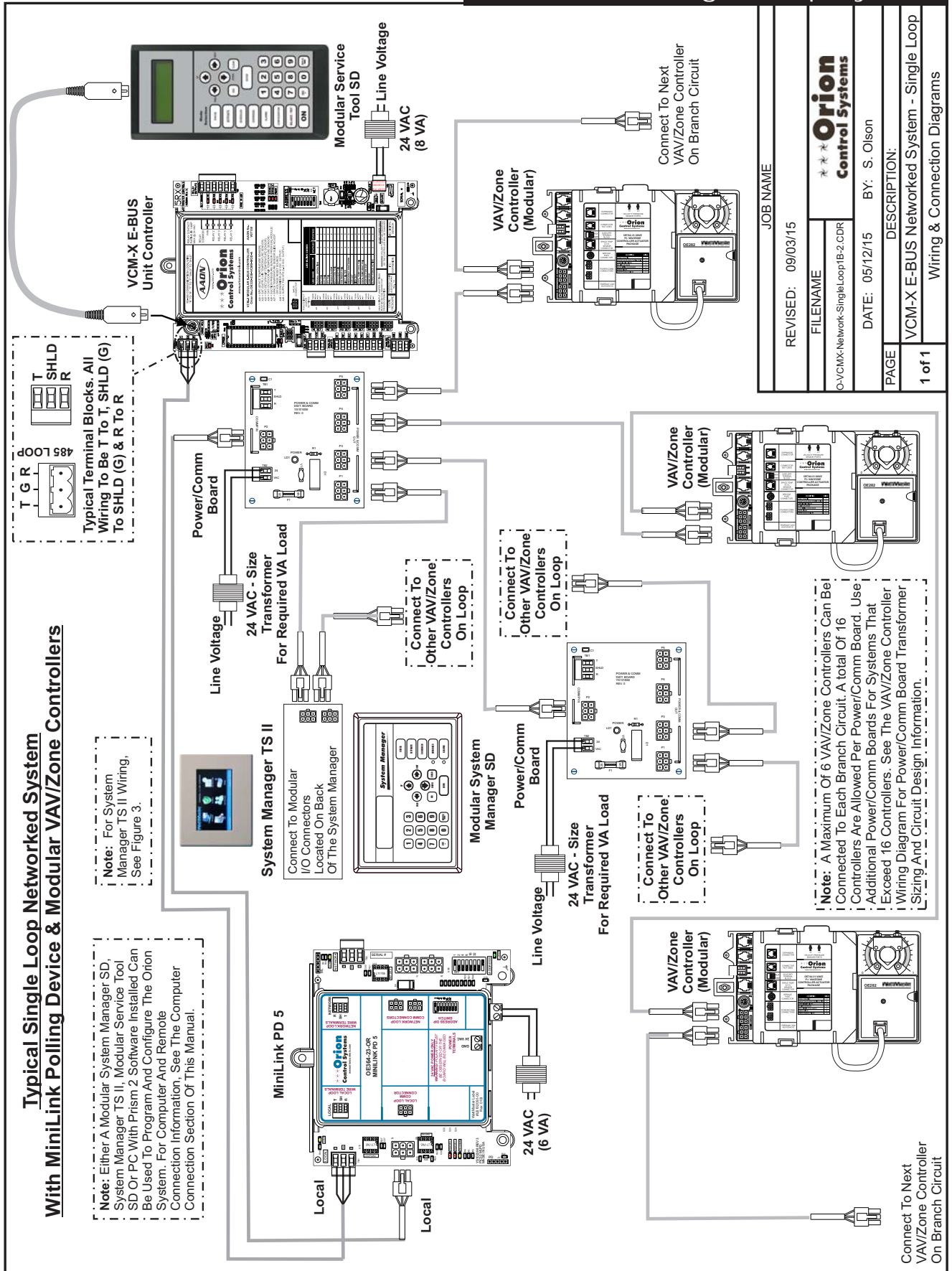


Figure 6: Networked Single Loop System With MiniLink PD And Modular VAV/Zone Controllers Wiring

Networked Single Loop System

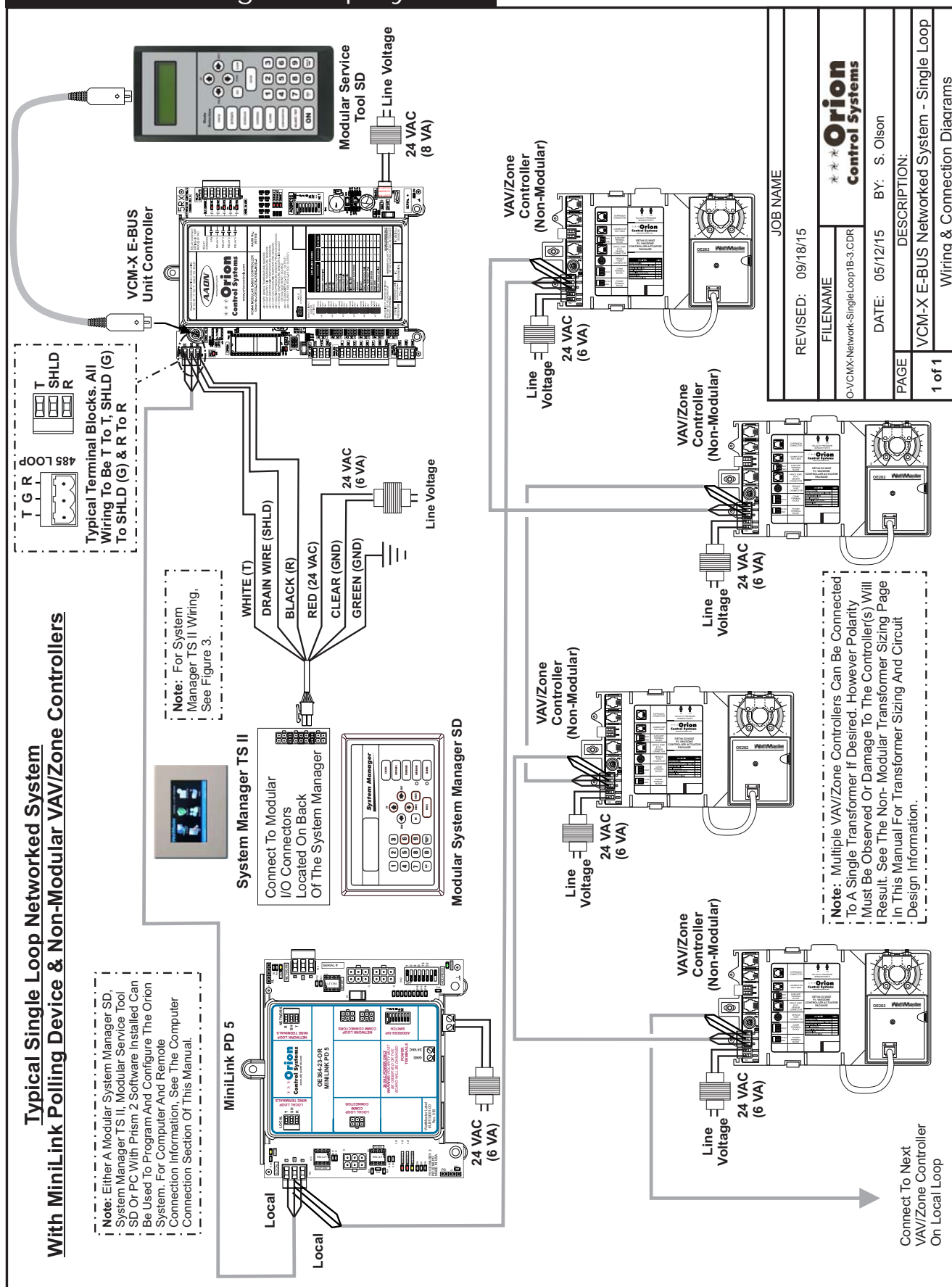


Figure 7: Networked Single Loop System With MiniLink PD And Non Modular VAV/Zone Controllers Wiring

Networked Single Loop System

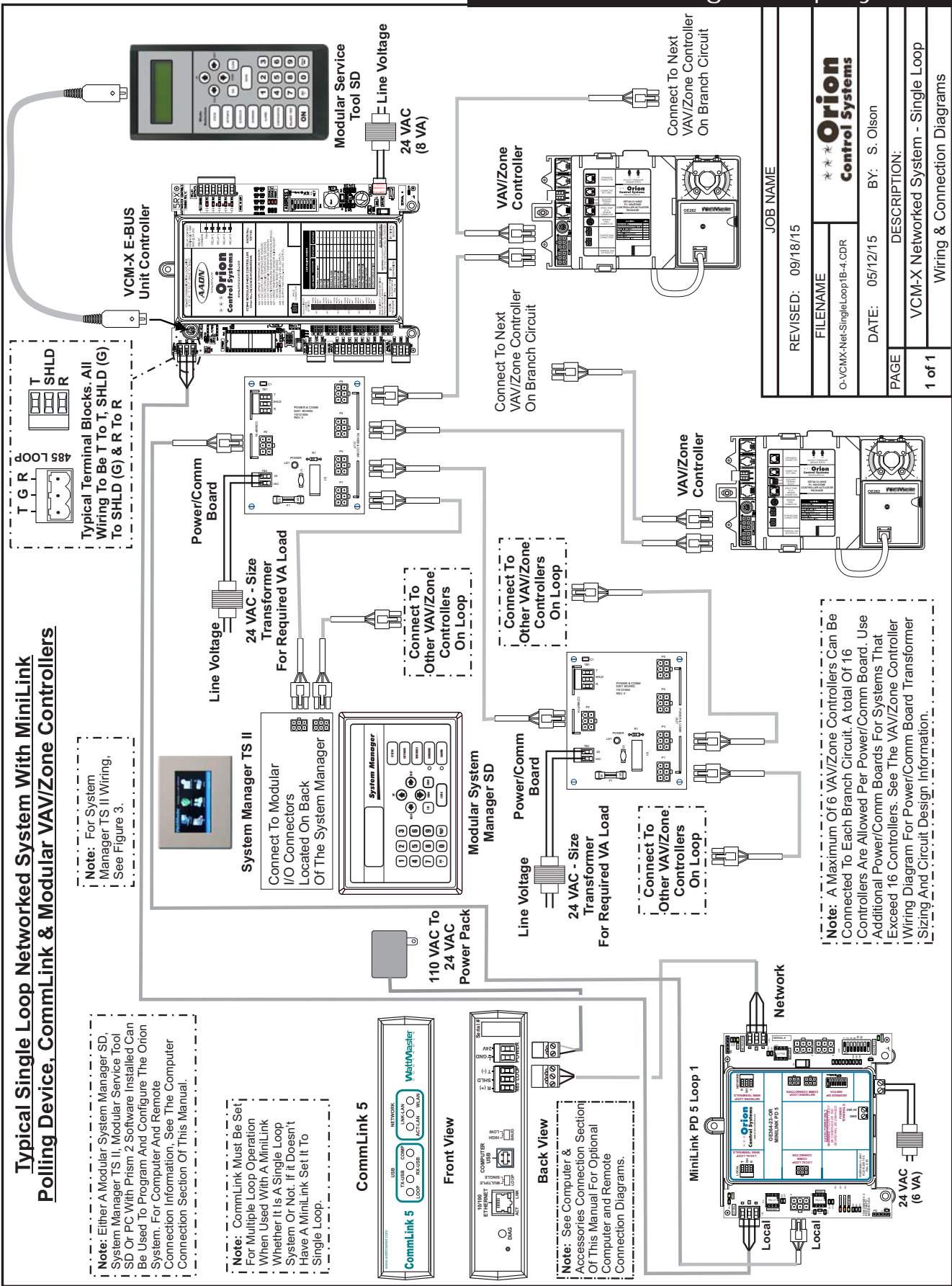


Figure 8: Networked Single Loop System With CommLink & MiniLink PD - Modular VAV/Zone Controllers

Networked Single Loop System

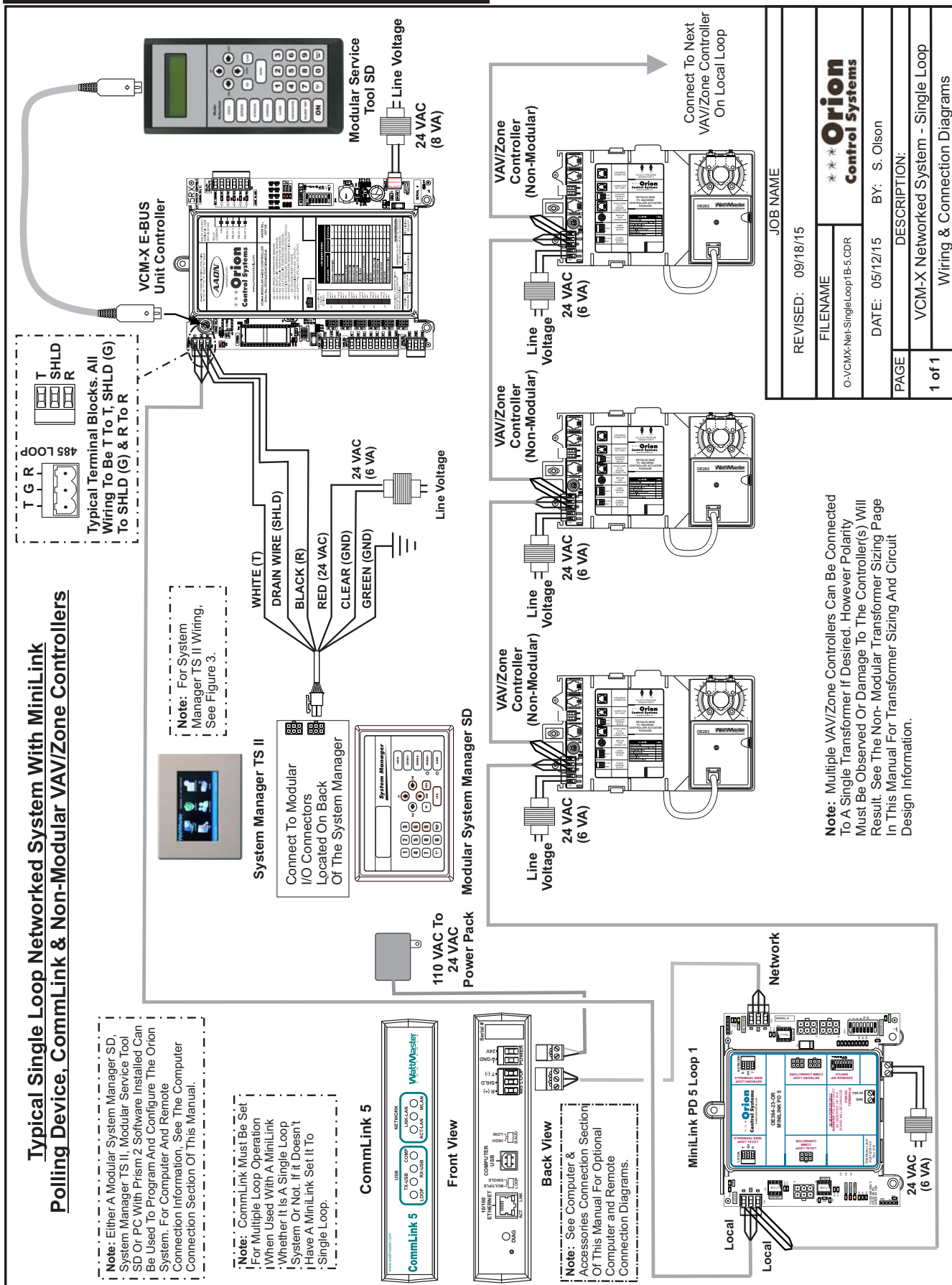


Figure 9: Networked Single Loop System With CommLink & MLPD - Non-Modular VAV/Zone Controllers

Networked Multiple Loop System Connections & Wiring

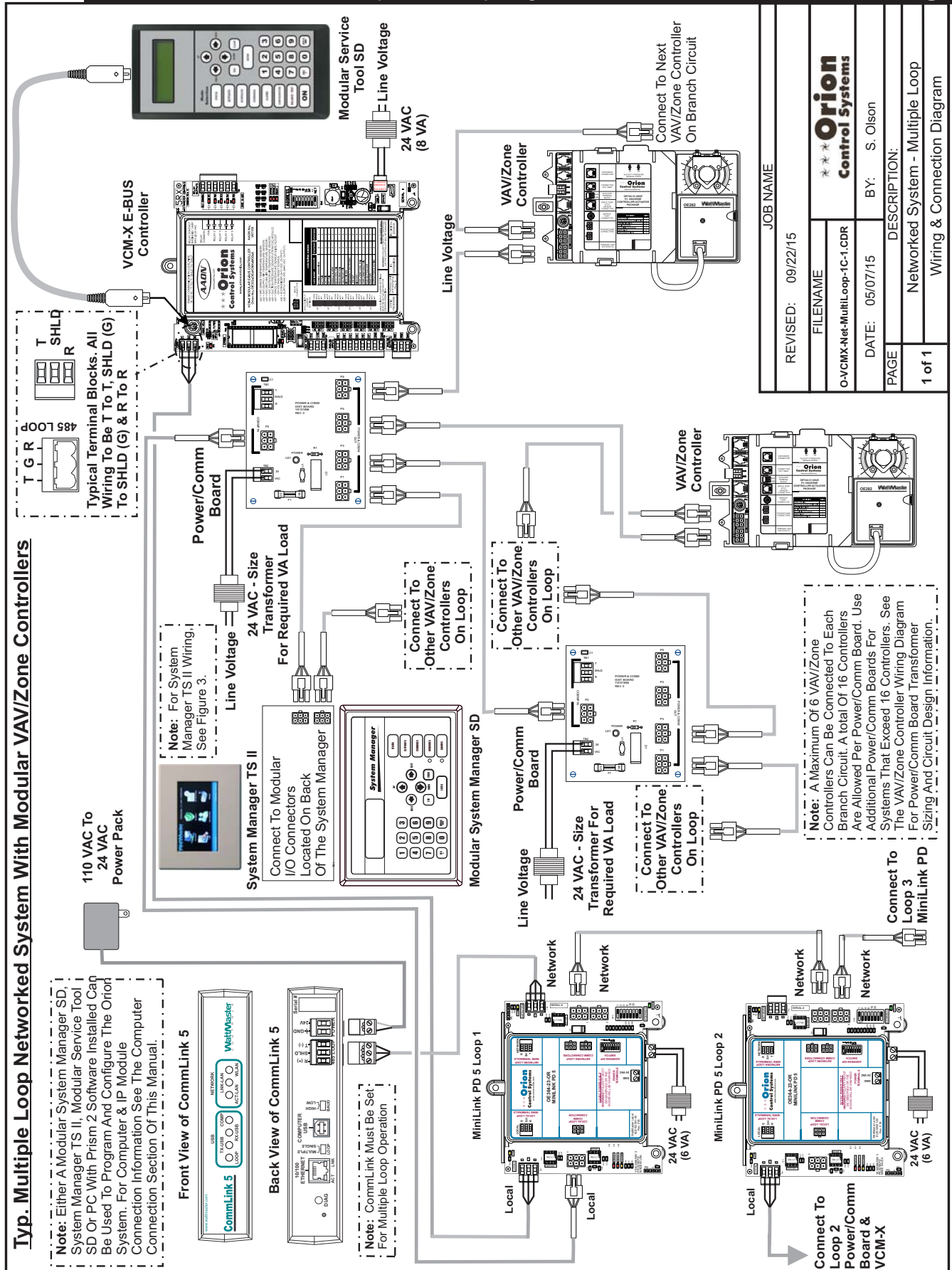


Figure 10: Networked Multiple Loop System Wiring With Modular VAV/Zone Controllers

Networked Multiple Loop System Connections & Wiring

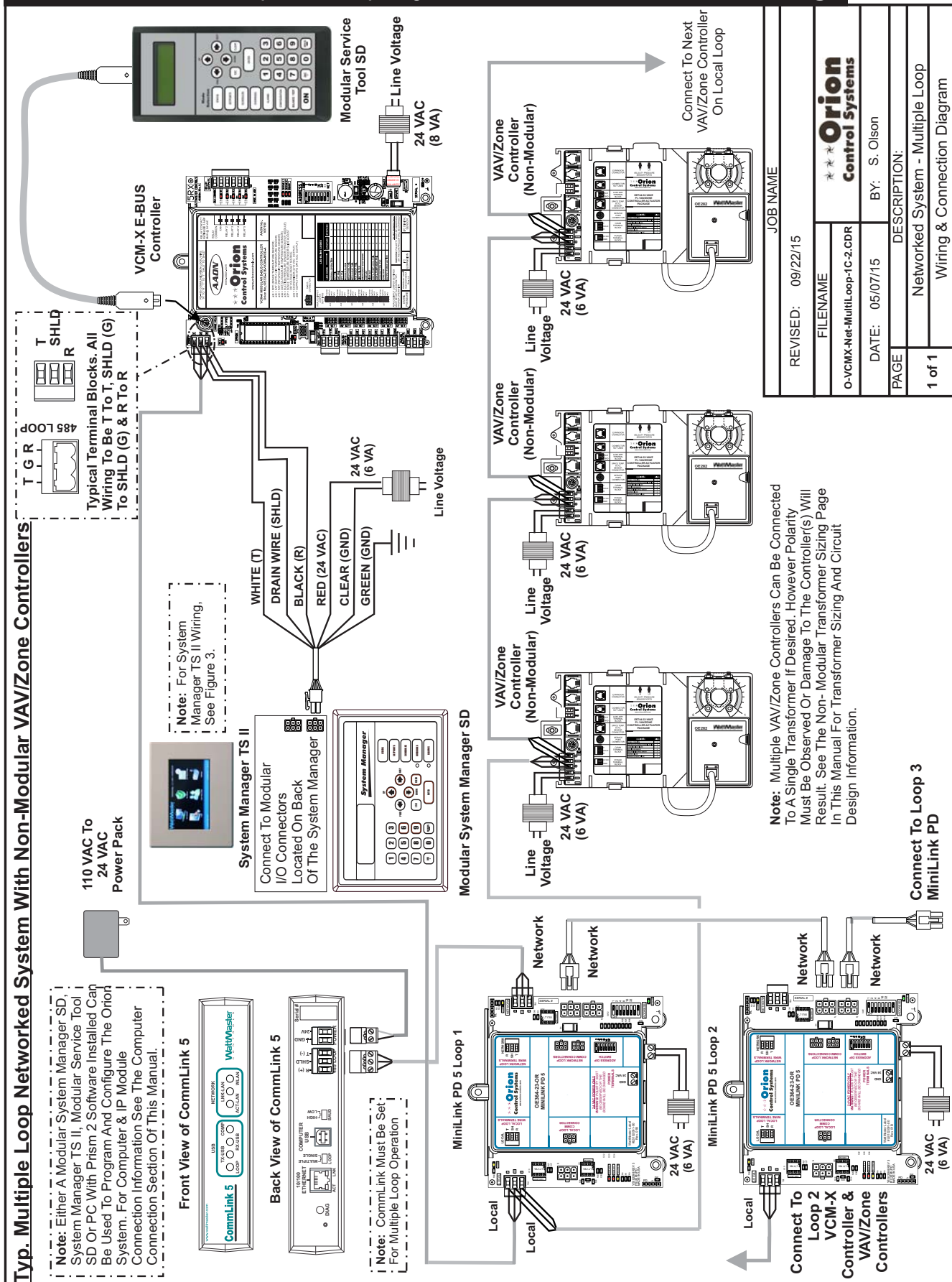


Figure 11: Networked Multiple Loop System Wiring With Non Modular VAV/Zone Controllers

VCM-X E-BUS Controller Wiring

VCM-X E-BUS Controller Wiring

Main Controller Wiring

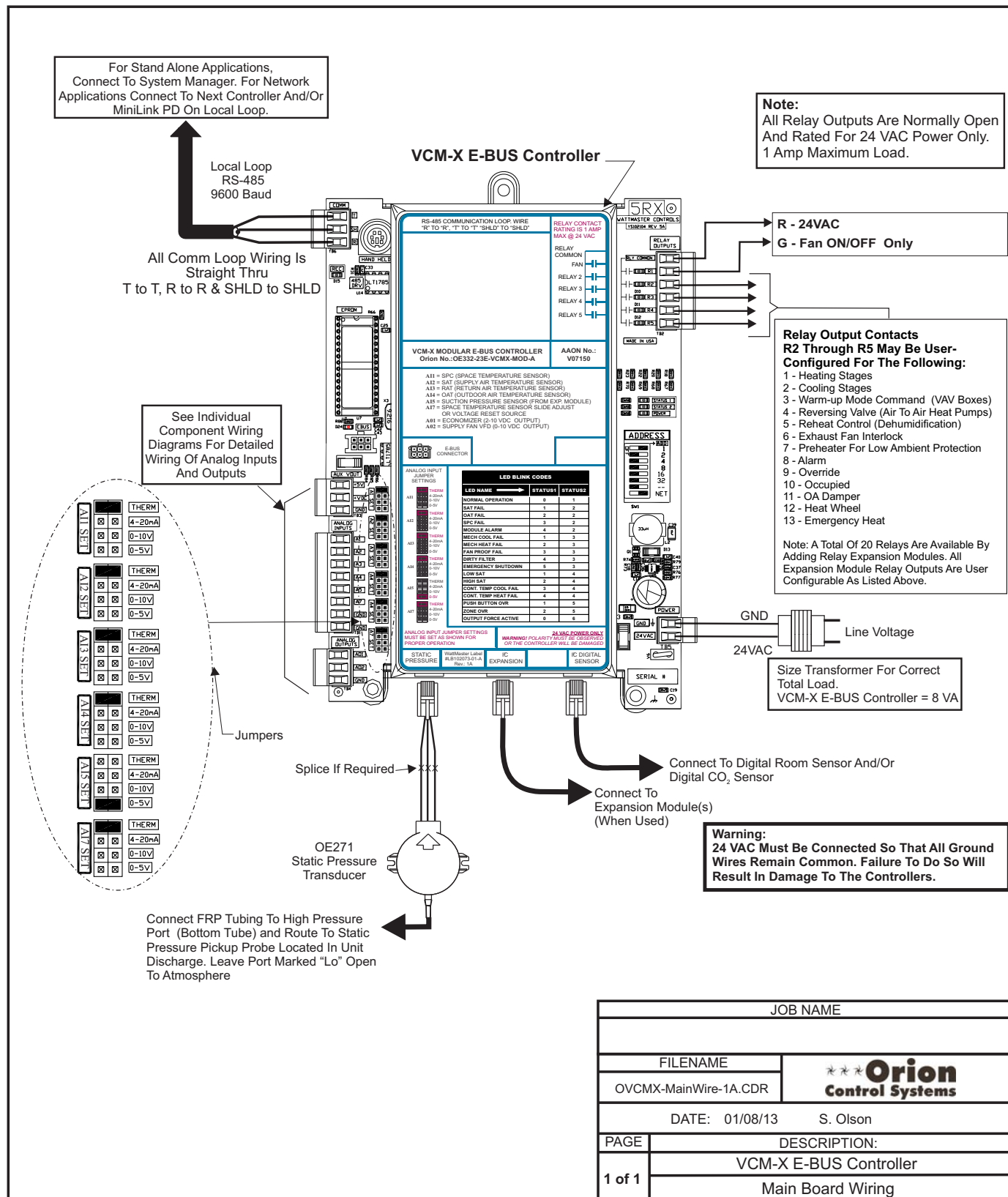


Figure 12: OE332-23E-VCM-X-MOD - VCM-X E-BUS Controller Wiring

VCM-X E-BUS Controller Wiring

Main Controller Addressing

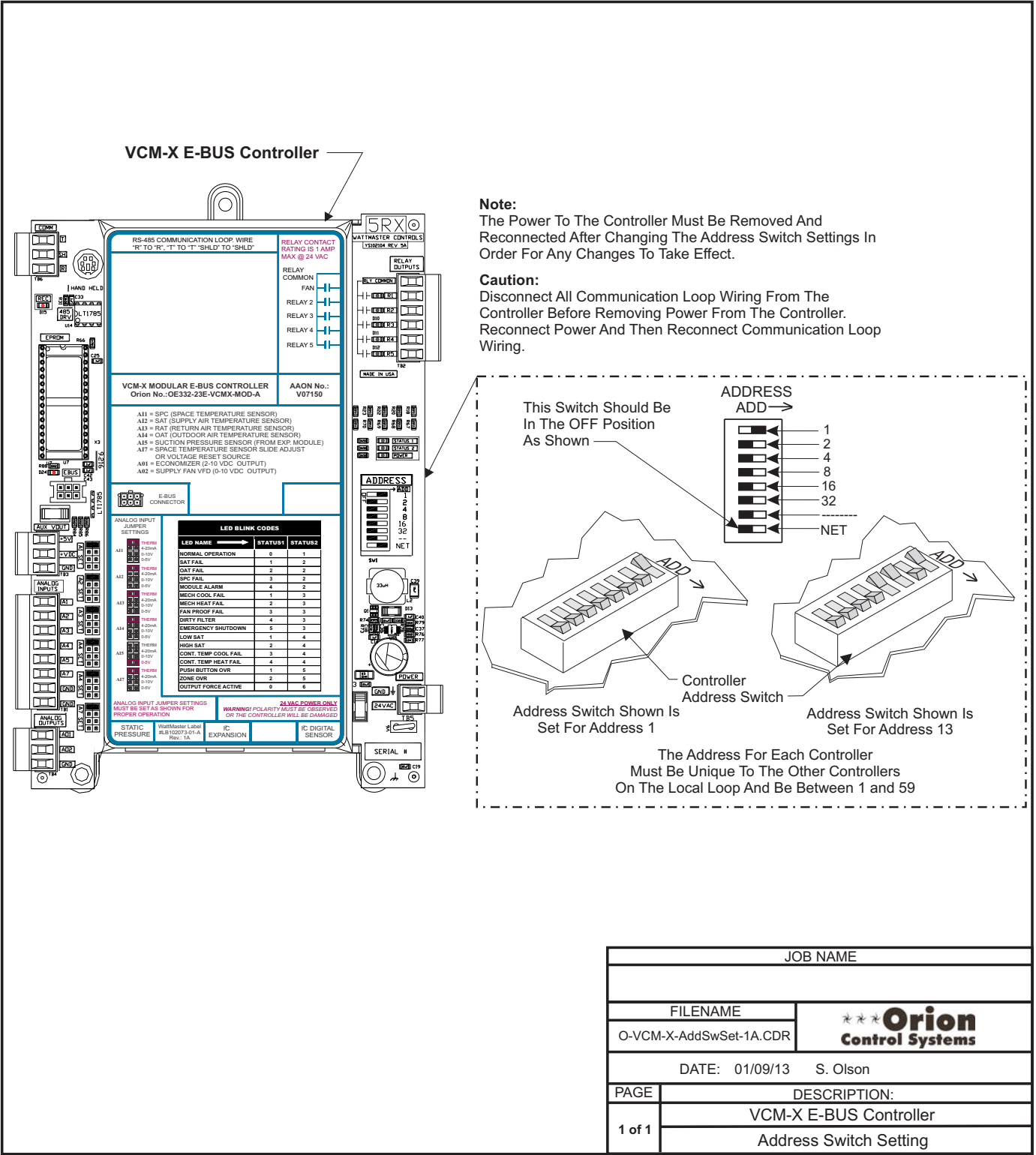
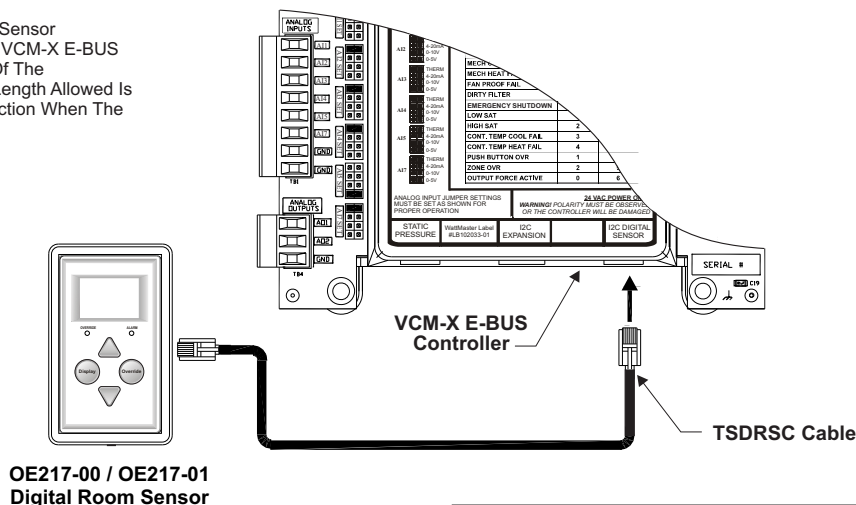


Figure 13: VCM-X E-BUS Controller Addressing

Digital Room Sensor & Wall-Mounted CO₂ Sensor Wiring

Note: When Only The Digital Room Sensor Is Used, It Connects Directly To The VCM-X E-BUS Controller Using A TSDRSC Cable Of The Appropriate Length. The Maximum Length Allowed Is 160 Feet. See **Figure 19** For Connection When The Space CO₂ Sensor Is Also Used.

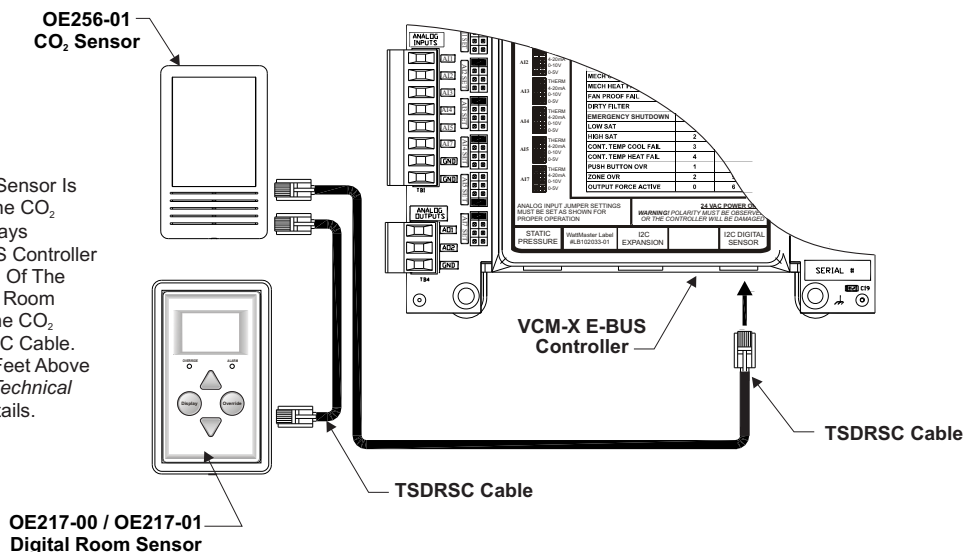


JOB NAME	
FILENAME	*** Orion Control Systems
O-VCM-X-DigiRoom-1A.CDR	
DATE: 01/09/13 S. Olson	
PAGE	DESCRIPTION:
1 of 1	VCM-X E-BUS Controller
	Digital Room Sensor

Figure 14: OE217-00 / OE217-01 Digital Room Sensor

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

Note: When a Digital Room Sensor Is Used In Combination With The CO₂ Sensor, The CO₂ Sensor Always Connects To The VCM-X E-BUS Controller First Using A TSDRSC Cable Of The Required Length. The Digital Room Sensor Then Connects To The CO₂ Sensor With Another TSDRSC Cable. Mount Sensor(s) At Least 5 Feet Above Floor. See The CO₂ Sensor Technical Guide For Further Wiring Details.




JOB NAME	
REVISED: 05/12/15	
FILENAME	
O-VCM-X-WallCO2-1A.CDR	
DATE: 01/09/13 S. Olson	
PAGE	DESCRIPTION:
1 of 1	VCM-X E-BUS Controller
	Wall-Mounted CO2 Sensor

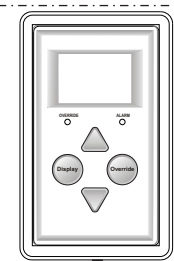
Figure 15: OE256-01 Wall-Mounted CO₂ Sensor

Note:

1.) The CO₂ Sensor Always Connects To The VCM-X E-BUS Controller Using A TSDRSC Cable Of The Required Length. If Also Using a Digital Room Sensor, Connect the Digital Room Sensor to the CO₂ Sensor Using Another TSDRSC Cable Of The Required Length. The Total Length Of Cable For All Sensor Cables Combined Cannot Exceed 160 Feet.

2.) In This Configuration, Set The CO₂ Sensor To Address 1.

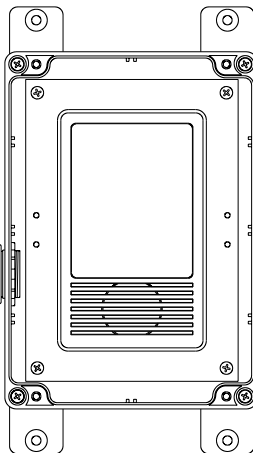
OE217-00 / OE217-01
Wall Mounted
Digital Room Sensor



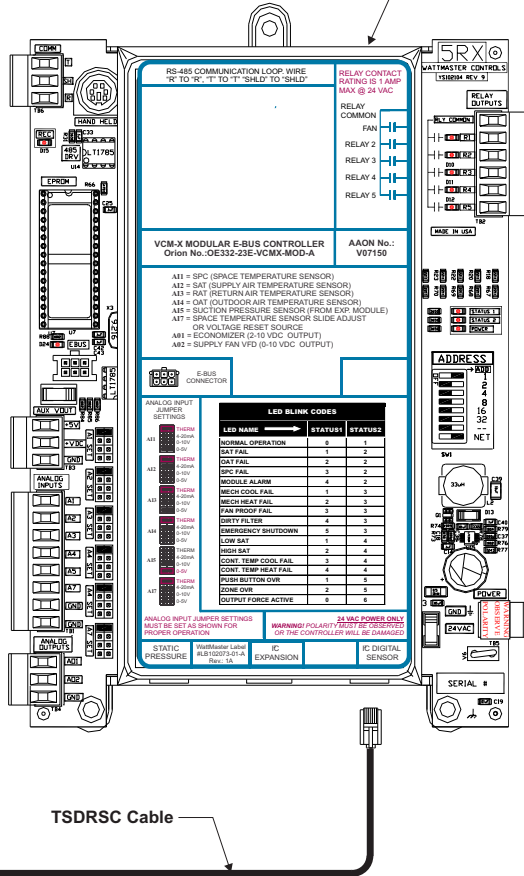
Connection Of Wall
Mounted
Digital Room Sensor
(When Used)

TSDRSC Cable

OE256-02
Duct Mounted CO₂ Sensor



VCM-X E-BUS Controller



JOB NAME	
REVISED: 05/12/15	
FILENAME	*** Orion Control Systems
O-VCM-X-DuctCO2-1A.CDR	
DATE: 01/09/13	S. Olson
PAGE	DESCRIPTION:
1 of 1	VCM-X E-BUS Controller
	Duct-Mounted CO2 Sensor

Figure 16: OE256-02 Duct-Mounted CO₂ Sensor

Space Temperature Sensor & Remote Supply Air Reset Wiring

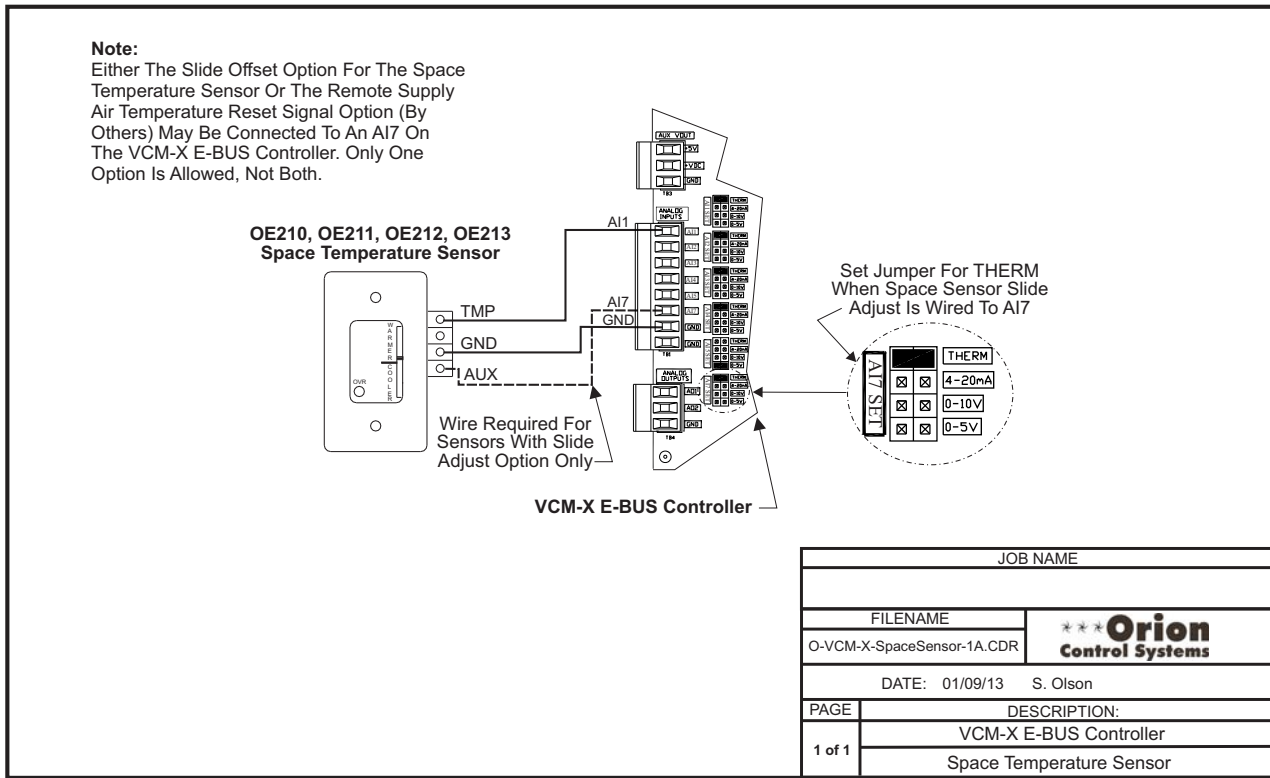


Figure 17: OE210, OE211, OE212, OE213 Space Temperature Sensor Wiring

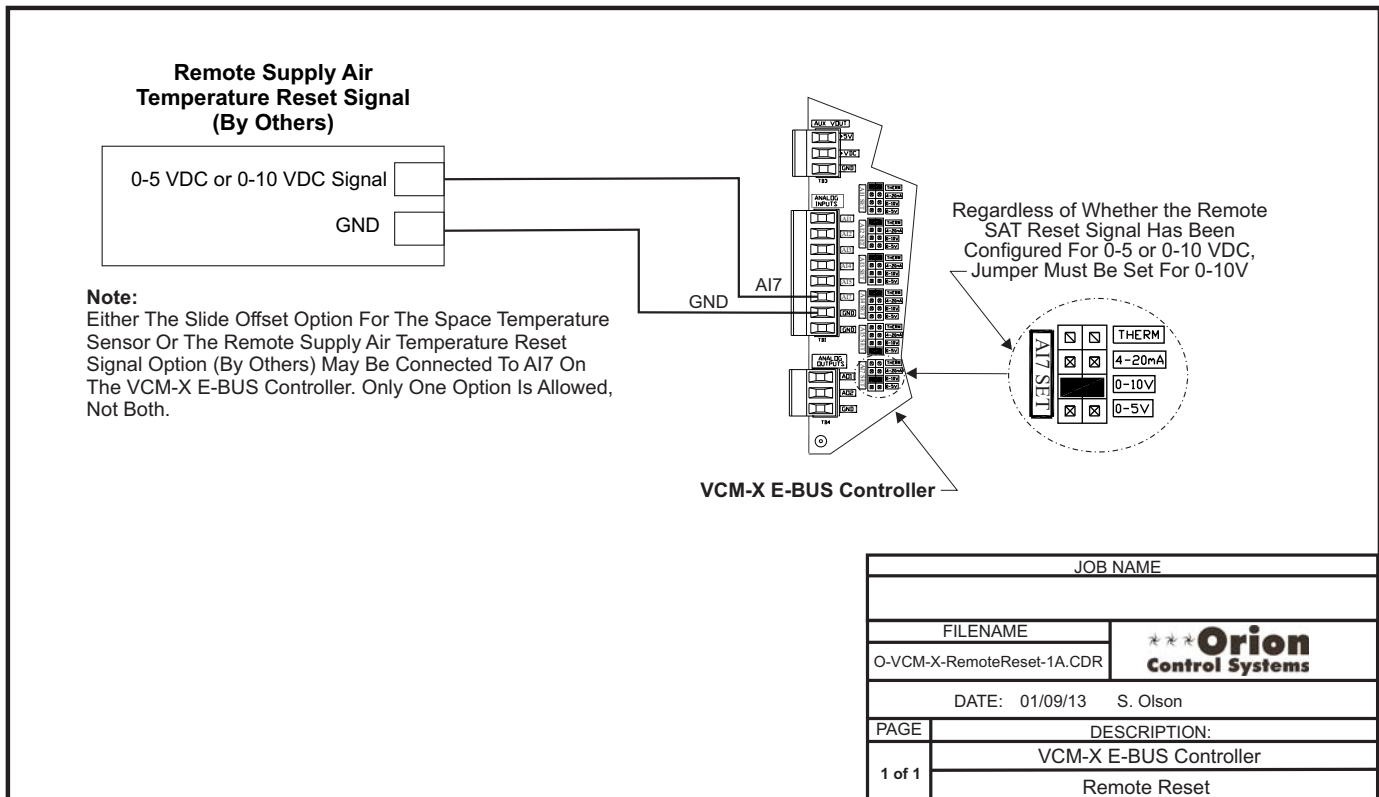


Figure 18: Remote Supply Air Reset Wiring

Supply Air, Return Air, and Outdoor Air Temperature Sensor Wiring

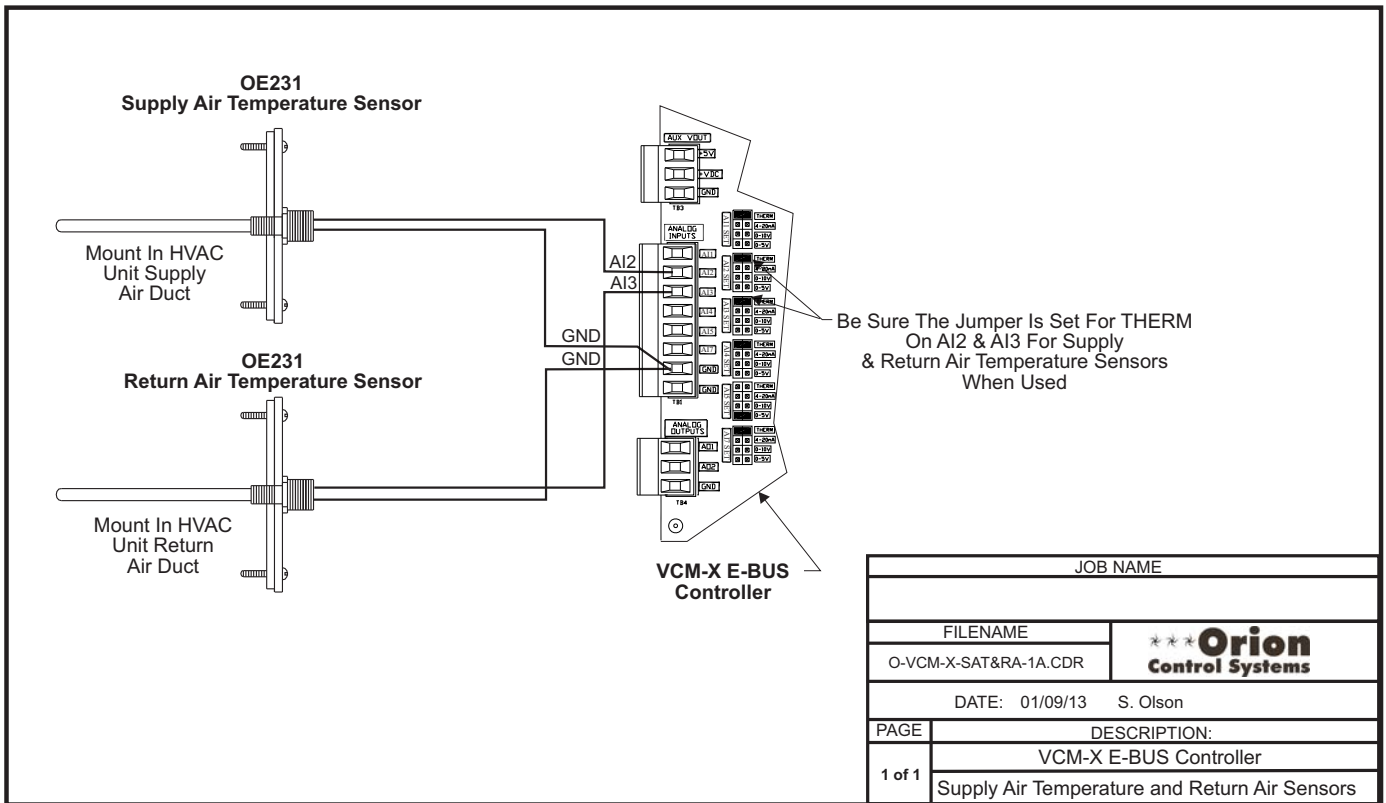


Figure 19: OE231 Supply Air Temperature Sensor & OE231 Return Air Temperature Sensor Wiring

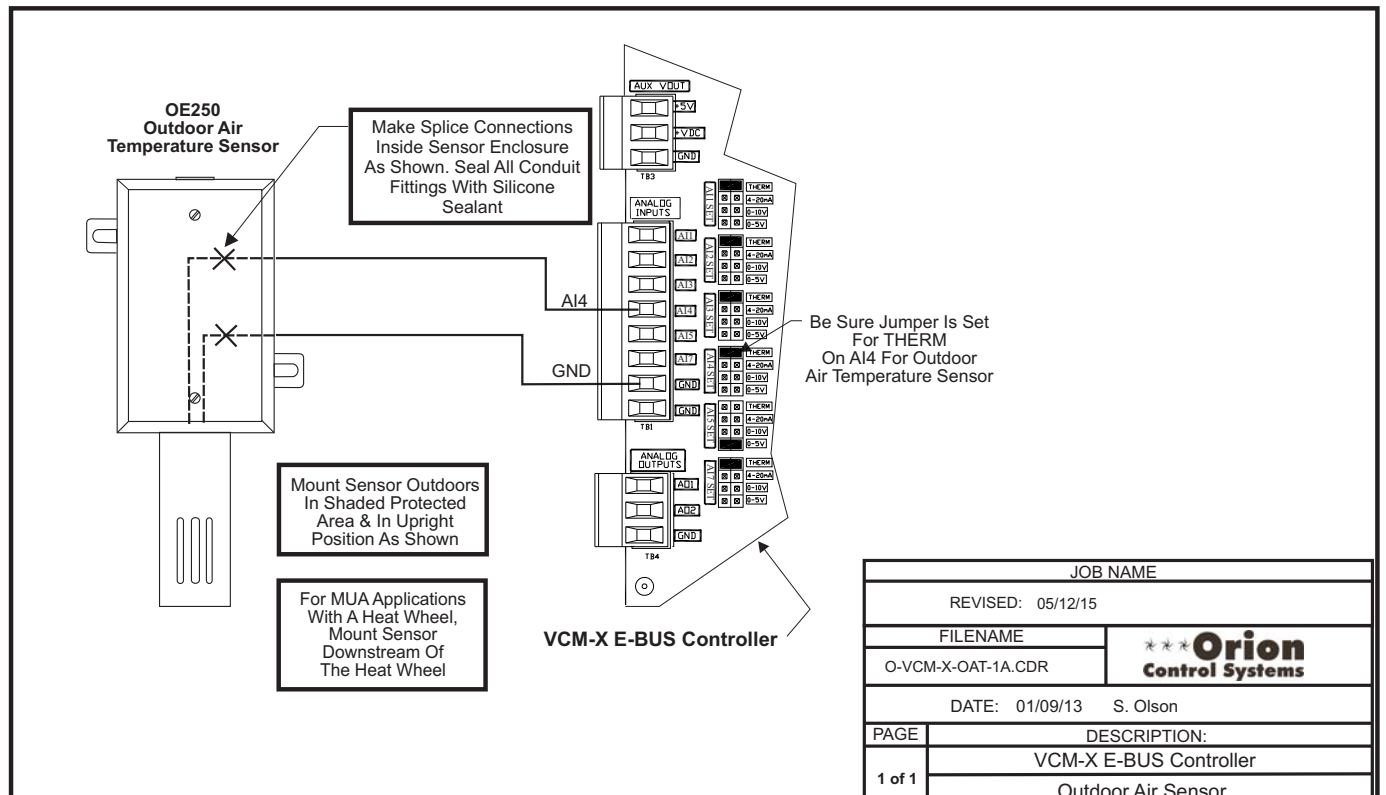


Figure 20: OE250 Outdoor Air Temperature Wiring

Economizer Damper Actuator Wiring

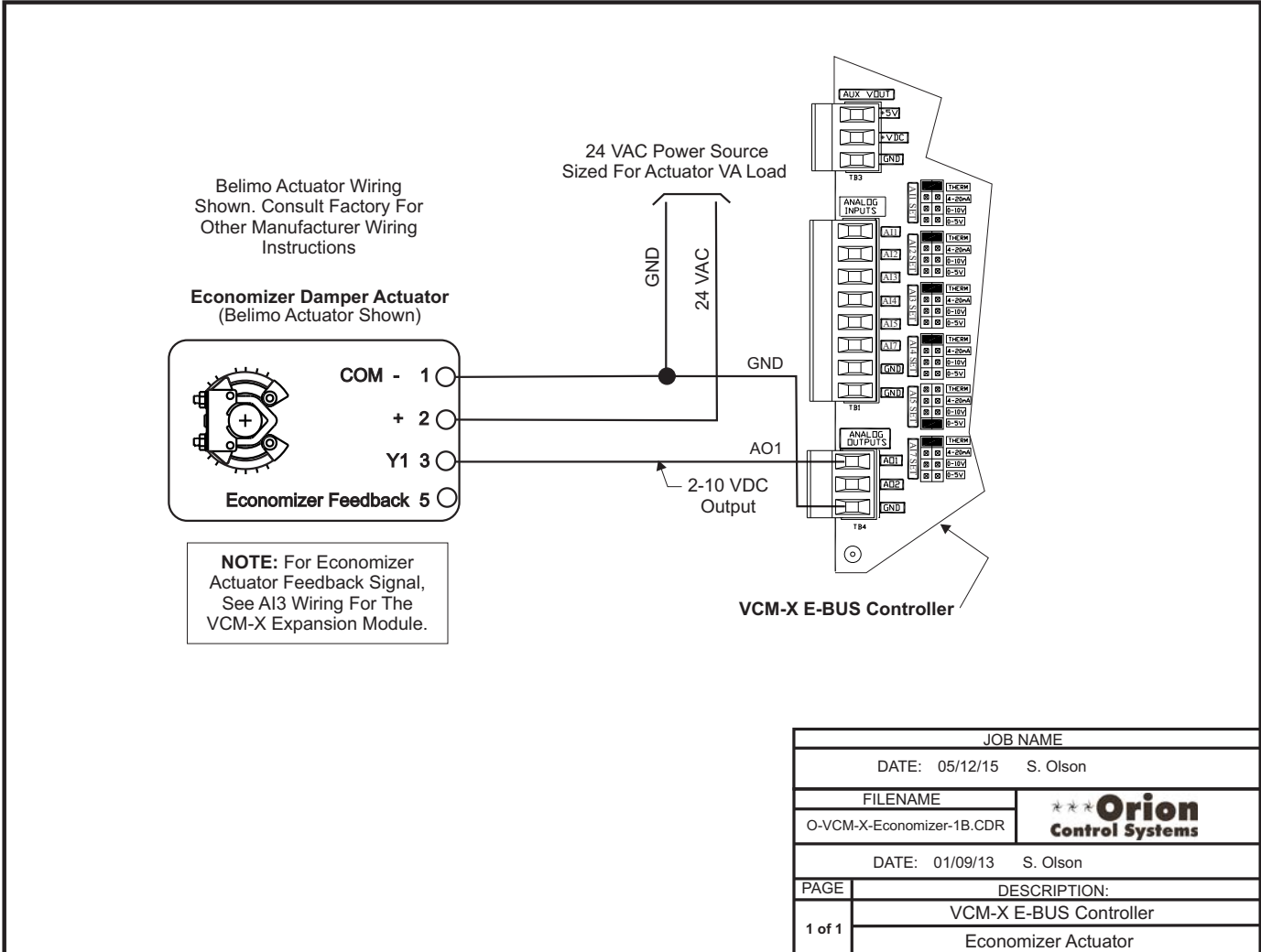


Figure 21: Economizer Damper Actuator Wiring

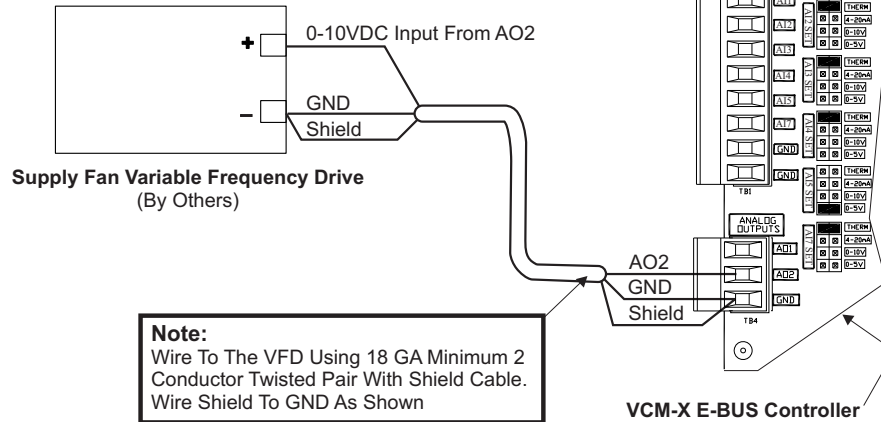
Supply Fan VFD & Bypass Damper Actuator

Note:

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

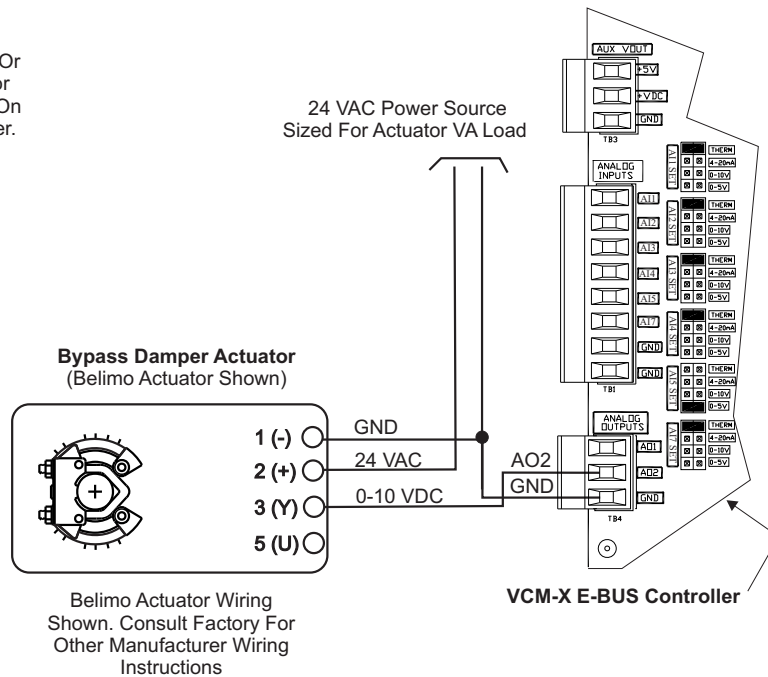
Caution:

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



JOB NAME	
FILENAME	*** Orion Control Systems
OVCMX-ZoneByp-SFVFD-Wr1A.CDR	
DATE: 01/09/13	S. Olson
PAGE	DESCRIPTION:
1 of 1	VCM-X E-BUS Controller Wiring Detail
	Supply Fan VFD or Bypass Damper Actuator

Figure 22: Supply Fan VFD & Bypass Damper Actuator Wiring

VCM-X Expansion, 4 Binary Input & 12-Relay Expansion Module Wiring

Output Wiring



Suction Pressure Transducer Without Digital Compressor

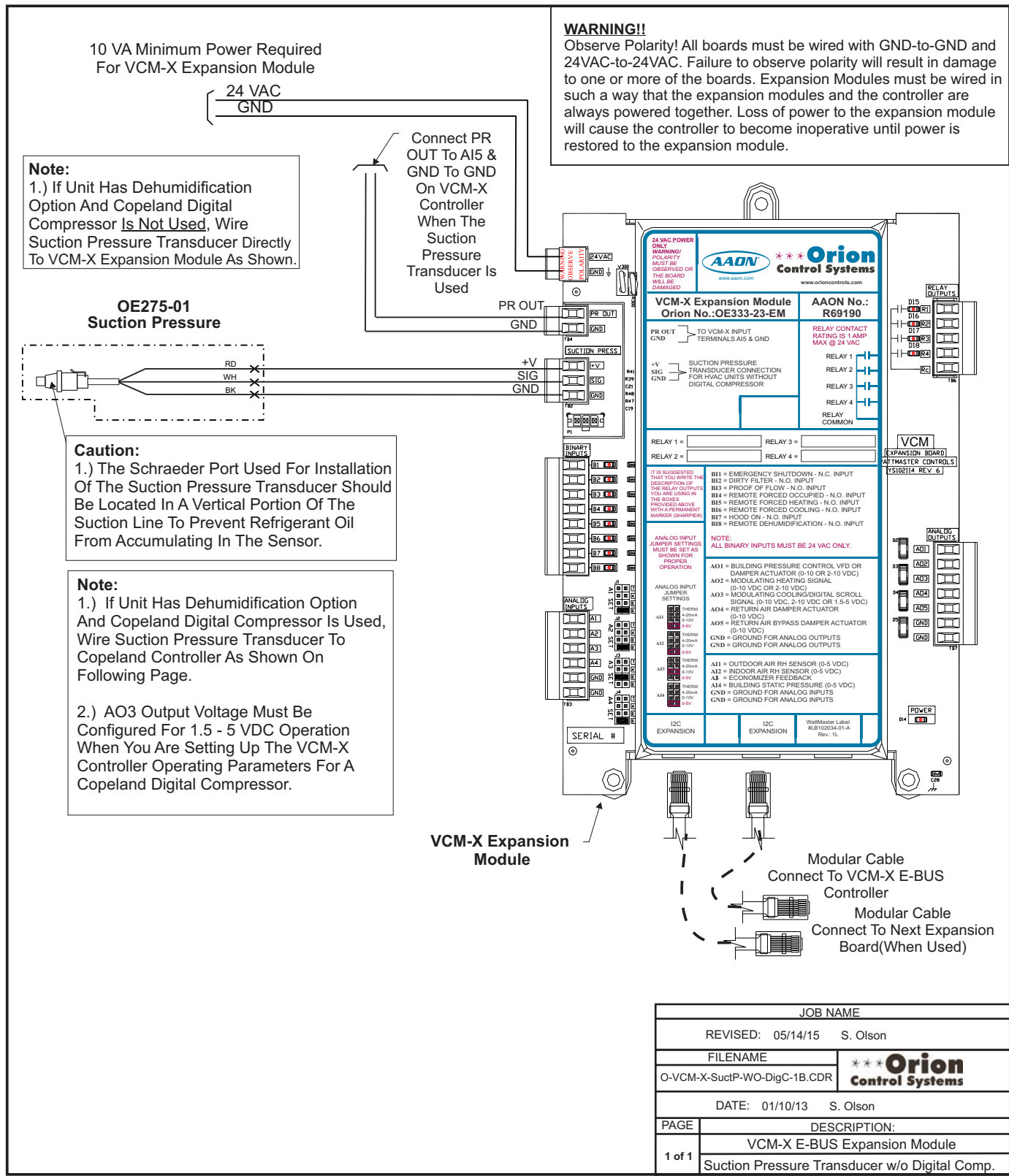


Figure 25: OE275-01 Suction Pressure Transducer Without Digital Compressor Wiring

Suction Pressure Transducer With Digital Compressor

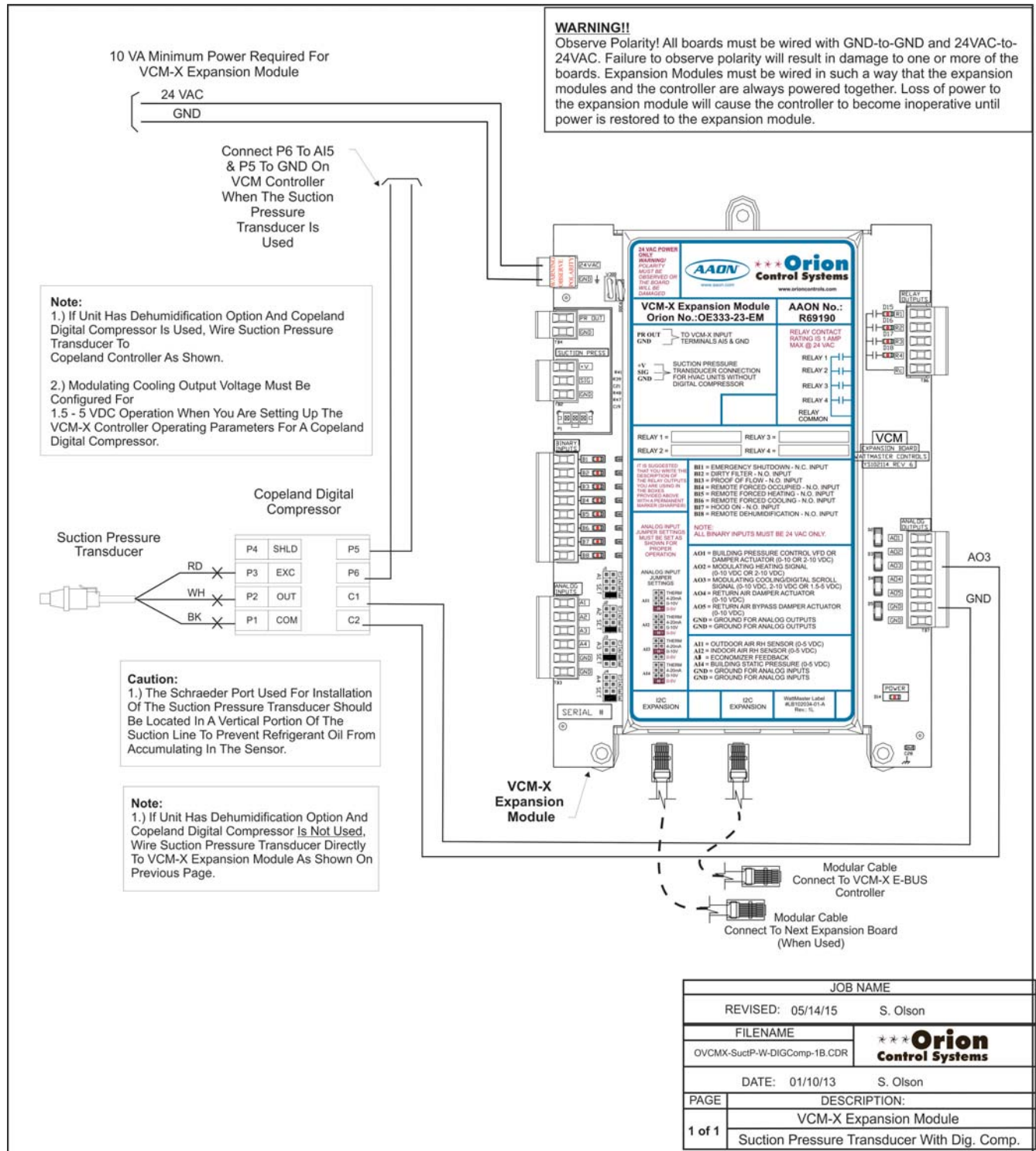


Figure 26: OE275-01 Suction Pressure Transducer With Digital Compressor Wiring

VCM-X Expansion Module Wiring

Expansion Module Binary Inputs

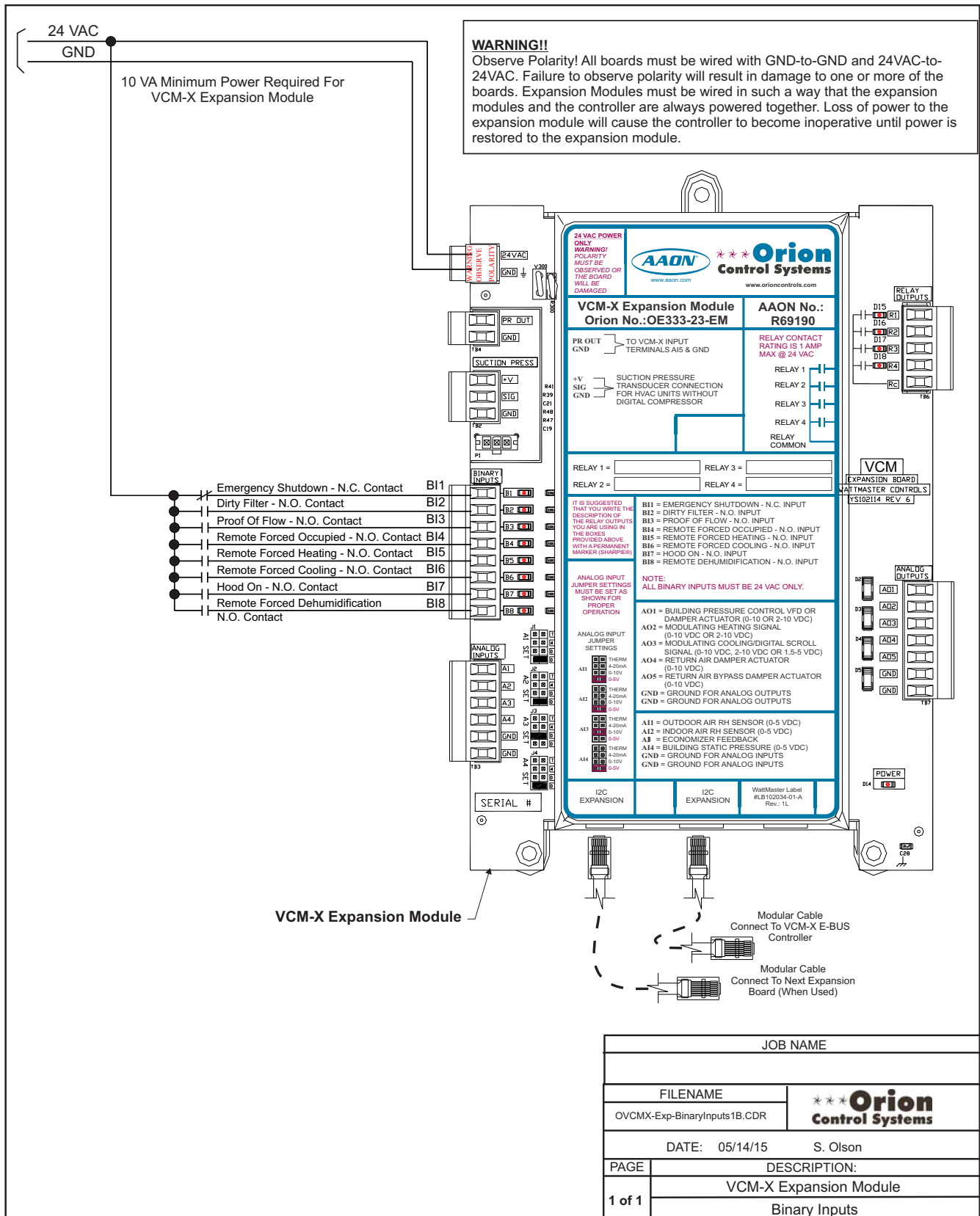


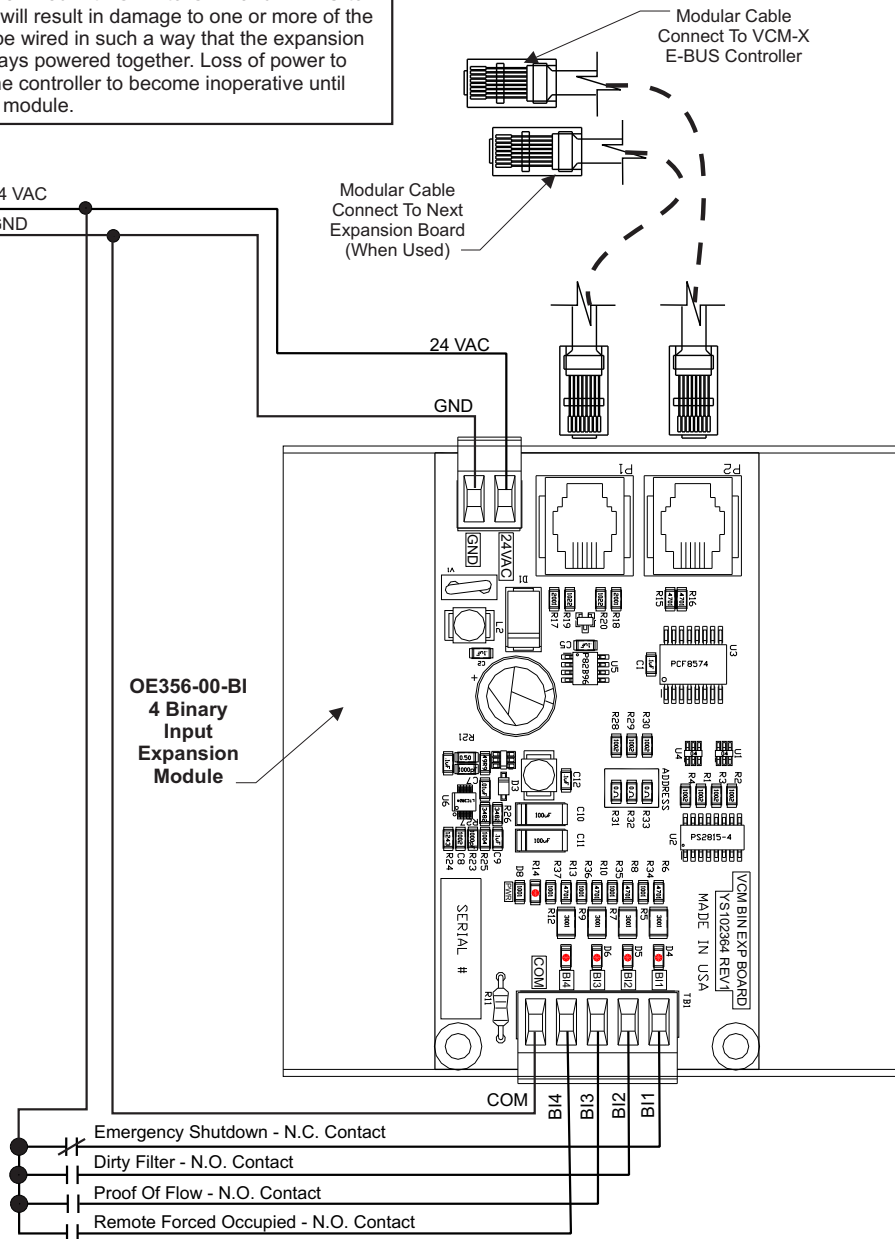
Figure 27: VCM-X Expansion Module Binary Inputs Wiring

4 Binary Input Expansion Module

WARNING!!

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

5 VA Minimum Power Required
For 4 Binary Input Expansion
Module



JOB NAME	
FILENAME	
OVCMX-BinInput-4BIN-1A.CDR	
DATE: 01/10/13	S. Olson
PAGE	DESCRIPTION:
1 of 1	VCM-X Expansion Module
	Binary Inputs On 4 Binary Input Module

Figure 28: OE356-00-BI 4 Binary Input Expansion Module Wiring

VCM-X E-BUS Controller Wiring

Indoor Wall-Mounted Humidity Sensor

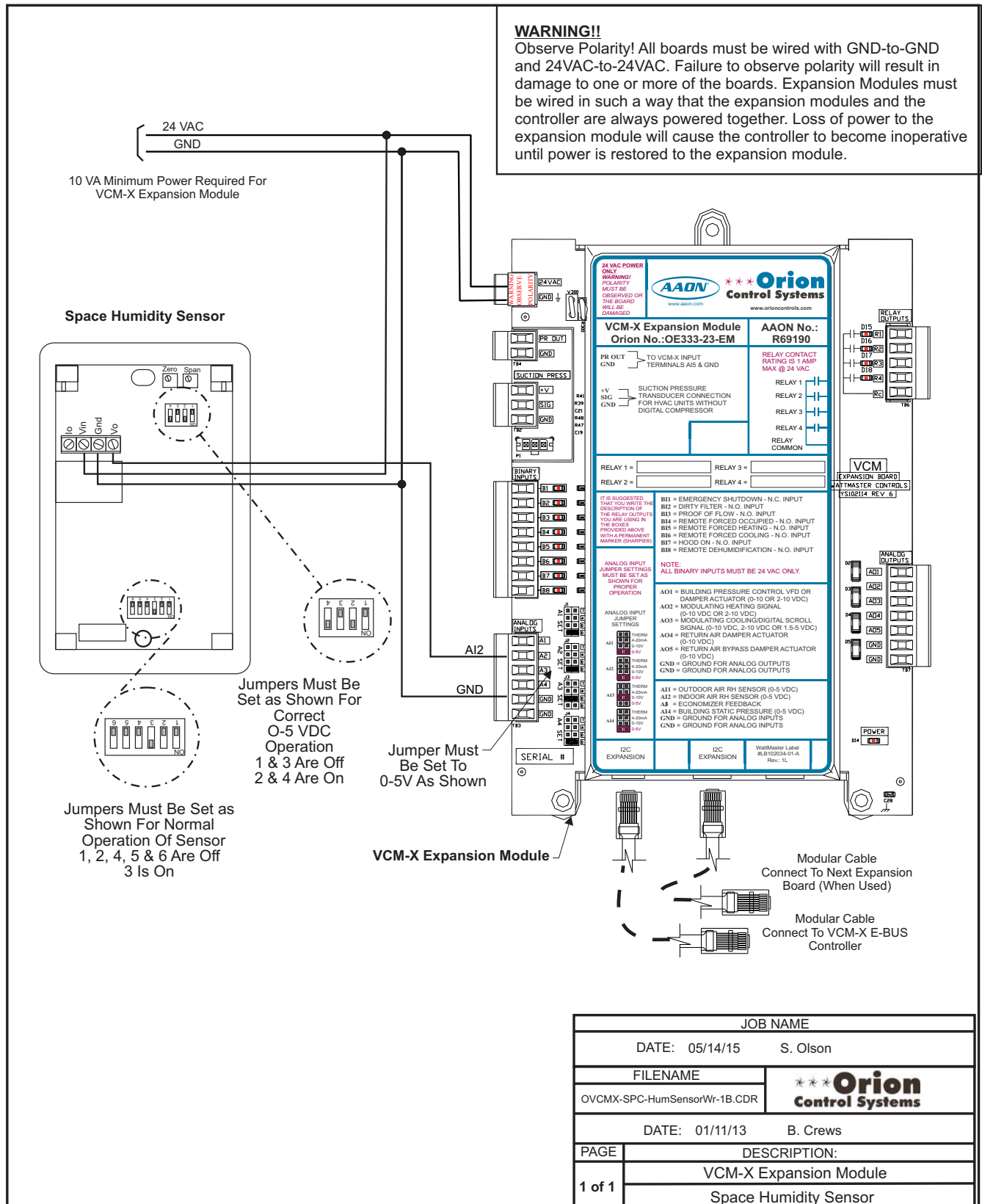


Figure 30: OE265-11 - Indoor Wall Mounted Humidity Sensor Wiring

VCM-X Expansion Module Wiring

Return Air Humidity Sensor

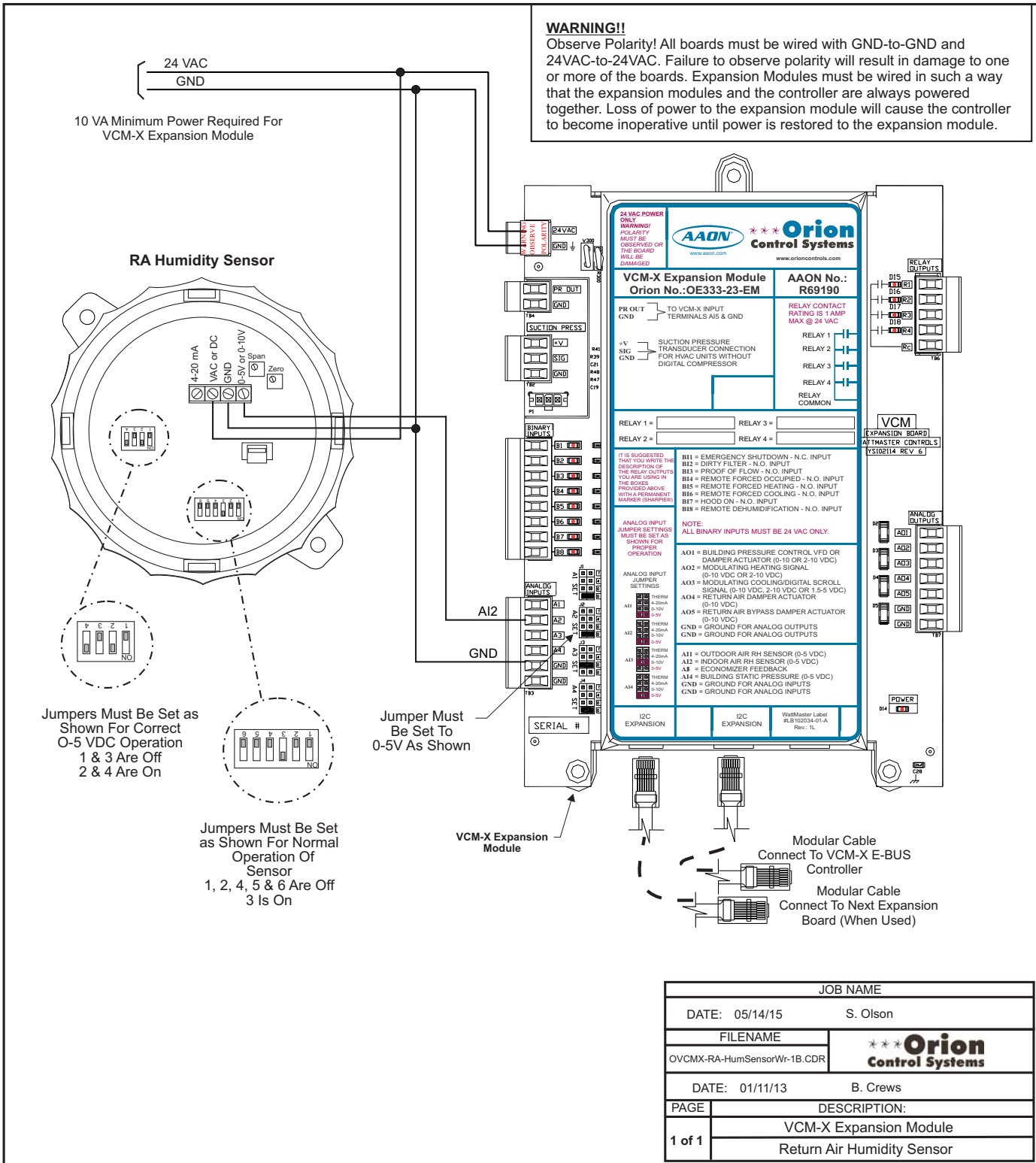


Figure 31: OE265-14 - Indoor Return Air Humidity Sensor Wiring

Title 24 Economizer Actuator Feedback

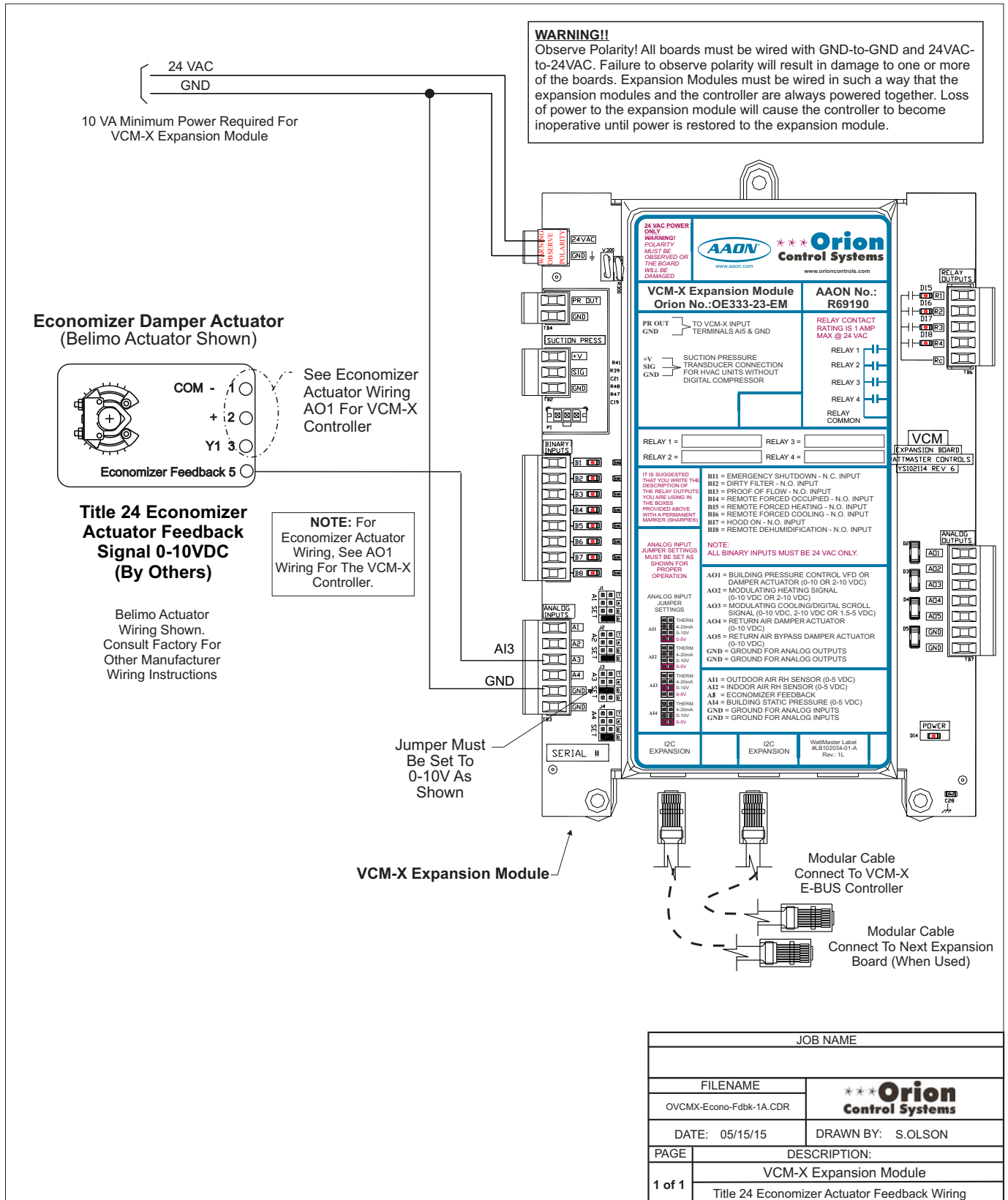


Figure 32: Title 24 Economizer Actuator Feedback Wiring

VCM-X Expansion Module Wiring

Building Pressure Sensor, Actuator & VFD

WARNING!!

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

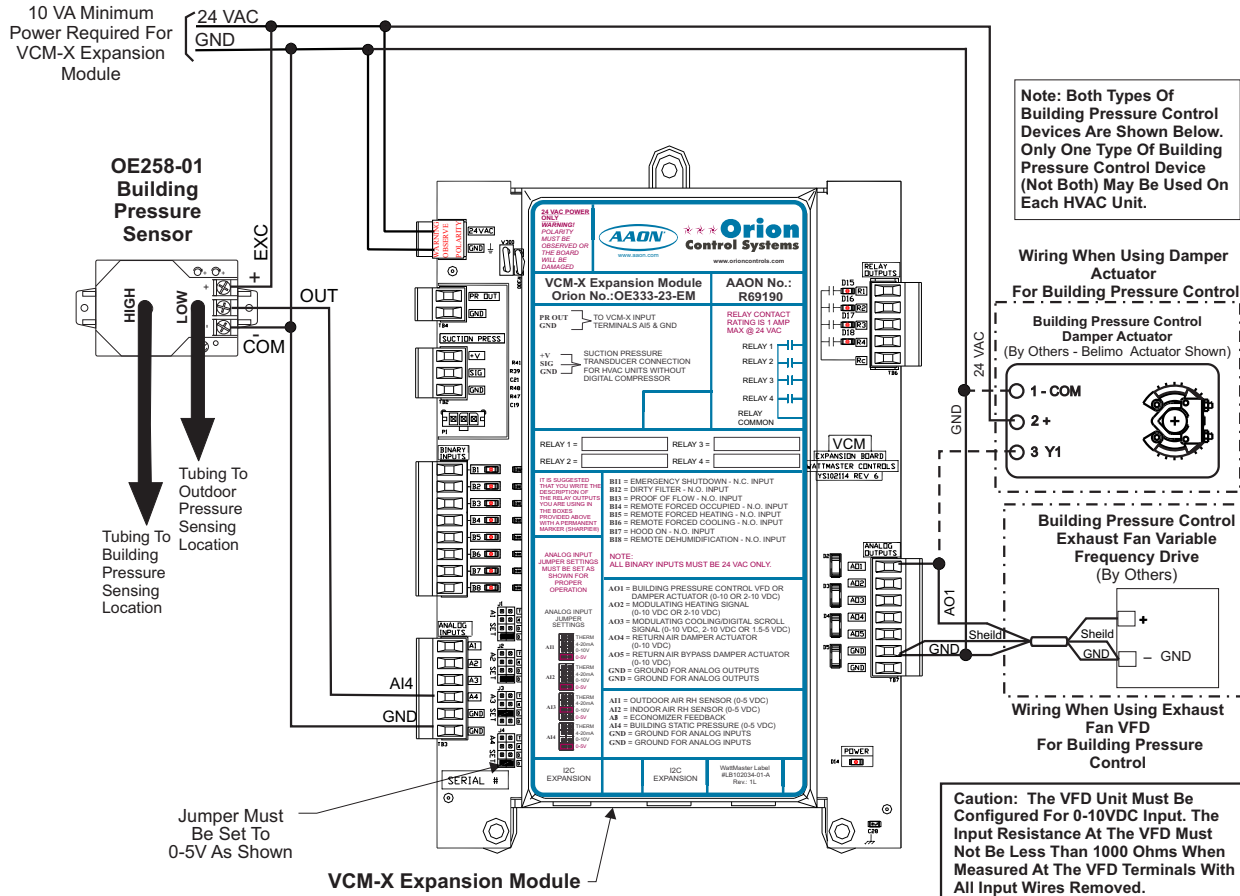
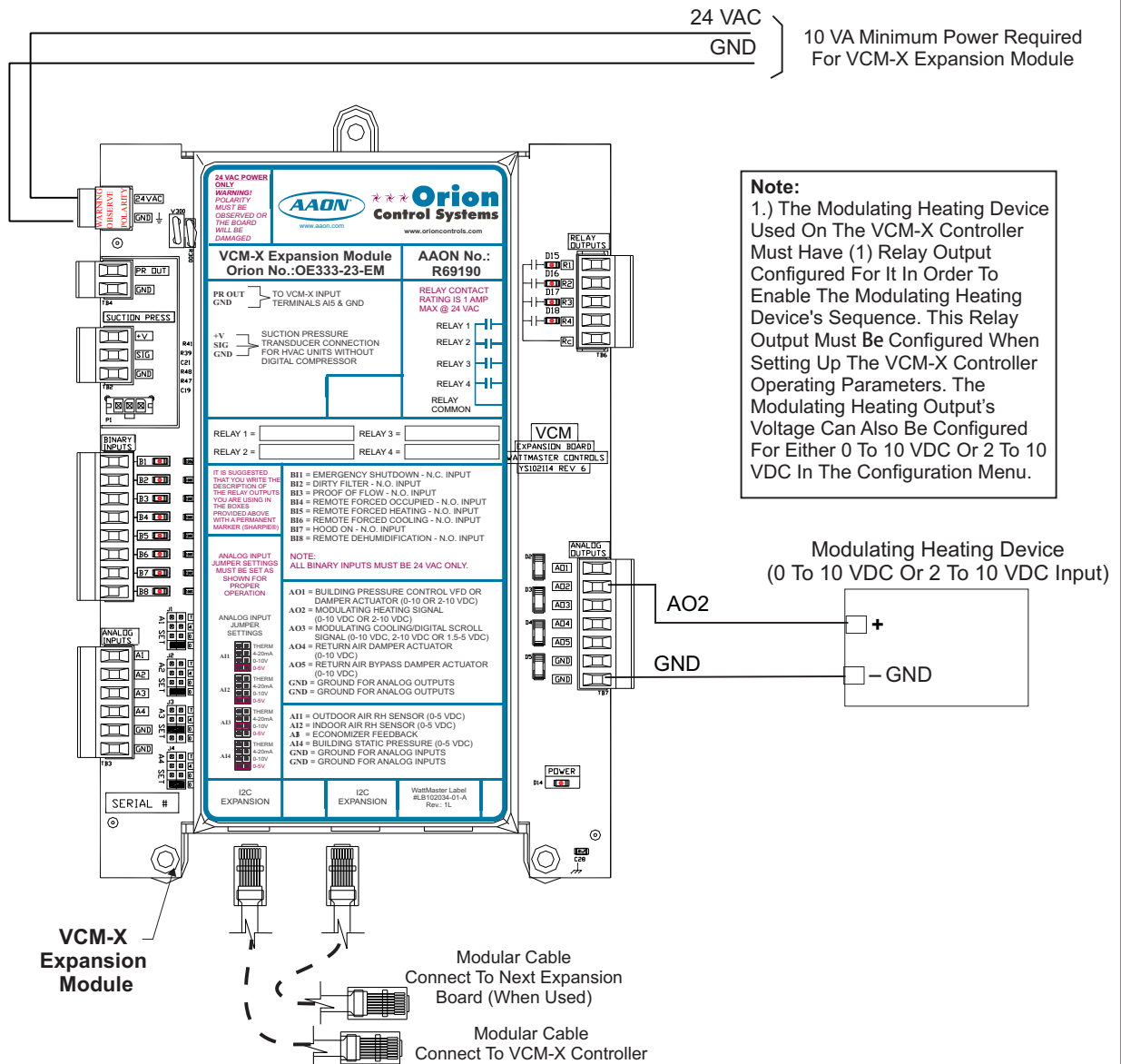


Figure 33: OE258-01 - Building Pressure Sensor & Actuator & VFD Wiring

Modulating Heating Device

WARNING!!

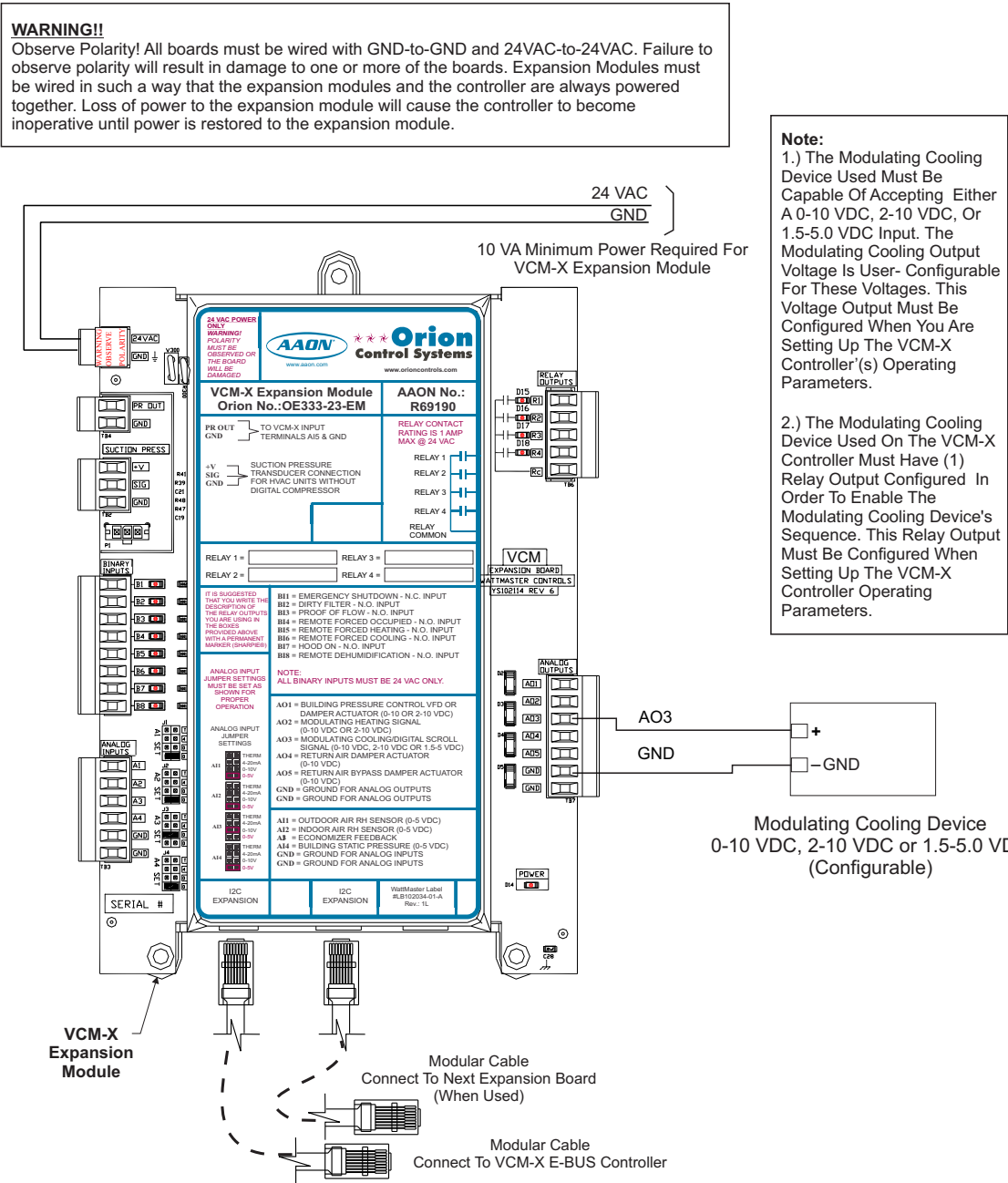
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion Modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the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



JOB NAME	
FILENAME	*** Orion Control Systems
OVCMX-Mod-Heat-Output-1B.CDR	
DATE: 05/15/15 S. Olson	
PAGE	DESCRIPTION:
1 of 1	VCM-X Expansion Module
	Modulating Heating Output

Figure 34: Modulating Heating Device Wiring

Modulating Cooling Device



JOB NAME	
FILENAME	*** Orion Control Systems
OVCMX-Mod-Cool-Output-1B.CDR	
DATE: 05/15/15 S. Olson	
PAGE	DESCRIPTION:
1 of 1	VCM-X Expansion Module
	Modulating Cooling Output

Figure 35: Modulating Cooling Device Wiring



12 Relay Expansion Module

WARNING!!

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

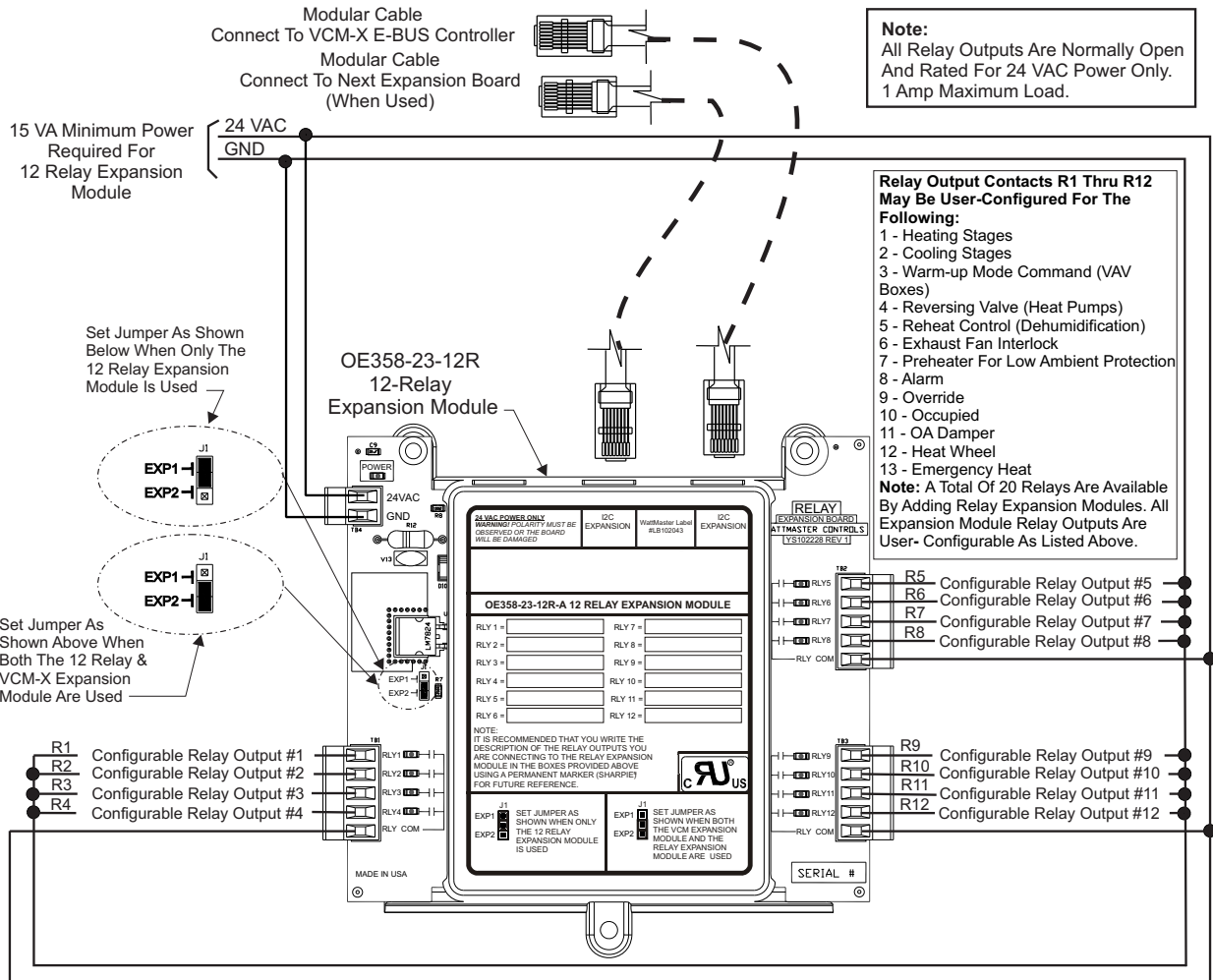


Figure 37: OE358-23-12R - 12 Relay Expansion Module Wiring

JOB NAME	
FILENAME	
OVCMX-12RelayWire-1A.CDR	
DATE: 01/11/13 S. Olson	
PAGE	DESCRIPTION:
1 of 1	VCM-X Controller Wiring Detail
	12 Relay Expansion Module

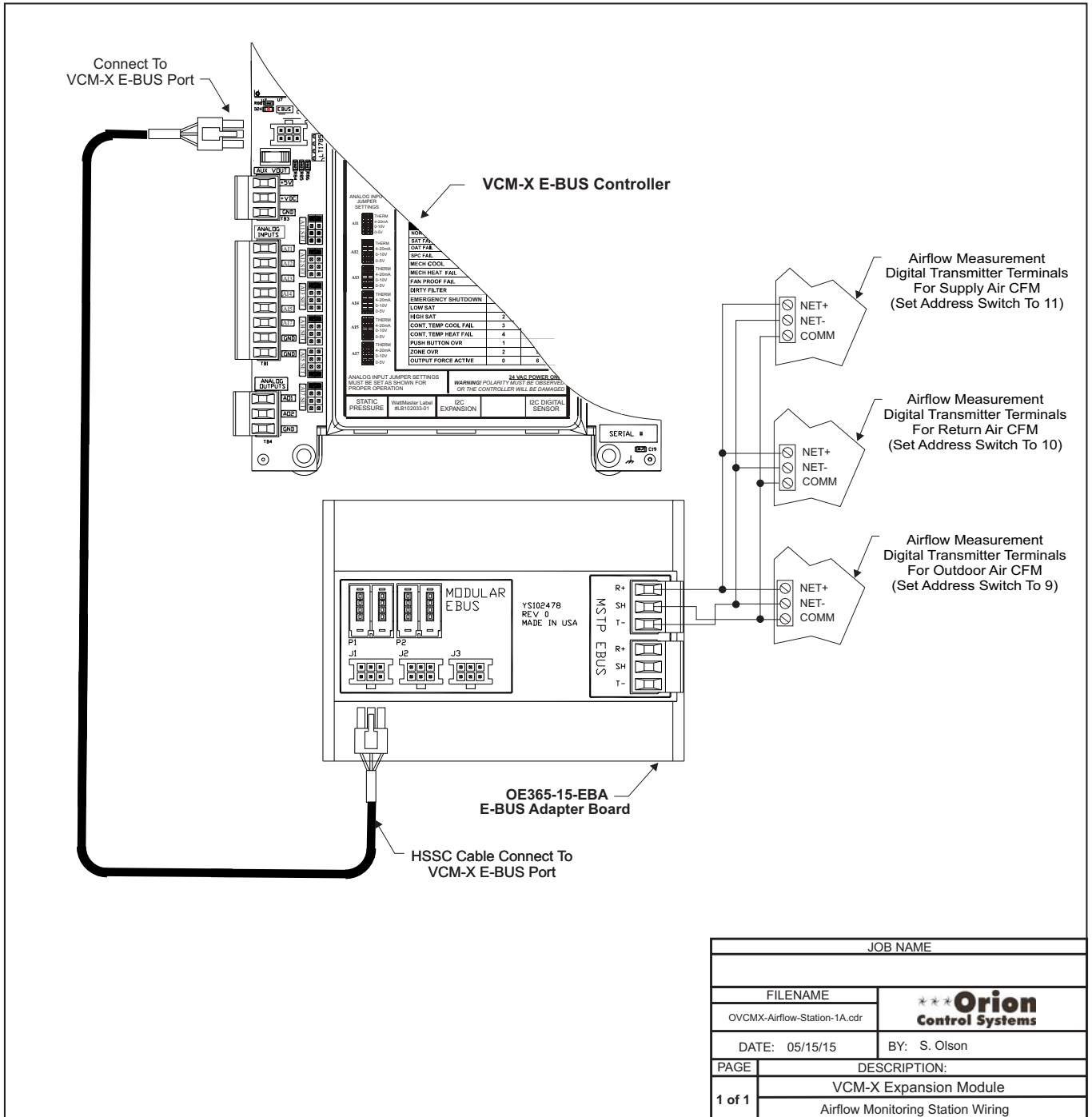


Figure 38: OE365-15-EBA - EBTRON® GTC116 Series, GreenTrol™ GA-200-N Series, and Paragon MicroTrans^{EQ} Series Air Flow Measurement Digital Transmitter Wiring

Modular & Non-Modular VAV/Zone Controller Diagrams

Modular VAV/Zone Controller Actuator Package Wiring

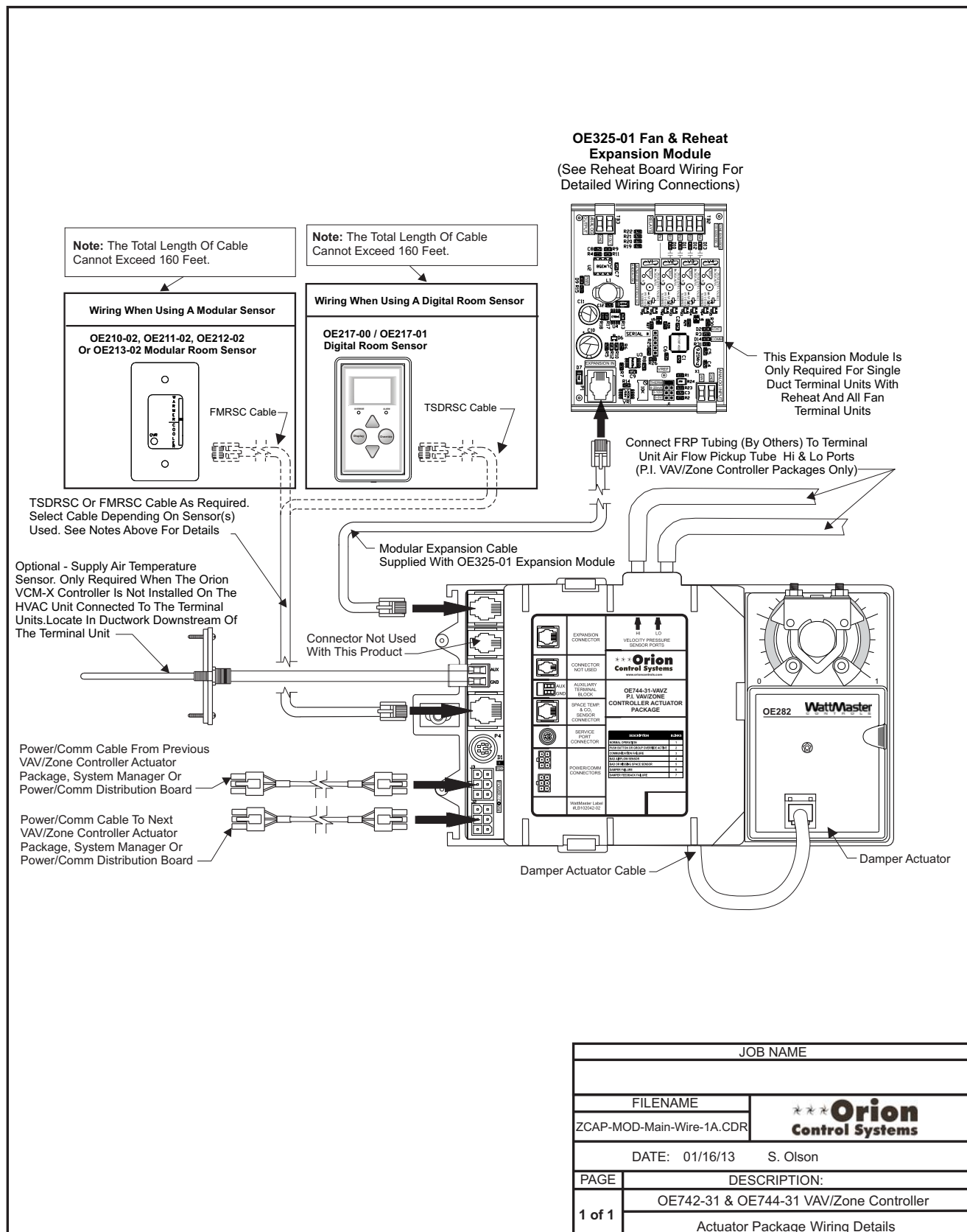


Figure 39: OE742-31 & OE744-31 - Modular Zone Controller Actuator Package - P.I. & P.D. Wiring

Non-Modular VAV/Zone Controller Actuator Package Wiring

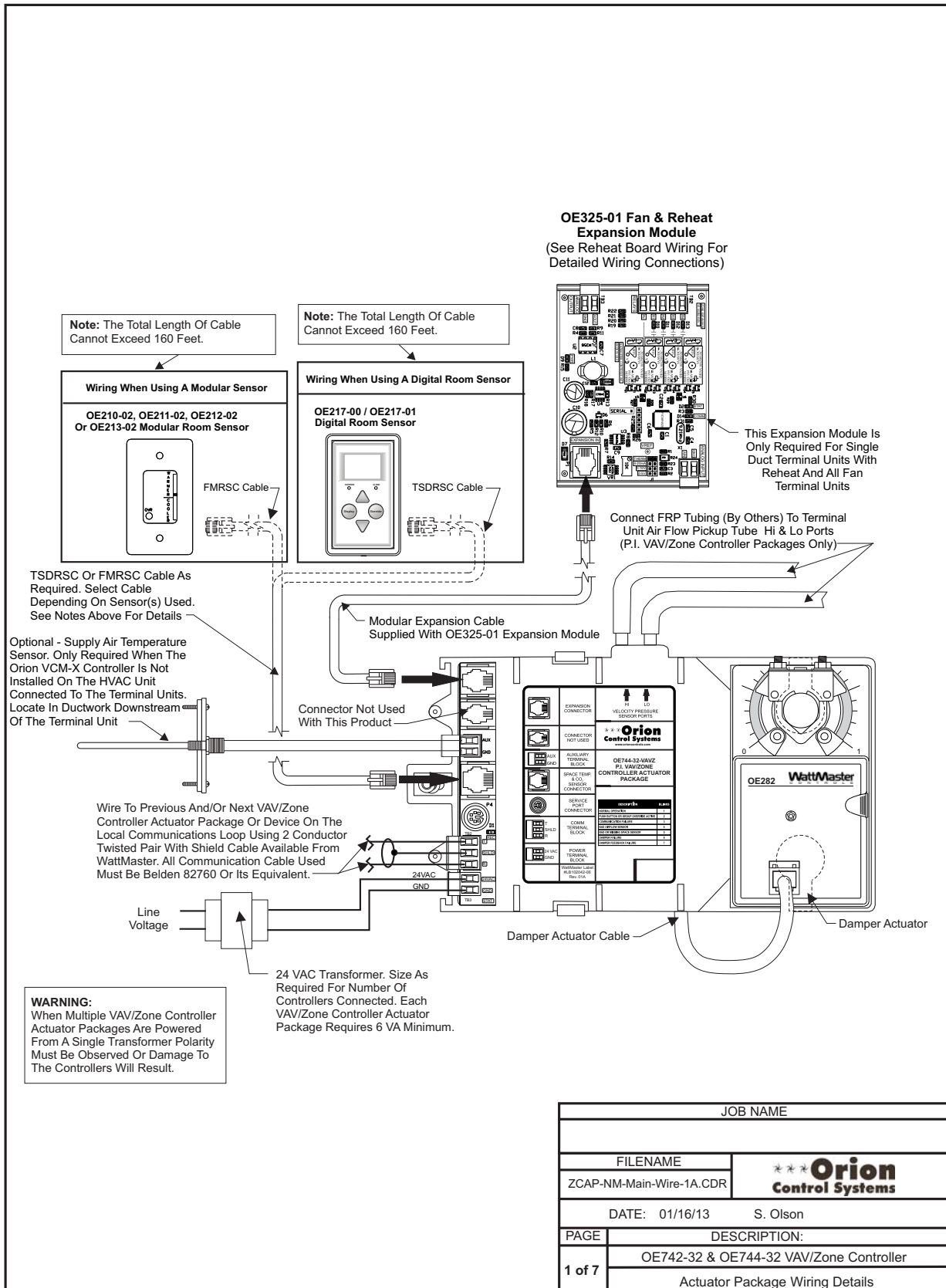


Figure 40: OE742-32 & OE744-32 - Non-Modular Zone Controller Actuator Package - P.I. & P.D. Wiring

Modular & Non-Modular VAV/Zone Controller Wiring

Expansion Module Wiring

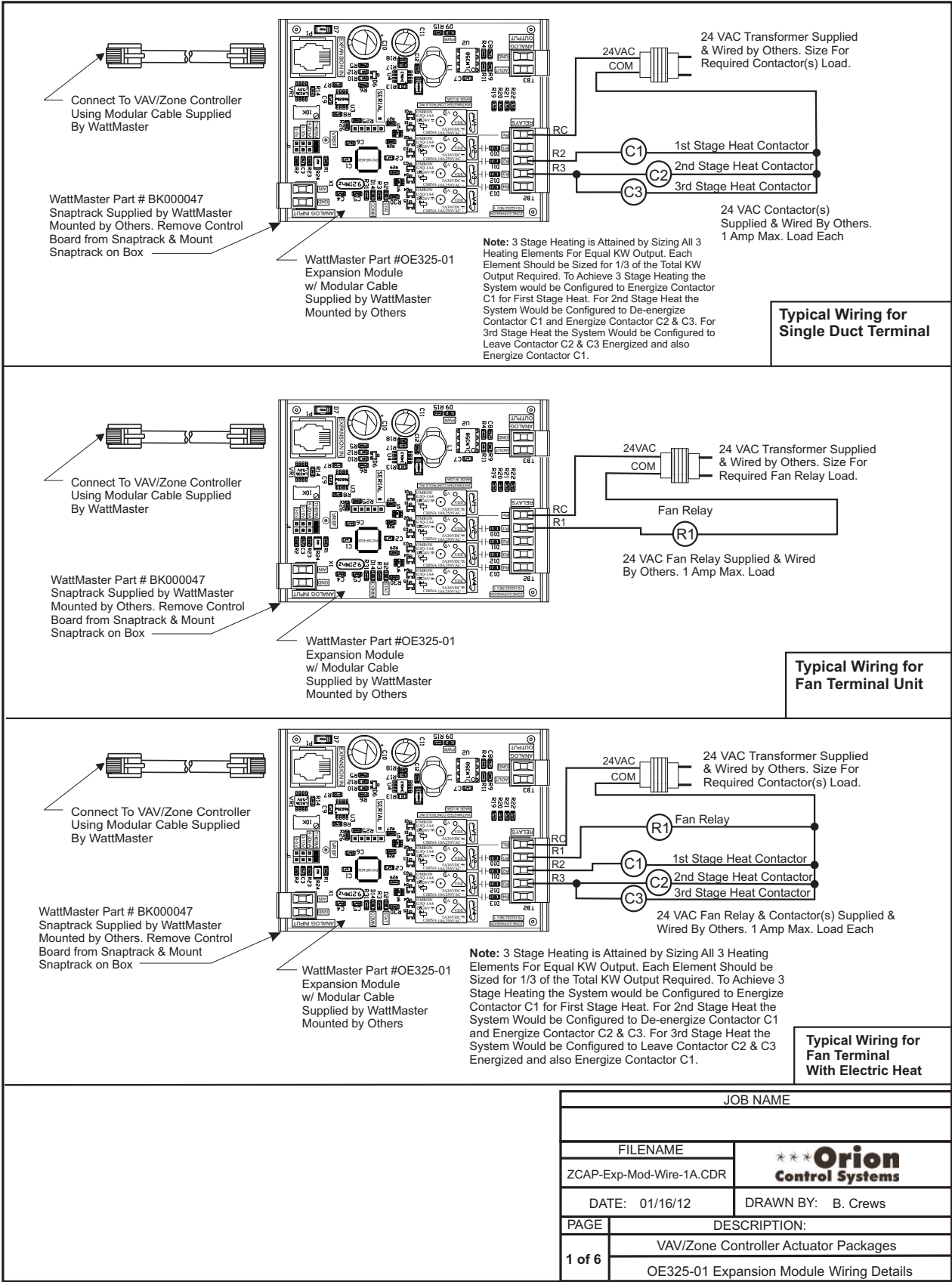


Figure 41: OE325-01 Expansion Module Wiring

Expansion Module Wiring

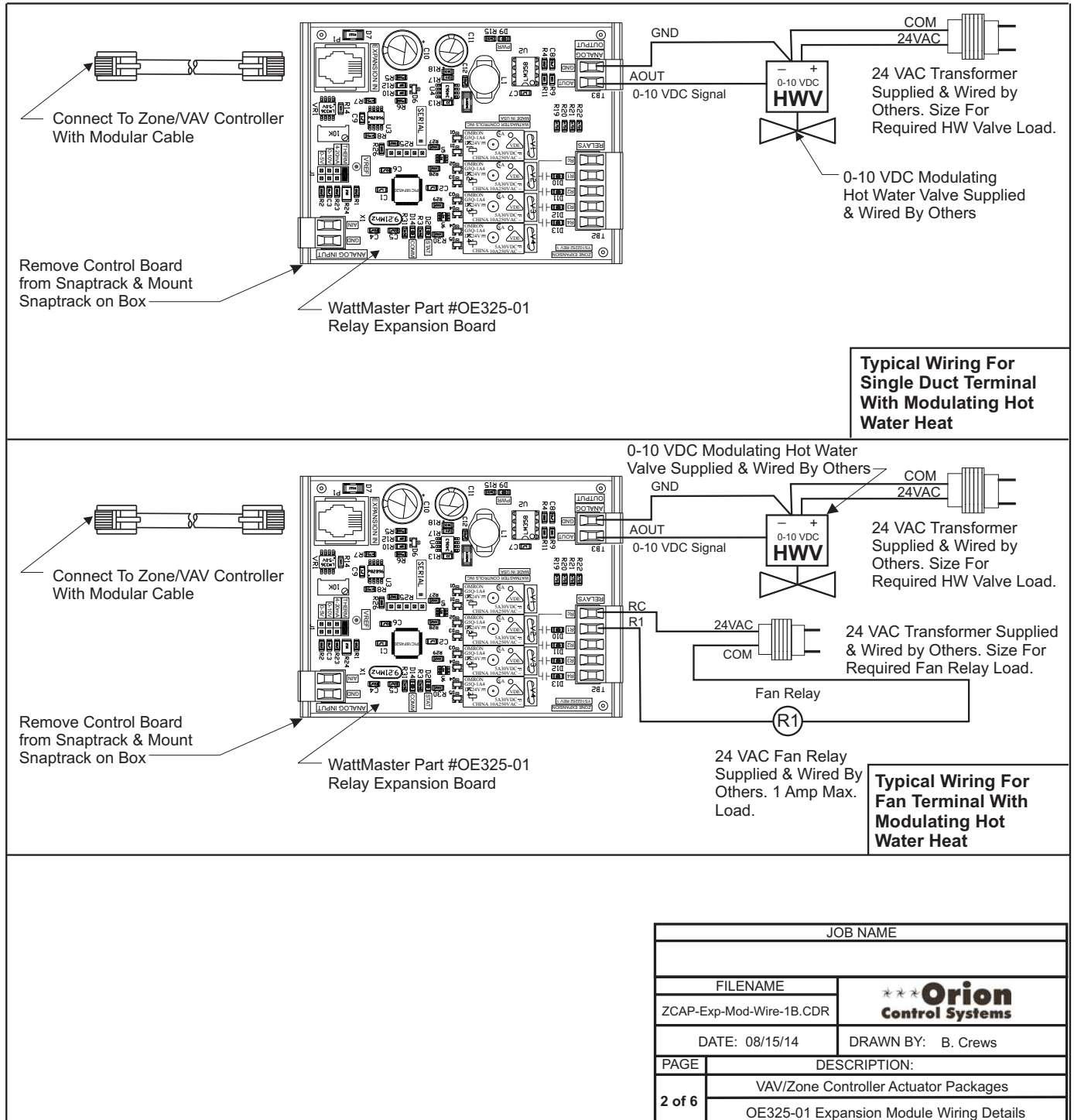


Figure 42: OE325-01 Expansion Module Wiring

Modular & Non-Modular VAV/Zone Controller Wiring

Expansion Module Wiring

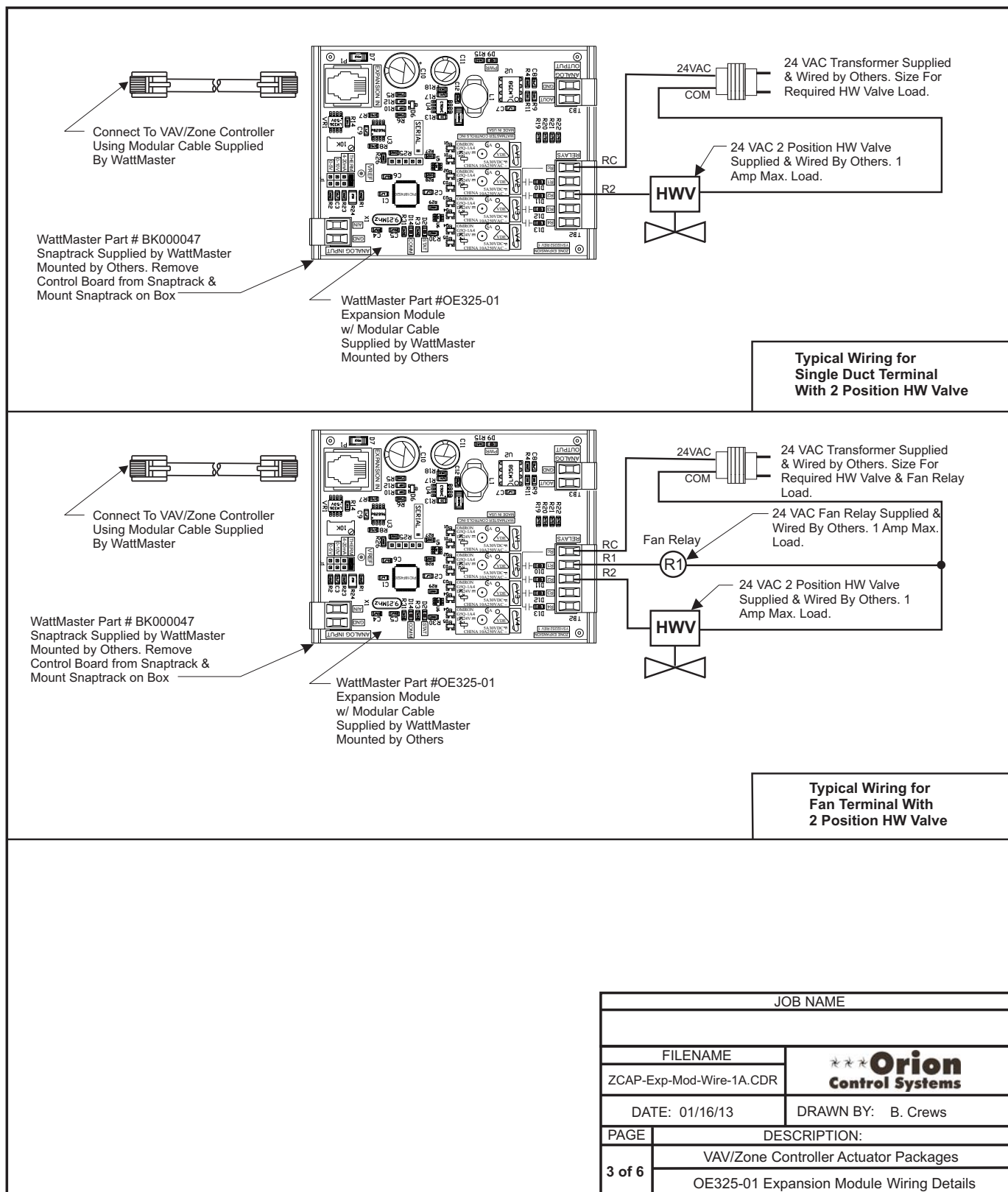


Figure 43: OE325-01 Expansion Module Wiring

Expansion Module Wiring

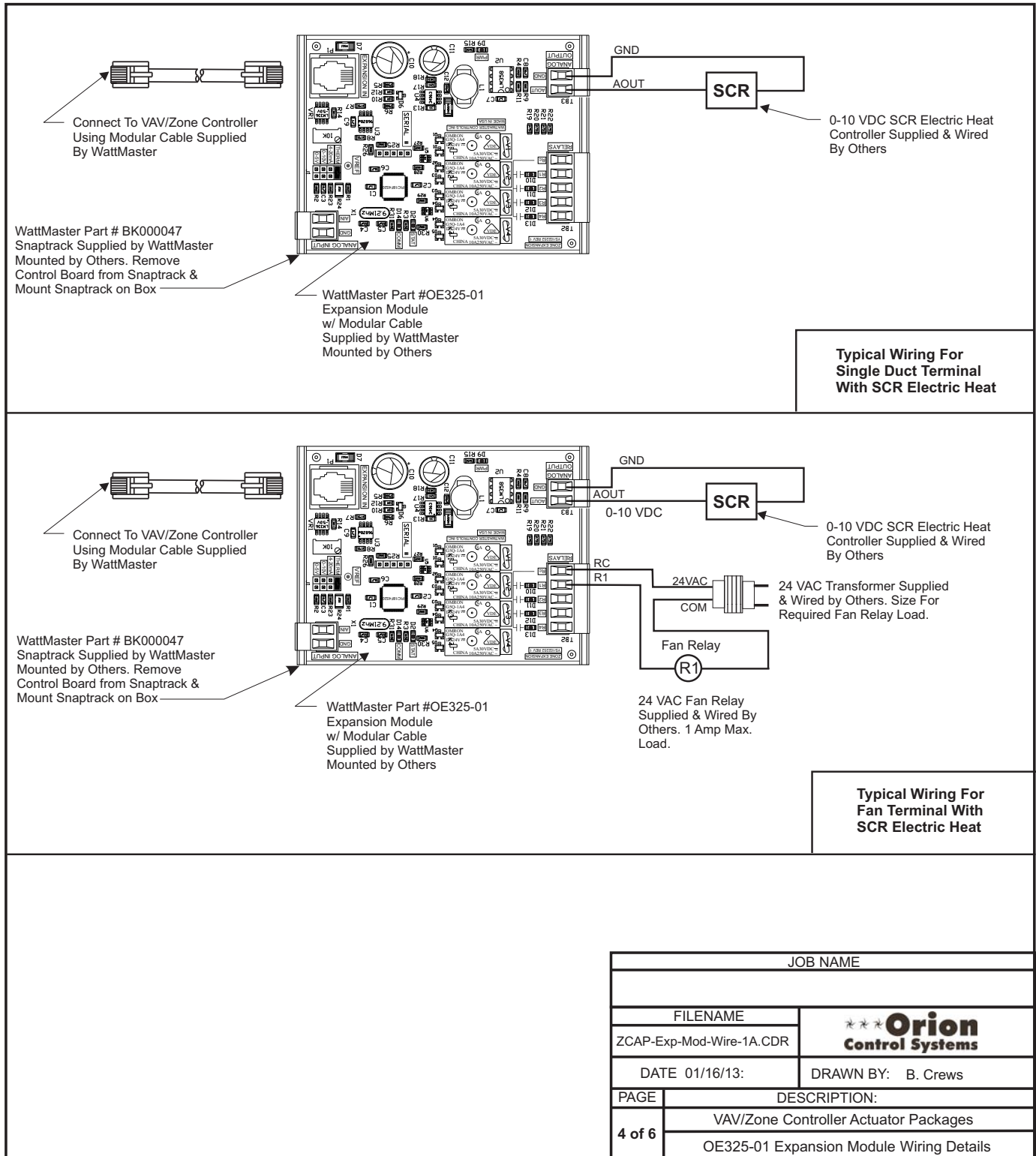


Figure 44: OE325-01 Expansion Module Wiring

Modular & Non-Modular VAV/Zone Controller Wiring

Expansion Module Wiring

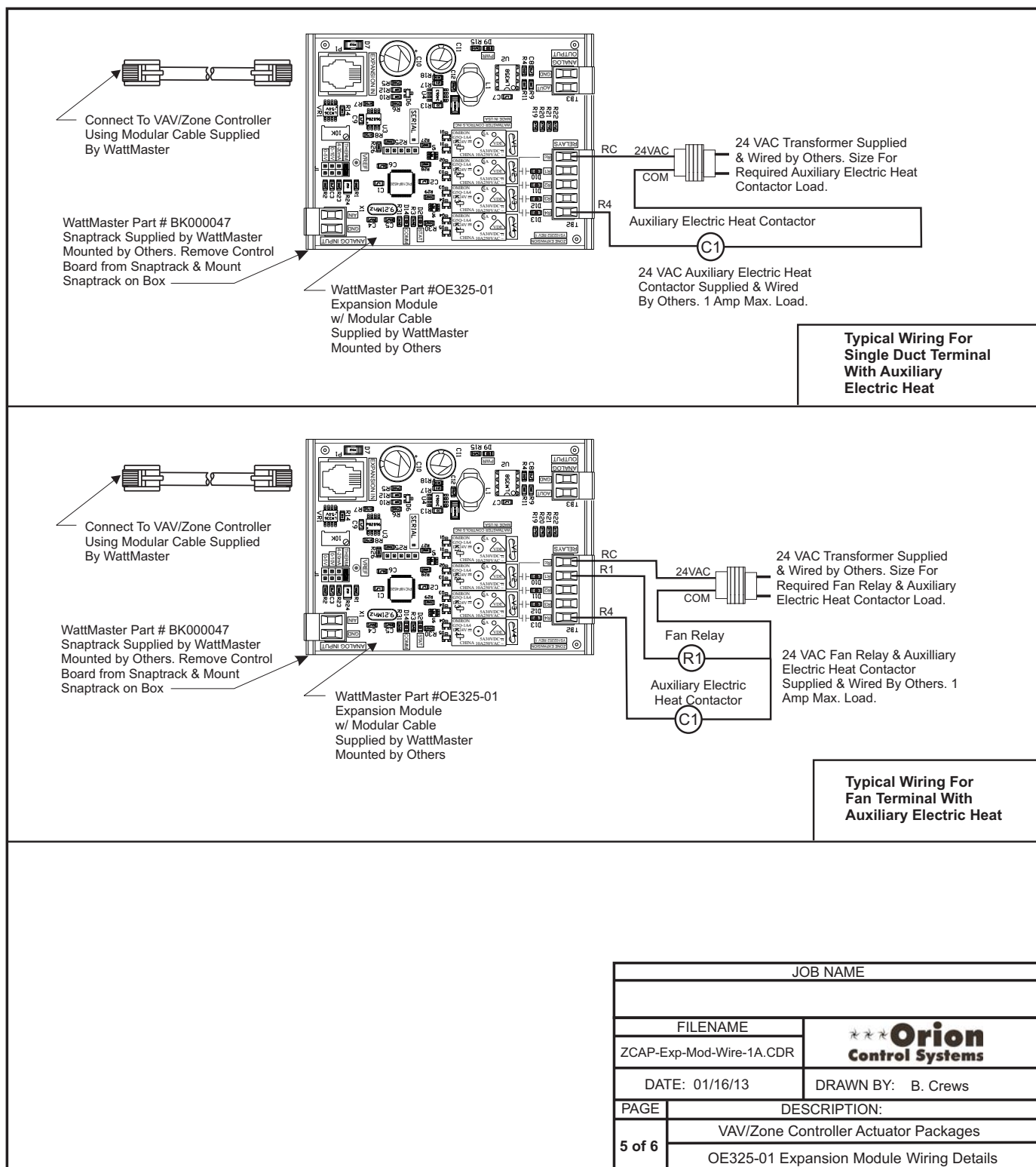


Figure 45: OE325-01 Expansion Module Wiring

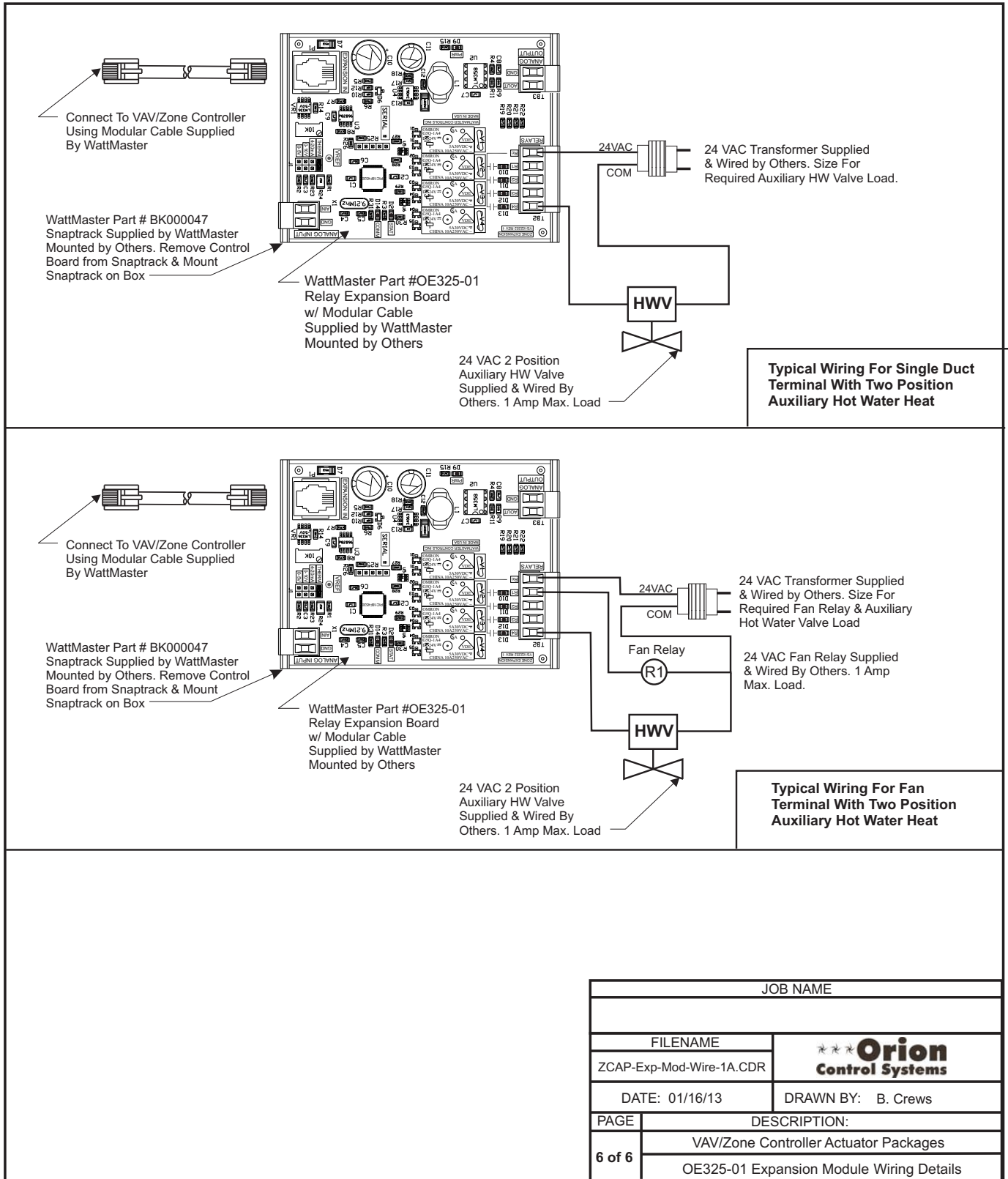


Figure 46: OE325-01 Expansion Module Wiring

Slaved Zone Wiring

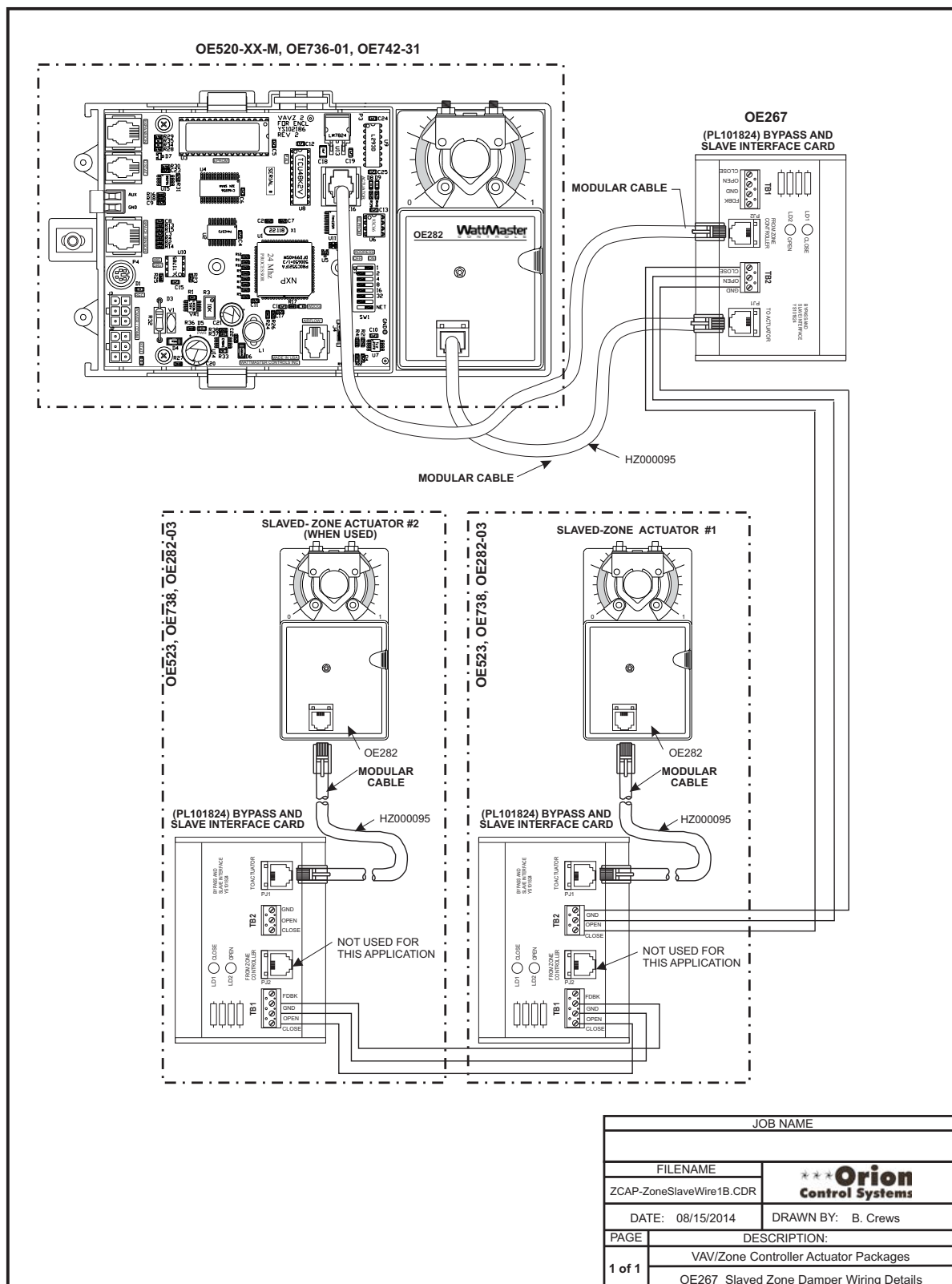


Figure 47: Slaved Zone Wiring

Communication Devices Diagrams

System Manager Stand-Alone Wiring

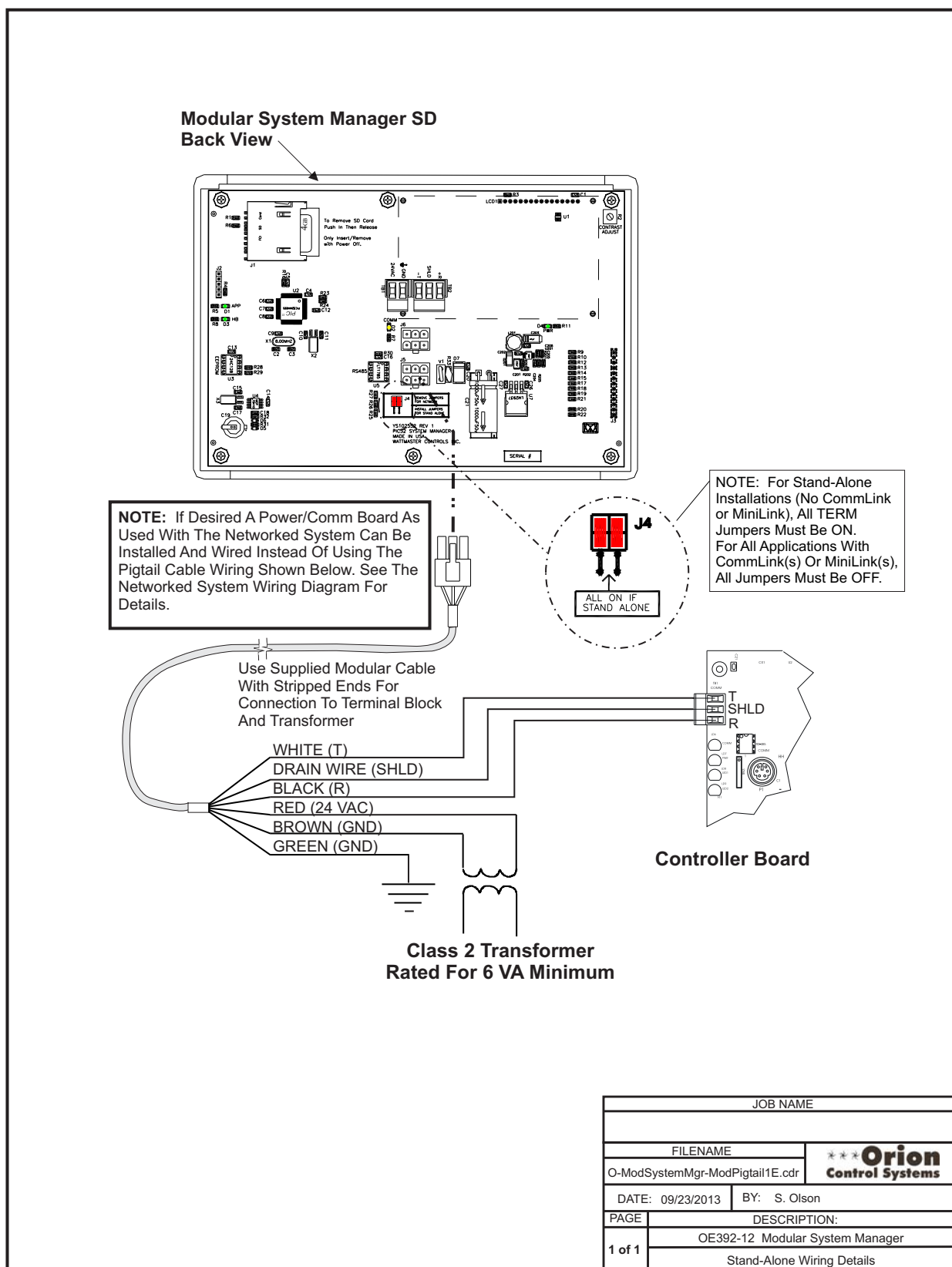


Figure 48: OE392-12 Modular System Manager Stand-Alone Wiring

System Manager Modular Cable Pigtail - Wiring Detail

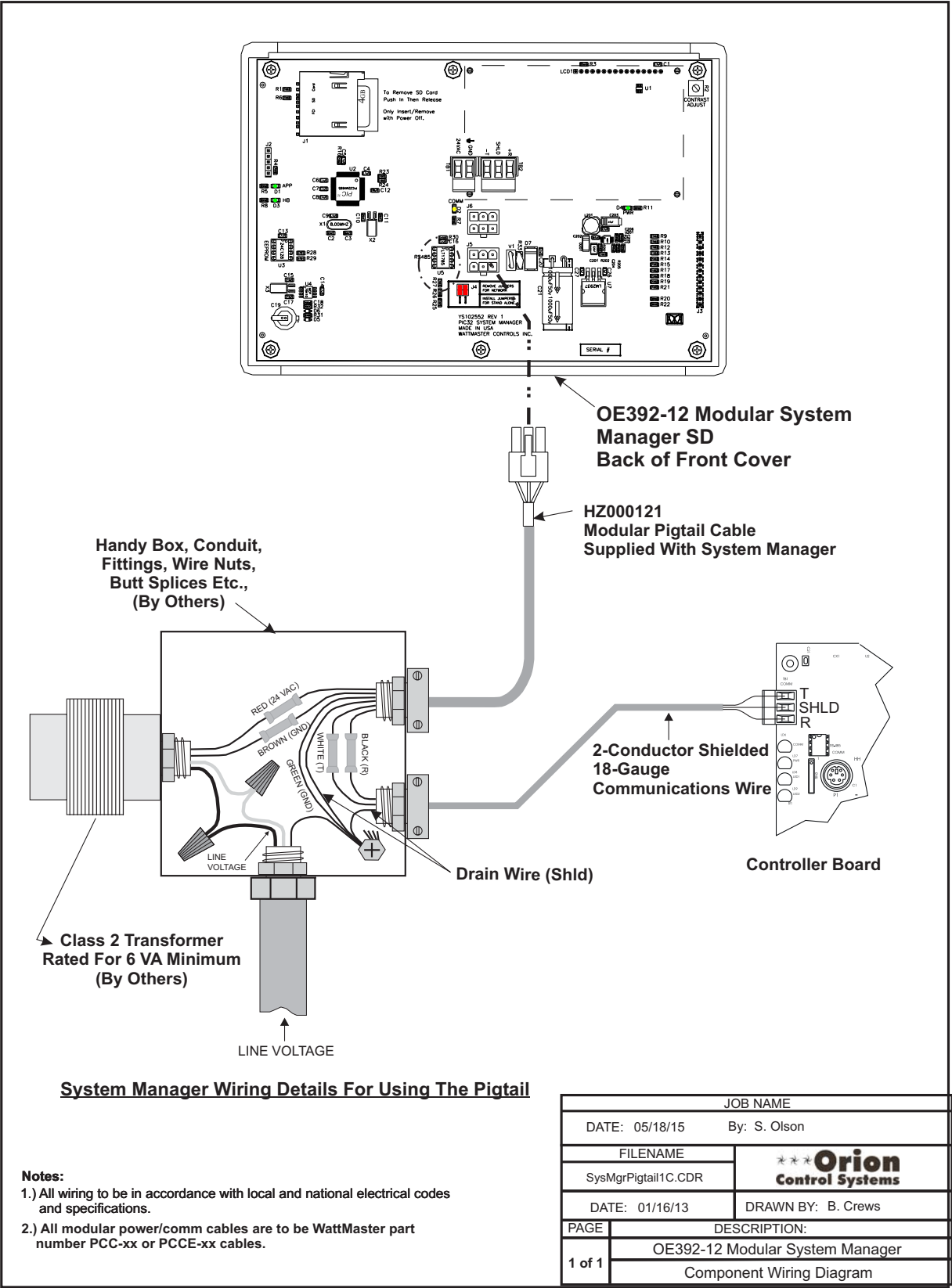
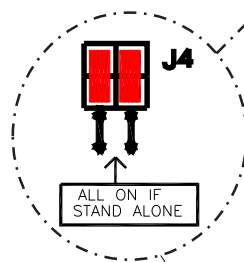
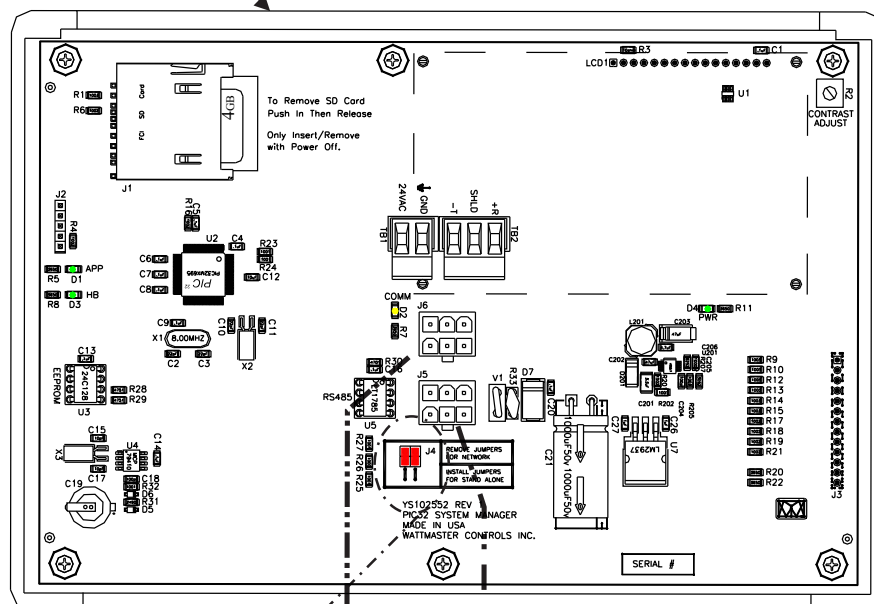


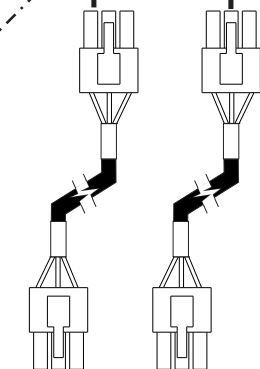
Figure 49: OE392-12 Modular System Manager SD Cable Pigtail - Wiring Detail

System Manager Networked Wiring

Modular System Manager SD
Back View



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



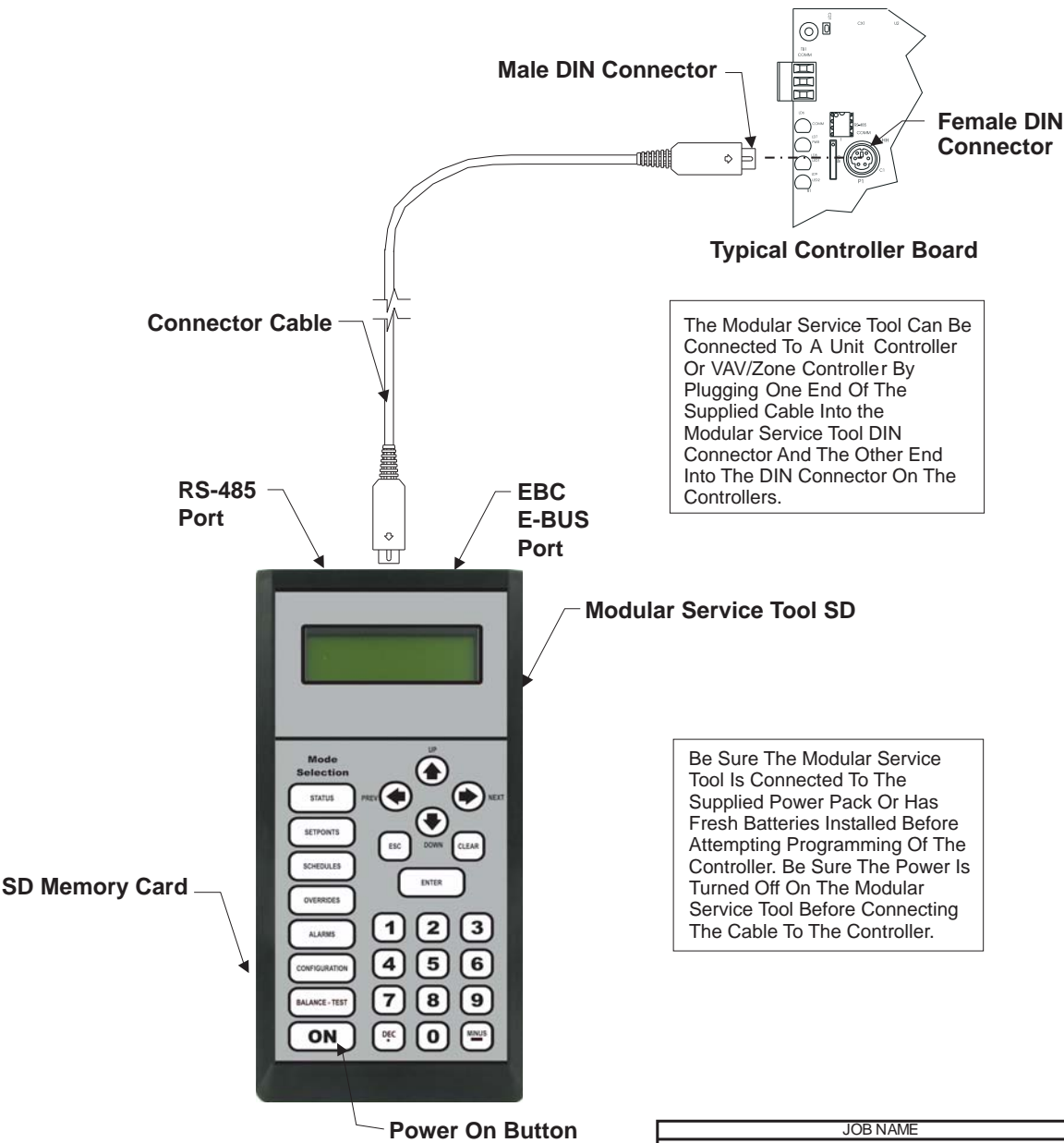
Power/Comm Cables To Power/Comm Distribution Board, MiniLink Polling Device Or VAV/Zone Controllers On Local Loop.

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

JOB NAME	
FILENAME	
O-ModSystemMgr-ModConnect-1C.cdr	
DATE: 05/15/15	BY: S. Olson
PAGE	DESCRIPTION:
1 of 1	OE392-12 Modular System Manager
	Networked Wiring Details

Figure 50: OE392-12 Modular System Manager SD Networked Wiring

Modular Service Tool Connections



JOB NAME	
FILENAME	
G-ModServiceTool-SD-1A.cdr	
DATE: 05/15/15	BY: S. Olson
PAGE	DESCRIPTION:
1 of 1	OE391-12 Modular Service Tool
Connection Diagram	

Figure 51: OE391-12 - Modular Service Tool SD Connections

System Manager TS II to VCM-X E-BUS Controller Wiring

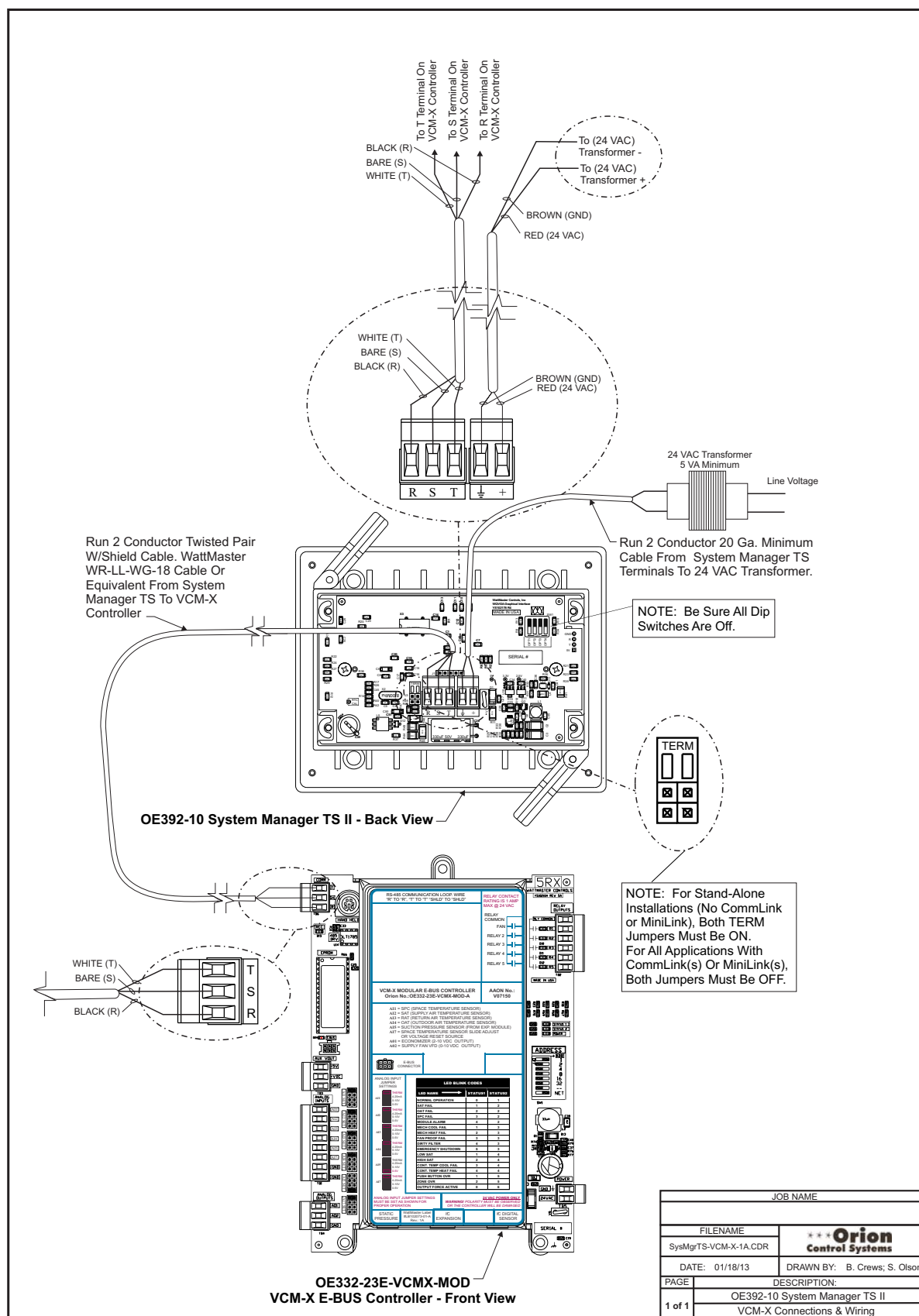


Figure 52: OE392-10 System Manager TS II to VCM-X E-BUS Controller Wiring

System Manager TS II to VAV/Zone Controller Wiring

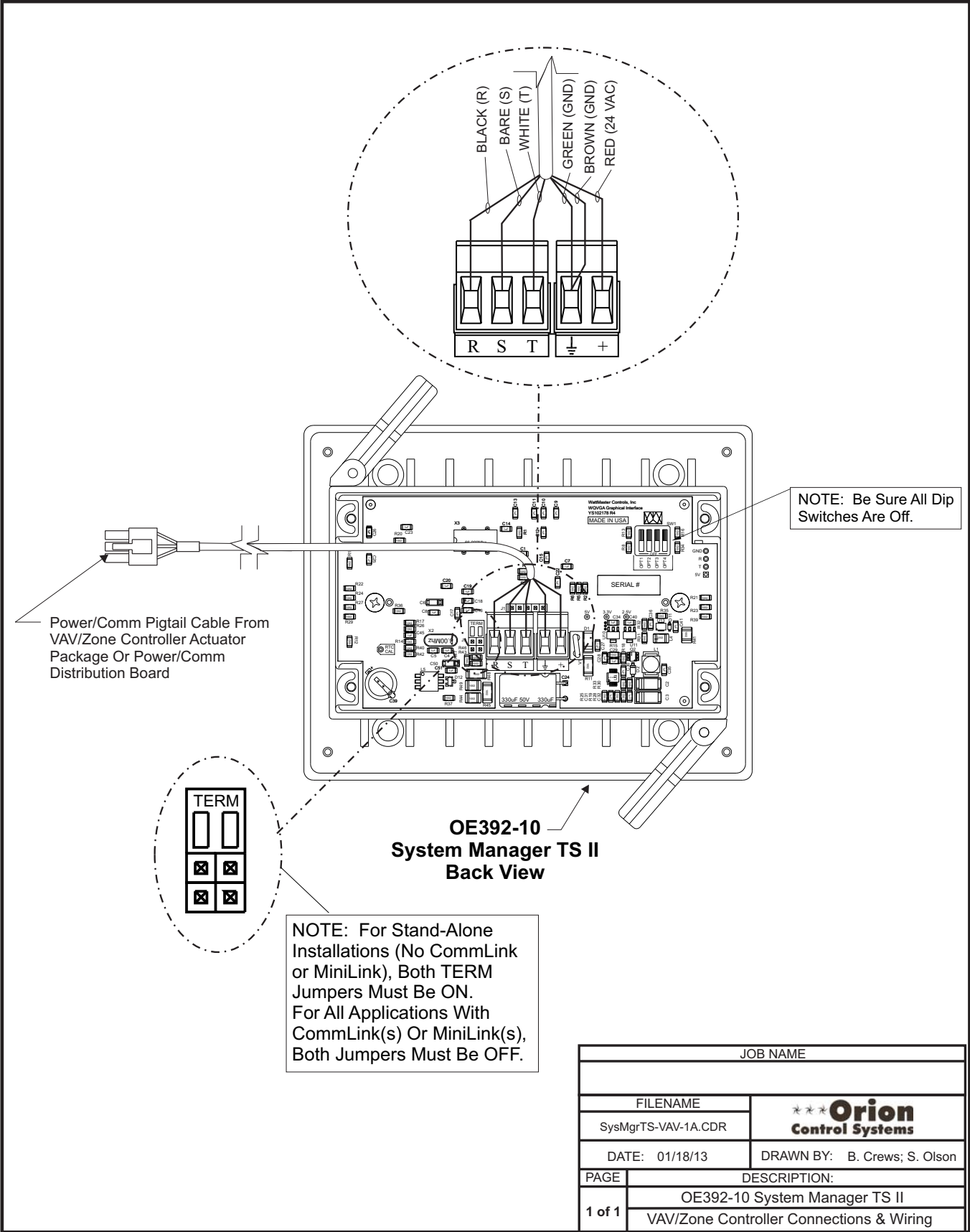


Figure 53: OE392-10 System Manager TS II to VAV/Zone Controller Wiring

CommLink 5 Connections & Wiring

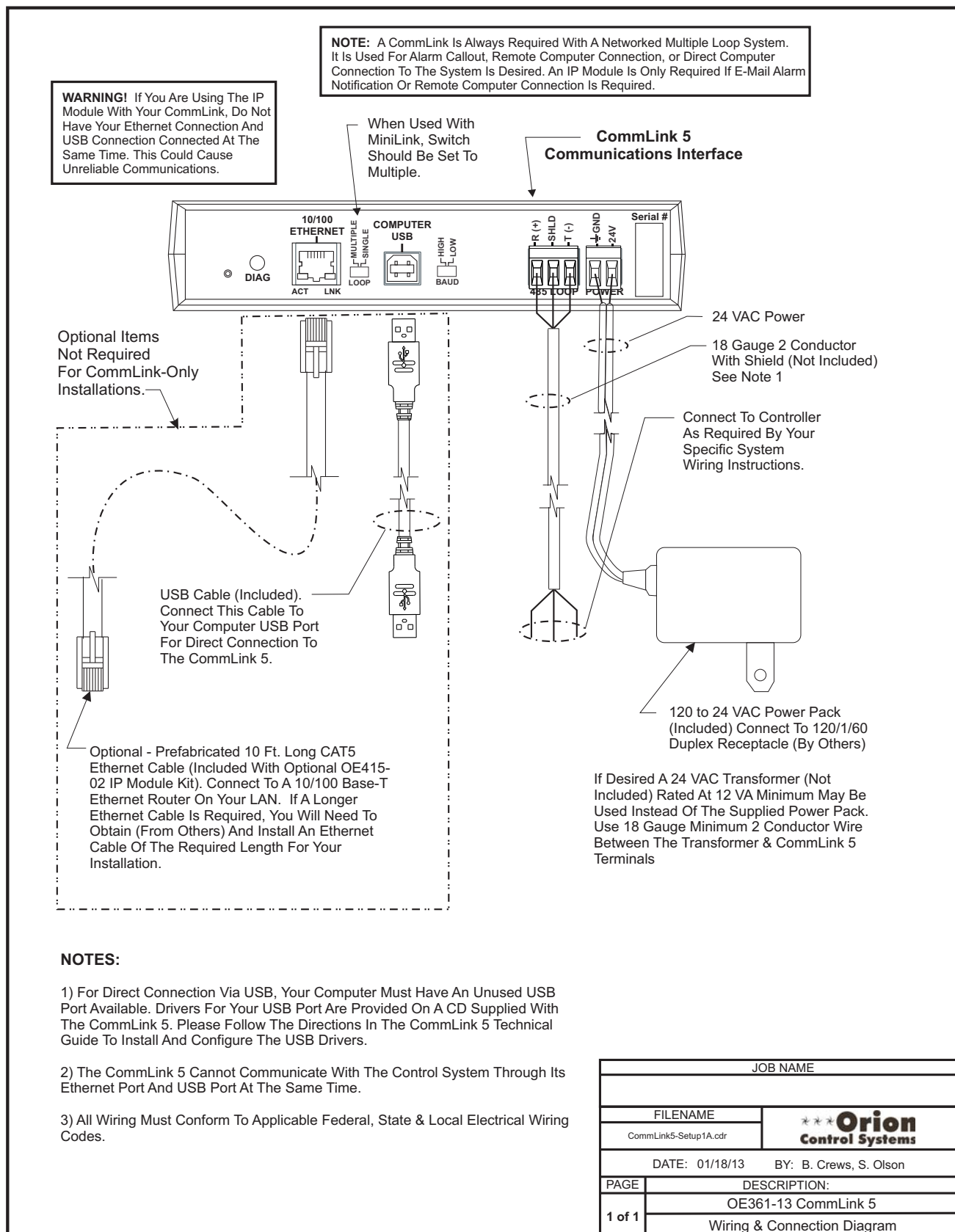


Figure 54: OE361-13 CommLink 5 Computer Connection and Wiring

On-Site Computer Connections & Wiring

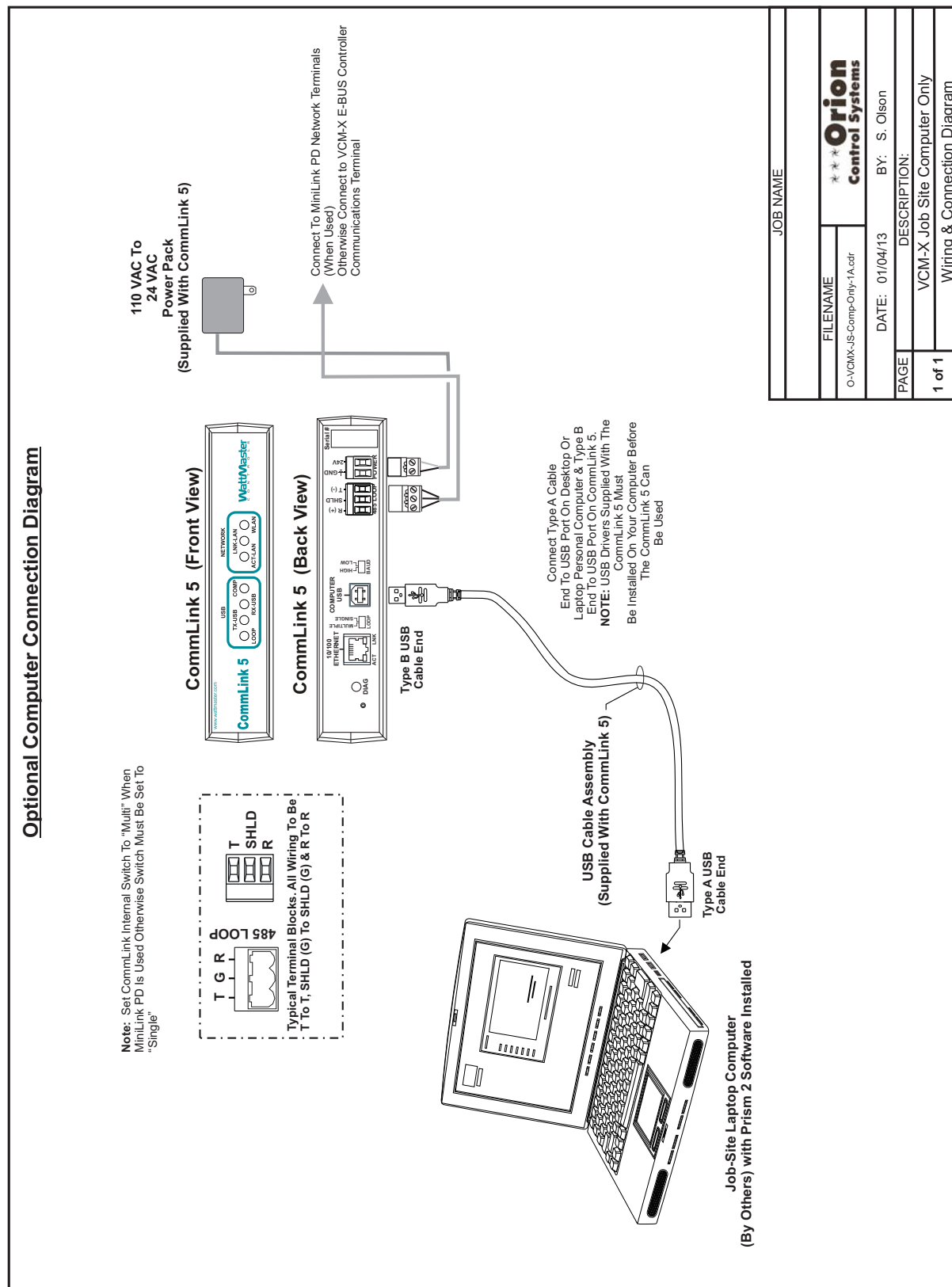


Figure 56: On-Site Computer Connection

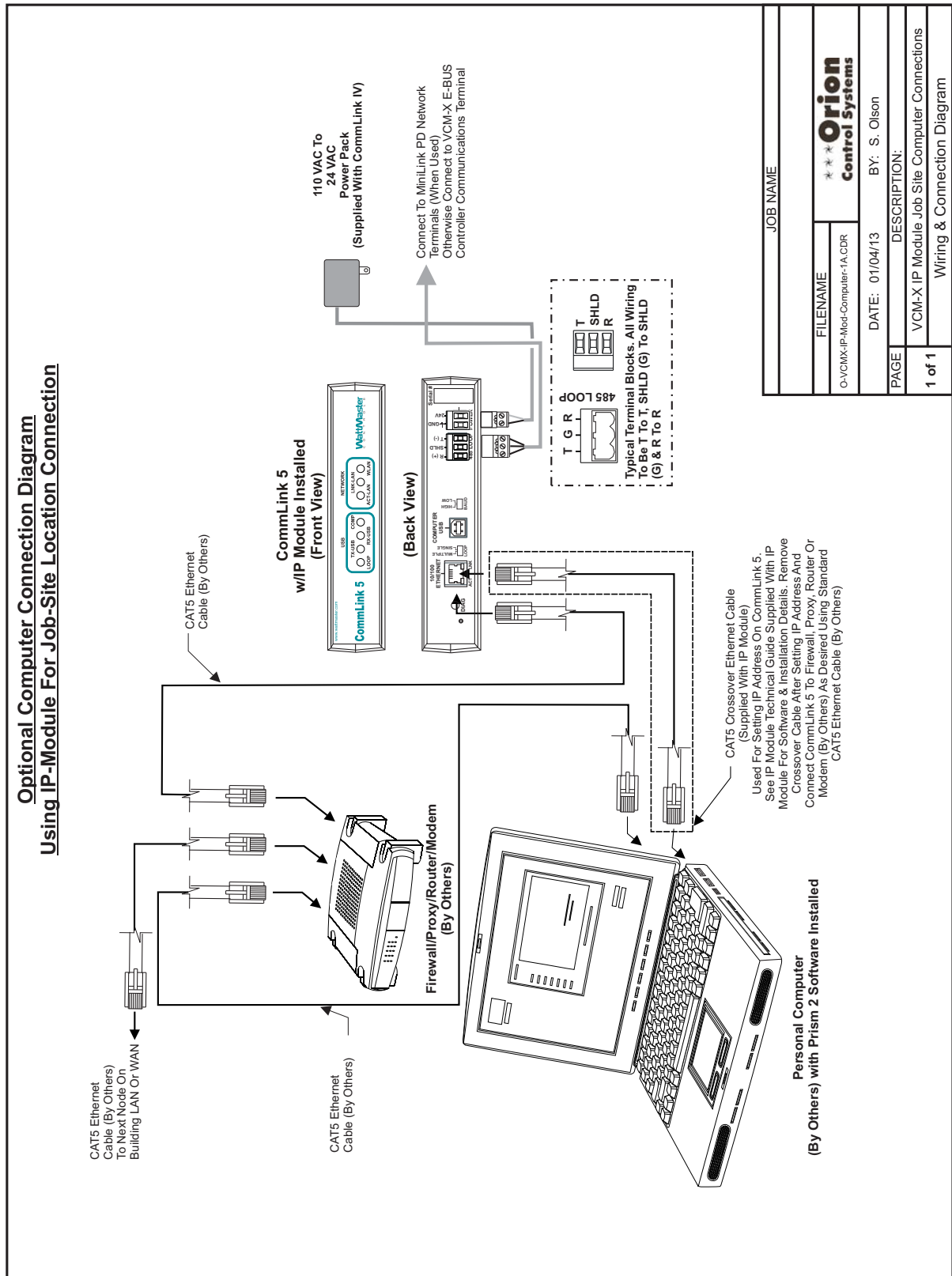


Figure 57: Remote Job-Site Computer Connection

USB-Link 2 Computer Connections & Wiring

Optional USB-Link 2 Connection Diagram

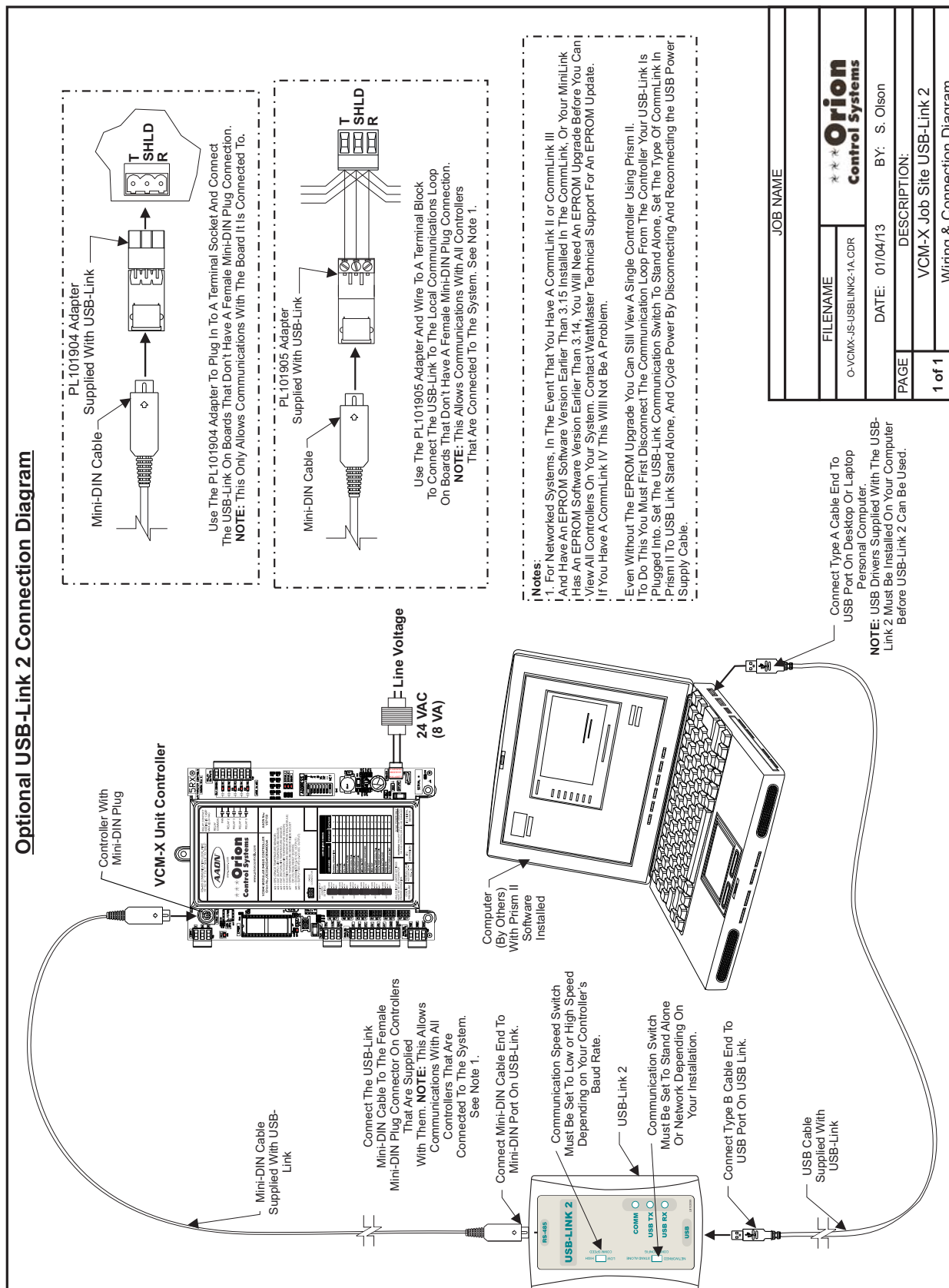


Figure 58: Computer Connections Using USB-Link 2

MiniLink Polling Device Wiring Using Modular Connectors

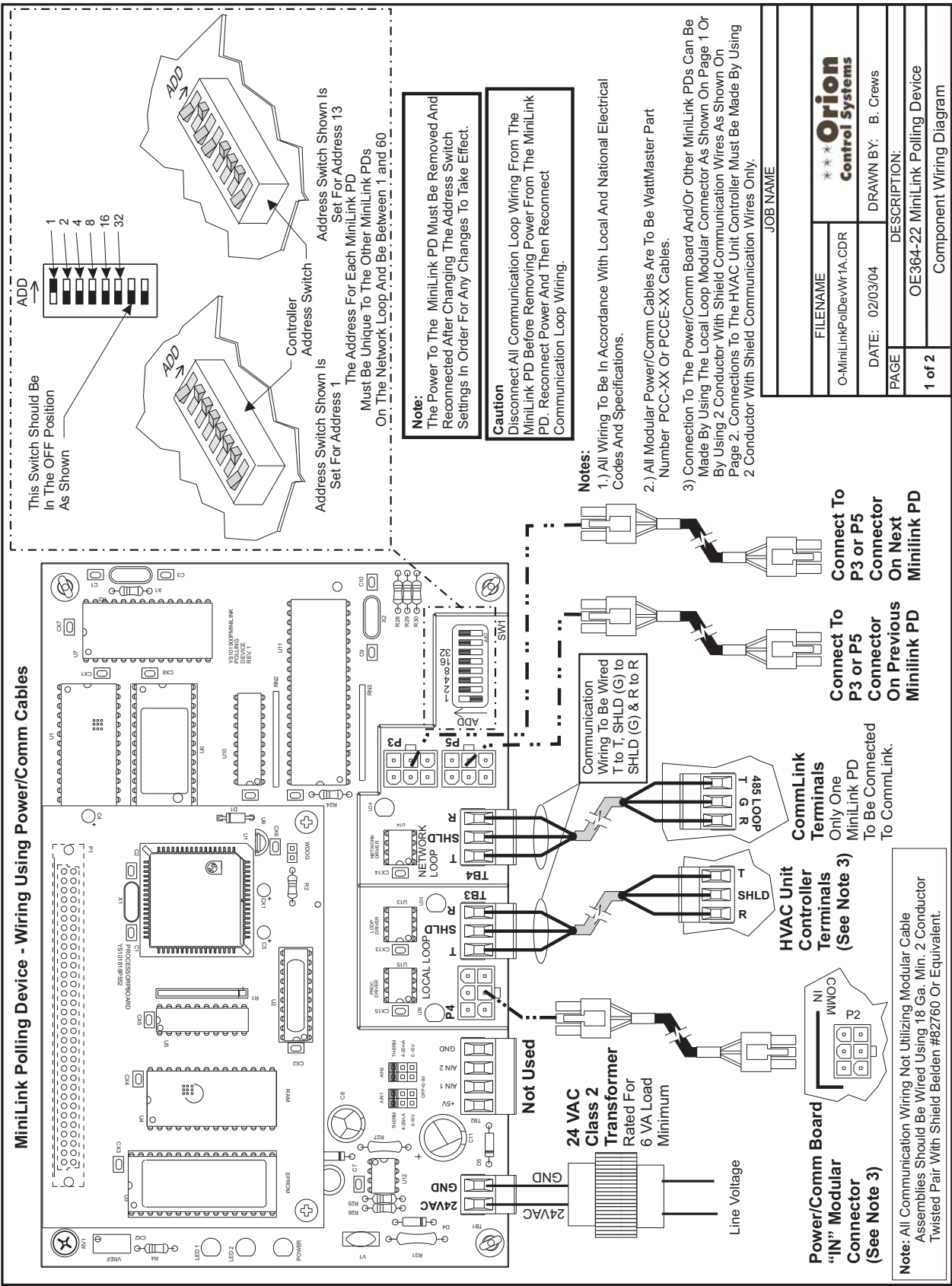


Figure 59: OE364-22 MiniLink Polling Device Wiring Using Modular Connectors

MiniLink Polling Device Wiring Using Wire Terminals

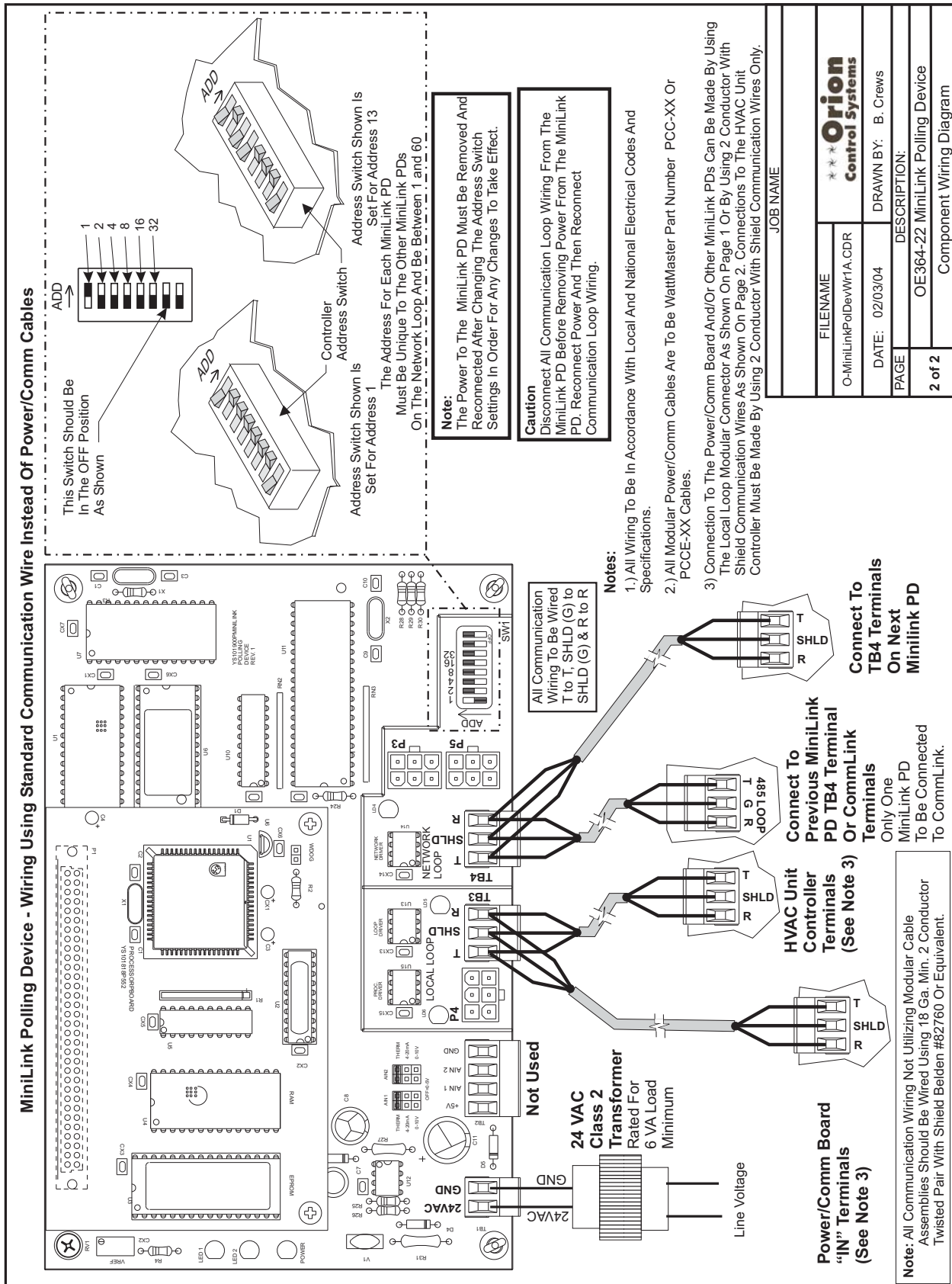


Figure 60: OE364-22 MiniLink Polling Device Wiring Using Wire Terminals

Power/Comm Board Wiring For Local Loops

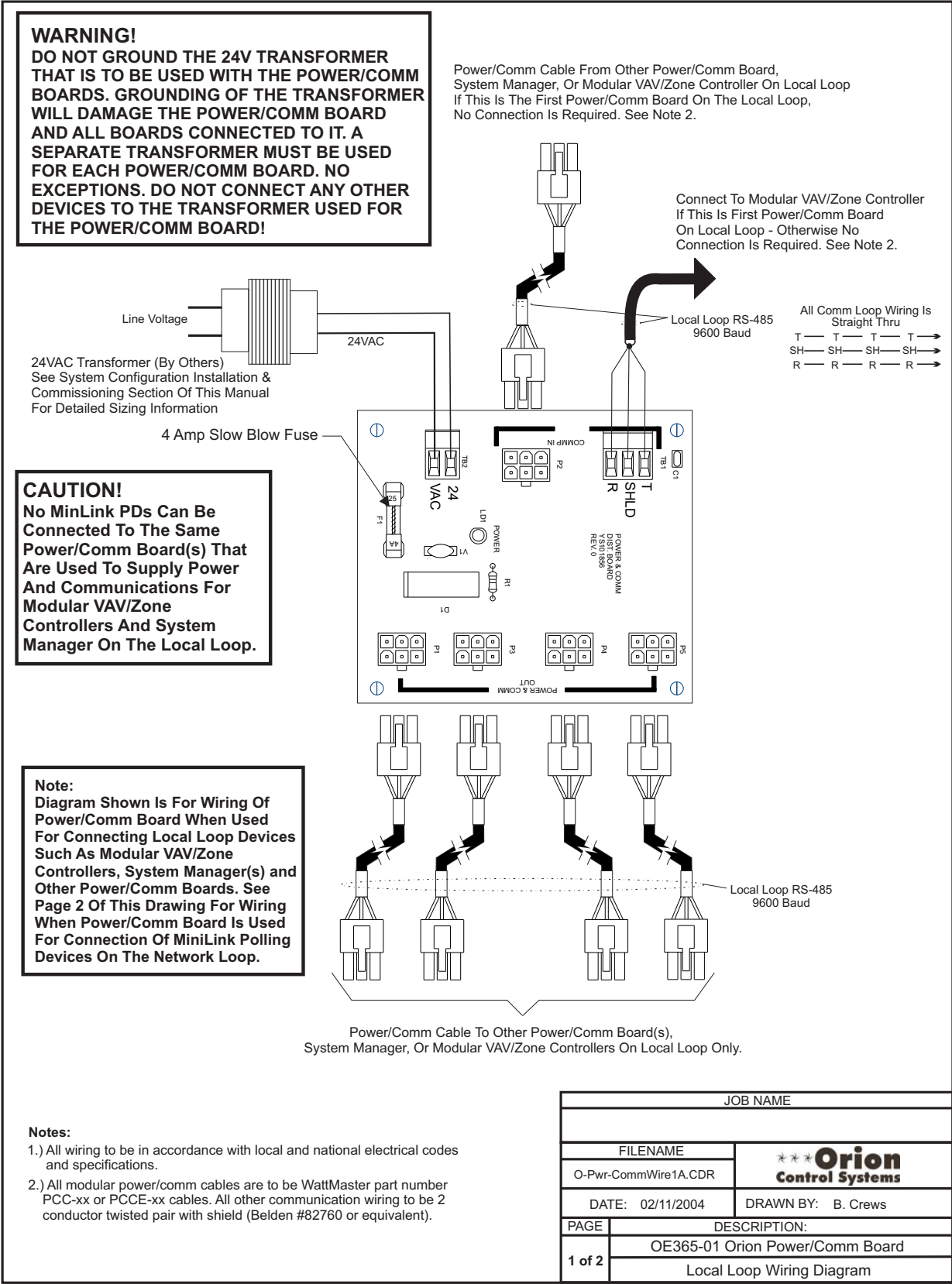


Figure 61: OE365-01 Power/Comm Board Wiring When Used For Local Loop Devices



Add-On Devices Diagrams

Lighting Panel Wiring For Standard Lighting Contactors

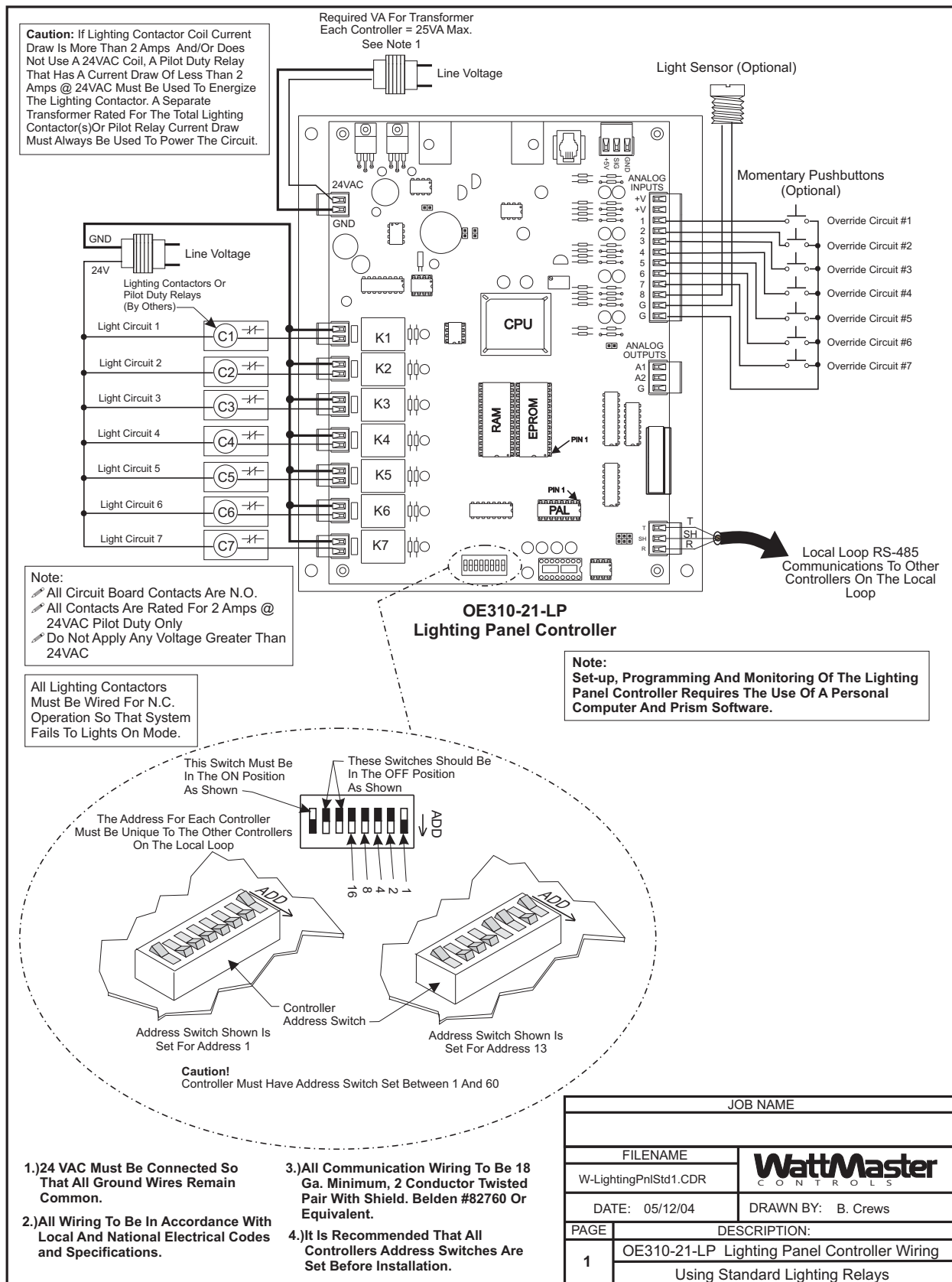
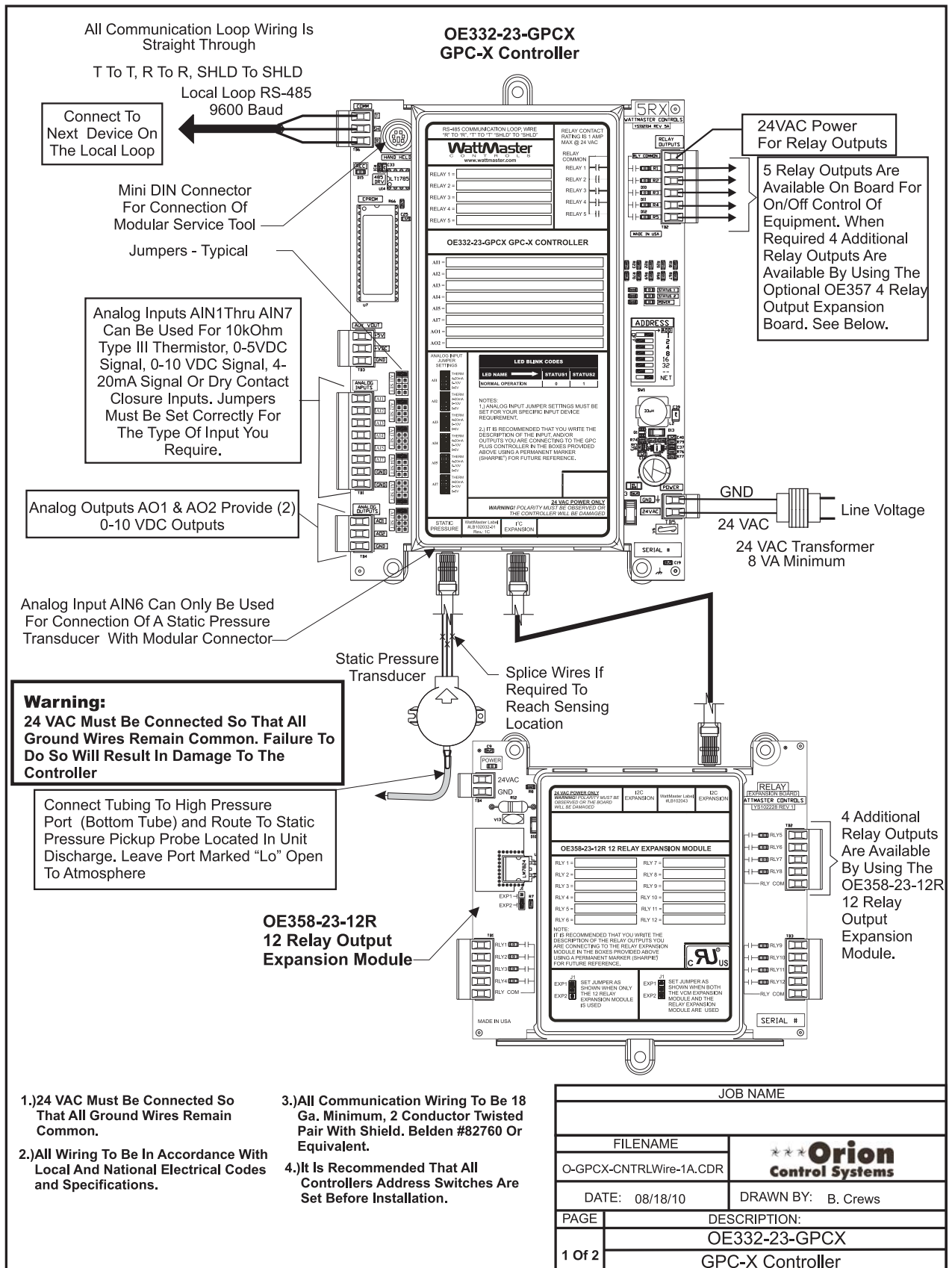


Figure 63: OE310-21-LP Lighting Panel Controller Wiring

GPC-X Controller Wiring



GPC-X Controller - Address Switch Setting

This Switch Should Be In The OFF Position As Shown

ADDRESS → ADD

1
2
4
8
16
32
NET

Controller Address Switch

Address Switch Shown Is Set For Address 1

Address Switch Shown Is Set For Address 13

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

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

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

**OE332-23-GPCX
GPC-X Controller**

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

- All Communication Wiring To Be 18 Ga. Minimum, 2 Conductor Twisted Pair With Shield. Belden #82760 Or Equivalent.
- It Is Recommended That All Controllers Address Switches Are Set Before Installation.

JOB NAME	
FILENAME	<div style="text-align: center;"> </div>
O-GPCX-CNTRLWire-1A.CDR	
DATE: 08/18/10	DRAWN BY: B. Crews
PAGE	DESCRIPTION:
2 Of 2	OE332-23-GPCX
	GPC-X Controller

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

GPC-XP Controller Wiring

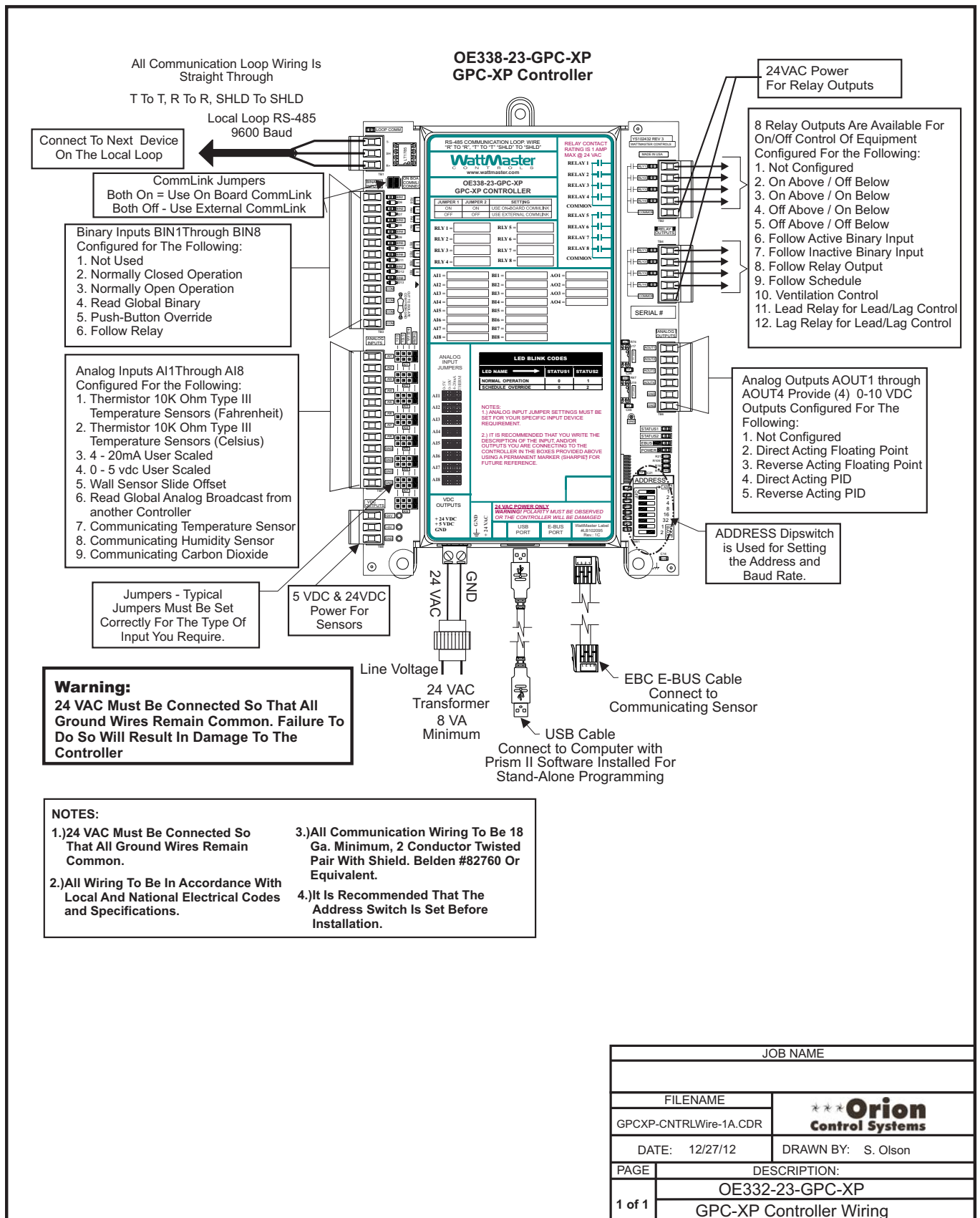


Figure 66: OE332-23-GPCXP GPC-XP Controller Wiring

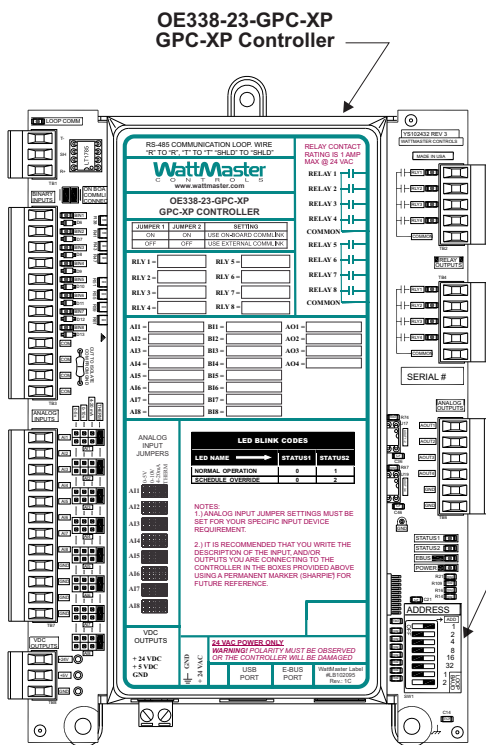
GPC-XP Controller Addressing & Baud Rate Selection

Caution:

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

Note:

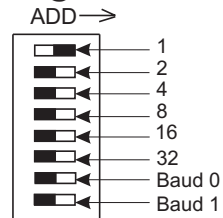
The Power To The Controller Must Be Removed And Reconnected After Changing The Address Switch Settings In Order For Any Changes To Take Effect.



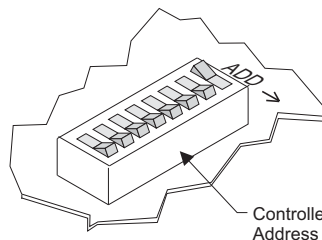
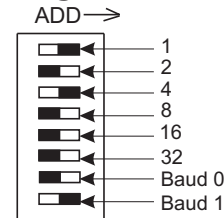
BAUD RATE SELECTION

Baud	Switch 7	Switch 8	Communication Setting
9600	OFF	OFF	CommLink IV
57600	OFF	ON	CommLink 5 & Stand Alone

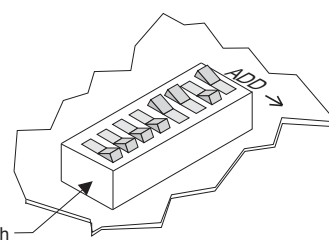
Address 1 @ 9600 Baud



Address 5 @ 57,600 Baud



Address Switch Shown Is Set For Address 1



Address Switch Shown Is Set For Address 13

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

JOB NAME	
FILENAME	
GPCXP-AddressSwitchSet-1A.CDR	
DATE: 12/27/12	DRAWN BY: S. Olson
PAGE	DESCRIPTION:
1 of 1	OE332-23-GPC-XP
GPC-XP Controller Address & Baud Rate	

Figure 67: OE332-23-GPCXP GPC-XP Controller Addressing & Baud Rate Selection

GPC-XP Controller On-Board CommLink Setting

Caution:

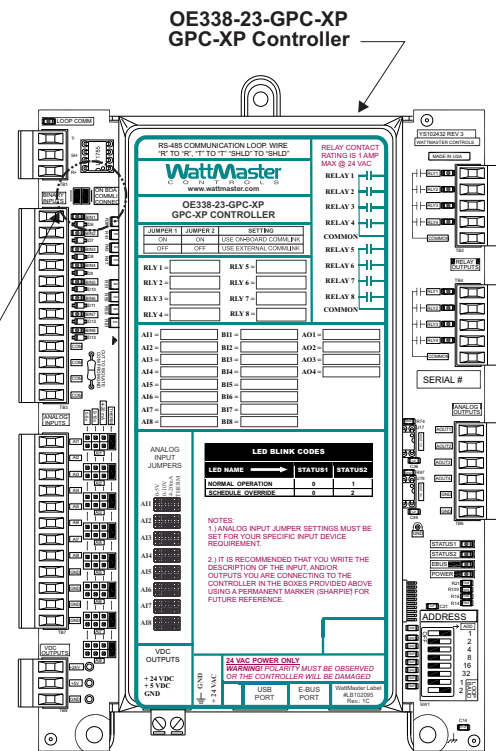
Disconnect All Communication Loop Wiring From The Controller Before Removing Power From The Controller. Reconnect Power And Then Reconnect Communication Loop Wiring.

Note:

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

ON-BOARD COMMLINK SETTING

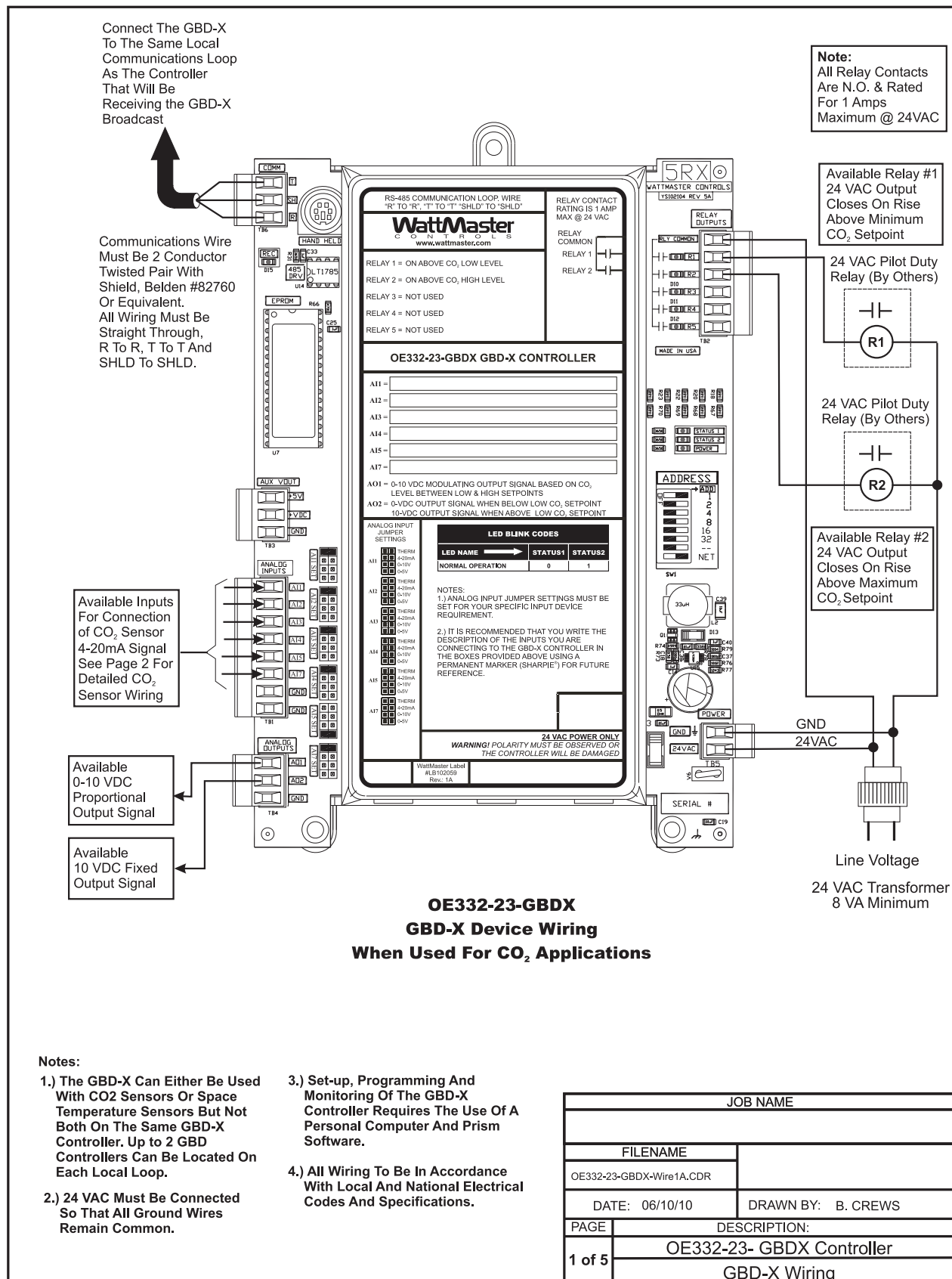
Jumper 1	Jumper 2	Setting
ON	ON	Use On-Board CommLink
OFF	OFF	Use External CommLink

Both Jumpers ON**Both Jumpers OFF**

JOB NAME	
FILENAME	
GPCXP-CommLinkSwitchSet-1A.CDR	
DATE: 12/27/12	DRAWN BY: S. Olson
PAGE	DESCRIPTION:
1 of 1	OE332-23-GPC-XP GPC-XP CommLink Setting

Figure 68: OE332-23-GPCXP GPC-XP Controller On-Board CommLink Setting

GBD-X Controller - CO₂ Applications Wiring

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

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

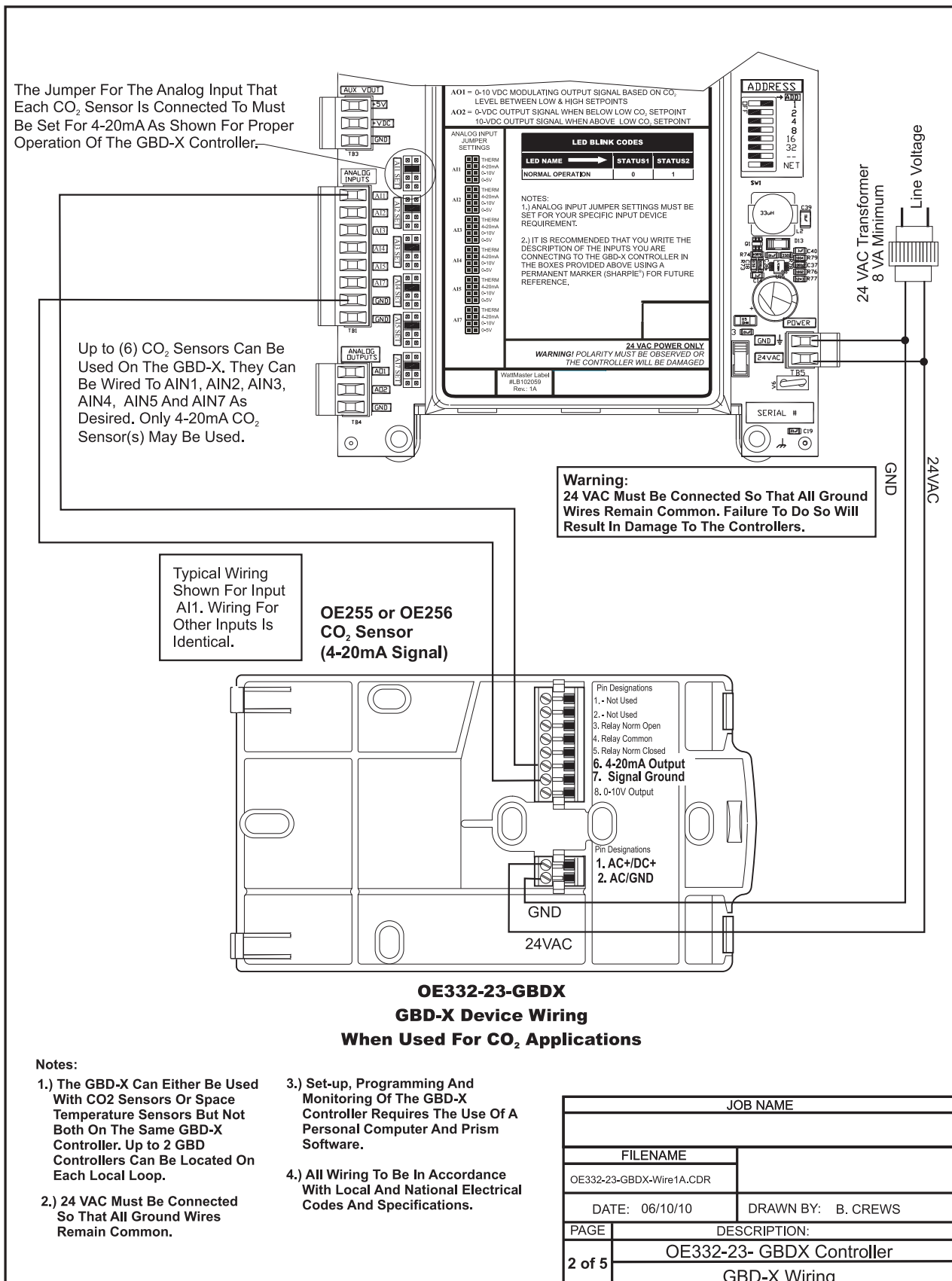


Figure 70: OE332-23-GBDX GBD-X Controller Wiring CO₂ Applications

GBD-X Controller - Space Temp. Sensor Averaging Wiring

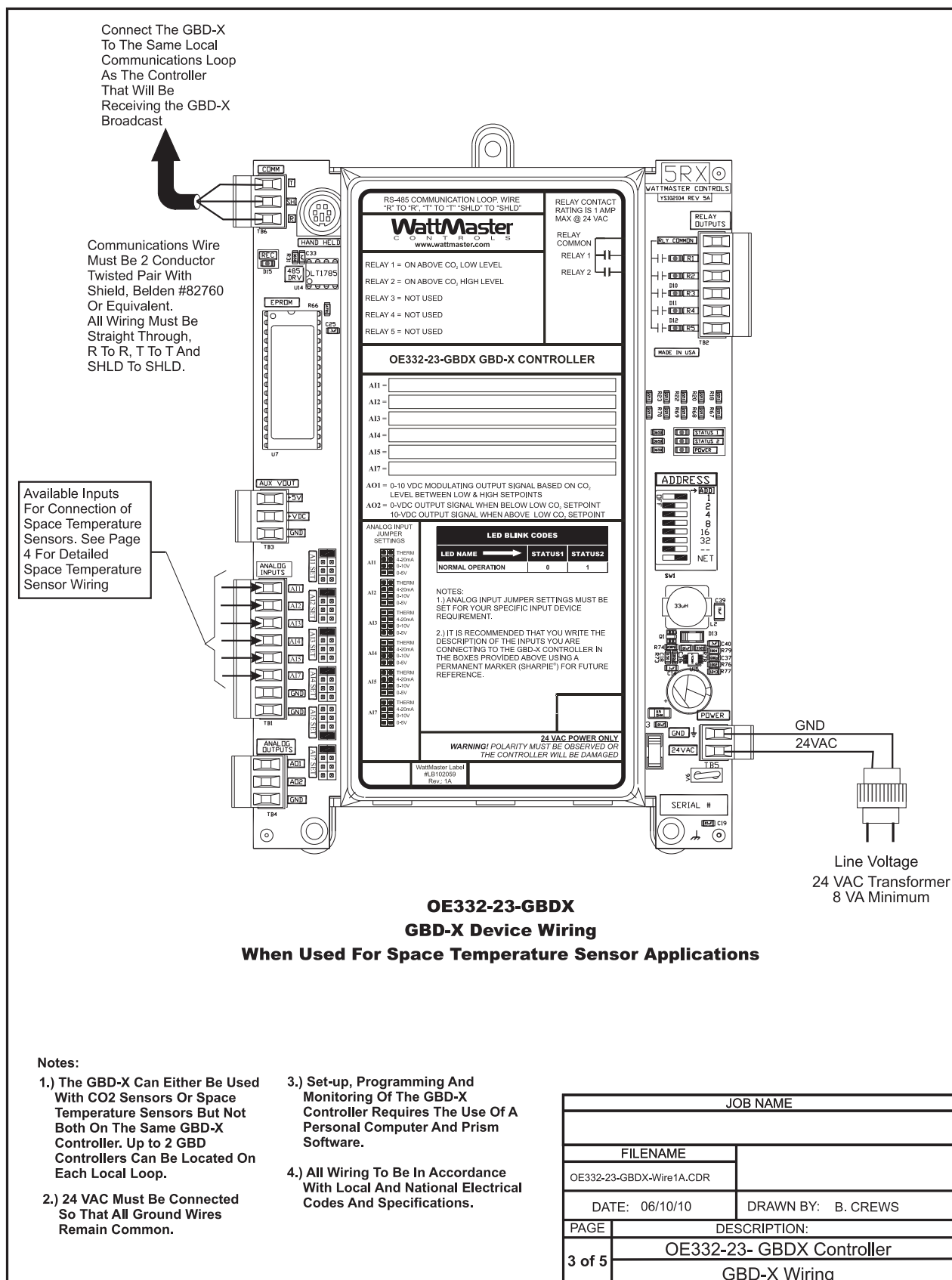


Figure 71: OE332-23-GBDX GBD-X Controller Wiring- Space Temperature Sensor Averaging

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

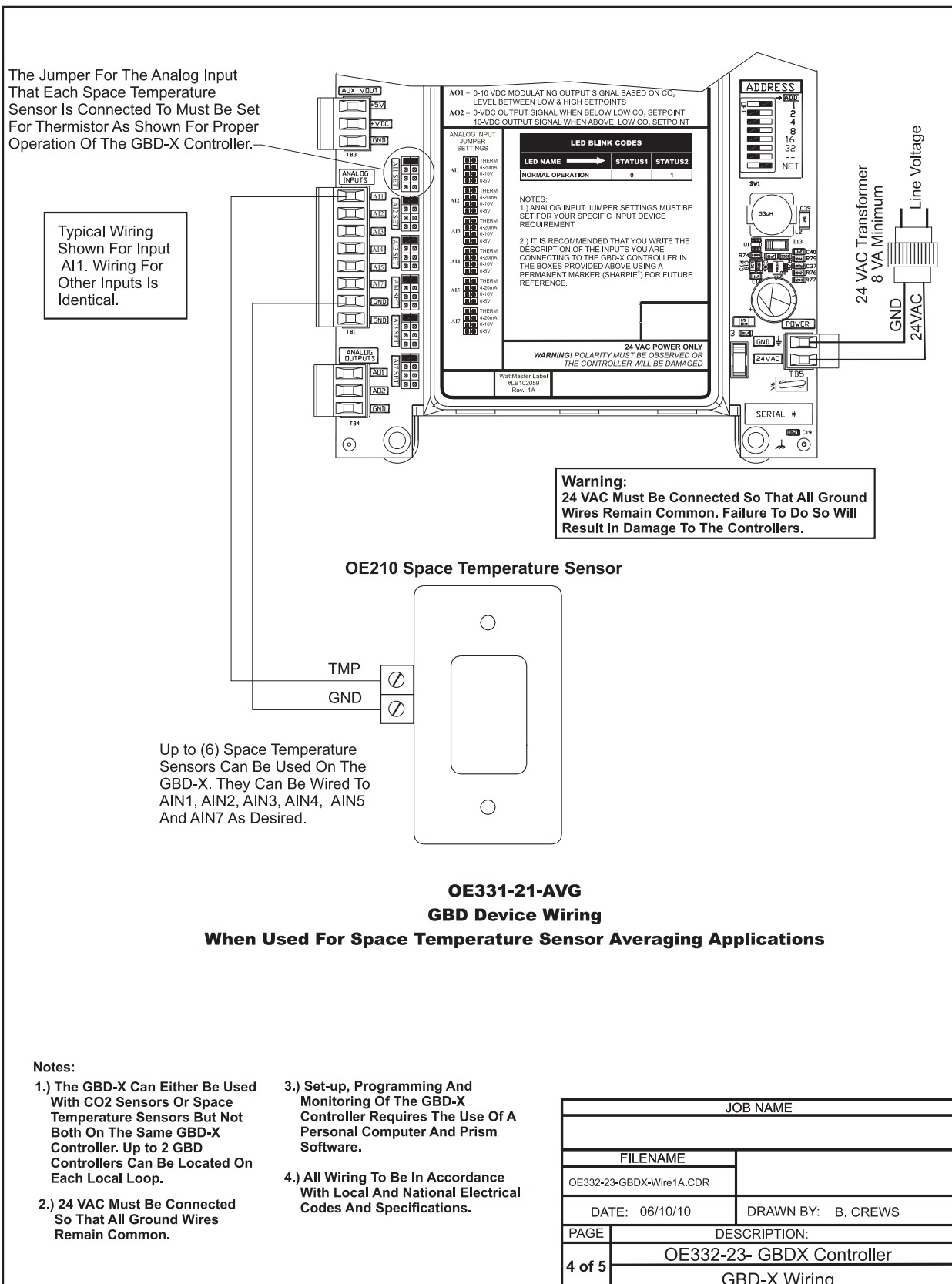


Figure 72: OE332-23-GBDX GBD-X Controller Wiring- Space Temperature Sensor Averaging

GBD-X Controller Address Switch Setting

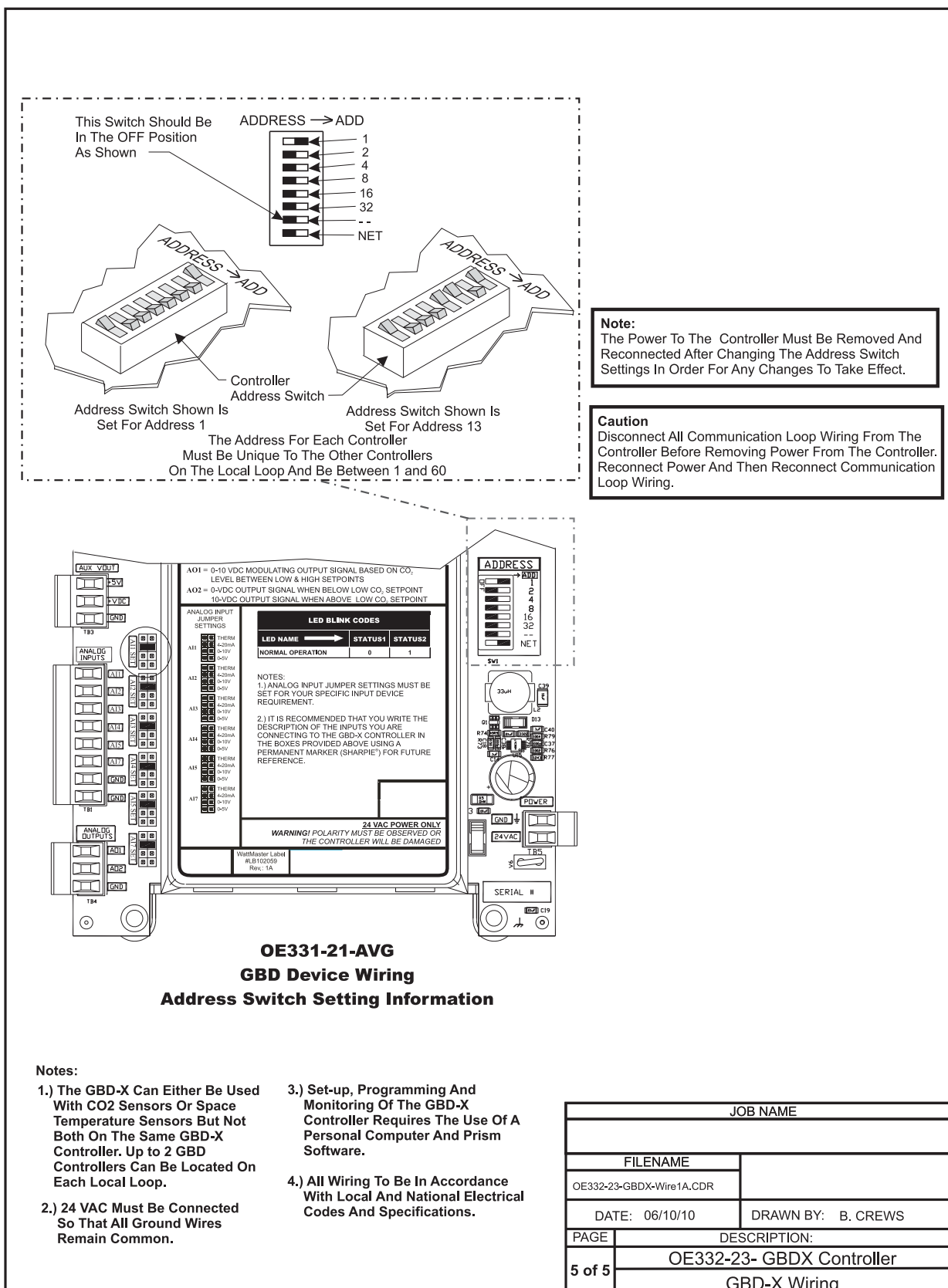


Figure 73: OE332-23-GBDX GBD-X Controller Addressing

Module Wiring & Connections

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

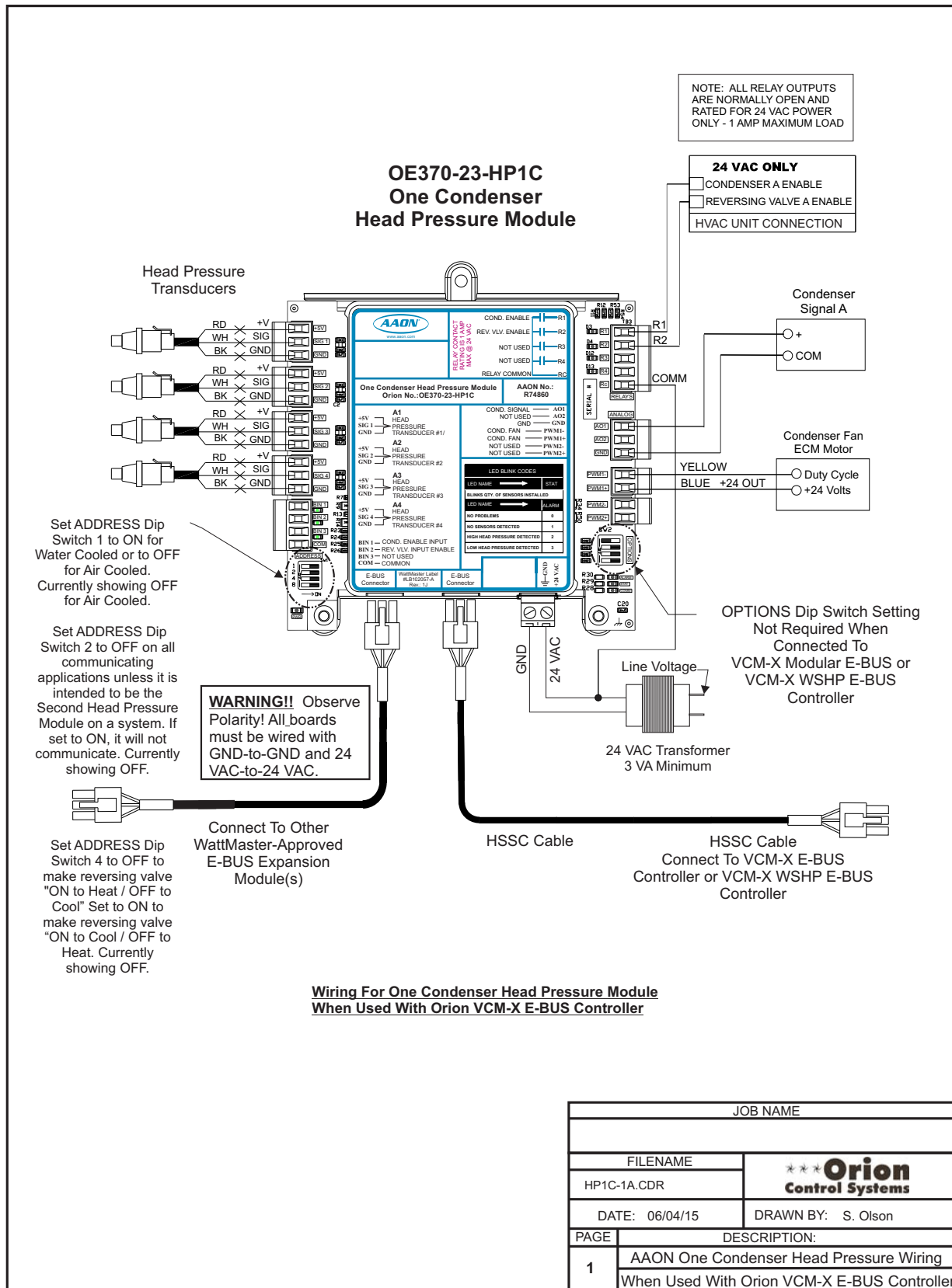


Figure 74: OE370-23-HP1C One Condenser Head Pressure Module to VCM-X E-BUS Controller Wiring

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

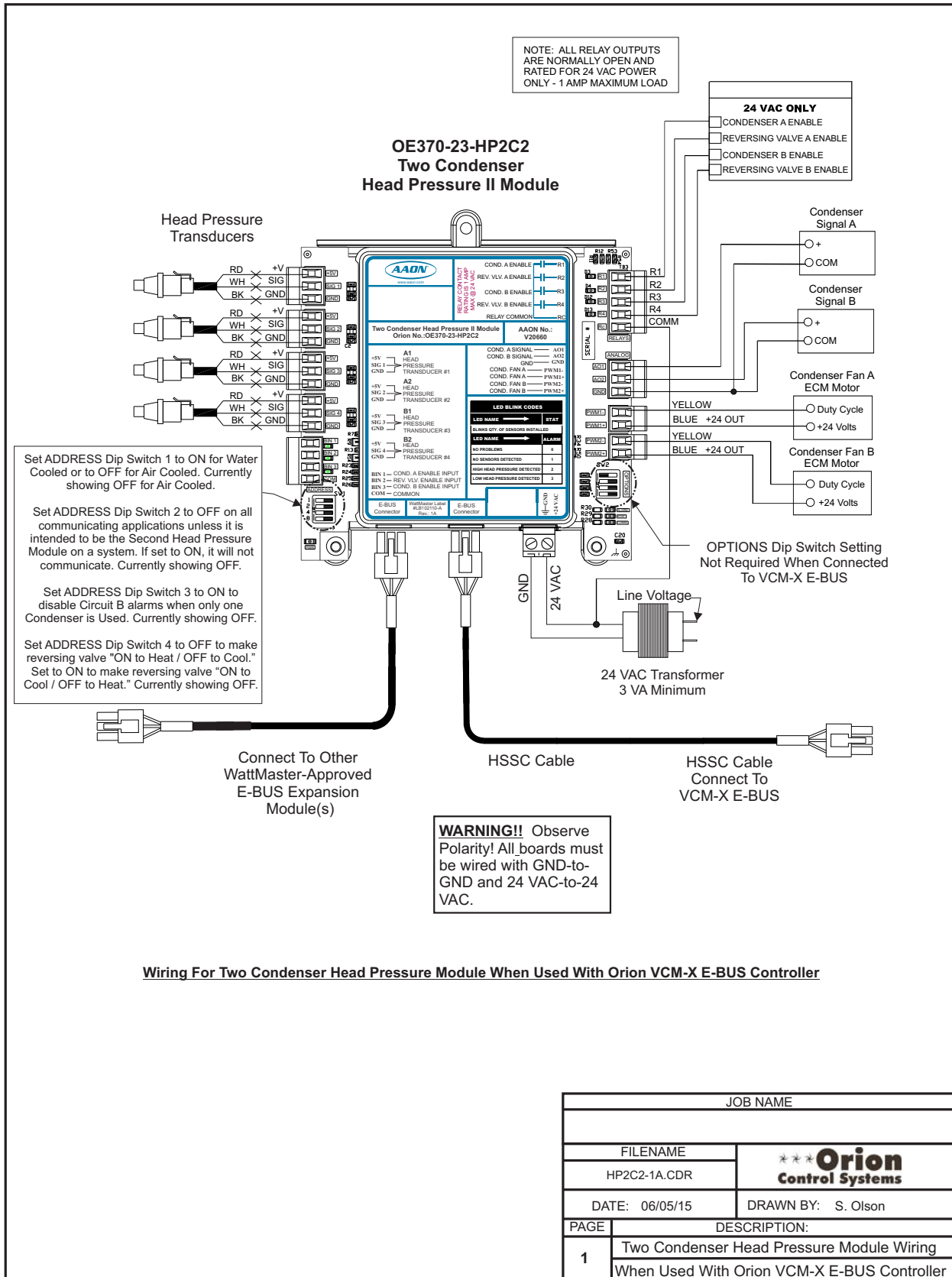


Figure 75: OE370-23-HP2C2 Two Condenser Head Pressure Module to VCM-X E-BUS Controller Wiring

Full Digital Module Wiring When Used With The VCM-X E-BUS

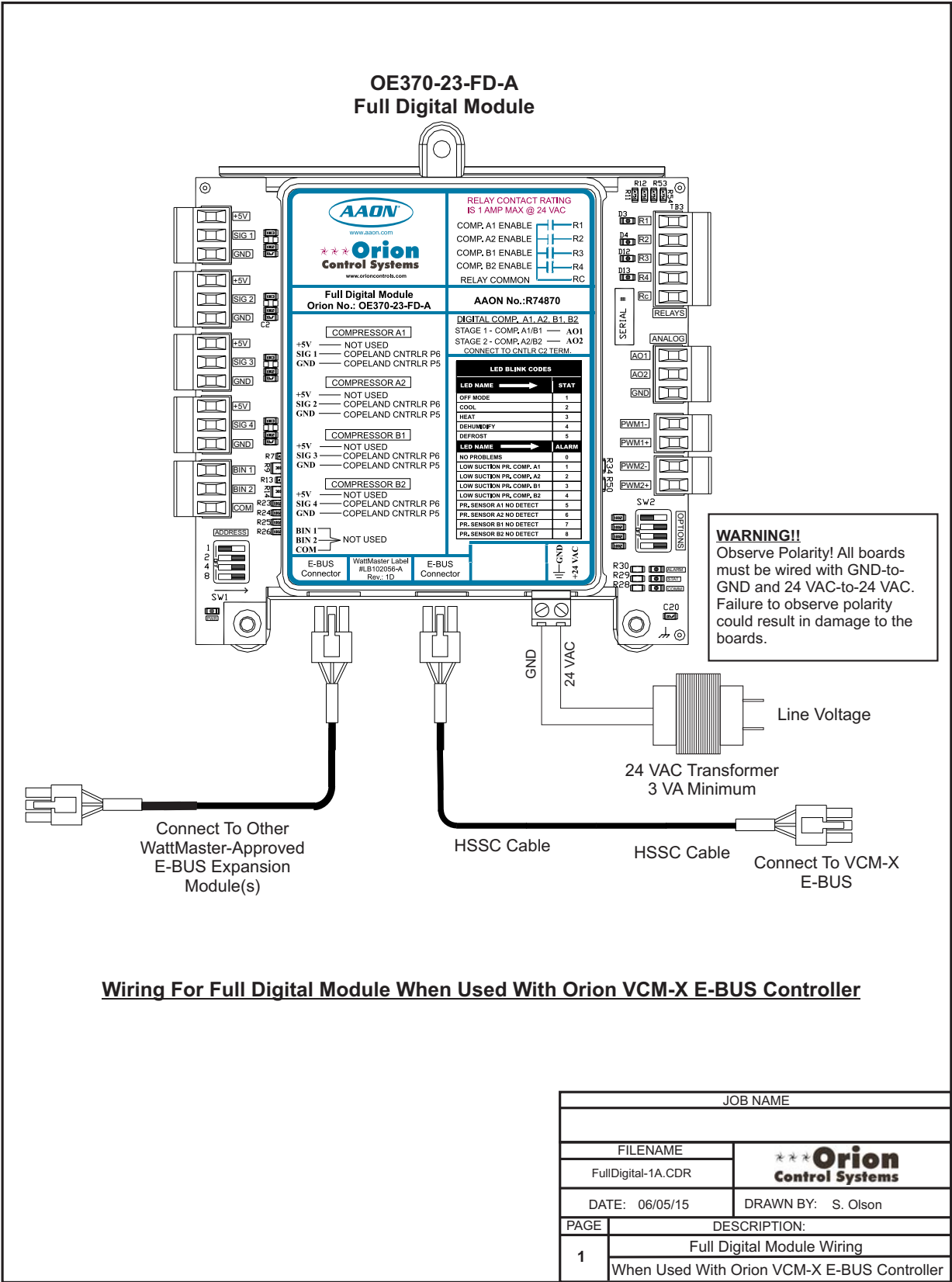


Figure 76: OE370-23-FD-A Full Digital Module to VCM-X E-BUS Controller Wiring

Dual Digital Wiring When Used With The VCM-X E-BUS

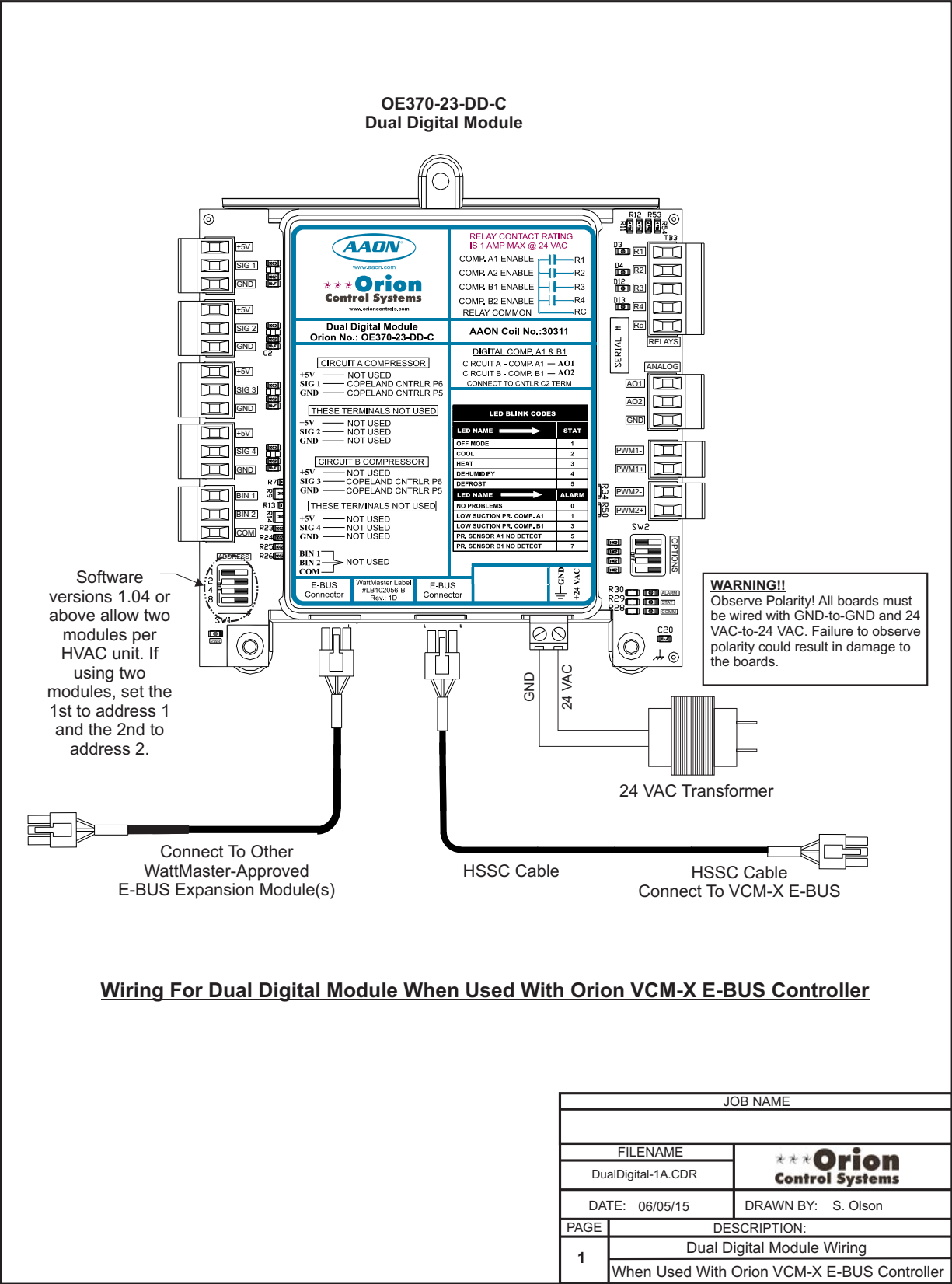


Figure 77: OE370-23-DD-A Dual Digital Module to VCM-X E-BUS Controller Wiring

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

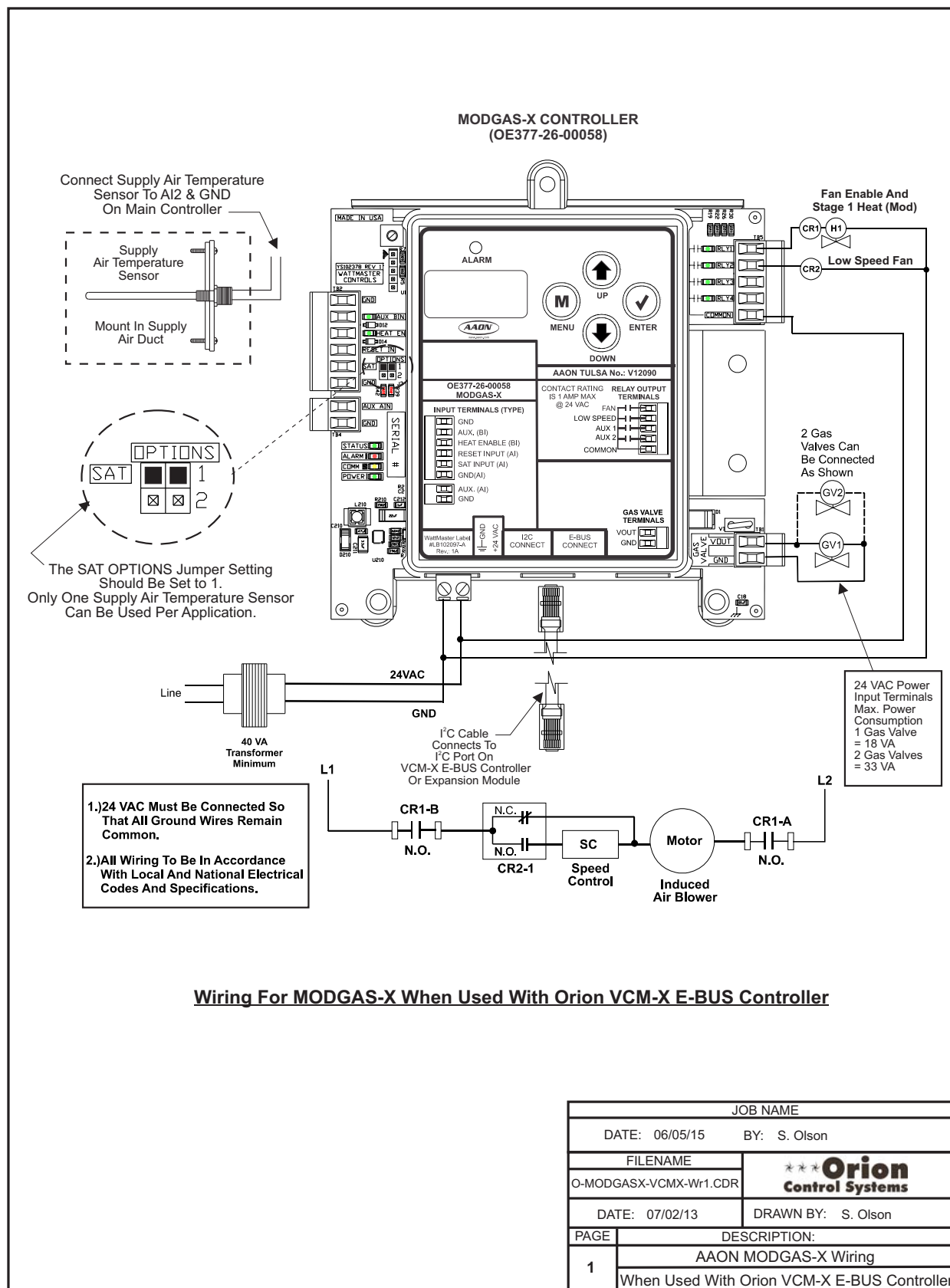


Figure 78: OE377-26-00058 MODGAS-X Controller Single Modulating Valve - No Staging to VCM-X E-BUS Controller Wiring

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

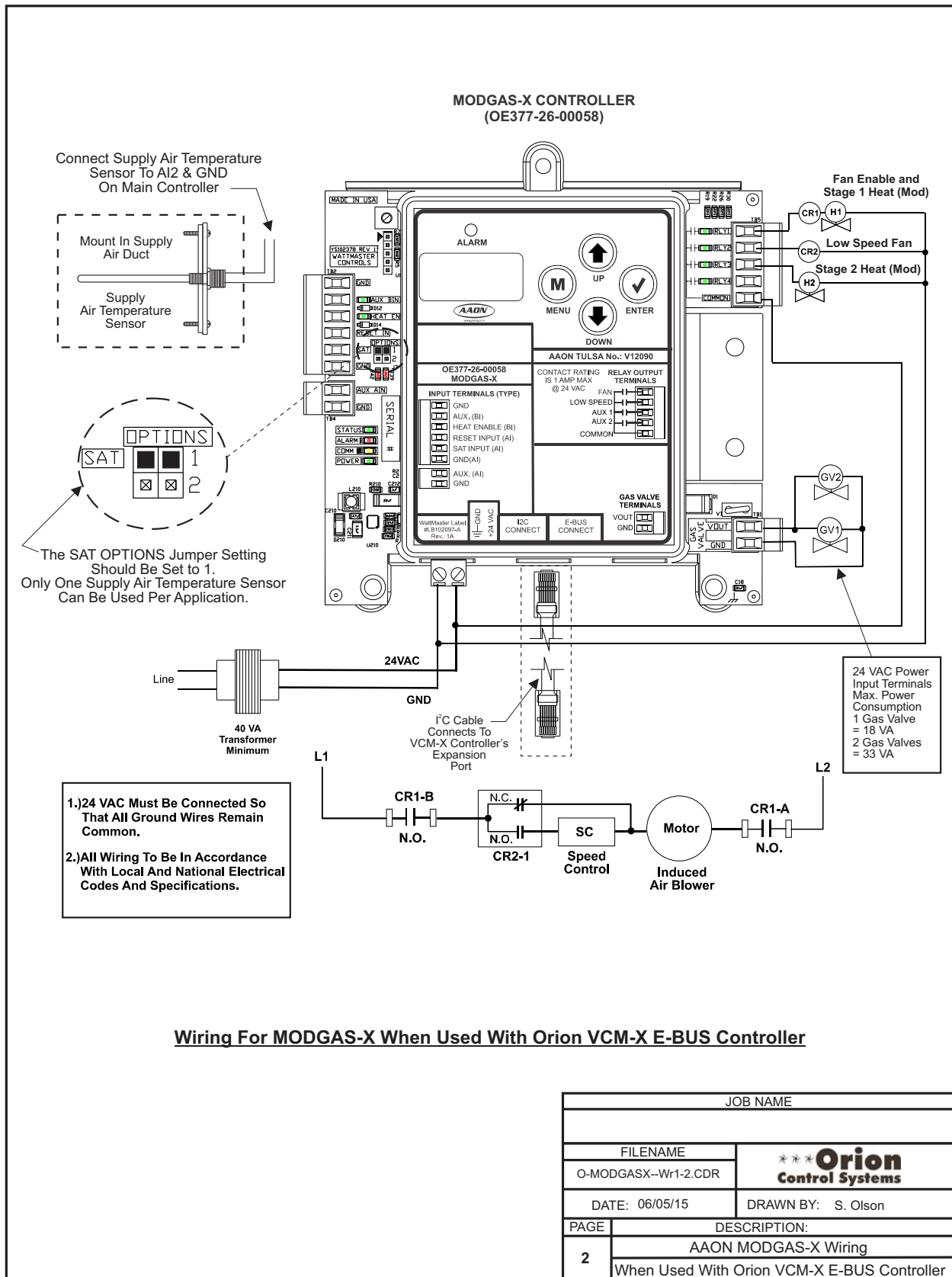


Figure 79: OE377-26-00058 MODGAS-X Controller Two Modulating Staged Valves to VCM-X E-BUS Wiring

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

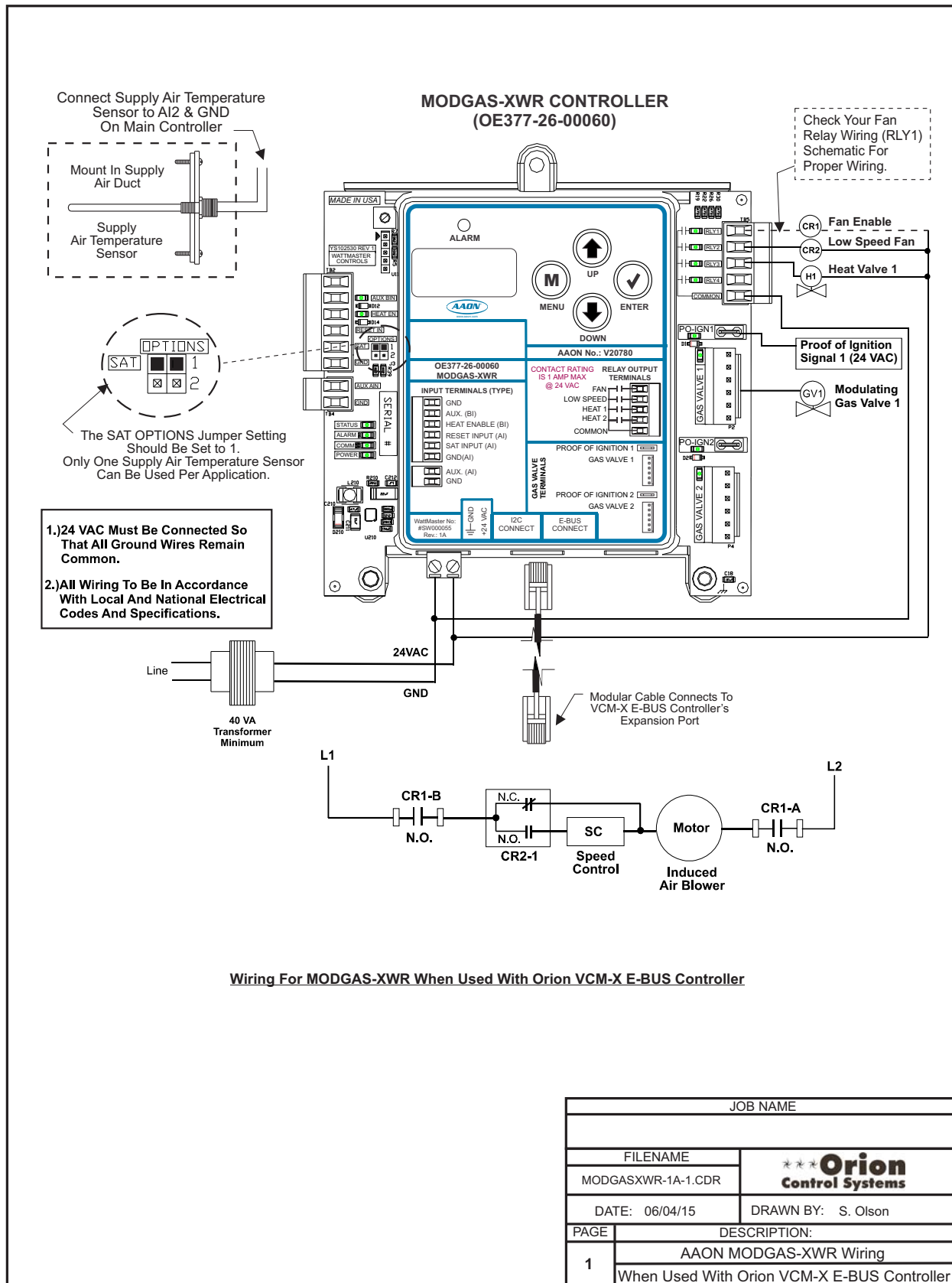


Figure 80: MODGAS-XWR Controller Single Modulating Valve No Staging to VCM-X E-BUS Wiring

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

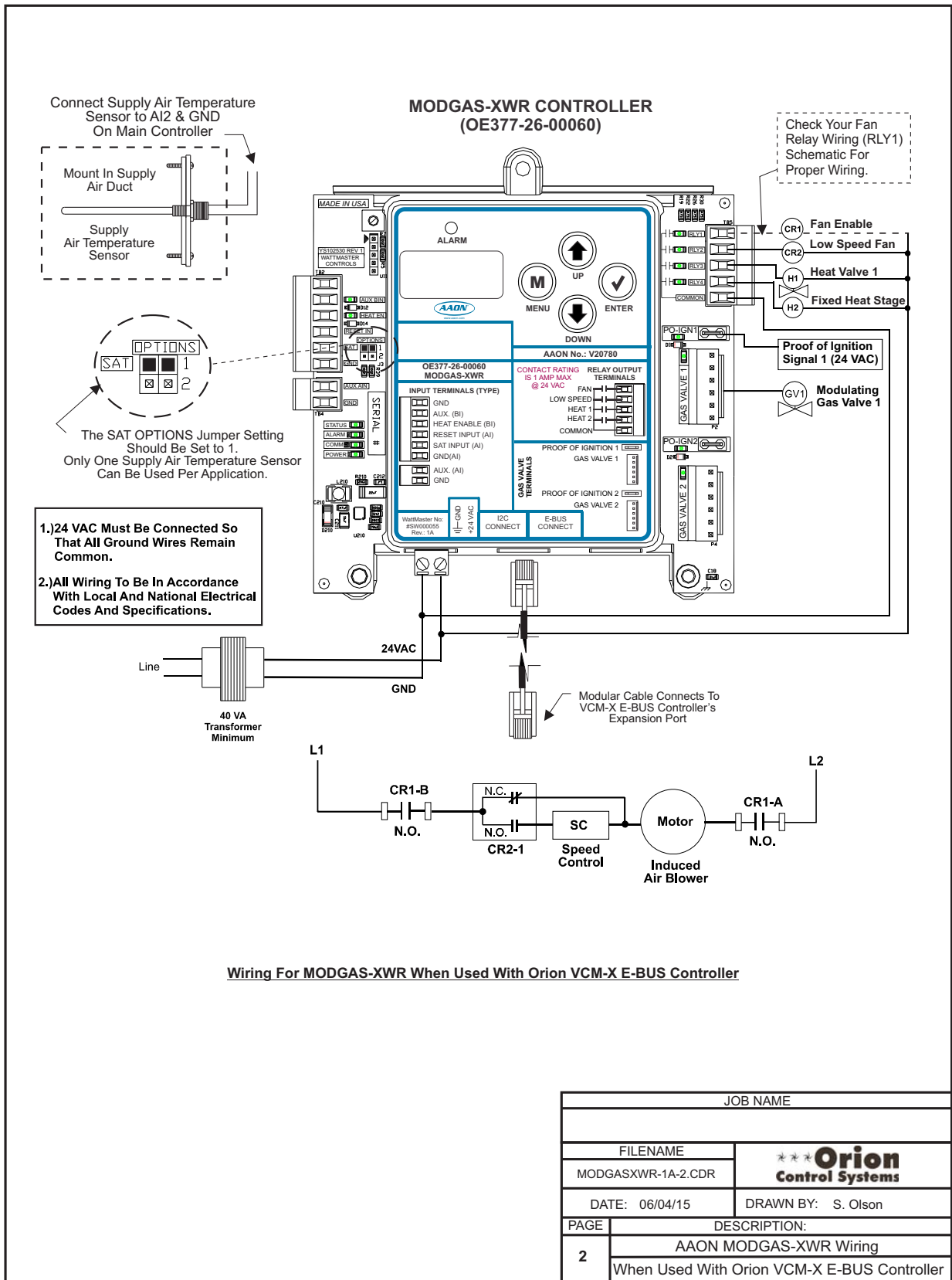


Figure 81: MODGAS-XWR Controller Single Modulating Valve & 1 Fixed Stage to VCM-X E-BUS Wiring

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

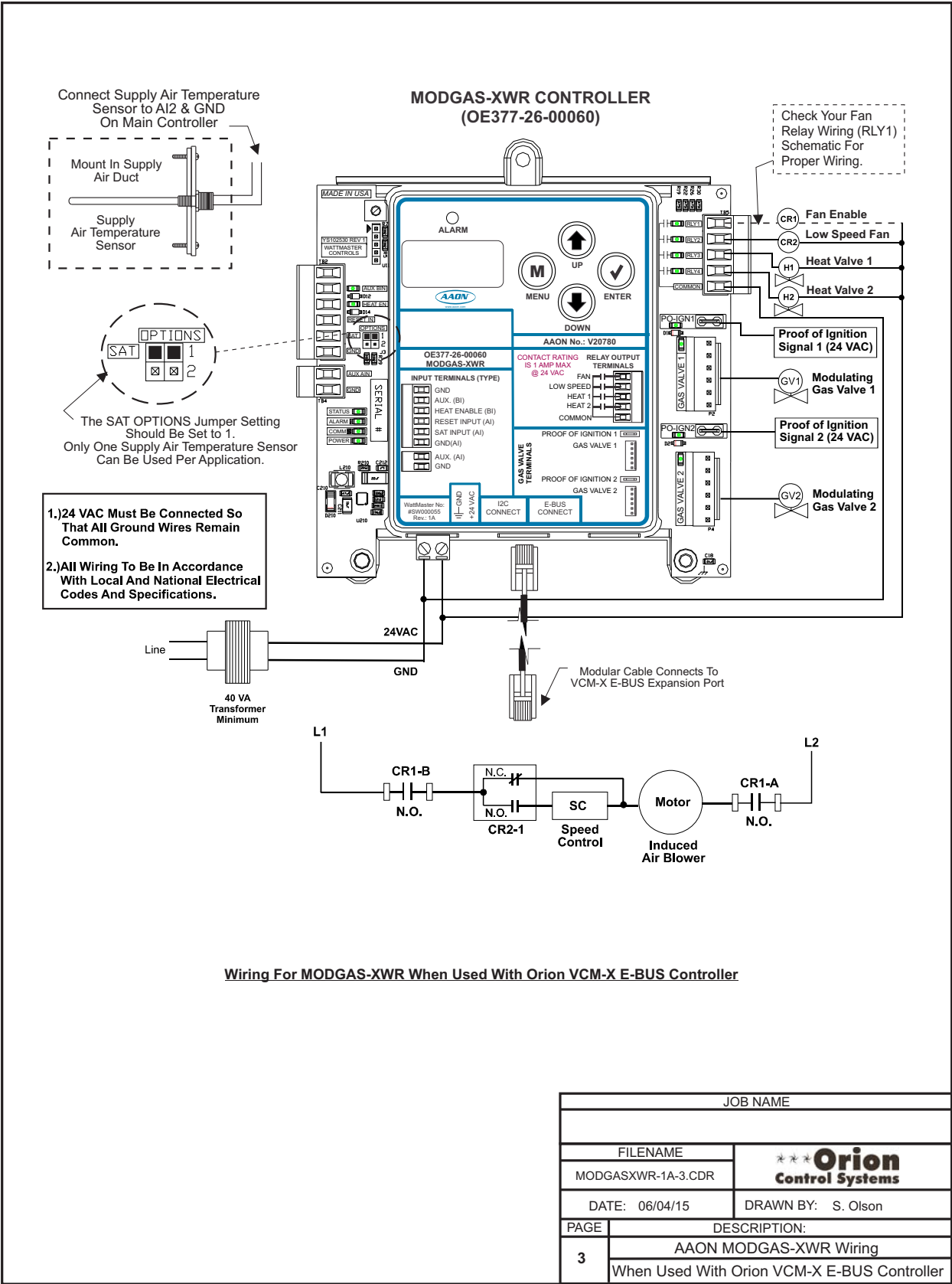


Figure 82: MODGAS-XWR Controller Two Modulating Valves Staged to VCM-X E-BUS Wiring

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

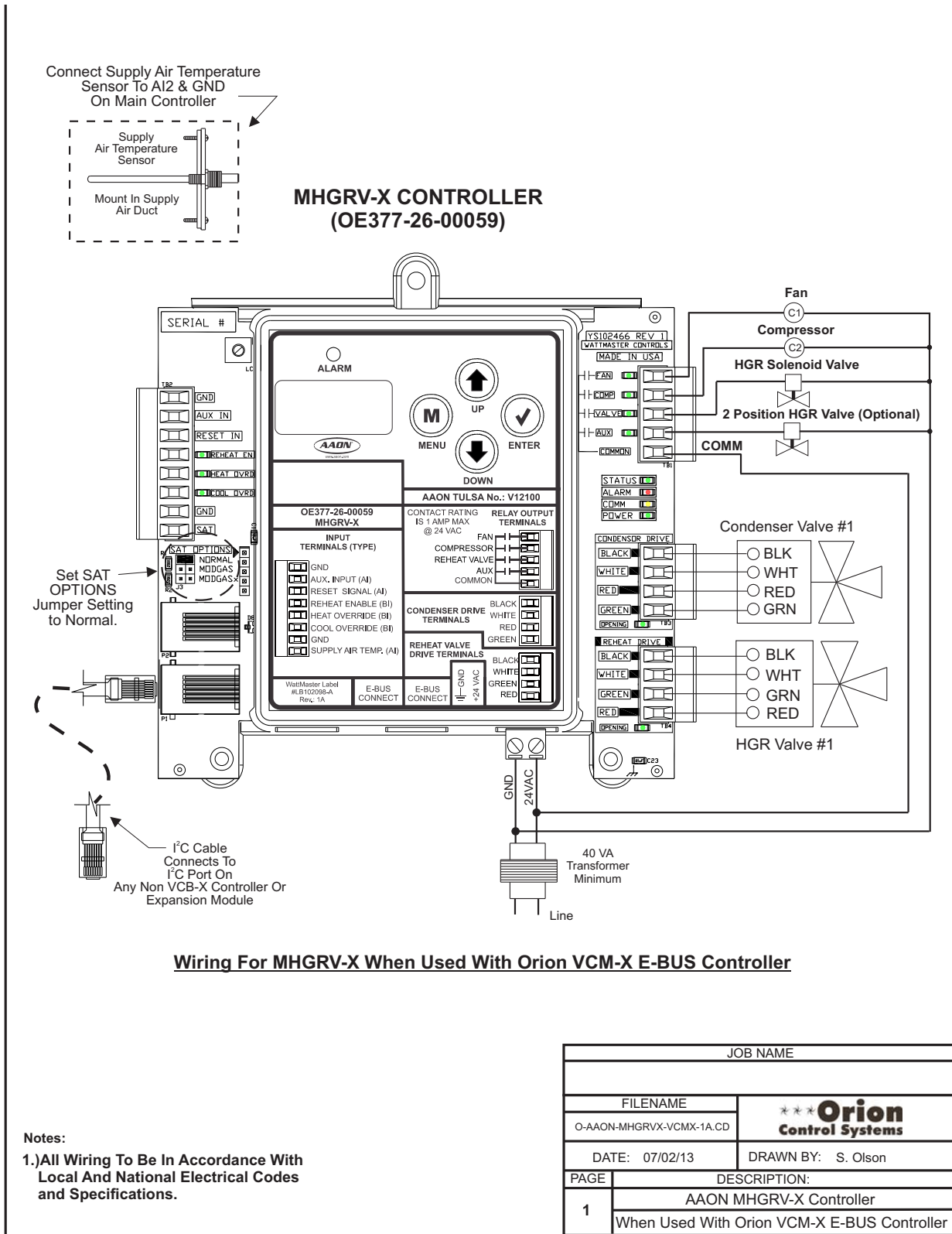


Figure 83: OE377-26-00059 MHGRV-X Controller to VCM-X E-BUS Controller Wiring

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



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

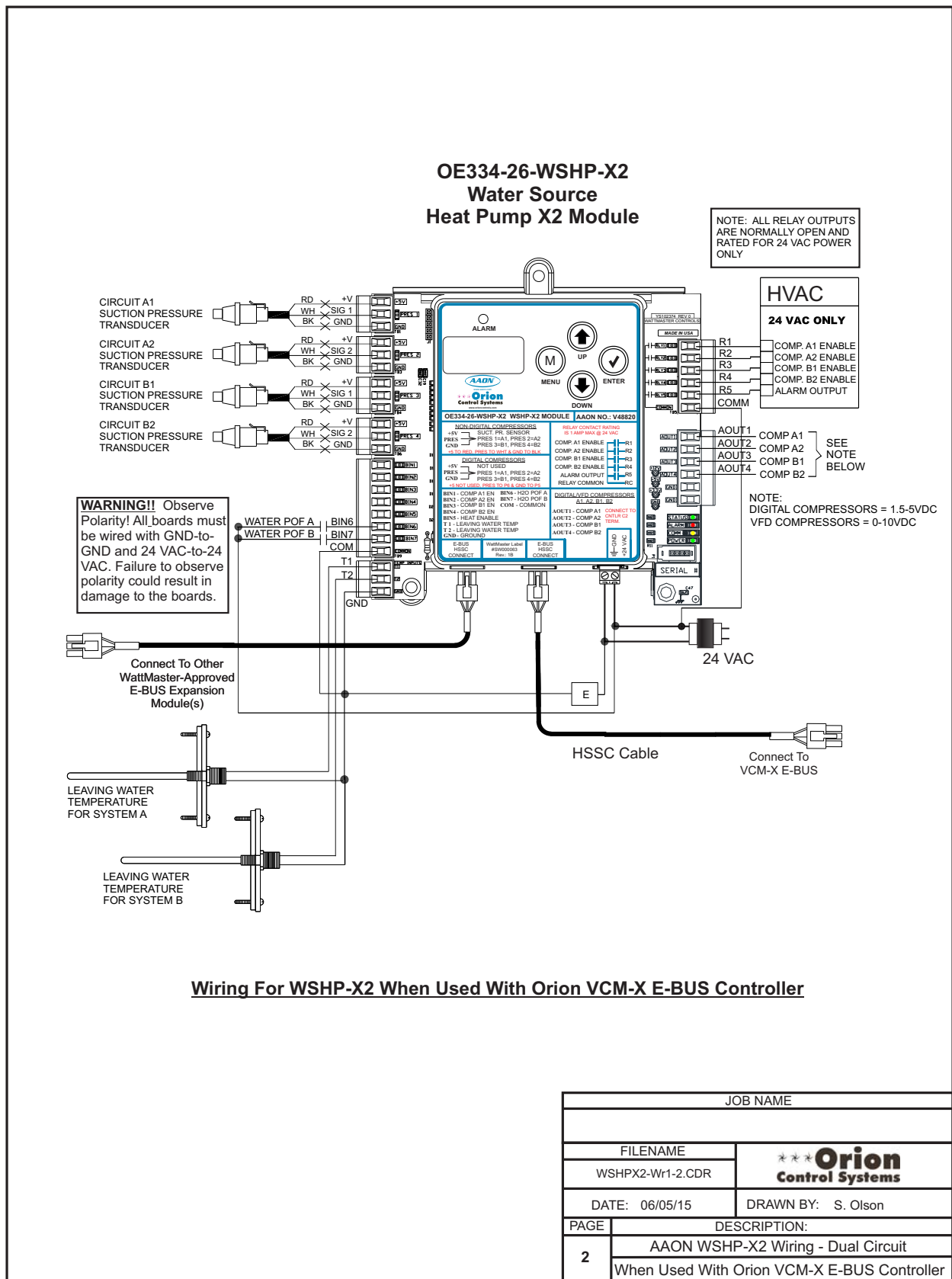
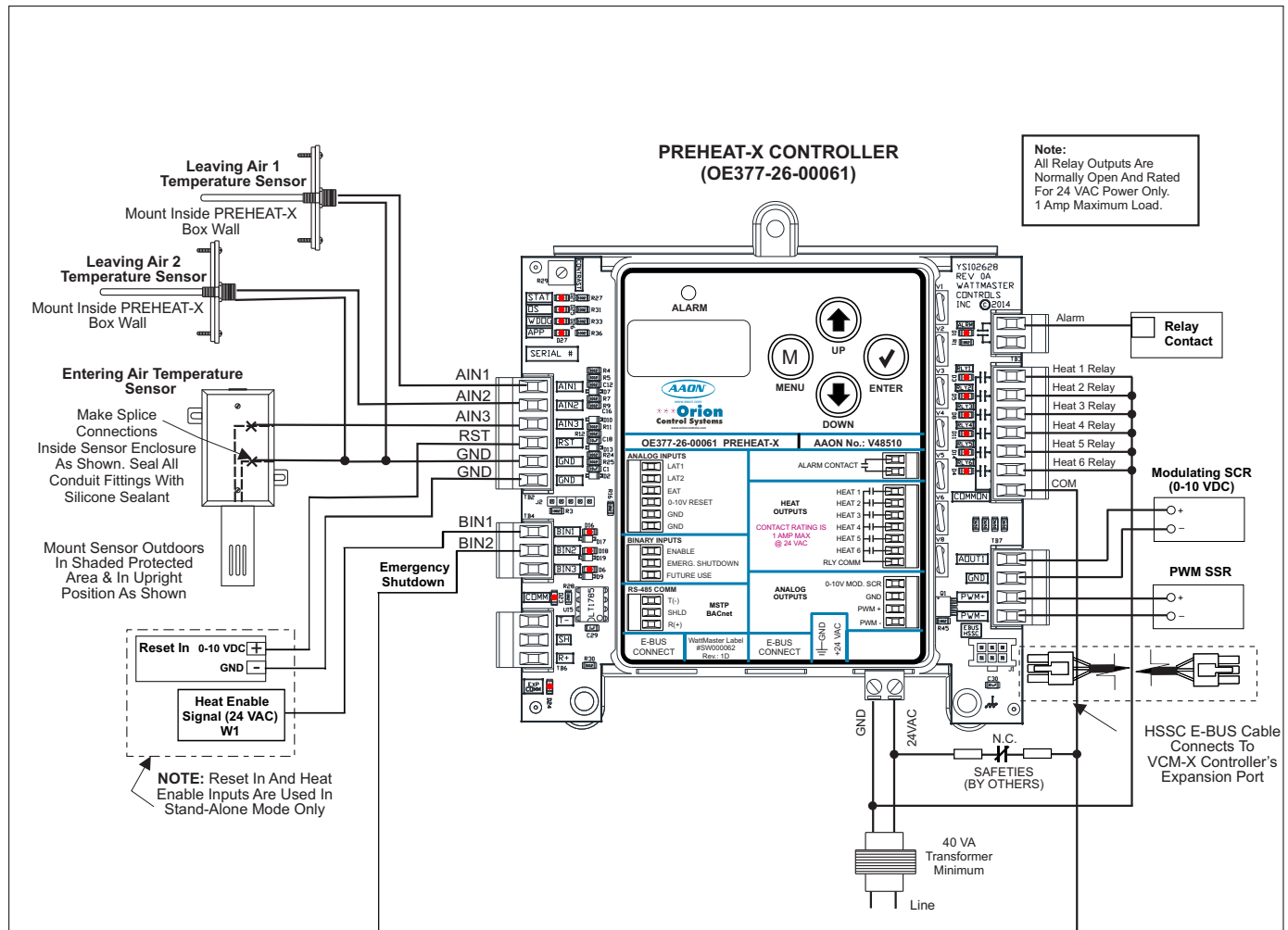


Figure 85: OE334-26-WSHP-X2 WSHP-X2 Controller Dual Circuit Wiring to VCM-X E-BUS Controller

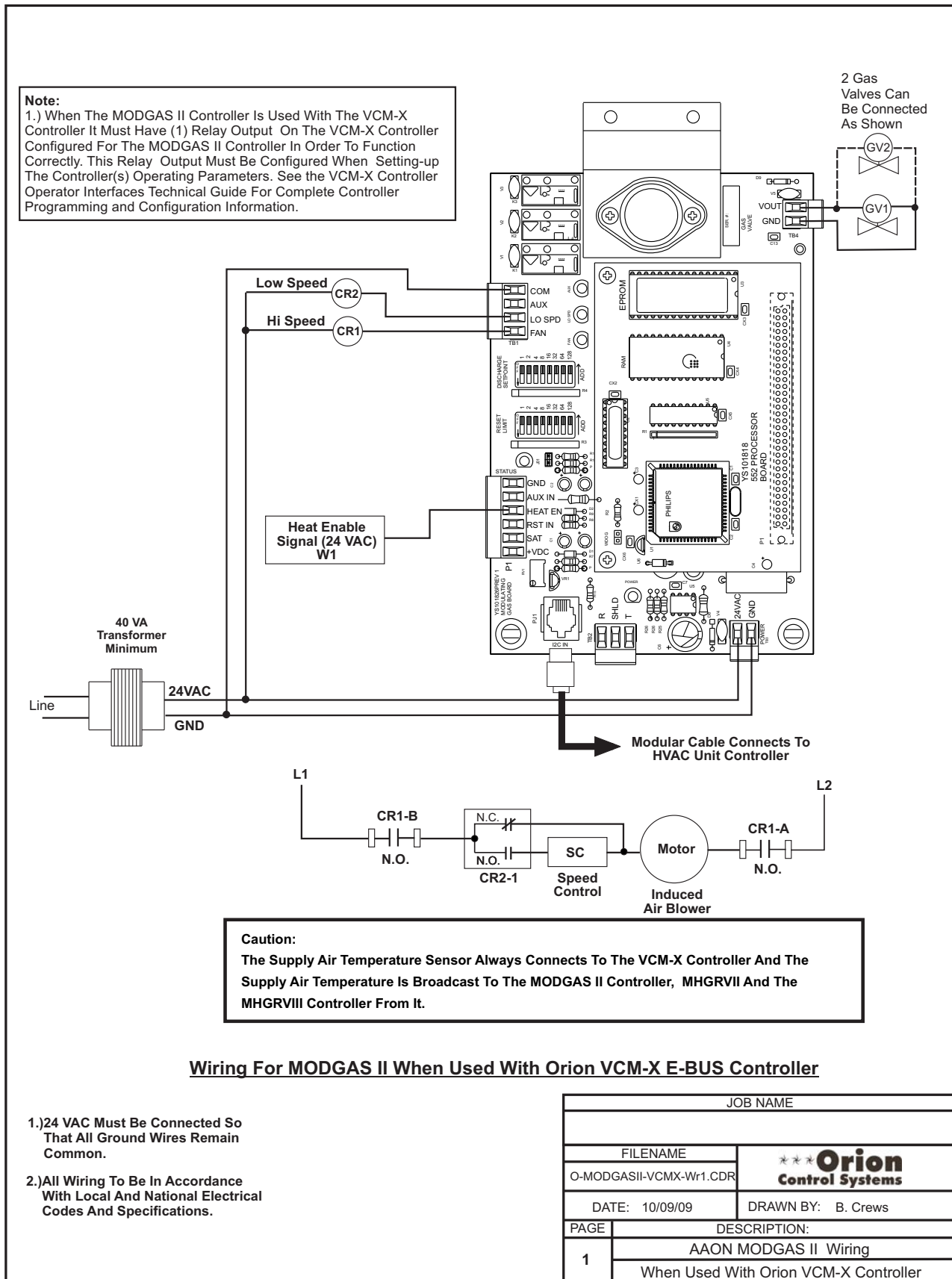
PREHEAT-X Controller Wiring When Used With The VCM-X E-BUS



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

JOB NAME	
FILENAME	
PREHEATX-1A.CDR	
DATE: 06/10/15	DRAWN BY: S. Olson
PAGE	DESCRIPTION:
1	AAON PREHEAT-X Wiring
	When Used With Orion VCM-X E-BUS Controller

Figure 86: OE377-26-00061 PREHEAT-X Controller Single Circuit Wiring to VCM-X E-BUS Controller

MODGAS II Controller Wiring When Used With The VCM-X E-BUS**Figure 87: OE377-00-00041 MODGAS II Controller to VCM-X E-BUS Controller Wiring**

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

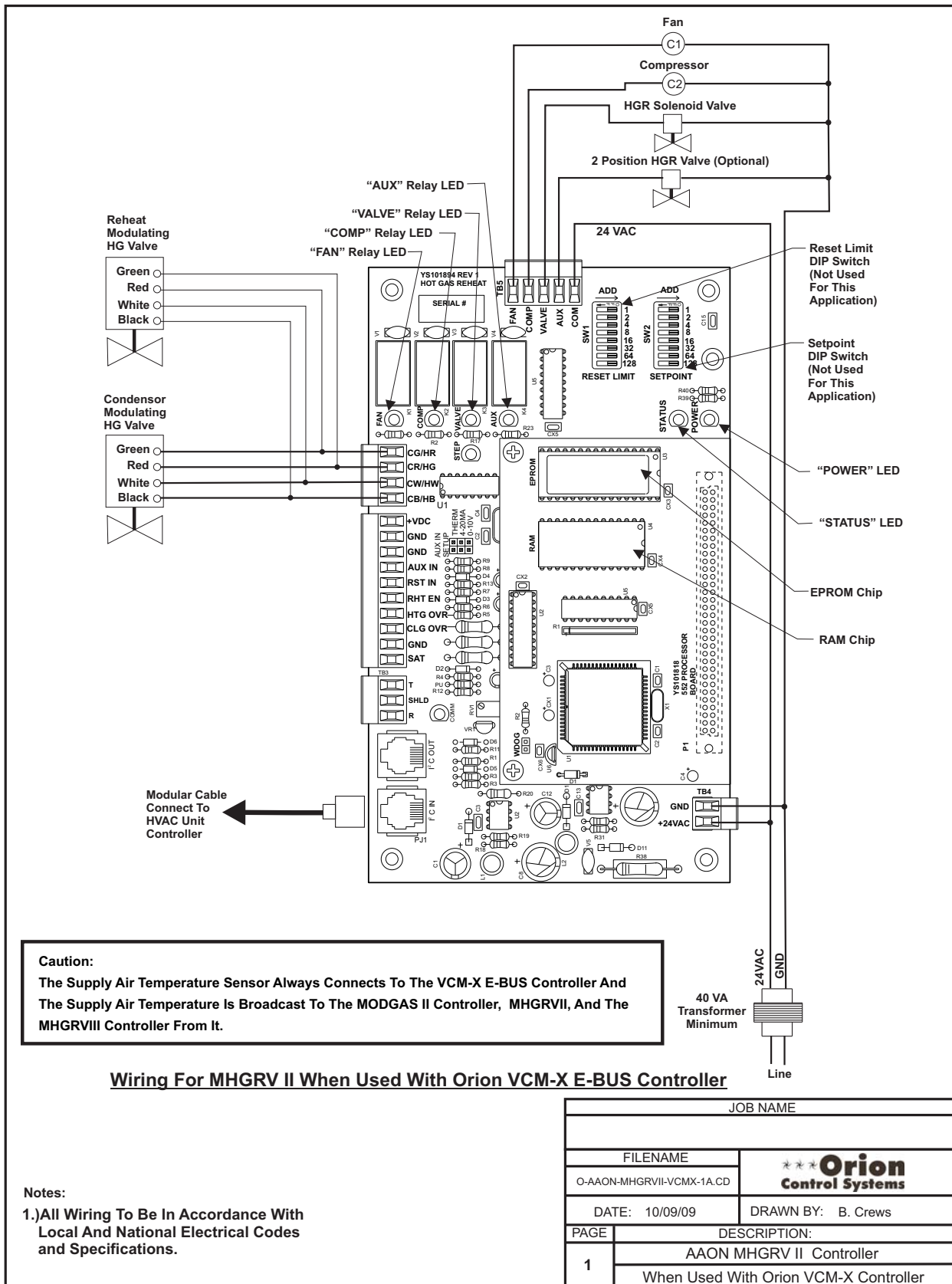


Figure 88: OE377-00-00042 MHGRV II Controller to VCM-X E-BUS Controller Wiring

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

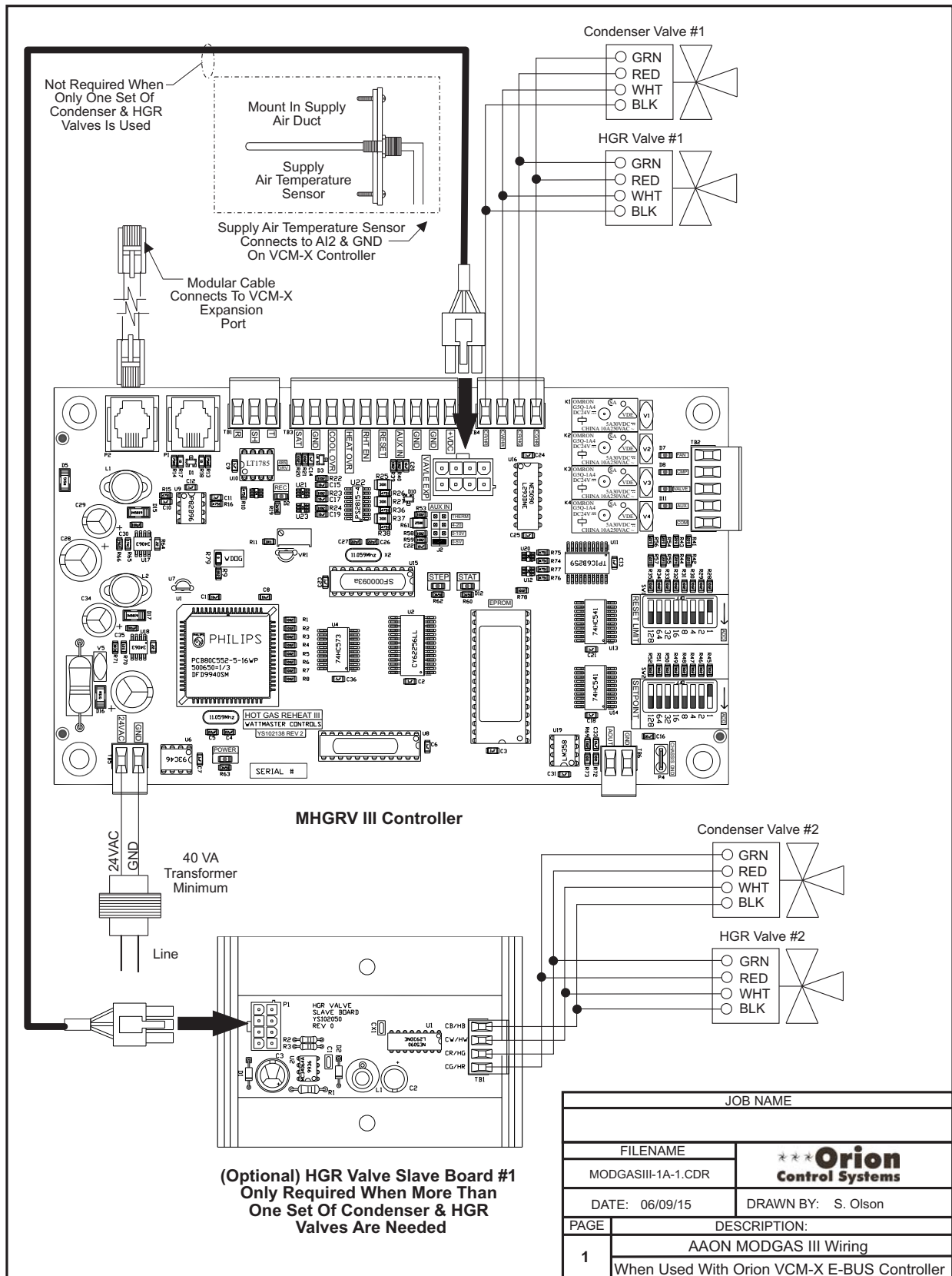


Figure 89: OE377-00-00054 MHGRV III Controller to VCM-X E-BUS Controller Wiring

Miscellaneous Diagrams & Technical Information

Modular Room Sensor Wiring

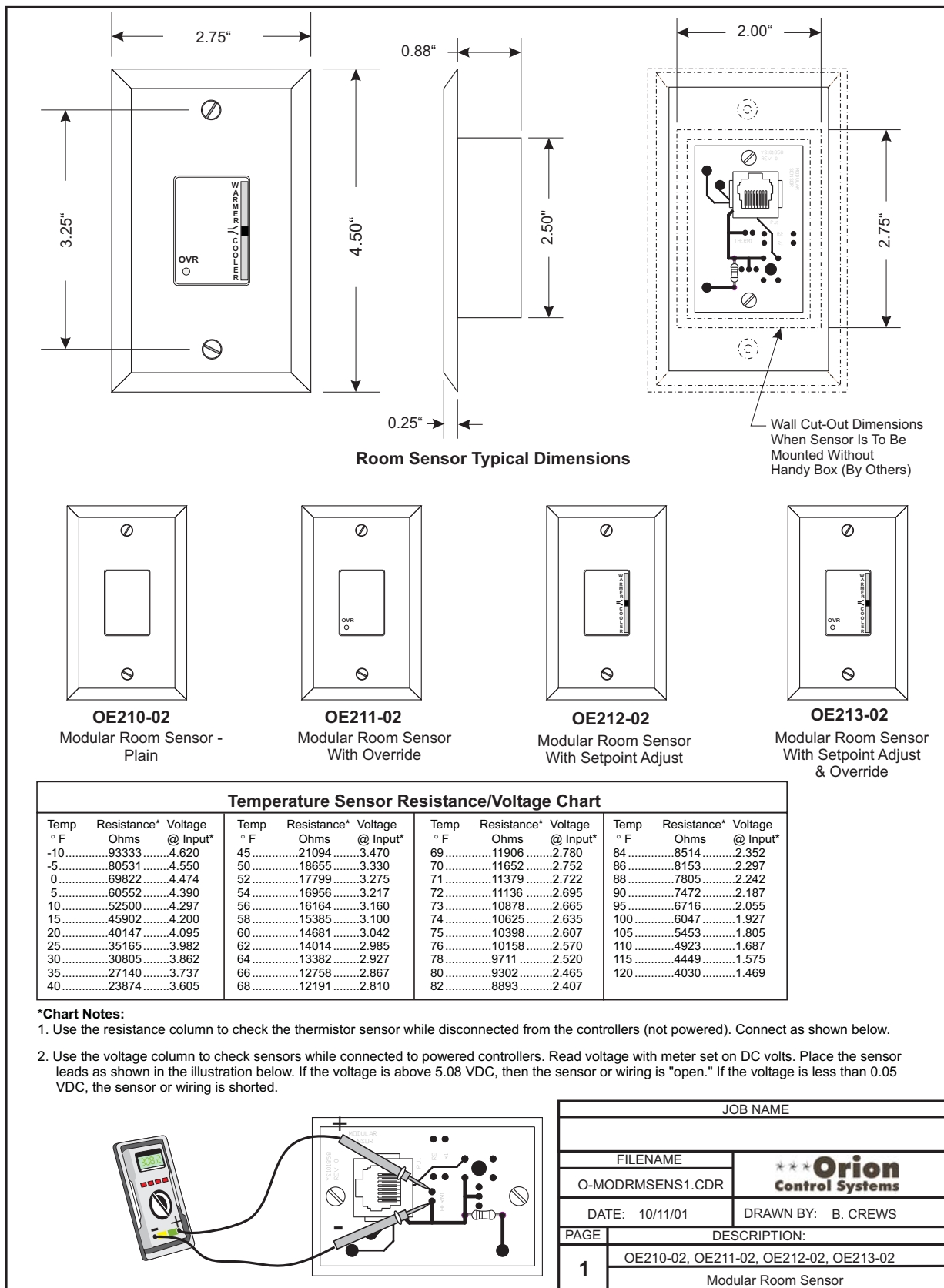


Figure 90: OE210-02, OE211-02, OE212-02, OE213-02 Modular Room Sensor Wiring

EPROM Chip Locations

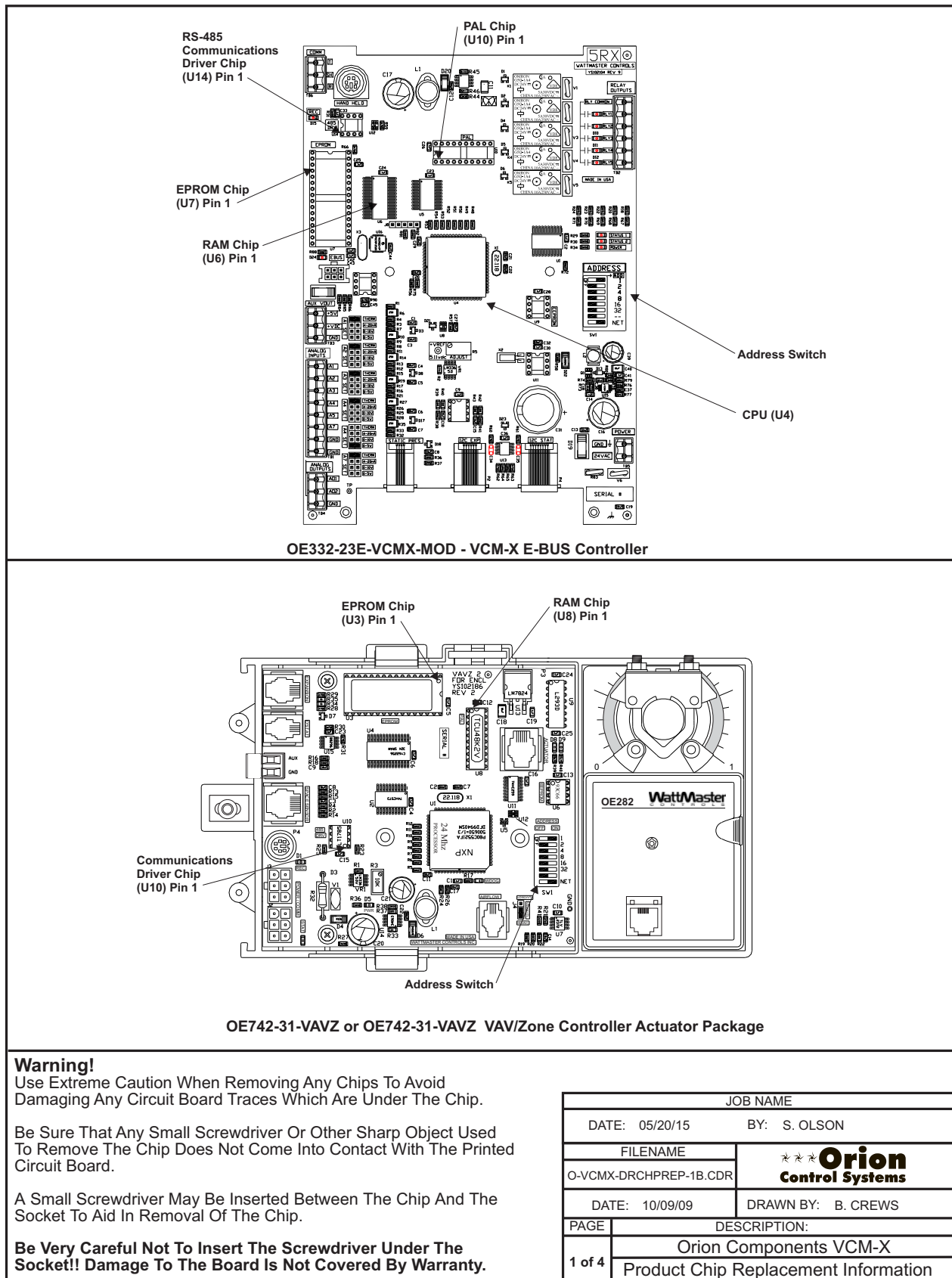


Figure 91: EPROM Chip Locations for VCM-X E-BUS & VAV/Zone Controller Actuator Package

EPROM Chip Locations (Cont'd)

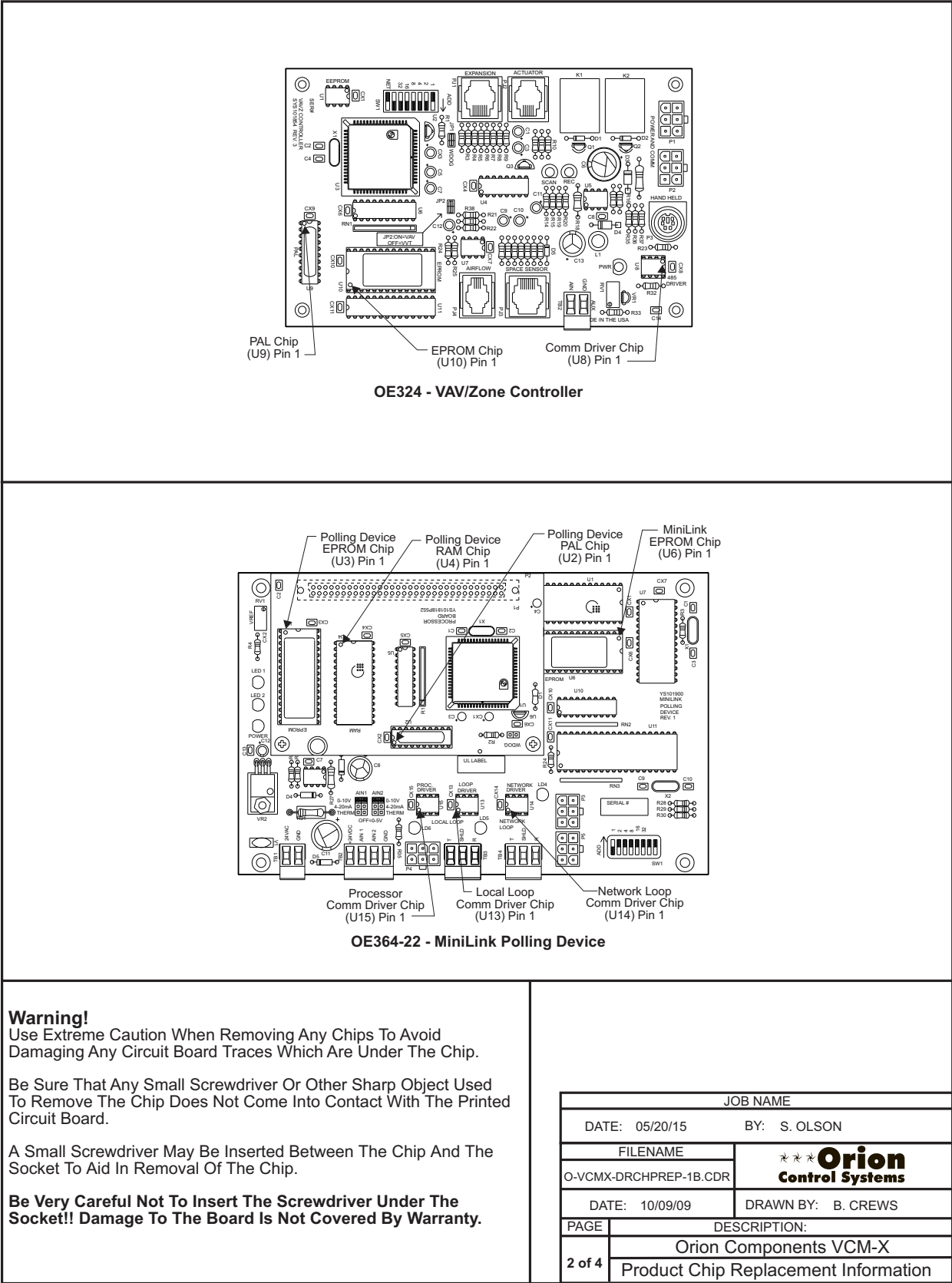


Figure 92: EPROM Chip Locations for VAV/Zone Controller & MiniLink Polling Device

EPROM Chip Locations (Cont'd)

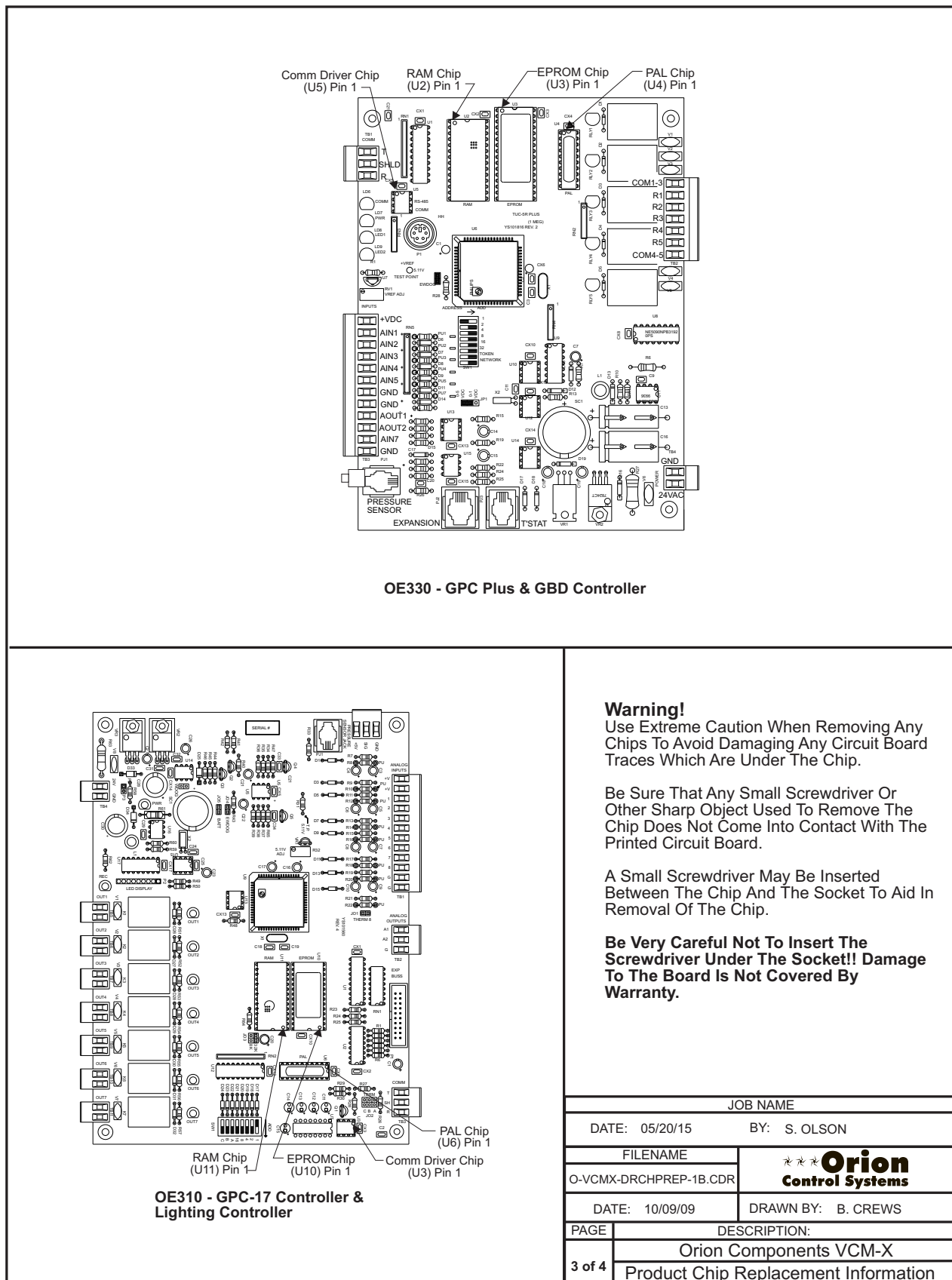


Figure 93: EPROM Chip Locations for GPC Plus, GBD, and GPC-17 Controller

Chip Installation Procedures

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

Using I.C. Puller To Remove Socketed Chip

WARNING!

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

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

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

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

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

Using Screwdriver To Remove Socketed Chip

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.

Top View Of Socketed Chip Assembly

End View Of Socketed Chip Assembly

Typical RS-485 Communications Driver Chip Detail

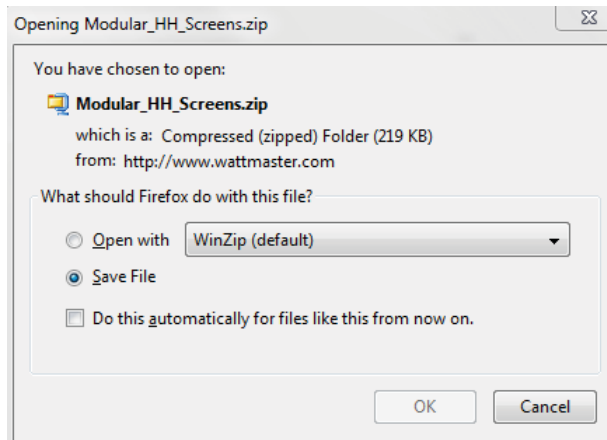
JOB NAME	
DATE: 05/20/15	BY: S. OLSON
FILENAME	Orion Control Systems
DATE: 10/09/09	DRAWN BY: B. CREWS
PAGE	DESCRIPTION:
4 of 4	Orion Components VCM-X Product Chip Replacement Information

Figure 94: EPROM Chip Installation Instructions

Updating The SD Memory Card

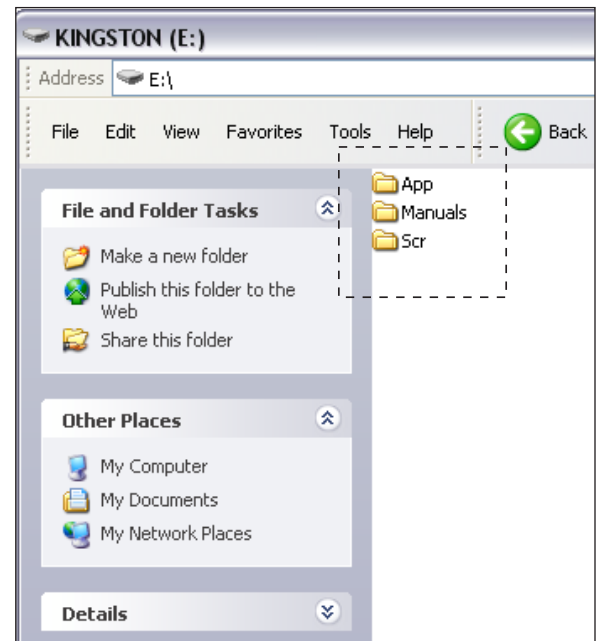
You may need to update the SD memory card from time to time, either for a new release or to add data for another Controller. Follow the instructions below to download the update file from our tech support webpage:

1. Insert the SD memory card in your computer's SD drive and open the drive's window.
2. Open your browser and type in the address: <http://wattmaster.com/techsupport>.
3. On the Tech Support webpage, locate the file `Modular_HH_Screens.zip` and *double-click* on it.
4. Click <Save File> when asked to save or open the file and then *click* <OK>. This option will save the file to the "Downloads" folder on your PC.



5. *Open* the "Downloads" folder in Windows Explorer. You will find a folder labeled, "Modular_HH_Screens.zip" *Right-click* on the folder and choose "Extract All" from the options list. **NOTE:** Any compression software can be used to extract the zip folder's contents, for example, Winzip.

6. Once you unzip the file, you will see a window similar to the one below.



7. Press <CTRL> <A> to highlight the folders in the window—App, Manuals & Scr. Press <CTRL> <C> to copy the folders.
8. Paste the folders into the SD memory card drive's window by *pressing* <CTRL> <V>.
9. Remove the SD Memory Card from your computer and reinsert it in the Modular Hand Held Service Tool or Modular System Manager.

Updating E-BUS Module Software

Updating Controller & E-BUS Module Software Using the Modular Service Tool SD

To update the software for various WattMaster E-BUS modules, follow these simple steps.

1. Update your SD memory card with the new software file for the controller or module you need to update. Follow the steps on **page 121** for Updating the SD memory card.
2. Connect the Modular Service Tool to the device you wish to update using the mini DIN communication cable or EBC E-BUS cable provided.
3. Power up the controller or E-BUS module you wish to update.
4. Apply power to the Modular Service Tool SD and *press* the <ON> button.
5. After initialization of the Modular Service Tool SD, *press* <NEXT> at the first Setup Screen and <4> at the second Setup Screen shown below.

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

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

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

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

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

E-BUS Modules

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

```
Enter Board Address
0
Esc) Exit Menu
```

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

```
WSHP-X2 - address 17
MHGRV-X - address 132
MODGAS-X - address 138
PREHEAT-X - address 157
RSM #1 - address 152
RSM #2 - address 153
RSM #3 - address 154
RSM #4 - address 155
```

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

```
Software Version
Enter 0 for Latest
0
Esc) Exit Menu
```

4. The screen will display the following messages:
"Resetting Unit"
"Load Sys Info"

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

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

6. When updating is complete, the screen will display, "Finish Download."

Temperature & Humidity Sensor Voltage-Resistance Table

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								
Temp (°F)	Resistance (Ohms)	Voltage @ Input (VDC)	Temp (°F)	Resistance (Ohms)	Voltage @ Input (VDC)	Temp (°F)	Resistance (Ohms)	Voltage @ Input (VDC)
-10	93333	4.620	60	14681	3.042	86	8153	2.297
-5	80531	4.550	62	14014	2.985	88	7805	2.242
0	69822	4.474	64	13382	2.927	90	7472	2.187
5	60552	4.390	66	12758	2.867	95	6716	2.055
10	52500	4.297	68	12191	2.810	100	6047	1.927
15	45902	4.200	69	11906	2.780	105	5453	1.805
20	40147	4.095	70	11652	2.752	110	4923	1.687
25	35165	3.982	71	11379	2.722	115	4449	1.575
30	30805	3.862	72	11136	2.695	120	4030	1.469
35	27140	3.737	73	10878	2.665	125	3656	1.369
40	23874	3.605	74	10625	2.635	130	3317	1.274
45	21094	3.470	75	10398	2.607	135	3015	1.185
50	18655	3.330	76	10158	2.577	140	2743	1.101
52	17799	3.275	78	9711	2.520	145	2502	1.024
54	16956	3.217	80	9302	2.465	150	2288	0.952
56	16164	3.160	82	8893	2.407			
58	15385	3.100	84	8514	2.352			

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.

Temperature & Humidity Sensor Voltage-Resistance Table

OE265-11, 13 & 14 Relative Humidity Transmitters – Humidity vs. Voltage For 0-5 VDC Sensors							
Humidity Percentage (RH)	Voltage @ Input (VDC)	Humidity Percentage (RH)	Voltage @ Input (VDC)	Humidity Percentage (RH)	Voltage @ Input (VDC)	Humidity Percentage (RH)	Voltage @ Input (VDC)
0%	0.00	26%	1.30	52%	2.60	78%	3.90
2%	0.10	28%	1.40	54%	2.70	80%	4.00
4%	0.20	30%	1.50	56%	2.80	82%	4.10
6%	0.30	32%	1.60	58%	2.90	84%	4.20
8%	0.40	34%	1.70	60%	3.00	86%	4.30
10%	0.50	36%	1.80	62%	3.10	88%	4.40
12%	0.60	38%	1.90	64%	3.20	90%	4.50
14%	0.70	40%	2.00	66%	3.30	92%	4.60
16%	0.80	42%	2.10	68%	3.40	94%	4.70
18%	0.90	44%	2.20	70%	3.50	96%	4.80
20%	1.00	46%	2.30	72%	3.60	98%	4.90
22%	1.10	48%	2.40	74%	3.70	100%	5.00
24%	1.20	50%	2.50	76%	3.80		

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

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

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.

OE271 Duct Static Pressure Sensor			
Pressure @ Sensor (" W.C.)	Voltage @ Input (VDC)	Pressure @ Sensor (" W.C.)	Voltage @ Input (VDC)
0.00	0.25	2.60	2.33
0.10	0.33	2.70	2.41
0.20	0.41	2.80	2.49
0.30	0.49	2.90	2.57
0.40	0.57	3.00	2.65
0.50	0.65	3.10	2.73
0.60	0.73	3.20	2.81
0.70	0.81	3.30	2.89
0.80	0.89	3.40	2.97
0.90	0.97	3.50	3.05
1.00	1.05	3.60	3.13
1.10	1.13	3.70	3.21
1.20	1.21	3.80	3.29
1.30	1.29	3.90	3.37
1.40	1.37	4.00	3.45
1.50	1.45	4.10	3.53
1.60	1.53	4.20	3.61
1.70	1.61	4.30	3.69
1.80	1.69	4.40	3.77
1.90	1.77	4.50	3.85
2.00	1.85	4.60	3.93
2.10	1.93	4.70	4.01
2.20	2.01	4.80	4.09
2.30	2.09	4.90	4.17
2.40	2.17	5.00	4.25
2.50	2.25		

OE271 Pressure Sensor Testing Instructions

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

OE258-01 Building Pressure Sensor

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

OE258 Building Pressure Sensor			
Pressure @ Sensor (" W.C.)	Voltage @ Input (VDC)	Pressure @ Sensor (" W.C.)	Voltage @ Input (VDC)
-0.25	0.00	0.01	2.60
-0.24	0.10	0.02	2.70
-0.23	0.20	0.03	2.80
-0.22	0.30	0.04	2.90
-0.21	0.40	0.05	3.00
-0.20	0.50	0.06	3.10
-0.19	0.60	0.07	3.20
-0.18	0.70	0.08	3.30
-0.17	0.80	0.09	3.40
-0.16	0.90	0.10	3.50
-0.15	1.00	0.11	3.60
-0.14	1.10	0.12	3.70
-0.13	1.20	0.13	3.80
-0.12	1.30	0.14	3.90
-0.11	1.40	0.15	4.00
-0.10	1.50	0.16	4.10
-0.09	1.60	0.17	4.20
-0.08	1.70	0.18	4.30
-0.07	1.80	0.19	4.40
-0.06	1.90	0.20	4.50
-0.05	2.00	0.21	4.60
-0.04	2.10	0.22	4.70
-0.03	2.20	0.23	4.80
-0.02	2.30	0.24	4.90
-0.01	2.40	0.25	5.00
0.00	2.50		

OE258-01 Building Pressure Sensor Testing Instructions

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

OE275-01 Suction Pressure Transducer Testing

OE275-01 Suction Pressure Transducer Testing for R22 and R410A Refrigerant

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

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

See the OE275-01 Suction Pressure Transducer, Pressure, Temperature, and Voltage Chart for R22 and R410A Refrigerant testing (**Tables 8 and 9**). The charts show a temperature range from 20°F to 80°F. For troubleshooting purposes, the DC Voltage readings are also listed with their corresponding temperatures and pressures.

OE275-01 Suction Pressure Transducer Coil Pressure - Temperature - Voltage Chart for R22 Refrigerant					
Temperature °F	Pressure PSI	Signal DC Volts	Temperature °F	Pressure PSI	Signal DC Volts
20.00	31.13	1.0	55.32	93.39	2.0
20.00	37.36	1.1	58.86	99.62	2.1
20.46	43.58	1.2	62.13	105.84	2.2
25.71	49.80	1.3	65.27	112.07	2.3
30.84	56.03	1.4	68.42	118.29	2.4
35.41	62.26	1.5	71.39	124.52	2.5
39.98	68.49	1.6	75.20	130.75	2.6
44.00	74.71	1.7	77.00	136.97	2.7
48.00	80.94	1.8	79.80	143.20	2.8
51.78	87.16	1.9	80.00	149.42	2.9

OE275-01 Suction Pressure Transducer Coil Pressure - Temperature - Voltage Chart for R410A Refrigerant					
Temperature °F	Pressure PSI	Signal DC Volts	Temperature °F	Pressure PSI	Signal DC Volts
21.19	80.94	1.8	59.03	168.10	3.2
24.49	87.16	1.9	61.17	174.32	3.3
27.80	93.39	2.0	63.19	180.55	3.4
30.99	99.62	2.1	65.21	186.78	3.5
33.89	105.84	2.2	67.23	193.00	3.6
36.80	112.07	2.3	69.24	199.23	3.7
39.71	118.29	2.4	71.15	205.46	3.8
42.30	124.52	2.5	72.95	211.68	3.9
44.85	130.75	2.6	74.76	217.91	4.0
47.39	136.97	2.7	76.57	224.14	4.1
49.94	143.2	2.8	78.37	230.36	4.2
52.23	149.42	2.9	80.18	236.59	4.3
54.50	155.65	3.0			
56.76	161.88	3.1			

