Section 1. Product Description

This document describes the hardware installation procedures for the DIN rail mounted series of Programmable Control Modules PCM501, PCM502 and PCM503.

The BACnet® Programmable Controller product line is designed to work in conjunction with Phoenix Controls BACnet MS/TP Theris® and Traccel® valve mounted room controller to implement custom control sequences.

Each controller uses the BACnet® MS/TP LAN communication protocol interface with the Theris and Traccel product lines to provide additional I/O and allow for customized control sequences.

These product lines are based on the BACnet® technology for peer-to-peer communication between controllers and are BTL® certified.

NOTE

- These controllers are all built on a similar platform, but have different numbers of inputs and outputs. For more information on the specific layout and functionality of each controller, please refer to Figures 6, 7, 8 and to Section 2.3.
- The PCM501 and PCM502 controllers are housed in small enclosures.
- The PCM503 is housed in the large enclosure.

Figure 1. PCM503 (large enclosure)

Figure 2. PCM501 and PCM502 (small enclosure)

The PCM is offered in a variety of configurations with varying numbers of inputs and outputs. All have universal inputs, offering a wide variety of input configurations which are jumper selectable and software configurable to suit the specific application.

Model Number	Universal Inputs	Universal Outputs	Triac Outputs	Options
PCM501	6	3	5	R01 to R03
PCM502	10	8	—	R01 to R08
PCM503	12	12	—	R01 to R12

Section 2. General Installation Requirements

For proper installation and subsequent operation of each controller, pay special attention to the following recommendations:

- It is recommended that the controller(s) be kept at room temperature for at least 24 hours before installation to allow any condensation that may have accumulated due to low temperature during shipping/storage to evaporate.
- Upon unpacking the product, inspect the contents of the carton for shipping damages. Do not install damaged controllers.
- Allow for proper clearance of controller enclosure, wiring terminals and MAC addressing switches for easy access, hardware configuration and maintenance.
- Each controller is designed to operate under the following environmental conditions:
  - Ambient temperature from 32°F to 122°F (0°C to 50°C)
  - Storage temperature from -4°F to 122°F (-20°C to 50°C)
  - Relative humidity from 0% to 90%, non-condensing
- Ensure proper ventilation of each controller and avoid areas where corroding, deteriorating or explosive vapors, fumes or gases may be present. Each controller must be oriented with the ventilation slots and power supply/output terminal block connector towards the top to permit proper heat dissipation.
- The PCM plastic enclosure has a back plate that is separable from the front plate allowing the back plates (with the connectors) to be shipped directly to the installation site while all the engineering is done in the office.
- Do not drop the controller or subject it to physical shock.

If the controller is used and/or installed in a manner not specified by Phoenix Controls, the functionality and the protection provided by the controller may be impaired.

CAUTION

Any type of modification to any Phoenix Controls product will void the product's warranty.

NOTE

Take special care to keep the front and back plate aligned when separating and joining them.

WARNING

Take reasonable precautions to prevent electrostatic discharges to each controller when installing, servicing or operating the controller. Discharge accumulated static electricity by touching one's hand to a securely grounded object before working with each controller.

2.1 Mounting Instructions

Each controller can be mounted on a DIN rail to speed up the installation procedure. They are also equipped with two mounting holes of 0.25" (6.35mm) by 0.165" (4.191mm). The controller can be mounted in a panel or on a wall by using appropriate screw types (use sheet metal, thread forming or self-tapping screws accordingly).

2.1.1 DIN Rail-Mounted Installation

1. Make sure that the DIN rail is properly mounted on the wall. See Figure 5.

2.1.2 Wall-Mounted Installation

1. Open the controller by separating the front and back plate using the side clips.
2. From within the back plate, use the mounting holes to mark the location of holes that need to be drilled.
3. Remove the back plate and drill holes.
4. Finally, clean the perforated surface and fasten the device using the appropriate screw types.

2.2 Controller Dimensions

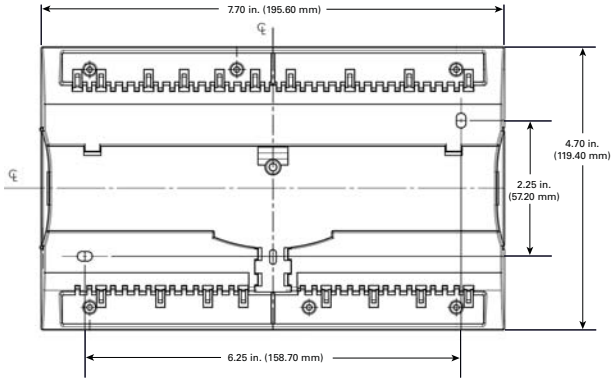

Figure 3. Rear view of PCM503 enclosure

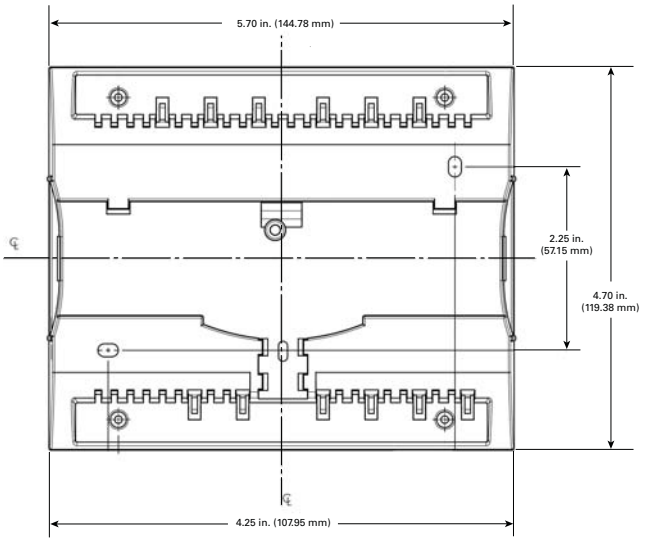

Figure 4. Rear view of PCM501 and PCM502 encosure

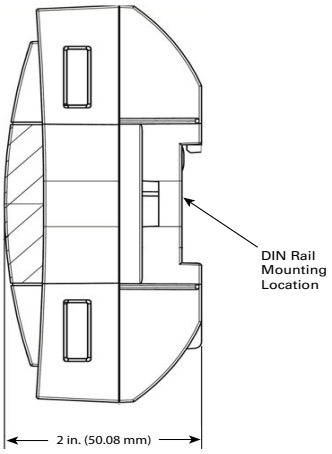

Figure 5. Side view of PCM501, PCM502 and PCM503 enclosure

2.3 General Wiring Recommendations

CAUTION

Turn off power before any kind of servicing. Please note that there may be multiple power sources.

2.3.1 Phoenix Controls Wiring Recommendations

- Use cables recommended by Phoenix Controls (refer to Phoenix Controls Cables on page 9).
- Stranded wire is strongly recommended for ease of installation.
- Follow good wiring practices:
- Do not run the signal cable in the same conduit or wireway as the power cables.
- If the signal cable must cross power cables, it is best to do so at a 90-degree angle.

- Shield or drain wires, if required, should be wrapped with insulating tape to prevent contact with exposed conductors or contacts.
- Maintain a consistent color code or polarity all the way through the wiring system.
- All connections must meet the requirements of an NEC Class 2 circuit.
- Local and national electrical codes take precedence.
- To connect the wiring to each controller, use the terminal connectors.
  - It is recommended to remove the front plate from the back plate to facilitate the wiring process, however it is possible to do all wiring with the front and back plates together.
  - Use a small flat screwdriver to tighten the terminal connector screws once the wires have been inserted.
- The board connectors accept wires or flat cables ranging from 22 to 14 AWG (0.64-1.63 mm diameter) per pole. However, power cables must remain between 18 and 14 AWG (1.02-1.63 mm diameter).

For BACnet communications:

- The BACnet MS/TP communication wire is polarity sensitive and the only acceptable topology is to daisy-chain the cable from one controller to the next.
- The network cable must be a 22 AWG (0.64 mm) stranded, three conductor twisted cable.
- Network segments may not exceed 4000 feet (1219 meters) in length.

For power connections:

- Power type cables (i.e., for power, 2- and 3-wire voltage and current inputs and outputs, as well as triac outputs) should be kept apart from other types of wiring to avoid any ambient noise transmission to other wires.
- Do not connect the universal inputs, analog/digital outputs or common terminals to earth or chassis ground (unless stated otherwise).

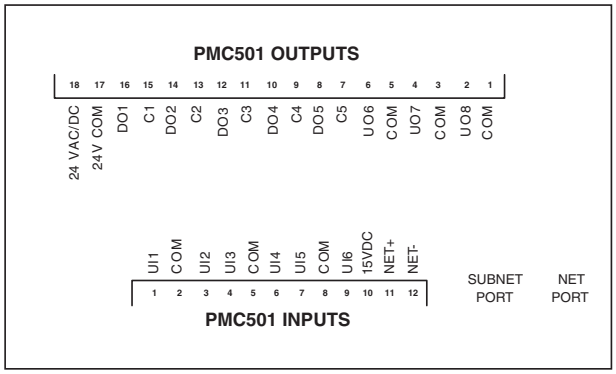

Figure 6. PCM501 connections

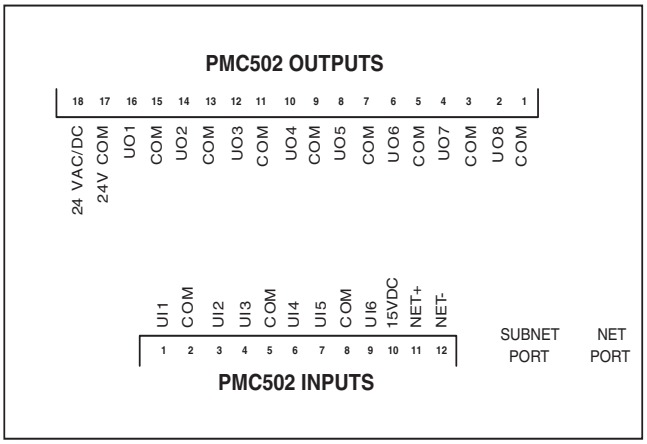

Figure 7. PCM502 connections

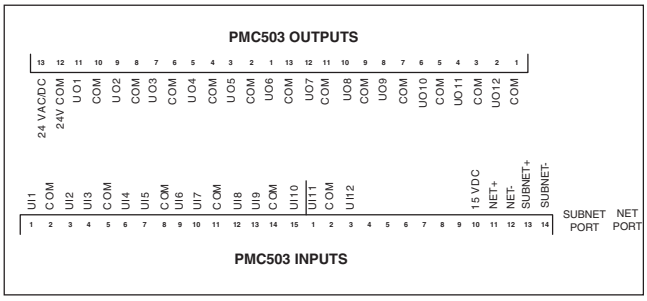

Figure 8. PCM503 connections

2.3.2 Power Wiring

Voltage: 24 Vac/dc; ± 15%, Class 2

CAUTION

To conform to Class 2 requirements in the United States, use transformers of 100 VA or less at 24 Vac to power the controller(s).

It is recommended to wire only one controller per 24 VAC transformer.

If only one 24 VAC transformer is available, determine the maximum number of controllers that can be supplied using the following method to size required power transformer:

- Add up the maximum power consumption of all controllers and multiply this sum by 1.3.
- If the resulting number is higher than 100 VA, consider using multiple transformers.

Use an external fuse on the 24 Vac/dc side (secondary side) of the transformer, as shown in See Figure 9., to protect all controllers against power line spikes.

Maintain consistent polarity when connecting controllers and devices to the transformer. One terminal on the secondary side of the transformer must be connected to the building's ground. All 24V COM terminals of all controllers and peripherals throughout the BACnet MS/TP network must be connected to the grounded transformer terminal as shown in Figure 9 and Figure 10. This ensures that the 24V COM terminals of all devices connected to any BACnet MS/TP bus in the building are at the same potential.

CAUTION

A mechanical ground is unacceptable: Do not use a pipe, conduit, or duct work for a ground. The power supply must have a dedicated ground wire that comes from the main electrical supply panel.

Failure to maintain consistent polarity throughout the entire BACnet MS/TP network will result in a short circuit and/or damage to the controller!

The COM terminals of the controller are internally wired to the 24V COM terminal of the power supply. Connecting a peripheral or another controller to the same transformer without maintaining polarity between these devices will cause a short circuit.

It is highly recommended to wire only one controller per 24 Vac transformer.

If only one 24 Vac transformer is available, wire no more than five controllers to it (total wire length less that 200 feet (60.96 m).

If powering 5-10 controllers with one 24 Vac transformer, consider one of the following two options:

- Wire the controllers in a closed loop topology (total wire length less than 400 feet [121.92 m]), i.e., wire the last controller back to the power supply transformer.
- Wire the controllers in a star topology having no more than five controllers on each bus (total wire length less than 200 feet [60.96 m]/bus).

CAUTION

The controllers are half-wave rectified. Connecting two half-wave power supplies to the same transformer without maintaining polarity will cause a short circuit.

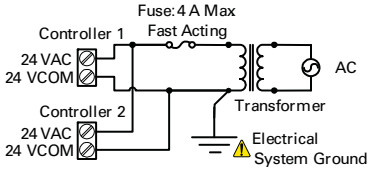

Figure 9. Power wiring - AC

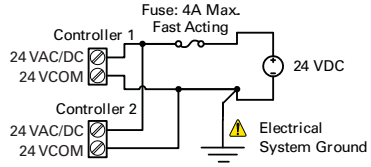

Figure 10. Power wiring - DC

CAUTION

The COM terminals of the controller are internally wired to the 24V COM terminal of the power supply. Therefore, if powering peripherals and controllers with the same transformer, it is essential to maintain polarity. Failure to do so will result in a short circuit and/or a damaged controller.

2.3.3 Input Wiring

Each controller has physical connections for inputs (marked as UIx) that are software configurable from within the controller's software. Each input can be configured for digital, resistive, current, voltage signals or pulse signals. Input types must be configured properly in the software to ensure proper input readings..

CAUTION

Before connecting any input equipment to the controller, refer to the installation guide of the equipment manufacturer.

NOTE

- For a wire length less than 75' (23m), either a shielded or unshielded 22 AWG wire may be used.
- For a wire length less up to 200' (61m), a shielded 22 AWG wire is recommended.
- The wire should be shielded on the controller side and the shield length should be kept as short as possible.

2.3.3.1 Wiring Digital Inputs

This input configuration is used to monitor digital dry contacts, as well as pulsed contacts.

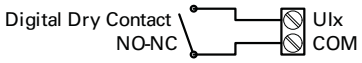

Figure 11. Digital input- Digital dry contact (NO and NC)

2.3.3.2 Wiring Resistive Inputs

This input configuration is used to monitor Resistance Temperature Detectors (RTDs) thermistors such as 1000Ω RTDs to 10kΩ type II and III thermistors, as well as 10kΩ and 100kΩ potentiometers.

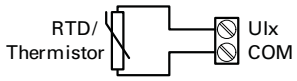

Figure 12. Resistive input—RTD/Thermistor input

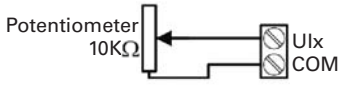

Figure 13. Resistive input—10kΩ potentiometer input

NOTE

When using a 100Ω input, the wire length should be kept short so as to avoid a possible temperature offset. For example, an 22 AWG wire, 25' (7.6m) in length can create an offset of up to 2°F (1.1°C).

2.3.3.3 Wiring Current Inputs

Current inputs have a range of 0 to 20mA. Depending on the transducer power requirements, any one of the following input configurations can be used. Use the following configuration for a 2-wire, 0-20mA transducer powered by the controller's internal 15 Vdc power supply.

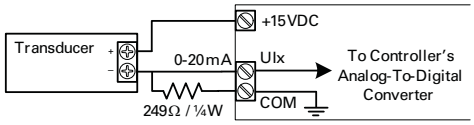

Figure 14. Current input—2-wire transducer powered by the controller

NOTE

The onboard 15 Vdc output can be used to supply the current loop up to 120 mA shown in Figure 14. Refer to the transducer installation guide for further details.

Use the following configuration for a 2-wire, 0-20mA transducer powered by an external 24 AC/DC power supply.

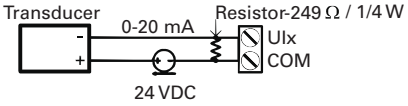

Figure 15. Current input—2-wire transducer, externally powered

Use the following configuration for a 3-wire, 0-20mA transducer powered by an external 24 AC/DC power supply.

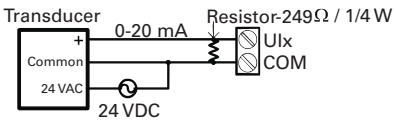

Figure 16. Current input - 3-wire transducer, externally powered

Use the following configuration for a transducer powered by its own power source.

Figure 17. Current input - Transducer with its own power source

NOTE

For PCM502 and PCM503 Series controllers, it is unnecessary to connect a 249Ω resistor at the input as this resistor is built-in to the controller. For these models, configure the input jumper as follows.

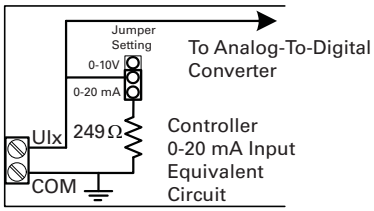

Figure 18. Equivalent circuit for 0-20mA current input showing the jumper setting for PCM502 and PCM503 Series controllers

2.3.3.4 Wiring Voltage Inputs

Voltage inputs have a range of 0 to 10 Vdc. Connect the voltage input according to the following figure if a 3-wire 0—10V or 0-5 V transducer is being used.

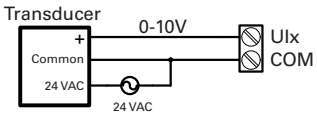

Figure 19. Voltage input— 3-wire transducer

Connect the voltage input according to the following figure if the transducer is powered by its own power source.

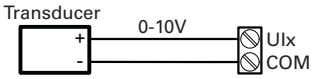

Figure 20. Voltage input—Transducer with its own power source

2.3.3.4.1 Wiring Pulse Inputs

When an input has been software configured as a pulse input, the input must be wired according to the type of pulse (fast pulse or slow pulse).

Table 1. Controller support for fast and slow pulse inputs

Controller	Pulse Inputs	
	50 Hz: 10ms minimum ON/OFF (Fast Pulse)	1 Hz 500ms minimum ON/OFF (Slow Pulse)
PCM501	None	UI1 to UI6
PCM502	UI1 to UI4	UI5 to UI0
PCM503	UI1 to UI4	UI5 to UI2

Pulse input types must be configured properly in software according to how the pulse meter is powered (supply type: internal/external).

Connect the pulse input according to the following figure for a pulse meter that can pull-down a +5 Vdc supply with a 10KΩ pull-up resistor (internal supply type).

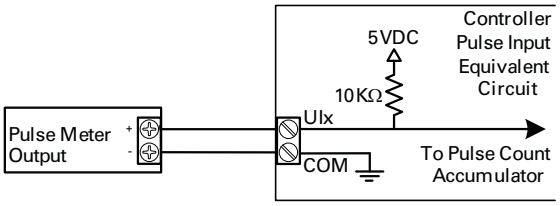

Figure 21. All pulse input types—2-wire pulse meter for PCM50x controllers

When using a pulse meter that requires more than 5 Vdc to operate, a Fast Pulse Input type (see Table 1) must be used. An external power supply is required to operate the pulse meter. For this, the controller's built-in power supply may be used as shown in Figure 22, or by using an external power source (from 6 Vdc to 27 Vdc maximum) as shown in Figure 22.

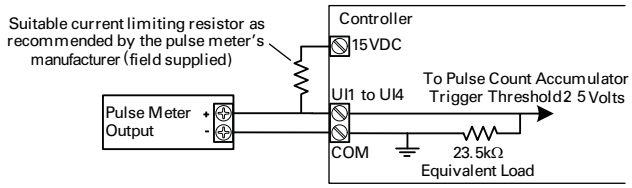

Figure 22. Fast pulse input type—2-wire pulse meter for PCM502 and PCM503 controllers

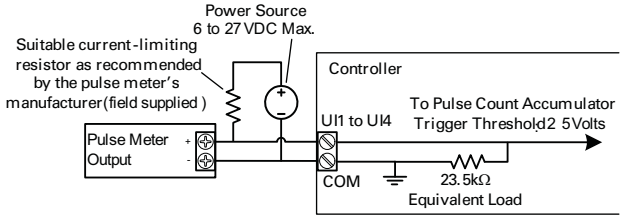

Figure 23. Fast pulse input type—2-wire pulse meter for PCM502 and PCM503 controllers

2.4 Output Wiring

Each controller has physical connections for digital (triac) outputs and/or universal outputs, depending on the type and model. These outputs are all software configurable.

Controller	Triac Outputs	Universal Outputs	Jumper 0-10 Vdc/ 0-20 mA
PCM501	5	3	
PCM502	0	8	X
PCM503	0	12	X

CAUTION

Before connecting any output device (actuator, relay, etc.) to the controller, refer to the installation guide of the equipment manufacturer.

NOTE

- For a wire length less than 75' (23 m), either a shielded or unshielded 22 AWG wire may be used.
- For a wire length less up to 200' (61m), a shielded 22 AWG wire is recommended.
- The wire should be grounded on the controller side and the shield length should be kept as short as possible.

2.4.1 Wiring Digital Outputs (DOx)

Digital outputs are all made of triacs and there is no voltage present on the output terminals. Therefore, an external power source, typically 24 Vac has to be added.

Connect the digital output according to the following figure if a relay is being controlled.

NOTE

To measure the state of a triac output, an external load must be connected.

If a 24 Vac relay is being controlled, connect the digital output according to Figure 24 or Figure 25, ensuring that the transformer's secondary winding is grounded as shown.

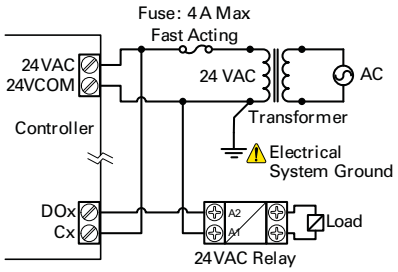

Figure 24. Digital triac output—Relay using the same power source as the controller

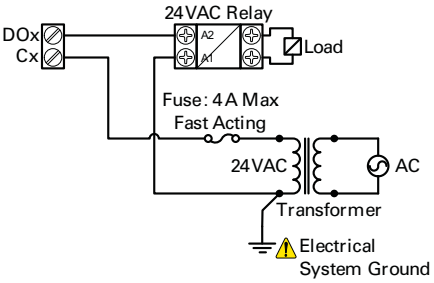

Figure 25. Digital triac output—Relay using an external power source

Connect the digital output according to the following figure if a floating actuator is being controlled.

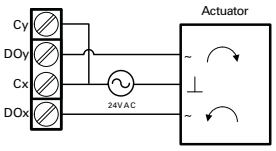

Figure 26. Digital triac output— Floating actuator

2.4.2 Wiring Universal Outputs (UOx)

Universal outputs can be configured to provide either a discrete signal of 0 or 12 Vdc, a linear signal ranging from 0 to 10 Vdc, or a 0 to 20mA signal (PCM502 and PCM503 only). The discrete signal can be used to generate a pulse wave modulation (PWM) signal or a simple two-state signal. These outputs are protected by an auto-reset fuse. If the controller was ordered with relays to be provided by Phoenix Controls, the quantity is determined by the number following the -R*nn*.

2.4.2.1 Wiring Discrete Outputs

If a 12 Vdc relay is being controlled, connect it to a universal output according to the following figure.

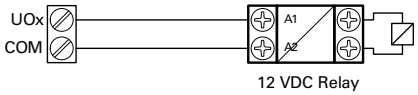

Figure 27. Discrete 0 or 12 Vdc universal output—Relay

2.4.2.2 Wiring Current Outputs

The 0 to 20 mA signal is configurable by jumper (available for PCM502 and PCM503 only).

Figure 28. Current 0-20 mA universal output and jumper configuration

2.4.2.3 Wiring Voltage Outputs

Connect the 0 to 10 Vdc output according to the following figure.

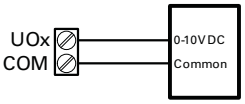

Figure 29. Voltage 0-10 Vdc universal output

If an analog actuator is being controlled, connect the 0 to 10 Vdc output, along with an external 24 Vac power source, to the analog actuator according to the following figure.

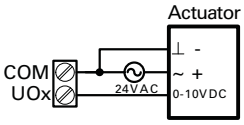

Figure 30. Voltage 0-10 Vdc universal output - Analog actuator

2.5 Communications Wiring

For optimal performance, use three conductor, stranded, twisted, shielded cable with the following electrical characteristics:

- Characteristic impedance between 100 and 130Ω
- Distributed capacitance between conductors shall be less than 30 pF/foot (100 pF/m)
- Distributed capacitance between conductors and shield shall be less than 60 pF/foot (200 pF/m)

Phoenix Controls recommends 22 AWG (0.65 mm) cable. Alternate wire size which meets these specifications may be used, but will not extend the maximum cable length per segment.

The BACnet MS/TP communication wire is polarity sensitive and the only acceptable topology is to daisy-chain the cable from one controller to the next.

As shown in Figure 31 below:

NOTE

- The first and last daisy-chained BACnet MS/TP device must have its EOL resistors enabled / installed. All other devices must have their EOL resistor disabled (default factory setting).
- When the BACnet MS/TP data bus is connected to a following device, twist data bus shields together.
- Isolate all shields with electrical tape so there is no exposed metal that can touch ground or other conductors.
- The shield of the data bus must be connected to the electrical system ground at only one point - usually at one end of the bus as shown below.
- Connect no more than 50 devices to a BACnet MS/TP data bus.

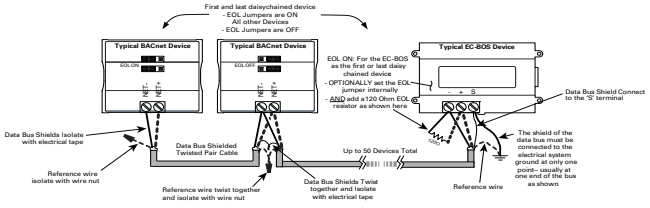

Figure 31. Communications wiring

If inserting multiple wires in the terminals, ensure to properly twist wires together prior to inserting them in the terminal connectors.

The quality of the cable, the cable installation, the number of devices and the amount of data to be passed will influence the practical cable length and communications speed (baud rate). Cabling has the greatest

influence on the quality of communications. Depending on the quality of the installation, it may be necessary to reduce the baud rate to avoid intermittent communications.

NOTE: Using a larger gauge wire will not allow you to exceed the maximum recommended cable length.

2.6 Device Addressing

The MAC Address must be set according to your network planning document by setting the DIP switch located on the faceplate or when this DIP switch is set to 0 (all off). An example of how to set the device's MAC Address DIP switch is shown below.

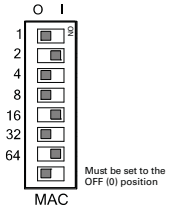

Figure 32. Typical device MAC address DIP switch set to 82

The address is the sum of the numbers set to ON. For example, if the second (2), fifth (16), and seventh (64) DIP switches are set to ON, the device MAC address is 82 (2 + 16 + 64). Only addresses from 1 to 127 are recommended to be used.

The controller must be power cycled after the MAC address DIP switch has been changed. The device instance (DevID) is automatically configured when setting the MAC Address to prevent network address conflict. The following formula is used to determine the device instance:

DevID = 364 * 1000 + MAC

For example:

MAC: 37

DevID = 364 * 1000 + 37 = 364037

The Device Instance can be changed once the controller has been commissioned through the network management software interface.

2.7 Comissioning the PCM50x Controllers

Once the BACnet MS/TP network is operational, the controller can be programmed with the Graphical Programming Interface (GPI) tool. Refer to the *PCM200/PCM500 Programming Guide (MKT-0027)* for more details.

2.8 Setting the Baud Rate (Optional)

By default, the BAUD rate for the controller is set to automatically detect the current communication BAUD rate of the connected BACnet MS/TP network (AUTO). This is the preferred setting for a controller. However, at least one controller on the BACnet MS/TP network data bus must have its BAUD rate set. The preference is to set the building controller's BAUD rate (if present). Otherwise, set the BAUD rate on one controller that will set the BAUD rate for all other controllers (to act as the master for setting the BAUD rate).

NOTE

When the Baud rate is set to AUTO, the controller cannot initiate any communication until it has detected the baud rate of the BACnet MS/TP network. If all controllers on the BACnet MS/TP network are set to AUTO, then all controllers will not communicate.

2.8.1 How to Set the Baud Rate

Refer to the *Section 3, Getting Started with EC-NET^{AX} for BACnet® Controllers in the PCM200/PCM500 Programming Guide (MKT-0027)*for details.

2.9 Strain Relief and Terminal Block Cover

In certain jurisdictions, terminal block covers are required to meet local safety regulations. Strain reliefs and terminal block covers are available for controllers housed in the large enclosures and are used to relieve tension on the wiring and conceal the controllers' wire terminals. Strain reliefs and terminal block covers are optional and are sold as peripherals.

Prior to connecting all wires, it is recommended to install the strain relief. Three screws are provided for its installation under the bottom part of the enclosure. Tie wraps can then be used to group wires together and attach them securely to the strain relief in an effort to relieve undue tension. If necessary, the terminal block cover can then be clipped on to the strain relief as shown below

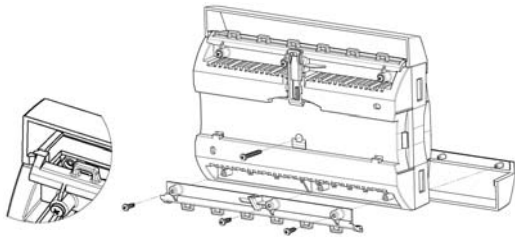

Figure 33. Large enclosure strain relief and terminal block cover installation

2.10 Maintenance

CAUTION

Turn off power before any kind of servicing.

Note that there may be multiple power sources.

Each controller requires minimal maintenance, but it is important to take note of the following:

- If it is necessary to clean the outside of the front plate and/or the inside of the back plate, use a dry cloth.
- Verify the tension of all wires and cables whenever the controller is serviced.

2.11 Disposal

The Waste Electrical and Electronic Equipment (WEEE) Directive sets out regulations for the recycling and disposal of products. The WEEE2002/96/EG Directive applies to standalone products, i.e., products that can function entirely on their own and are not a part of another system or piece of equipment.

For this reason Phoenix Controls products are exempt from the WEEE Directive. Nevertheless, Phoenix Controls products are marked with the WEEE symbol, indicating that disposal of the devices shall not be done together with municipal waste.

Figure 34. WEEE Directive symbol

Products must be disposed of at the end of their useful life according to local regulations and the WEEE Directive.

2.12 FCC Statement

CAUTION

FCC: This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

2.13 Phoenix Controls Cables

Cable Type	Plenum Rated	Function	Wire Gauge	Primary Vendor/Part #	Alternate Vendor/ Part #	Color Code	Notes
2C Round	No	24 Vac power	18	Belden 9409		1: Red 2: Black	Must be stranded
		24 Vac power	14	Belden 9411			
2C Round	Yes	24 Vac power	18	Belden 82740	Windy City NP002360	1: Red 2: Black	Must be stranded
		24 Vac power	14	Windy City NP007960			
TSP	No	I/O signal wiring	22	Belden 9501		1: Black&Red	Twisted Shielded Pair
2 TSP	No	I/O signal wiring	22	Belden 9502		1: Black&Red 2: Black&White	Two Twisted Pair, Shielded
3C Round	No	Signal	22	Belden 8443		1: Red 2: Black 3: Green	Must be stranded
3C or 4C Round	Yes	Signal	22	Belden 88444	Windy City 004380	1: Red 2: Black 3: Green 4: White (not used as 3C)	Must be stranded
4C Round	No	Signal	22	Belden 8444	Manhattan M13304	1: White 2: Green 3: Black 4: Red	Must be stranded
5C Round	No	Signal	22	Belden 8445	Manhattan M13305	1: White 2: Brown 3: Black 4: Red 5: Green	Must be stranded

Cable Type	Plenum Rated	Function	Wire Gauge	Primary Vendor/Part #	Alternate Vendor/ Part #	Color Code	Notes
8C	No	Signal	22	Belden 9421	Manhattan M13308	1: White 2: Orange 3: Black 4: Red 5: Green 6: Yellow 7: Blue 8: Brown	No substitutes
8C	Yes	Signal	22	Comtran 4956		1: White 2: Orange 3: Black 4: Red 5: Green 6: Yellow 7: Blue 8: Brown	No substitutes
3C MS/TP	No	Shielded	22	Belden 3106A (120 ohm)		1: White with Orange stripe 2: Orange with White stripe 3: Blue with White stripe	Shielded with drain
3C MS/TP	Yes	Shielded	22	Connect-Air W223C-2060YPC		1: Black 2: White 3: Red	Foil shield with drain wire

Section 3. Troubleshooting

Controller is powered but does not turn on	
Fuse has blown (Auto-reset fuse)	Disconnect the power, the input and the output terminals. Then wait a few seconds to allow the auto-reset fuse to cool down. Check the power supply and check input and output wiring. Reconnect the power.
Power supply polarity	Verify that consistent polarity is maintained between all controllers and the transformer. Ensure that the 24 V COM terminal of each controller is connected to the same terminal on the secondary side of the transformer. See Figure 2-7 and Figure 2-8.
Controller cannot communicate on a BACnet MS/TP network	
Absent or incorrect supply voltage	1. Check power supply voltage between 24 Vac ±15% and 24 V COM pins, and ensure that it is between acceptable limits. 2. Check for tripped fuse or circuit breaker.
Overloaded power transformer	Verify that the transformer used is powerful enough to supply all controllers.
Network not wired properly	Double check that the wire connections are correct.
Absent or incorrect network termination	Check the network termination(s).
Max Master parameter	Configure the maximum number of master device on the MS/TP network in all devices to the controller's highest MAC address used on the MS/TP trunk.
There is another controller with the same MAC Address on the BACnet MS/TP data bus	Each controller on a BACnet MS/TP data bus must have a unique MAC Address. Look at the MAC Address DIP switch on the faceplate of each controller.
There is another controller with the same Device ID on the BACnet intranetwork	Each controller on a BACnet intranetwork (the entire BACnet BAS network) must have a unique Device ID.

Controller communicates well over a short network, but does not communicate on a large network	
Network length	Check that the total wire length does not exceed specifications.
Wire type	Check that the wire type agrees with the Phoenix Recommended Cables on page 20.
Network wiring problem	Double check that the wire connections are correct.
Absent or incorrect network termination	Check the network termination(s). Incorrect or broken termination(s) will make the communication integrity dependent upon a controller's position on the network.
Number of controllers on network segment exceeded	The number of controllers on a channel should never exceed 50.
Max Master parameter	Configure the maximum number of master device on the MS/TP network in all devices to the controller's highest MAC address used on the MS/TP trunk.
Hardware input is not reading the correct value	
Input wiring problem	Check that the wiring is correct according to this manual and according to the peripheral device's manufacturer.
Open circuit or short circuit	Using a voltmeter, check the voltage on the input terminal. Short circuit (0V) and Open circuit (5V).
Configuration problem	Using the controller configuration wizard, check the configuration of the input. Refer to the controller's user guide for more information.
Over-voltage or over-current at an input	An over-voltage or over-current at one input can affect the reading of other inputs. Respect the allowed voltage/current range limits of all inputs. Consult the appropriate datasheet for the input range limits of this controller.
Hardware output is not working correctly	
Fuse has blown (Auto reset fuse)	Disconnect the power and outputs terminals. Then wait a few seconds to allow the auto-reset fuse to cool down. Check the power supply and the output wiring. Reconnect the power.
Output wiring problem	Check that the wiring is correct according to this manual and according to the peripheral device's manufacturer.
Configuration problem	Using the controller configuration plug-in, check the configuration of the input. Refer to the controller's user guide for more information.
0-10 V output, 24 Vac powered actuator is not moving	Check the polarity of the 24 Vac power supply connected to the actuator while connected to the controller. Reverse the 24 Vac wire if necessary.
Rx/Tx LEDs	
RX LED not blinking	Data is not being received from the BACnet MS/TP data bus.
TX LED not blinking	Data is not being transmitted onto the BACnet MS/TP data bus.

Status LED—normal operation	
Fast blink	Initialization. The device is starting up.
Solid ON	Firmware upgrade in progress. Controller operation is temporarily unavailable. The new firmware is being loaded into memory. This takes a few seconds. Do not interrupt power to the device during this time
The Status LED is always OFF	The controller is operating normally.

Status LED blink patterns—Repeats every 2 seconds (highest priority shown first)	
Fast blink continuous 	Initialization or firmware upgrade The device is starting up or being upgraded.
Long Long Long blink 	The controller is offline. Appropriate action: Set the controller Online.
Short Short Long blink 	Poor-quality power; The device has browned-out: The voltage at the 24 Vac and 24 V COM terminals has gone below the device's acceptable limit during power up.
Short Long blink 	Invalid MAC address: The device's MAC address is set to zero (0) or is set to an address higher than the Max Master.
Long Short Short Short Short Long Short 	Backup and restore. The controller is being backed-up or restored.

For additional information and a listing of our global offices, please visit our Web site at www.phoenixcontrols.com or call (800) 340-0007.