

The Phoenix Controls **Programmable Control Module (PCM)** series provides a means of connecting additional inputs and outputs to the Celeris®, Theris® and Traccel® room-level network and developing custom control sequences to enhance the control functions already provided. The PCM offers varying numbers of configurable input and output connections, a graphical programming interface for developing custom control applications. The PCM adds tremendous power and flexibility to the Phoenix Controls environmental control system. The graphical programming interface makes developing custom control sequences simple and efficient.

## FEATURES

- Interfaces with Celeris, Theris and Traccel room-level networks
- 4, 6, 10 and 12 universal inputs
- 6, 8 and 12 universal/digital outputs
- Graphical block-oriented programming
- DIN rail mounting (all but PCM200)
- Separable housing allows removal of controller from wiring base

## SPECIFICATIONS

### Enclosure

- ABS type PA-765A tan enclosures with gray connectors

### Dimensions

- PCM200—4.8" x 5.9" x 2.5" (122.5 x 149.1 x 63.0 mm)
- PCM201—5.7" x 4.7" x 2.0" (144.8 x 119.4 x 50.8 mm)
- PCM202—5.7" x 4.7" x 2.0" (144.8 x 119.4 x 50.8 mm)
- PCM203—7.7" x 4.7" x 2.0" (195.6 x 119.4 x 50.8 mm)

### Approximate Weight

- PCM200—1.01lbs (0.45kg)
- PCM201—0.97lbs (0.44kg)
- PCM202—0.97lbs (0.44kg)
- PCM203—1.17lbs (0.53kg)

### Environmental

- Operating temperature 32 °F to 158 °F (0 °C to 70 °C)
- Storage temperature -4 °F to 158 °F (-20 °C to 70 °C)
- Relative humidity 0 to 90% non-condensing

### Power Inputs

- Voltage 24 Vac; ±15%, 50/60 Hz (PCM200 only)
- Voltage 24 Vac/Vdc; ±15%, 50/60 Hz (PCM201, PCM202, PCM203)
- Must be powered by a 24 Vac, Class 2 power supply
- Power supply polarity must be maintained

### Power Consumption

PCM200	18 VA (typical) / 85 VA (maximum)	3 A removable fuse
PCM201	18 VA (typical) / 25 VA (maximum)	1.85 A auto-reset fuse
PCM202	18 VA (typical) / 33 VA (maximum)	1.85 A auto-reset fuse
PCM203	25 VA (typical) / 50 VA (maximum)	2.5 A auto-reset fuse

### General Specifications

- Processor: Neuron® 3150®; 8 bits; 10 MHz
- Memory: Non-volatile Flash 64K (APB application)
  - Non-volatile Flash 128K (Storage)
- Communication: LonTalk® protocol
- Channel: TP/FT-10; 78 Kbps
- Transceiver: TP/FT-10; 78 Kbps



Programmable Control Module (PCM)

### General Specifications (continued)

- Clock: Real-time clock chip<sup>1</sup>
- Battery (for clock only): CR2032 Lithium (for clock)<sup>1</sup>
- Status indicator:
  - Green LEDs: power status and LON TX<sup>2</sup>
  - Orange LEDs: service and LON RX<sup>2</sup>
- Communication Jack: LON® audio jack mono 1/8" (3.5 mm)

<sup>1</sup> PCM200 and PCM201 do not have a clock function

<sup>2</sup> All except PCM200

### Inputs/Outputs

Type and quantity of I/O are determined by model number. For details on I/O, see the Selection Guide on pages 3 and 4.

### Agency Compliance

#### Electromagnetic Compatibility:

CE:	—Emission:	EN61000-6-3: 2001; Generic standards for residential, commercial and light-industrial environments
	—Immunity	EN61000-6-1: 2001; Generic standards for residential, commercial and light-industrial environments

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.



#### Agency Approvals

UL Listed (CDN and US):  
 UL916 Energy management equipment

Material: UL94-5VA

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## ORDERING GUIDE

### PCM 203 - R04

**PRODUCT FAMILY** \_\_\_\_\_  
PCM = Programmable Control Module

**SERIES** \_\_\_\_\_

**200** = Surface mount programmable controller:

4 universal inputs/2 universal outputs/4 digital triac outputs; supports up to 2 optional external DIN rail mounted 8A SPDT relays

**201** = DIN rail or surface mount programmable controller:

6 universal inputs/3 universal outputs/5 digital triac outputs; supports up to 3 optional external DIN rail mounted 8A SPDT relays

**202** = DIN rail or surface mount programmable controller:

10 universal inputs/8 universal outputs; supports up to 8 optional external DIN rail mounted 8A SPDT relays

**203** = DIN rail or surface mount programmable controller:

12 universal inputs/12 universal outputs; supports up to 12 optional externally mounted 8A SPDT relays

**OPTION** \_\_\_\_\_

**Rnn** = Optional externally DIN rail mounted 8A SPDT relay

*nn* = quantity of relays (universal outputs only); number of relays may not exceed number of universal outputs, single digits entries must be preceded by a zero (0n)

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. Each model offers different output configurations to suit the specific application.

Model Number	Universal Inputs	Universal Outputs 1	Triac Outputs 2	Options
PCM200	4	2	4	R01 to R02
PCM201	6	3	5	R01 to R03
PCM202	10	8	—	R01 to R08
PCM203	12	12	—	R01 to R12

## INPUTS AND OUTPUTS

Universal Inputs (Software configurable)	
Input Types:	
• Voltage:	0 to 10 Vdc
• Current:	4 to 20 mA with 249 $\Omega$ external resistor (wired in parallel)
• Digital:	Dry contact
• Pulse:	Dry contact; 500 ms minimum ON/OFF
Resistors:	
• Thermistor:	10 K $\Omega$ Type 2, 3—Range -40 °F to 302 °F (-40 °C to 150 °C)
• Platinum:	Pt1000 (1 K $\Omega$ )—Range -40 °F to 302 °F (-40 °C to 150 °C) Pt100 (100 $\Omega$ )—Range -40 °F to 275 °F (-40 °C to 135 °C)
• Nickel:	Ni1000 (1 K $\Omega$ )—Range -40 °F to 302 °F (-40 °C to 150 °C)
• Potentiometer:	Translation table configurable on several points
Input Resolution:	16-bit analog/digital converter

Outputs	
Digital <sup>1</sup>	24 Vac Triac, digital (on/off), floating <sup>2</sup> or PWM <ul style="list-style-type: none"> <li>• 0.75A @ 158 °F (70 °C)</li> <li>• 1A @ 104 °F (40 °C)</li> <li>• PWM control: adjustable period from 2 seconds to 15 minutes</li> <li>• Min. pulse on/off: 500 msec.</li> <li>• Adjustable drive time period</li> <li>• External or internal power supply (jumper selectable)</li> </ul>
Universal	Software configurable <ul style="list-style-type: none"> <li>• 0-10 Vdc, 0-20 mA<sup>3</sup>, digital 0-12 Vdc (on/off), floating or PWM</li> <li>• PWM control: adjustable period from 2 seconds to 15 minutes</li> <li>• Floating control: requires two consecutive outputs               <ul style="list-style-type: none"> <li>• Min. pulse on/off: 500 msec.</li> <li>• Adjustable drive time period</li> </ul> </li> <li>• 60 mA max. @ 12 Vdc 140 °F (60 °C)</li> <li>• Minimum resistance 200 Ω</li> <li>• Auto-reset fuse               <ul style="list-style-type: none"> <li>• 60 mA @ 140 °F (60 °C)</li> <li>• 100 mA @ 68 °F (20 °C)</li> </ul> </li> </ul>
Output Resolution	10-bit analog/digital converter
Power Supply	15 Vdc; maximum 240 mA <sup>3</sup>
DC Relay Kit	
Relay	<ul style="list-style-type: none"> <li>• Coil Characteristics:               <ul style="list-style-type: none"> <li>• Rated voltage: 12 Vdc</li> <li>• Rated current: 33.3 mA</li> <li>• Resistance: 360 Ω</li> <li>• Minimum operating voltage: 8.4 V</li> </ul> </li> <li>• Operating Temperature: -40°F to 185°F (-40°C to 85°C)</li> <li>• Storage Temperature: -40°F to 221°F (-40°C to 105°C)</li> <li>• Agency Approvals: VDE, RU, CSA, RoHS</li> <li>• Contact Characteristics:               <ul style="list-style-type: none"> <li>• Maximum power rating: 2500 VA</li> <li>• Rated current: 10A</li> <li>• Rated voltage: 250 Vac</li> <li>• Standard contact material: Silver-nickel 90/10</li> </ul> </li> <li>• Type of Duty: Continuous</li> <li>• Mechanical life expectancy: 1x10<sup>6</sup> operations</li> <li>• Weight: 10 grams</li> </ul> Dimensions (L x W x H): 3.0" x .62" x 2.42" (76.2 mm x 15.8 mm x 61.5 mm)

<sup>1</sup> PCM200 and PCM201 only.

<sup>2</sup> Floating control: requires two consecutive outputs.

<sup>3</sup> PCM203 only.

## APPLICATIONS

The Phoenix Controls PCM is a programmable input/output module that may be used as:

- **A standalone controller**

Physical sensors and switches may be connected to the PCM, which then performs the desired control by using built-in functions (see section below) to switch or modulate PCM outputs.

- **An input/output (I/O) expansion module**

Physical sensors, switches and actuators may be connected to the PCM and values passed across the room-level network to a Celeris valve controller for use in its control sequence. Data from the PCM may also be passed across the building-level network to the BMS for monitoring purposes.

- **A controller integrated into the Celeris, Theris or Tracel system**

Data may be passed between the valve mounted controllers and PCM on the room-level network to supplement the control functions of either device. An example might be interlocking door locks between an anteroom and a space under control so that doors may not be opened until the pressure stabilizes or a certain number of air changes have occurred.

The PCM may also be used to implement virtually any room-level control sequence that relies on inputs from physical sensors, switches or network based variables to develop the desired control output, function or interlock. Typical control applications include:

- Lighting
- Temperature (spaces adjacent to controlled spaces)
- Access

### Built-in Functions

Essentially any control sequence that can be defined using our programming language based on the graphical block style programming tool which includes:

- 16 PID loops
- Precision integers with 2 decimals places ( $\pm 83886.07$ )
- Direct support of SNVTs of 1 and 2 bytes
- 17 NVIs and 17 NVOs (changeable type and length)
- 5 NVI Fan-in bindings (changeable type)
  - 3 NVI - Hisel, Lowsel, Sum and Average (up to 85 NVIs)
  - 2 NVI - Hisel and Lowsel
- Extensive block library of the most commonly used functions divided into 12 convenient categories containing over 80 block objects

Toolbox	
+ Comparators	
+ Constants and Variables	
+ Custom	
+ General	
+ HVAC	
+ Inputs & Outputs	
+ Logic	
+ Math	
+ SNVT Conversions	
+ Time	
+ Tools	
+ VAV	

### INSTALLATION

1. Choose a location where the operating conditions may be maintained within the specified environmental limits:
  - The device is not subject to shock and vibration.
  - Cable lengths are kept to a minimum.
  - The device is protected from dripping or spraying liquids, airborne dust and metallic particles.
2. When mounting the device:
  - Mount vertically with the ventilation slots on top.
  - Mount on a smooth, flat surface using 35mm DIN rail (all but the PCM200) mounting screws.
  - Allow two-inch clearance on all sides for proper ventilation, routing of cables.

In some cases, it may be necessary to remove the PCM cover to access the mounting screw slots.

See Figure 1 through Figure 3 for mounting dimensions.

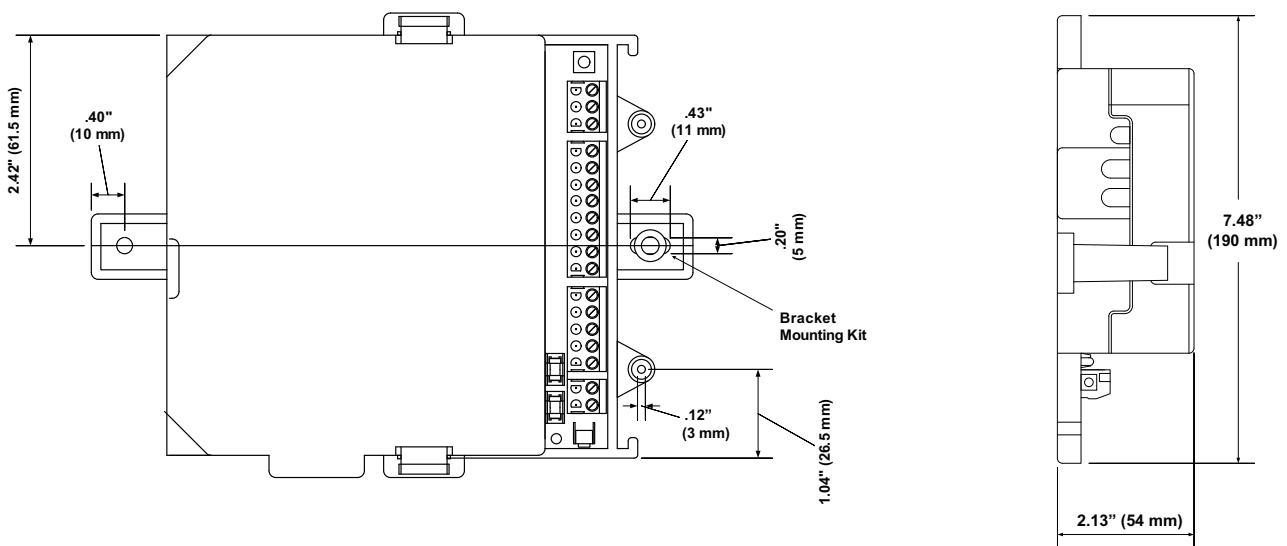


Figure 1. PCM200 Programmable Control Module

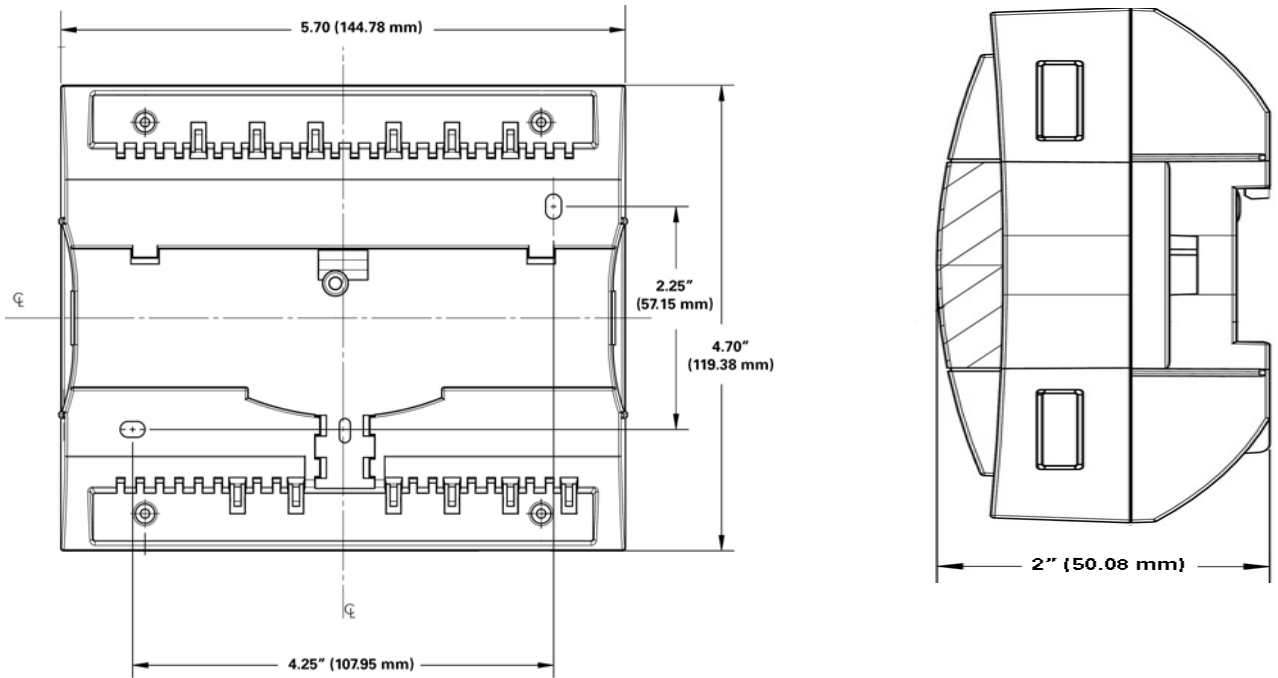


Figure 2. PCM201/PCM202 Programmable Control Module

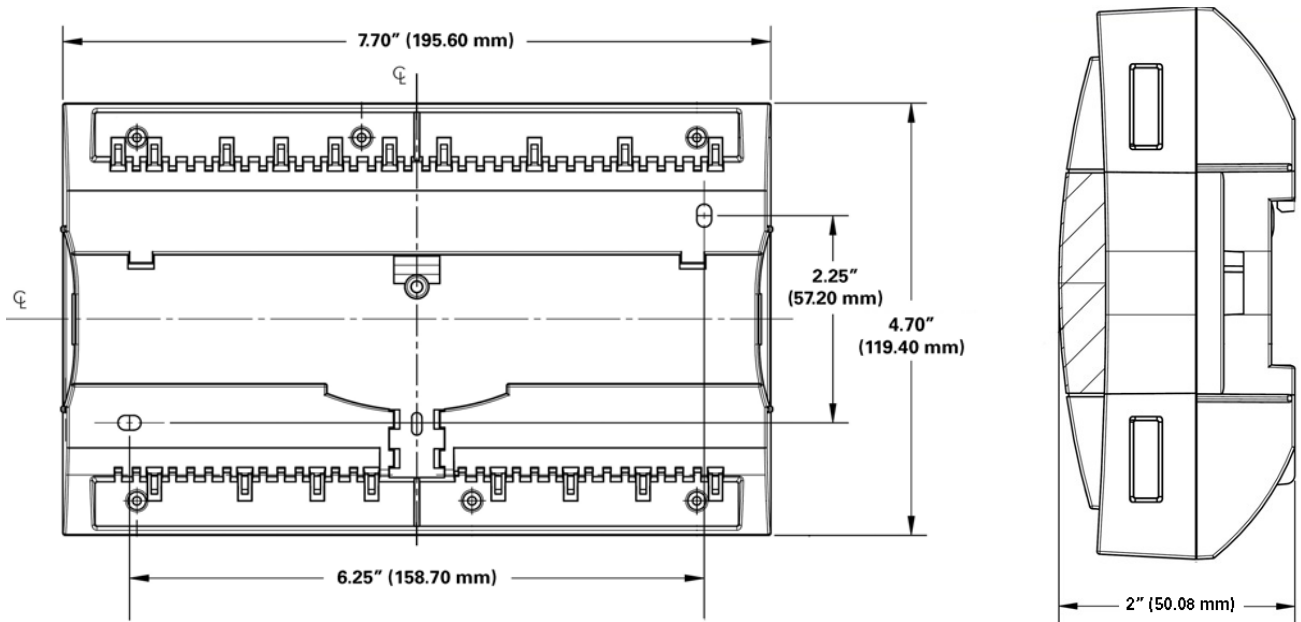


Figure 3. PCM203 Programmable Control Module

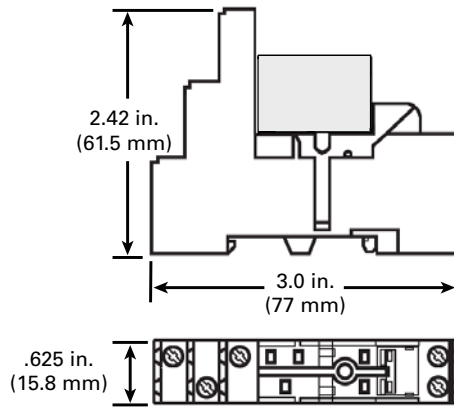


Figure 4. Relay Kit Dimensions

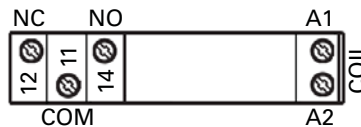


Figure 5. Relay Kit Connections

## WIRING

All wiring connections are via terminal blocks on the base plate that accommodate wire sizes from 22 to 12 AWG (0.14 to 2.5 mm). Multiple conductors may be placed under one terminal, providing the cumulative diameter does not exceed 0.1" (2.5 mm).

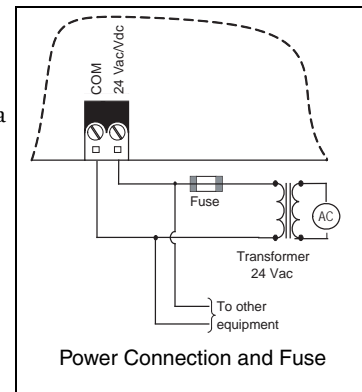
See Figure 6 for terminal location and typical connections.

### Phoenix Controls Wiring Recommendations

Table 1: Recommended Cable Specifications

Power:	Minimum cable section 18 AWG
Inputs:	Minimum cable section 20 AWG (twisted pair)
Digital outputs:	Minimum cable section 18 AWG
Analog outputs:	Minimum cable section 20 AWG (twisted pair)
Maximum wire gauge is 12 AWG (2.5 mm)	

- All circuits must conform to the requirements of an NEC Class 2 (dry) circuit.
- Use multiple transformers instead of larger transformers when more than 100 VA is required.
- Each pressurization zone should have either a dedicated single-phase primary circuit, or a secondary circuit disconnect
- Use cable sizes recommended by Phoenix Controls (see Table 1).
- Use stranded wire for ease of installation.
- Follow good wiring practices:
  - Locate cables away from sources of electrical interference (EMI/RFI).
  - Do not run signal or communication cable in the same conduit or wire way as power cables.
  - If signal cable must cross power cables place these 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.
- Power supply and signal isolation on I/O devices vary from manufacturer to manufacturer. Verify the wiring device manufacturer's recommendations for isolating power and signal common connections and maintain polarity.
- Local and national electrical codes take precedence.
- Strip 0.25" (6.4 mm) of insulation from each conductor, twist the strands, insert the conductor fully into the terminal block, and tighten the terminal.
- Test the wire connection by pulling on each conductor.
- See "Phoenix Recommended Cables" on page 9 for approved cable manufacturers and wire types.

### Power Connections

- The PCM may be powered by either 24 Vac or 24 Vdc. When locating the device, consider the location of the transformers/ power supplies, cable runs, and connected load to ensure proper operating voltage.

**NOTE:** PCM200 is 24 Vac only.

- Power connections are on the top left side of the control module (see Figure 6 for wiring configuration).
- An external fuse is recommended to protect the outputs and other equipment powered by the transformer.
- To calculate the required transformer power:
  - Add the power requirements of all of the controllers and peripheral devices.
  - Add the largest starting power of the group.
  - Multiply this value by 1.3.
  - This value is the required transformer power.

*Note: Failure to maintain proper polarity may cause damage to the control module.*

### Input and Output Connections

- The PCM supports a wide variety of universal inputs and analog and digital outputs.
- Signal input types are either jumper or software selectable; then defined and scaled using the PCM plug-in.
- Two terminations are provided for each input (+ and -). If a shield is used, it should be connected to the signal common (-) terminal.
- Power for inputs must be externally supplied. The PCM will not provide a power source for 4-20 mA input devices.
- Input connections are on the left side of the control module.
- Output connections are on the right side of the control module.

See Figure 6 for wiring configuration.

*Note: Multiple power sources may be present. Insure that all power is removed before handling bare conductors.*

## Network Connections

- Connect the PCM to the room-level (FTT-10) control network. Maintain a bus wiring topology.
- Network connections are on the lower left side of the control module.
- The recommended wire type for communications is Level IV, 22 AWG, unshielded cable, with six twists per foot.
- For more detailed information, please refer to the *“Phoenix Recommended Cables”* on page 9 or the *Junction Box and Wiring Guidelines* technical bulletin published by the Echelon Corporation.

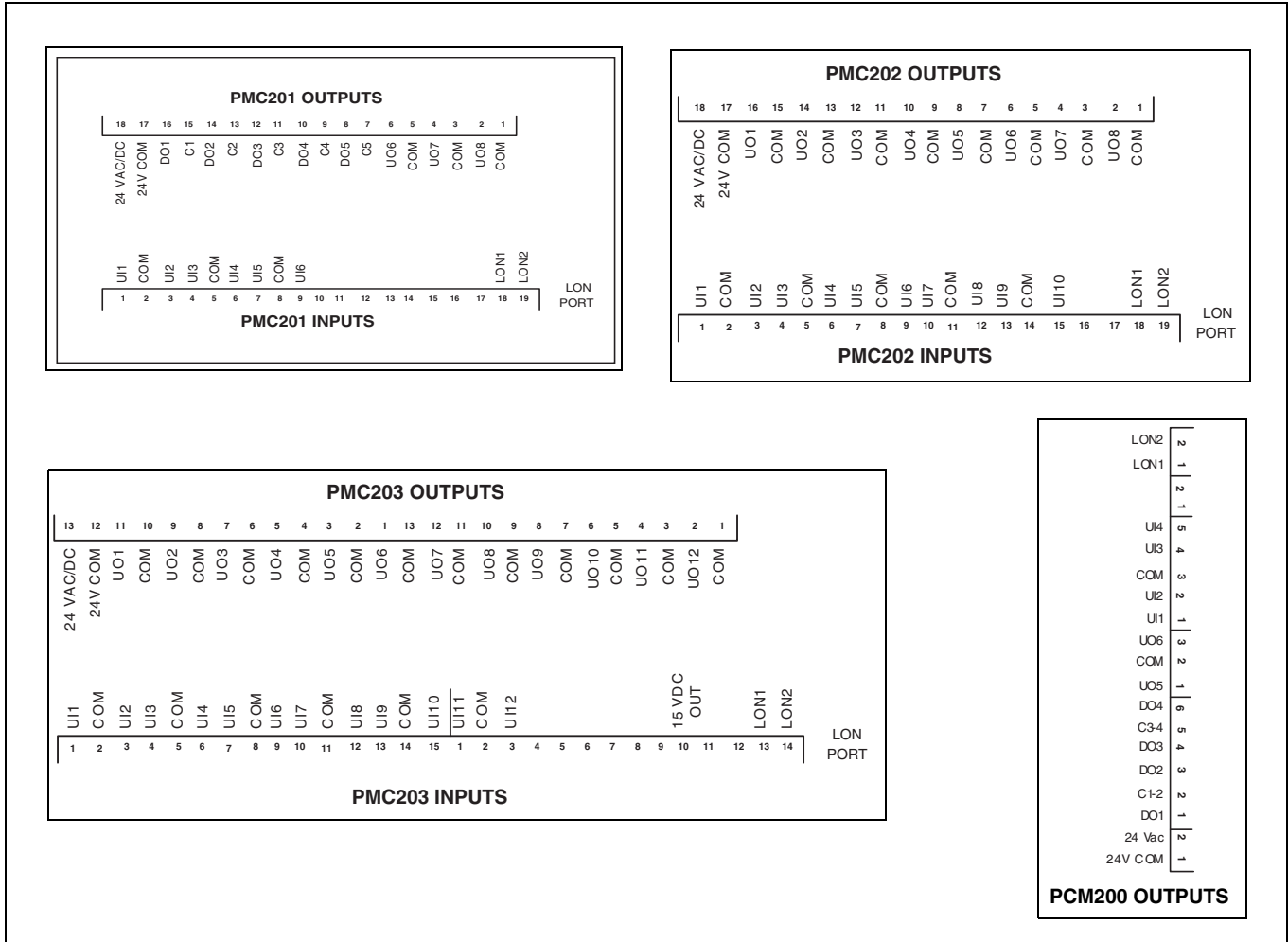


Figure 6. Electrical Connections

## PHOENIX RECOMMENDED CABLES

Cable Type	Plenum Rated	Function	Wire Gauge	Primary Vendor/Part #	Alternate Vendor/Part#	Color Code	Notes
2C Round	No	24 Vac power (110' max)	18	Belden 9409		1: Red 2: Black	Must be stranded
			14 <sup>1</sup>	Belden 9411			
3C Round	No	± 15 Vdc power	22	Belden 8443		1: Red 2: Black 3: Green	Must be stranded
2C Round	Yes	24 Vac power (110' max)	18	Belden 82740	Windy City NP002 360	1: Red 2: Black	Must be stranded
			14	Windy City NP007 960			
3C Round	Yes	± 15 Vdc power	22	Belden 88444	Windy City 004380	1: Red 2: Black 3: Green 4: White (N/A)	Must be stranded
TP	No	FTT-10 (4500')	22	Windy City 107500	BICC Gen C8641 Eastman Wire LEV4221	1: White/Blue stripe 2: Blue/White stripe	For more alternatives visit: <a href="http://echalon.com">echalon.com</a>
		TP1250 (425')	16	Windy City 109600	BICC Gen C8661 Eastman Wire 5705		
TP	Yes	FTT-10 (4500')	22	Windy City 105500	BICC Gen. 8601 Eastman Wire LEV4221P725	1: White/Blue stripe 2: Blue/White stripe	For more alternatives visit: <a href="http://echalon.com">echalon.com</a>
		TP1250 (425')	16	Windy City 109500	BICC Gen. C8621 Eastman Wire 725-5705		
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
3 TSP	No	I/O signal wiring	22	Belden 9503		1: Black&Red 2: Black&White 3: Black&Green	Three Twisted Pair Shielded
8C Shield	No	I/O fume hood controls, Thermostats	22	Belden 9944		1: White (N/A) 2: Orange 3: Black (N/A) 4: Red 5: Green 6: Yellow 7: Blue 8: Brown	8 Conductor, Shielded
8C Shield	Yes	I/O fume hood controls, Thermostats	22	Windy City 004352		1: White (N/A) 2: Orange 3: Black (N/A) 4: Red 5: Green 6: Yellow 7: Blue 8: Brown	8 Conductor, Shielded

<sup>1</sup> Required for high-speed electric actuation. Must be wired as a home run or star configuration, not daisy-chained.

## TROUBLESHOOTING

Problem	Solutions
<b>Controller is powered but does not turn on</b>	
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 COM terminal of each controller is connected to the same terminal on the secondary side of the transformer.
<b>Controller cannot communicate on a FTT network</b>	
Absent or incorrect supply voltage	<ol style="list-style-type: none"> <li>1. Check power supply voltage between 24 Vac/dc <math>\pm 15\%</math> and COM pins, and ensure that it is between acceptable limits.</li> <li>2. Check for tripped fuse or circuit breaker.</li> </ol>
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).
Incorrect APB/NXE file has been loaded	Use the memory erase jumper to reset the Neuron chip's memory, then load the proper APB or NXE into the controller using LonMaker.
Service pin not working	
<b>Controller communicates well over a short network, but does not communicate on large network</b>	
Network length	Check that the total wire length does not exceed the specifications of the <i>Junction Box and Wiring Guideline for Twisted Pair LonWorks Networks</i> .
Wire type	Check that the wire type agrees with the specification of the <i>Junction Box and Wiring Guideline for Twisted Pair LonWorks Networks</i> .
Network wiring problem	Double check that the wire connections are correct.
Absent or incorrect network termination	Check the termination(s). Incorrect or broken termination(s) will make the communication integrity dependent upon a controller's position on the network.
Extra capacitance	Make sure that no extra capacitance is being connected to the network other than the standard FTT circuit, and a maximum of a 3 meter stub (in bus topology).
Number of devices on network segment exceeded	The number of controllers on a channel should never exceed 64. Use a router or a repeater in accordance to the <i>Junction Box and Wiring Guideline for Twisted Pair LonWorks Networks</i> .
Network traffic	Query node statistic to check errors. Use a LON protocol analyzer to check network traffic.
<b>Hardware input is not reading the correct value</b>	
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 (0 V) and Open circuit (5 V).
Configuration problem	Using the controller configuration plug-in or wizard, check the configuration of the input. Refer to the controller's user guide for more information.
<b>Hardware output is not operating correctly</b>	
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.

<b>Problem</b>	<b>Solutions</b>
<b>Service LED (Orange Color)</b>	
Repeated Blink	The controller is in normal operation. The LED will blink according to the controller code execution time.
On	The controller is application-less. Appropriate action: Reload the APB or NXE.
Slow Blink (1 sec. On, 1 sec. Off)	The controller is not configured. Appropriate action: Commission the controller.
Fast Blink (0.3 sec. On, 1 sec. Off)	Watchdog time out. Application corrupted. Appropriate action: Use the memory erase jumper to reset the Neuron chip's memory, then load the proper APB or NXE into the controller using LonMaker.

## Replacement Parts

<b>Item</b>	<b>Part Number</b>
Replacement fuse kit—includes seven five-amp main power fuses and three 500 mA input/output fuses	260-000-018
Replacement battery kit—includes 25 CR2032 lithium batteries	250-220-374