

The Phoenix Controls **Programmable Control Module (PCM)** series provides a means of connecting additional inputs and outputs to the Celeris 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 BASIC-like programming interface for developing custom control applications, and a data logging function to capture trend data from the Celeris room-level network. The PCM adds tremendous power and flexibility to the Celeris environmental control system.

**FEATURES**

- Connects to Celeris room-level network
- 6, 8, or 12 universal inputs
- 7, 8, or 12 analog/digital outputs
- Programmable control functions:
  - 10 PID control loops
  - 15 internal timers
  - 50 internal variables
  - 50 internal constants
  - 18 configurable network variable inputs
  - 18 configurable network variable outputs
  - IF/THEN, AND/OR logic functions
  - Arithmetic functions (+, -, \*, /)
- Data logging function up to 12,000 events
- Pluggable terminal blocks
- Status indicators for outputs

**SPECIFICATIONS**

**Enclosure**

- Controller housing: 18-gauge painted metallic with mounting slots

**Dimensions**

- PCM167—6.5" H x 5.2" W x 1.5" D (165 x 132 x 38 mm)
- PCM108—7.5" H x 6.5" W x 1.5" D (191 x 166 x 38 mm)
- PCM112—9.0" H x 6.7" W x 1.5" D (229 x 170 x 38 mm)
- PCM188—10.3" H x 8.0" W x 1.8" D (262 x 203 x 45 mm)

**Approximate Weight**

- PCM167—1.8 lbs (0.8 kg)
- PCM108—2.4 lbs (1.1 kg)
- PCM112—2.9 lbs (1.3 kg)
- PCM188—3.6 lbs (1.6 kg)

**Environmental**

- Operating temperature 3 °F to 158 °F (-16 °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/Vdc; ±15%, 50/60 Hz
- Protection 5 amp removable fuse
- Must be powered by a 24 Vac, Class 2 power supply

**Power Consumption**

- PCM167—10 VA (max)
- PCM108—18 VA (max)
- PCM112—28 VA (max)
- PCM188—13 VA (max)

**General Specifications**

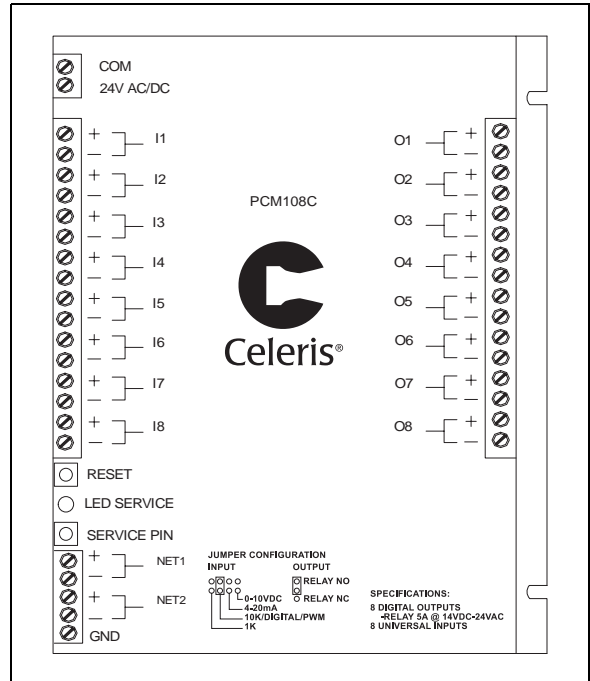
- Processor: Neuron® 3150®, 8 bits; 10 MHz
- Communication: LonTalk® protocol
- Transceiver: TP/FT-10; 78 Kbps
- Clock: Real-time clock chip [N/A on PCM167-E]
- Battery: CR2032 Lithium (for clock) [N/A on PCM167-E]
- Status indicator: Green LEDs on outputs

**Inputs/Outputs**

Type and quantity of I/O are determined by model number. For details on I/O, see the Selection Guide on pages 2 and 3.

**Agency Compliance**

- CE—European Directive 89/336/EEC, Electromagnetic Compatibility
- C/US UL listing for Energy Management Equipment—UL 916/CSA 22.2 # 205-M1983



Celeris® Programmable Control Module (PCM).

**ORDERING GUIDE**

**PCM108B**

**BASE MODEL NUMBER**

- PCM167E = 6 inputs, 2 analog and 5 digital outputs
- PCM108A = 8 inputs, 8 analog outputs
- PCM108B = 8 inputs, 4 analog and 4 digital outputs
- PCM108C = 8 inputs, 8 digital outputs
- PCM112A = 12 inputs, 12 analog outputs
- PCM112B = 12 inputs, 6 analog and 6 digital outputs
- PCM112C = 12 inputs, 12 digital outputs
- PCM188D = 8 inputs, 8 universal outputs

Under Directive 89/336, the PCM series of products have been designed and manufactured to meet the following standards:

- EN 55022: 1998 B Class; Conducted Emission
- EN 55022: 1998 B Class; Radiated Emission
- EN 61000-4-2: 1995 Level 3 in the Air; Electrostatic Discharge
- EN 61000-4-2: 1995 Level 2 by Contact; Electrostatic Discharge
- EN 61000-4-3: 1996 Level 2; Radiated Field Immunity
- EN 61000-4-4: 1995 Level 2; Electrical Fast Transient
- EN 61000-4-6: 1996 Level 2; Conducted Immunity
- ENV 50204: 1995 Level 2; Radiated Field Immunity

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## SELECTION GUIDE

The PCM is offered in a variety of configurations with varying numbers of inputs and outputs, and various output configurations. All have universal inputs, offering a wide variety of input configurations. Each model offers different output configurations to suit the specific application. The PCM may be mounted on any flat, level surface.

### Inputs

- The input resolution is set by a 12-bit analog/digital converter.
- The number of inputs varies, depending on the device.
- Inputs are jumper selectable for input type; range scale and other characteristics are set using the PCM plug-in.

Part Number	Inputs	Analog Outputs	Digital Outputs	Trending
PCM167E	6 <sup>1</sup>	2	5 <sup>2</sup>	Y
PCM108A	8	8	0	Y
PCM108B	8	4	4	Y
PCM108C	8	0	8	Y
PCM112A	12	12	0	Y
PCM112B	12	6	6	Y
PCM112C	12	0	12	Y
PCM188D	8	8 <sup>3</sup>		Y
<sup>1</sup> RTD input not supported				
<sup>2</sup> 1A Triac outputs in lieu of 5A relays				
<sup>3</sup> Universal Outputs w/Hand/Auto/Off switch				

Voltage	<ul style="list-style-type: none"> <li>• Linear voltage signal</li> <li>• Scaled from 0 to 10 Vdc</li> <li>• Accuracy ±0.5%</li> </ul>
Current	<ul style="list-style-type: none"> <li>• Linear current signal</li> <li>• Scaled from 4 to 20 mA using an external resistor (based on model number)</li> <li>• Accuracy ±0.5%</li> </ul>
Resistance	Various linear and non-linear resistive inputs: <ul style="list-style-type: none"> <li>• Thermistor 10 KΩ @ 77 °F (25 °C) Type 2 or 3               <ul style="list-style-type: none"> <li>• Range -40 °F to 302 °F (-40 °C to 150 °C)</li> <li>• Accuracy ±0.9 °F (0.5 °C)</li> <li>• Resolution 0.18 °F (0.1 °C)</li> </ul> </li> <li>• Platinum RTD 1 KΩ @ 32 °F (0 °C) [not available on PCM167E]               <ul style="list-style-type: none"> <li>• Range -40 °F to 167 °F (-40 °C to 75 °C)</li> <li>• Accuracy ±1.8 °F (1.0 °C)</li> <li>• Resolution 0.54 °F (0.3 °C)</li> </ul> </li> <li>• Potentiometer 0 to 10 KΩ or 0 to 100 KΩ               <ul style="list-style-type: none"> <li>• Configurable as linear or with a 21-point curve</li> <li>• Accuracy ±0.5%</li> </ul> </li> </ul>
Digital Dry Contact	As a two-state (ON/OFF) or pulsed input: <ul style="list-style-type: none"> <li>• 200 m/s minimum ON pulse (without trending)</li> <li>• 350 m/s minimum OFF pulse (without trending)</li> <li>• 350 m/s minimum ON/OFF pulse (with trending)</li> </ul>

## SELECTION GUIDE (CONTINUED)

### Outputs

- The output resolution is set by an eight-bit analog/digital converter.
- The number of outputs is determined by the model number.
- The type of output is determined by model number, jumper configuration, and plug-in settings.
- One model offers a hand-off-automatic option.

Relay [not available on PCM167E]	<ul style="list-style-type: none"> <li>• 5 amps @ 14-24 Vdc</li> <li>• Jumper selectable NO or NC</li> </ul>
TRIAC [PCM167E only]	1 amp @ 24 Vac external power supply
Tri-mode Voltage	<p>The tri-mode output may be configured as a linear voltage output, a two-state switched digital output, or a Pulse-Width Modulating (PWM) output.</p> <ul style="list-style-type: none"> <li>• Voltage: Output signal may be scaled to modulate from 0 to 10 Vdc (linear)</li> <li>• Digital: Output signal will switch from 0 to 12 Vdc (on/off) on all <i>except</i> the PCM188D, which is rated 0 and 10 Vdc</li> <li>• PWM output: Adjustable period from 2 seconds to 15 minutes</li> </ul>
Tri-mode Output Rating	<ul style="list-style-type: none"> <li>• Maximum current is 60 mA @ 12 Vdc on all <i>except</i> PCM188D, which is rated at 20 mA @ 10 Vdc</li> <li>• Maximum load is 200 ohms, <i>except</i> PCM188D, which is rated at 500 <math>\Omega</math></li> <li>• Internal auto-reset fuse is used to protect the outputs: <ul style="list-style-type: none"> <li>• 100 mA @ 68 °F (20 °C)</li> <li>• 60 mA @ 140 °F (60 °C)</li> </ul> </li> </ul>
Current [PCM188D only]	Output signal may be scaled to modulate from 4 to 20 mA (linear) into a maximum load of 500 $\Omega$

## 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 system**  
Data may be passed between the Celeris valve 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.
- **A local data logger for trending purposes**  
The PCM may be used to collect data from the room-level network and store it locally. The data may later be uploaded to a spreadsheet or database application for analysis or archiving. The PCM may be configured to collect data based on time interval, exceeding a predetermined differential, or both. The local data logging function may be the sole data storage device, or to supplement the BMS should building level communications be interrupted.

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 Celeris controlled spaces)
- Access

## APPLICATIONS (CONTINUED)

### Built-in Functions

Essentially any control sequence that can be defined using our programming language based on a simplified version of BASIC, which includes:

- Conditional IF/THEN, AND/OR, ELSE logic
- Comparative GREATER THAN, LESS THAN, EQUAL TO
- Calculations, such as AVERAGE, +, -, \*, /
- Up to 10 configurable PID control loops
- Up to 15 internal timers
- Up to 50 defined variable
- Up to 50 defined constants
- HI-SELECT, LO-SELECT, and FAN-IN functions

### INSTALLATION

1. Choose a location where the operating conditions may be maintained within the specified environmental limits:

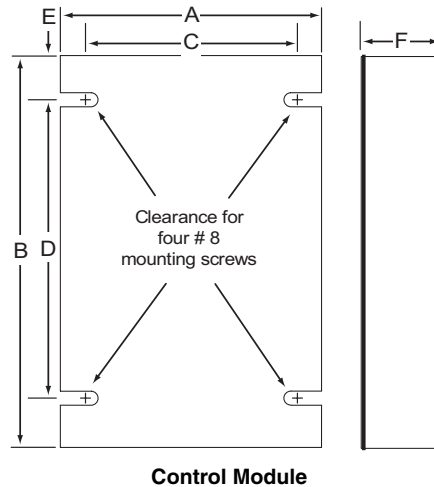
- The device is not subject to shock and vibration.
- Cable lengths are kept to a minimum.
- The device is protected from dripping or spraying liquids, airborne dust and metallic particles.

2. When mounting the device:

- Mount vertically with the ventilation slots on top.
- Mount on a smooth, flat surface using four mounting screws (see Figure 1).
- Allow two-inch clearance on all sides for proper ventilation, routing of cables and removal of pluggable terminal blocks.

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

See Figure 1 for mounting dimensions.



	A	B	C	D	E	F
PCM167	5.2 (132.1)	6.5 (165.1)	4.3 (109.2)	4.5 (114.3)	1.0 (25.4)	1.5 (38.1)
PCM108	6.5 (165.1)	7.5 (190.5)	5.6 (142.2)	4.97 (126.2)	1.3 (33.0)	1.5 (38.1)
PCM112	6.7 (170.2)	9.0 (228.6)	5.8 (147.3)	7.0 (177.8)	1.0 (25.4)	1.5 (38.1)
PCM188	8.0 (203.2)	10.3 (261.6)	7.2 (182.9)	7.75 (196.6)	1.3 (33.0)	1.9 (48.3)

Dimensions are in inches and (millimeters)

Fig 1 Mounting dimensions.

## WIRING

All wiring connections are via pluggable terminal blocks 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 2 for terminal location and typical connections.

### Phoenix Controls Wiring Recommendations

- 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.
- Refer to the Phoenix Controls Cable Selection Guide in the *Laboratory Engineering Guide* for approved cable manufacturers and wire types.

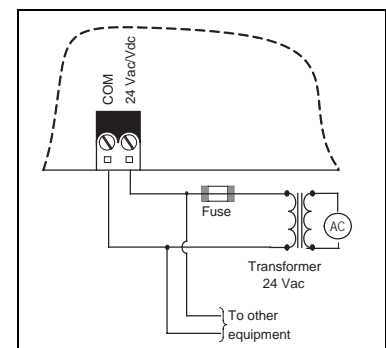
Power:	Minimum cable section 18 AWG
Inputs:	Minimum cable section 20 AWG (twisted pair)
Digital outputs:	Minimum cable section 18 AWG
Analog outputs:	Minimum cable section 20 AWG (twisted pair)
Maximum wire gauge is 12 AWG (2.5 mm)	

Table 1: Recommended Cable Specifications

### 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.
- Power connections are on the top left side of the control module (see Figure 2 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.*



Power Connection and Fuse

## WIRING (CONTINUED)

### 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 2 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 Controls Cable Selection Guide or the Junction Box and Wiring Guidelines* technical bulletin published by the Echelon Corporation.

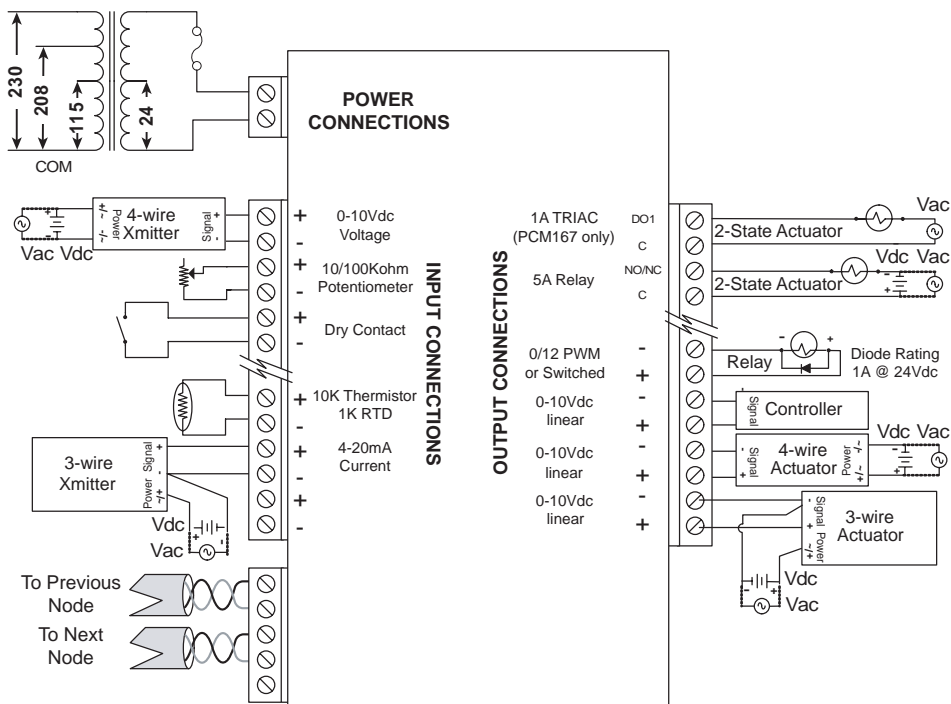


Fig 2 Electrical Connections.

## TROUBLESHOOTING

Problem	Possible Causes	Solutions
1. The PCM does not appear to be functioning.	<ul style="list-style-type: none"> <li>A. Determine whether the PCM is powered.</li> <li>B. No power has been applied.</li> <li>C. A fuse is open.</li> </ul>	<ul style="list-style-type: none"> <li>A. Press the service pin. The Service LED should then illuminate.</li> <li>B. Check the wiring and power.</li> <li>C. Remove the power. Then disconnect the input and output terminal blocks, and check the internal fuse.* Allow the device to remain unpowered for 5 minutes. Reapply the power and repeat step A above.</li> </ul>
2. The PCM is powered, but the program is not executing.	<ul style="list-style-type: none"> <li>A. The input or output devices may not be connected/powering.</li> <li>B. The program is not loaded.</li> <li>C. The program is not executing properly.</li> <li>D. Inputs and outputs may be manually overridden in the PCM.</li> <li>E. The PCM has no application (the LED flashes ON for 1 second, then OFF for 1 second).</li> <li>F. The watchdog timer is timing out (the LED flashes ON for 0.5 second, then OFF for 1 second).</li> </ul>	<ul style="list-style-type: none"> <li>A. Verify the wiring/power to the input and output sensors/actuators.</li> <li>B. Use the PCM plug-in to verify the status of the program. Load the program, if necessary.</li> <li>C. Use the PCM plug-in to analyze the code loaded in the PCM.</li> <li>D. Use the PCM plug-in to verify input/output configuration.</li> <li>E. Use LonMaker to download the appropriate PCM application image.</li> <li>F. Contact your local Phoenix Controls representative.</li> </ul>
3. The program is executing, but the output is not changing.	<ul style="list-style-type: none"> <li>A. The input or output devices may not be connected/powering.</li> <li>B. The internal fuse(s) are open.</li> </ul>	<ul style="list-style-type: none"> <li>A. Verify the wiring/power to the input and output sensors/actuators.</li> <li>B. Remove the power, disconnect the input and output terminal blocks, and check the internal fuse.* Allow the device to remain unpowered for 5 minutes. Then reapply the power. While the output is disconnected, observe the output LED status, which should switch ON/OFF or change from dim to bright, depending on the intended output state. Verify input/output wiring, power connections, and current draw.</li> </ul>

### \* Circuit Protection Devices

Model #	Main Power		Inputs		Tri-mode Output	
PCM167E	1.35	Auto-reset	None		20 mA @ 20 °C	Auto-reset
PCM108X	5	Replaceable	None		20 mA @ 20 °C	Auto-reset
PCM112X	5	Replaceable	None		20 mA @ 20 °C	Auto-reset
PCM188D	5	Replaceable	500 mA	Replaceable	500 mA	Replaceable

### Replacement Parts

Item	Part Number
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