PROLON

HARDWARE GUIDE

Hydronic Controller M2000 Series

Specifications and Operational Guide

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[IMPORTANT INFORMATION - READ BEFORE YOU BEGIN]

For simplicity and consistency, temperature values shown in this document are displayed in Fahrenheit (°F). Prolon Focus can be configured by the user to display either Fahrenheit (°F) or Celsius (°C) based on preference or regional requirements.

Prolon products also support metric and imperial measurement options, where applicable.

Product availability, features, and specifications may vary by region.

Images and information are provided for reference only and may change without notice.

General Information

PL-M2000 Hydronic Controller

Description

The PL-M2000 hydronic controller is designed to control a variety of different water-to-water heatpumps and hydronic systems. The on-board microcontroller offers precise digital control to maximize performance. The available control sequences are fully configurable, either locally or remotely, using free software. The PL-M2000 offers a variety of hydronic sequences such as hot and cold tank, dual recovery system, single hot tank with open or closed boiler loop, dual energy boilers and more.

General Behaviour

Although fully configurable, the Prolon PL-M2000 hydronic controller monitors dedicated inputs and uses pre-established control sequences to drive dedicated outputs that control various types of hydronic equipment. These sequences can be fully optimized to obtain the best results for each type of system. Numerous parameters enable the modification or fine tuning of the pumps, the boilers, the target supply temperature, the proportional bands, integration times, differentials, operational ranges, setpoints and a whole range of limits and safeguards. The various programming options also allow the user to modify the lead-lag sequences, conditions for pump activity and the influence of schedules or other data received over the network. All these parameters can be accessed and modified by using the Prolon Focus software.



Component Identification

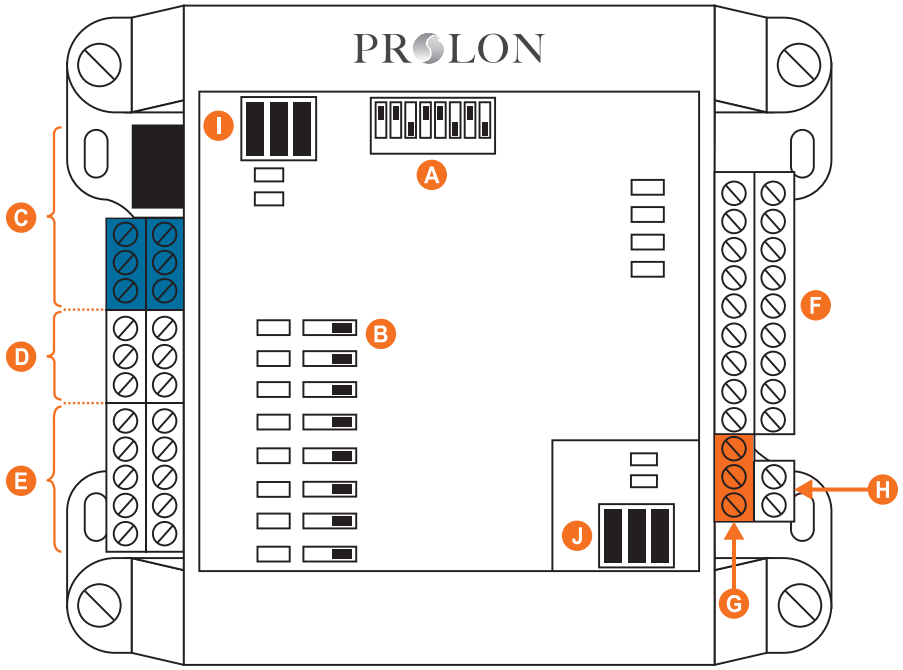


Figure 1 - Component Identification

Legend:

A - Addressing Dipswitch

B - AUTO/OFF/HAND Switches

C - RS485 INT port for interface communication (RJ45 plug and screw connectors are in parallel)

D - Analog outputs (3)

E - Digital outputs (5)

F - Analog inputs (9)

G - RS485 NET port for network communication

H - Terminal block for 24VAC (Class 2 transformer)

I - Jumpers for terminating and bias resistors for the INT port

J - Jumpers for terminating and bias resistors for the NET port

LEDs and Switches

The PL-M2000 has various LEDs which are linked to different functions and outputs of the controller. Each LED is individually identified to help the user make a quick visual diagnostic of the controller's activity and status.

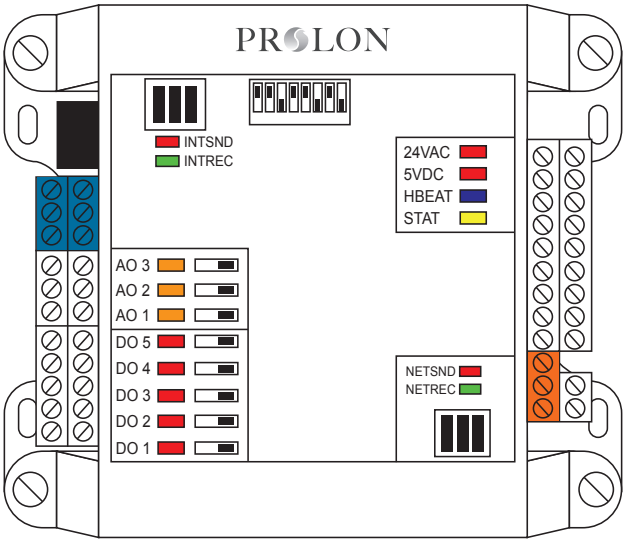


Figure 2 - LEDs Identification

LED Descriptions

- **24 VAC**: The PL-M2000 is receiving 24 VAC from the power source.
- **5V DC**: The microchip and other components on the PL-M2000 are being powered successfully by a 5 VDC source derived from the 24 VAC source.
- **HBEAT**: When this LED is blinking, the microchip is active and the controller's program is running (normal). When this LED is ON and steady, the PL-M2000 is inactive and the microchip is awaiting programming (you must use Prolon's Focus software to reprogram the microchip).
- **STAT**: Reserved.
- **NETSND**: Indicates the transmission of data onto the network communication bus.
- **NETREC**: Indicates reception of data from the network communication bus.
- **INTSND**: Indicates the transmission of data onto the interface communication bus.
- **INTREC**: Indicates the reception of data from the interface communication bus.
- **AO3**: The intensity of the LED represents the voltage present on analog output 3.
- **AO2**: The intensity of the LED represents the voltage present on analog output 2.
- **AO1**: The intensity of the LED represents the voltage present on analog output 1.
- **DO5**: Represents the activity of digital output 5.
- **DO4**: Represents the activity of digital output 4.
- **DO3**: Represents the activity of digital output 3.
- **DO2**: Represents the activity of digital output 2.
- **DO1**: Represents the activity of digital output 1.

HAND/OFF/AUTO Switches

Each output on the PL-M2000 has a dedicated switch that lets the user manually override the activity of the output. "HAND" mode (switch at rightmost position) fully activates the output (24 VAC for digital outputs, 10VDC for analog outputs). "OFF" (switch at center) deactivates the output and "AUTO" (switch at left) returns control of the output to the program in the PL-M2000's microchip.

Jumpers

The PL-M2000 has jumpers that are externally accessible (see Figure 3), as well as jumpers that are inside the controller on the top internal board (see Figure 4), that allow for configuration of various hardware elements.

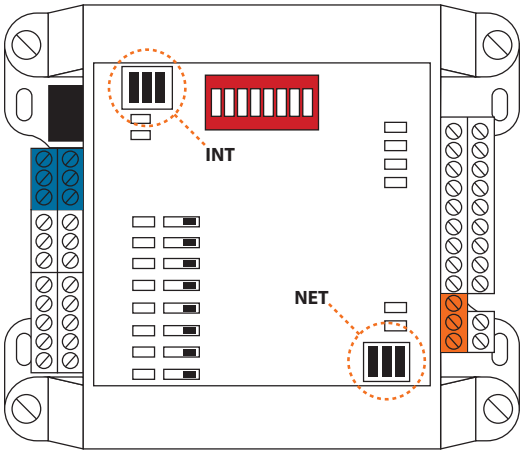


Figure 3 - Location of the EXTERNAL jumpers

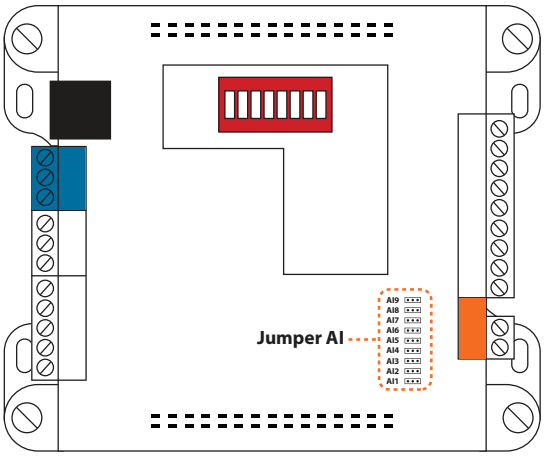


Figure 4 - Location of the INTERNAL jumpers

- **INT**: These are the jumpers for the bias and terminating resistors used for the interface communication bus. See the Prolon Network Guide for information about bias and terminating resistors. (See Figure 5)
- **NET**: These are the jumpers for the bias and terminating resistors used for the network communication bus. See the Prolon Network Guide for information about bias and terminating resistors. (See Figure 5)
- **AI 1 - 9**: These jumpers allow the user to select the signal mode of the associated analog input. (See Figure 6)

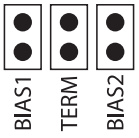


Figure 5 - INT and NET jumpers

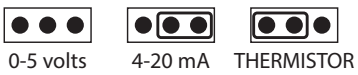


Figure 6 - AI jumpers

Addressing Dipswitch Configuration for Network Communication

For proper communication, a unique address must be configured on each controller by setting the first 7 switches on the addressing dipswitch to the desired value.

These switches are numbered from 1 to 7 and represent a binary value from 1 to 64 (1, 2, 4, 8, 16, 32, and 64 respectively). The last switch (#8) is reserved. The value of each switch that is in the ON position is added together to form the numerical address of the controller.

The example in Figure 7 shows the switches 1, 2 and 4 in the ON position. Therefore, the corresponding values are 1, 2 and 8, giving an address sum of 11.

The Prolon network allows a maximum of 127 addresses; therefore 127 controllers.

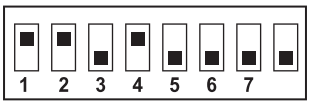


Figure 7 - Addressing Dipswitch

Hot and Cold Tank Sequence

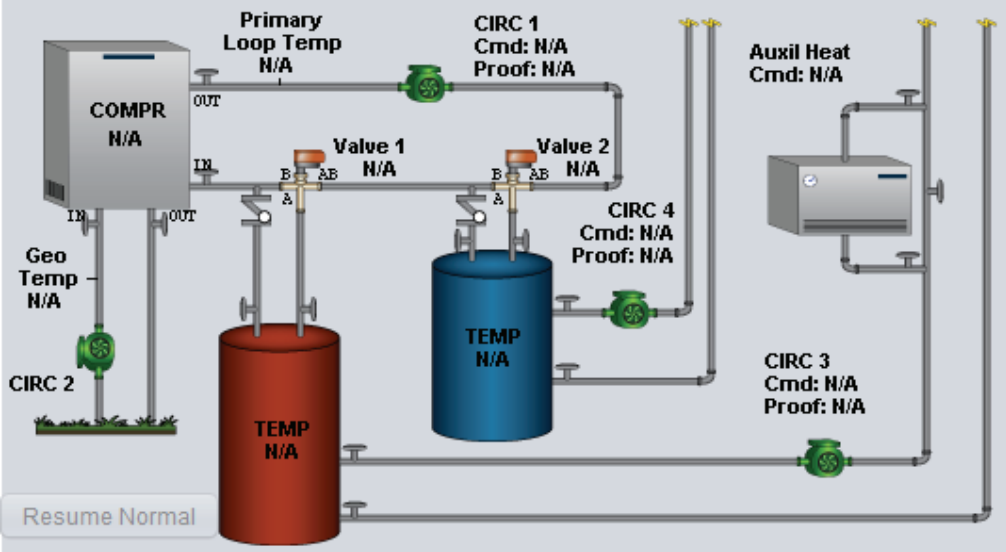


Figure 8 - Hot and Cold Tank Sequence

A water-to-water heatpump (single compressor or multistage with lead-lag functionality) is used to heat or cool a primary water loop. Valves are in place to allow or divert water into hot and cold tanks as needed. The target setpoint for each tank is calculated based on a configurable outside temperature reset scale. Priority between tanks is decided based either on outside temperature or on current offset from the calculated setpoint.

Pumps 1 and 2 ensure water circulation in the primary loop and ground loop. These pumps operate based on a request for compressor operation. Pumps 3 and 4 circulate water through the building and operate based on outside temperature or on request via analog inputs.

Auxiliary heat is enabled when the setpoint in the hot tank has not been reached after a configurable delay (default 60 min) of constant compressor operation has expired. At this point, both auxiliary heat and the compressor will operate until the setpoint is reached. Once auxiliary heat is enabled, it remains so for a configurable interval (default 4 hours).

Auxiliary heat can also be activated when the water temperature in the ground loop is too low. In this situation, only auxiliary heat is allowed and the compressor remains offline. Once auxiliary heat is enabled, it remains so for a configurable interval (default 4 hours). After the interval expires, and the ground loop water temperature has risen, the compressor may be used again.

Finally, Auxiliary Heat can also be used to maintain a low limit in the hot tank, even if cooling has priority and is active. This sequence depends on the current activity of Pump 3.

Input and Output Identification

All the inputs and outputs of the PL-M2000 use pluggable screw type terminal blocks with elevator style clamping, which make connections easier and more secure.

For incoming communication from a remote computer or network controller, dual RJ45 type connectors are available ***in parallel*** with screw type terminal blocks. The RJ45 connectors allow the use of premade CAT5 cables for simple plug-and-play RS485 communication. These RJ45 connectors follow the Modbus pinout specification for RS485 communication.

The I/O profile for the ***Hot and Cold Tank Sequence*** is as follows:

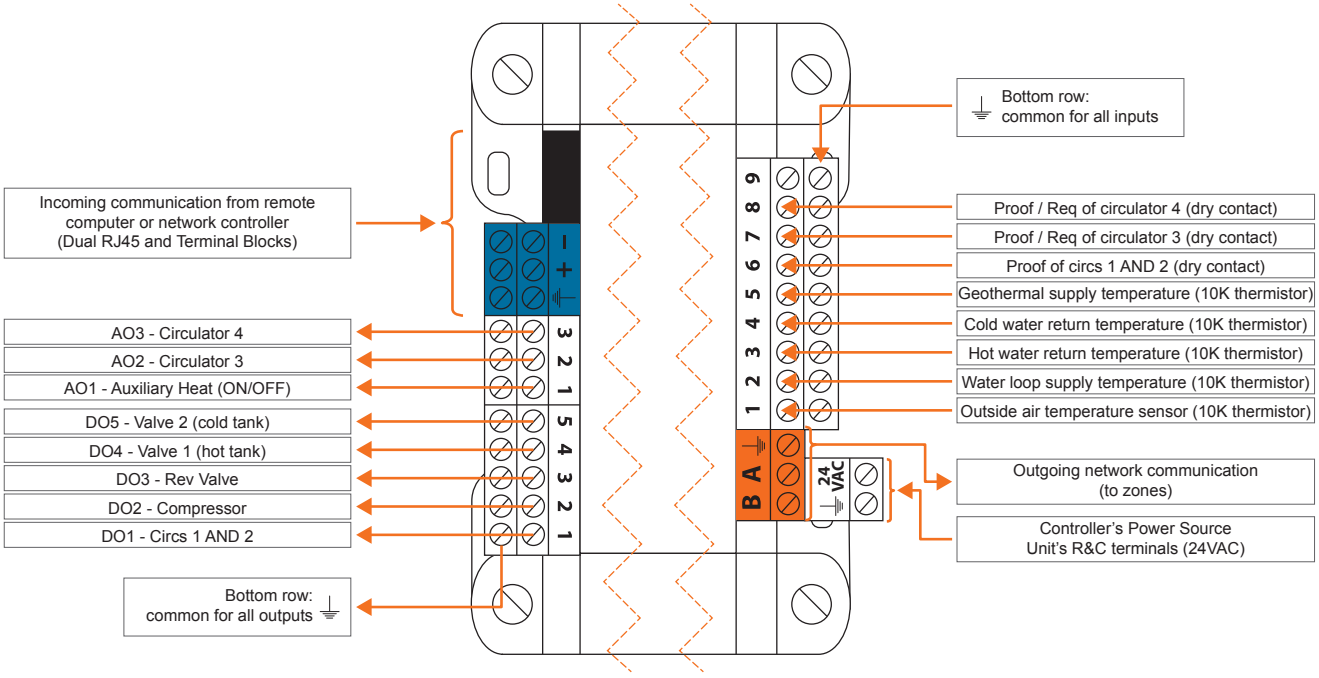


Figure 9 - Input and Output Identification (Hot and Cold Tank Sequence)

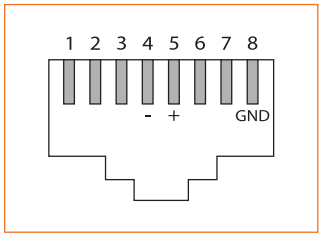


Figure 10 - RJ45 Pinout

Simple Hot Water Tank Sequence with Open Boiler Loop

The description of the Simple Hot Water Tank sequence with Open Boiler Loop used by the PL-M2000 Hydronic controller is as follows (see Figure 11):

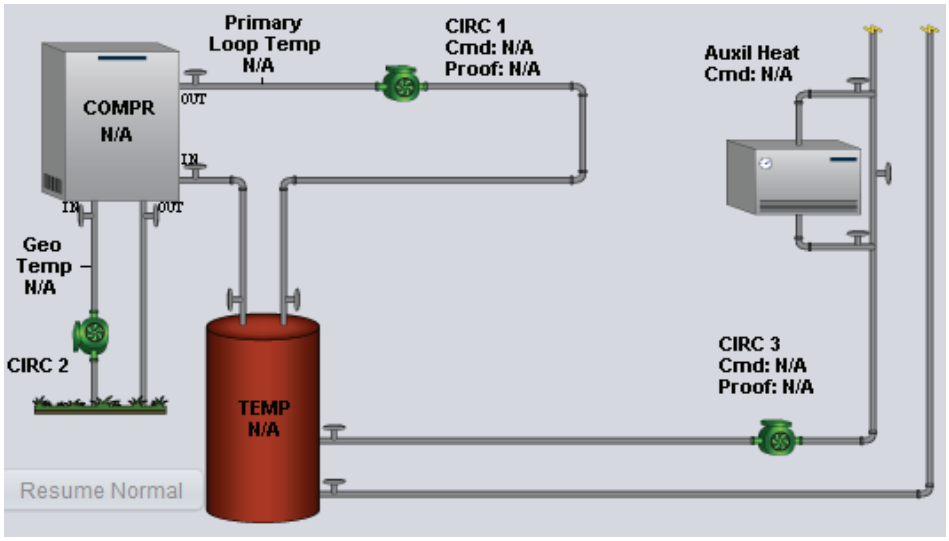


Figure 11 - Simple Hot Water Tank Sequence with Open Boiler Loop

A water-to-water heatpump (single compressor or multistage with lead-lag functionality) is used to heat a primary water loop. The target setpoint for the hot tank is calculated based on a configurable outside temperature reset scale.

Pumps 1 and 2 ensure water circulation in the primary loop and ground loop. These pumps operate based on a request for compressor operation. Pump 3 circulates water through the building and operates based on a physical contact input, building demand and outside temperature.

Auxiliary heat is enabled when the setpoint in the hot tank has not been reached after a configurable delay (default 60 min) of constant compressor operation has expired. At this point, both auxiliary heat and the compressor will operate until the setpoint is reached. On the next call for heat, the compressor will activate alone again.

Auxiliary heat can also be activated when the water temperature in the ground loop is too low. In this situation, only auxiliary heat is allowed and the compressor remains offline. Once the ground loop water temperature returns to normal, the compressor may be used again.

Input and Output Identification

All the inputs and outputs of the PL-M2000 use pluggable screw type terminal blocks with elevator style clamping, which make connections easier and more secure.

For incoming communication from a remote computer or network controller, dual RJ45 type connectors are available ***in parallel*** with screw type terminal blocks. The RJ45 connectors allow the use of premade CAT5 cables for simple plug-and-play RS485 communication. These RJ45 connectors follow the Modbus pinout specification for RS485 communication.

The I/O profile for the ***Simple Hot Water Tank sequence with Open Boiler Loop*** is as follows:

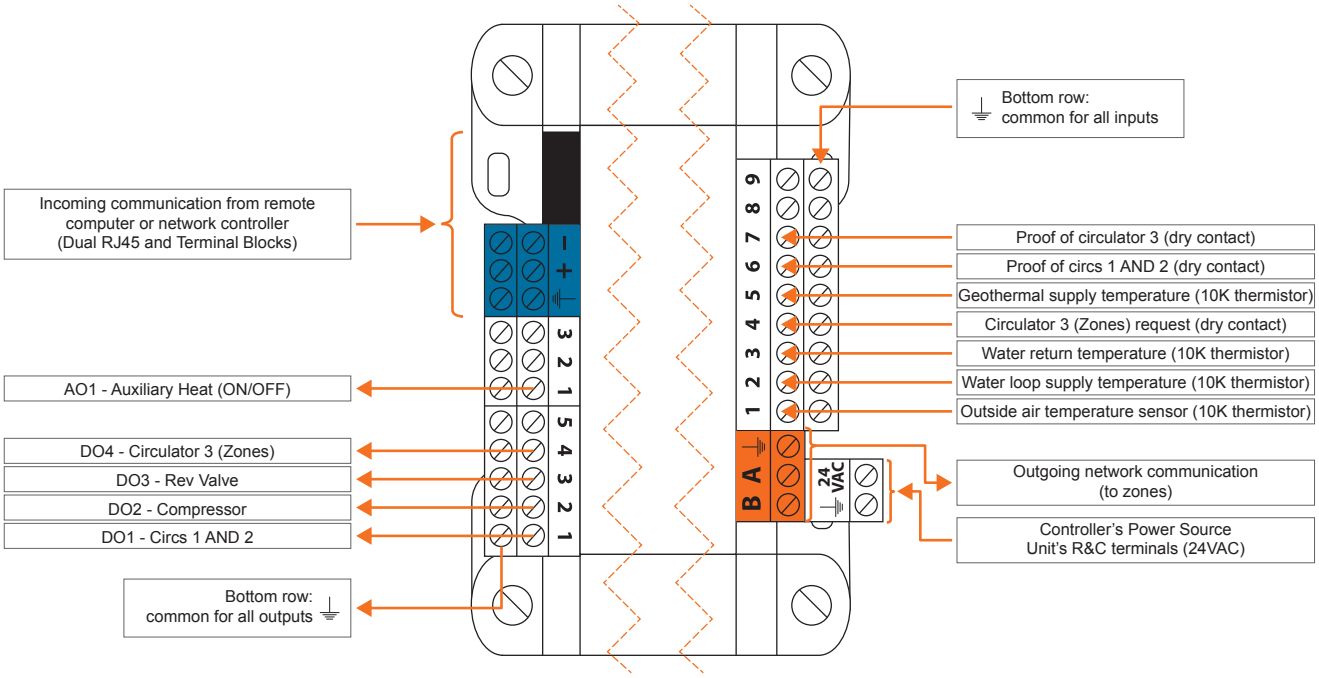


Figure 12 - Input and Output Identification (Open Boiler Loop)

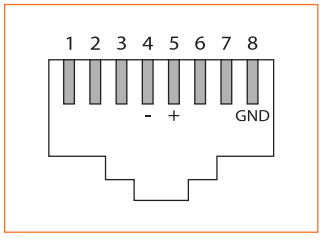


Figure 13 - RJ45 Pinout

Simple Hot Water Tank Sequence with Closed Boiler Loop

The description of the Simple Hot Water Tank sequence with Closed Boiler Loop used by the PL-M2000 Hydronic controller is as follows (see Figure 14):

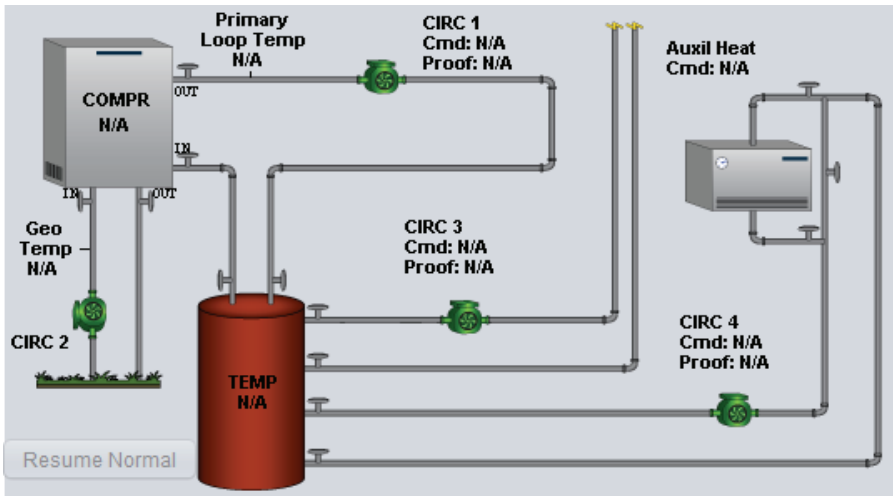


Figure 14 - Simple Hot Water Tank Sequence with Closed Boiler Loop

A water-to-water heatpump (single compressor or multistage with lead-lag functionality) is used to heat a primary water loop. The target setpoint for the hot tank is calculated based on a configurable outside temperature reset scale.

Pumps 1 and 2 ensure water circulation in the primary loop and ground loop. These pumps operate based on a request for compressor operation. Pump 3 circulates water through the building and operates based on a physical contact input, building demand and outside temperature. Pump 4 operates based on a call for auxiliary heat.

Auxiliary heat is enabled when the setpoint in the hot tank has not been reached after a configurable delay (default 60 min) of constant compressor operation has expired. At this point, both auxiliary heat and the compressor will operate until the setpoint is reached. On the next call for heat, the compressor will activate alone again.

Auxiliary heat can also be activated when the water temperature in the ground loop is too low. In this situation, only auxiliary heat is allowed and the compressor remains offline. Once the ground loop water temperature returns to normal, the compressor may be used again.

Input and Output Identification

All the inputs and outputs of the PL-M2000 use pluggable screw type terminal blocks with elevator style clamping, which make connections easier and more secure.

For incoming communication from a remote computer or network controller, dual RJ45 type connectors are available ***in parallel*** with screw type terminal blocks. The RJ45 connectors allow the use of premade CAT5 cables for simple plug-and-play RS485 communication. These RJ45 connectors follow the Modbus pinout specification for RS485 communication.

The I/O profile for the ***Simple Hot Water Tank Sequence with Closed Boiler Loop*** is as follows:

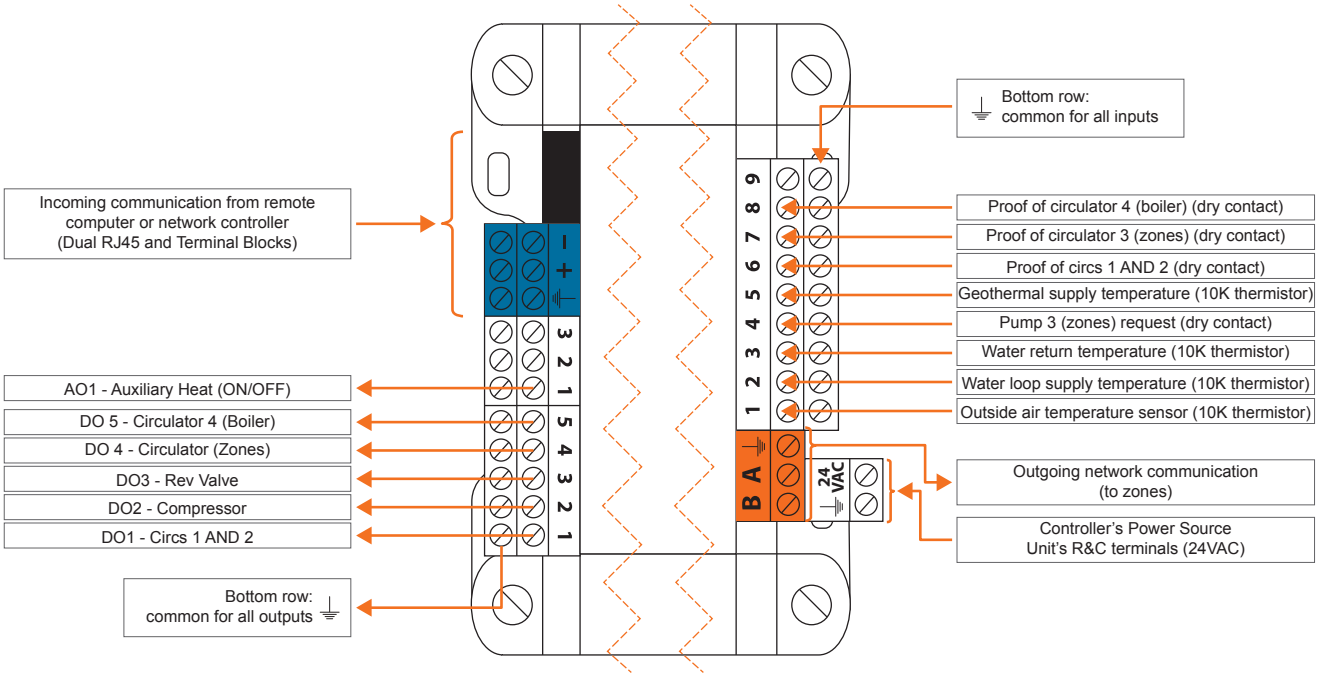


Figure 15 - Input and Output Identification (Closed Boiler Loop)

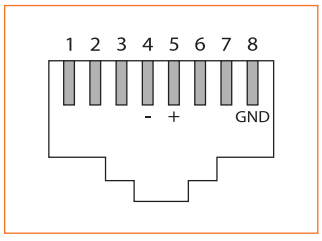


Figure 16 - RJ45 Pinout

Simple Cold Water Tank Sequence

The description of the Simple Cold Water Tank used by the PL-M2000 Hydronic controller is as follows (see Figure 17):

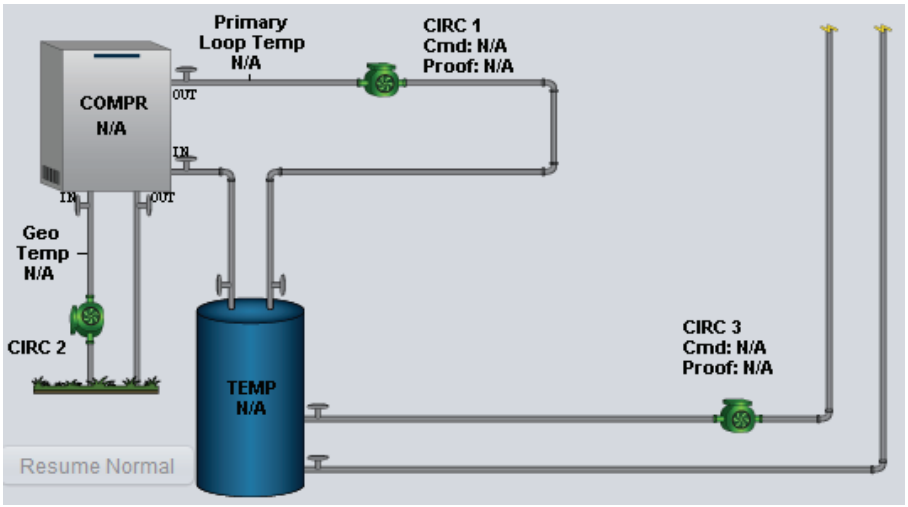


Figure 17 - Simple Cold Water Tank Sequence

A water-to-water heatpump (single compressor or multistage with lead-lag functionality) is used to cool a primary water loop. The target setpoint for the cold tank is calculated based on a configurable outside temperature reset scale.

Pumps 1 and 2 ensure water circulation in the primary loop and ground loop. These pumps operate based on a request for compressor operation. Pump 3 circulates water through the building and operates based on a physical contact input, building demand and outside temperature.

Input and Output Identification

All the inputs and outputs of the PL-M2000 use pluggable screw type terminal blocks with elevator style clamping, which make connections easier and more secure.

For incoming communication from a remote computer or network controller, dual RJ45 type connectors are available ***in parallel*** with screw type terminal blocks. The RJ45 connectors allow the use of premade CAT5 cables for simple plug-and-play RS485 communication. These RJ45 connectors follow the Modbus pinout specification for RS485 communication.

The I/O profile for the ***Simple Cold Water Tank Sequence*** is as follows:

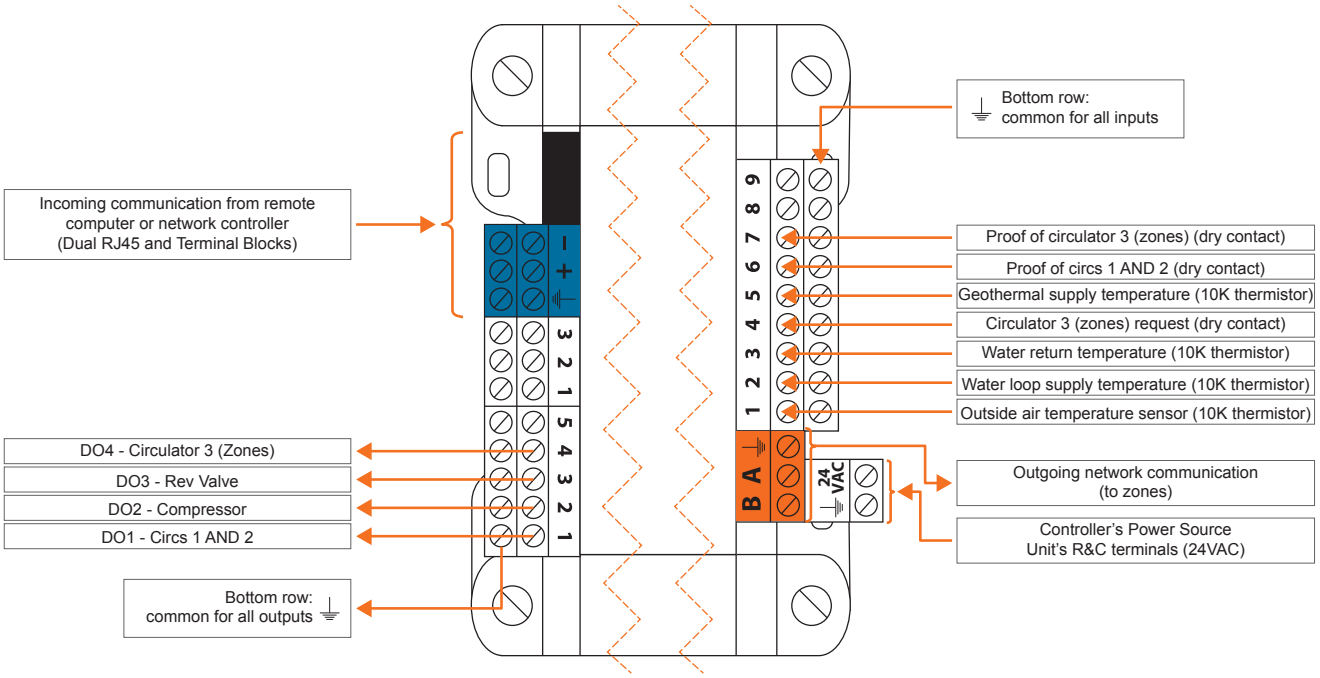


Figure 18 - Input and Output Identification (Simple Cold Water Tank)

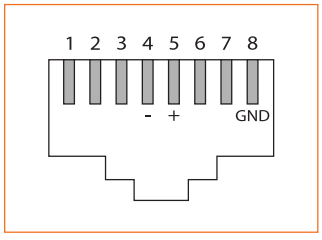


Figure 19 - RJ45 Pinout

Dual Recovery Sequence

The description of the Dual Recovery sequence used by the PL-M2000 Hydronic controller is as follows (see Figure 20):

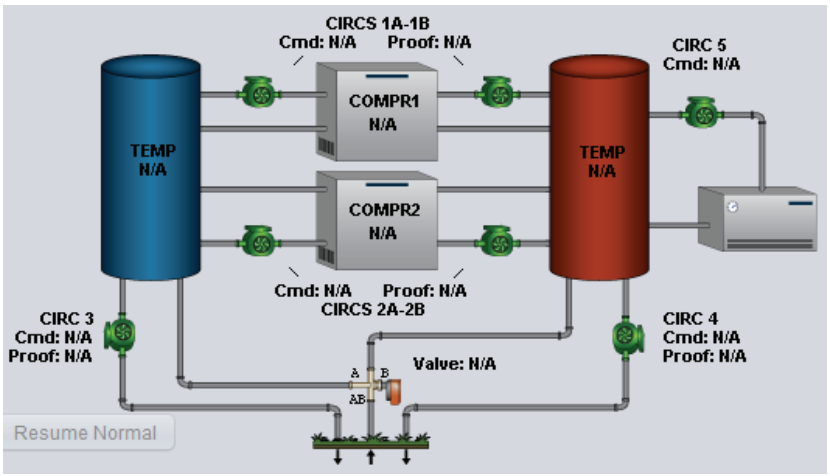


Figure 20 - Dual Recovery Sequence (Dual Compressors Shown)

A water-to-water heatpump (single or dual compressor with lead-lag functionality – dual shown above) is used to simultaneously provide hot and cold water to hot and cold tanks. Pumps 1A-1B (compressor 1) and Pumps 2A-2B (compressor 2) operate based on a request from their respective compressors

The target setpoint in each tank changes depending on the season (summer/winter), but remains fixed within a season (no reset scale).

In the summer sequence, the compressors only operate based on a demand from the cold tank. If the hot tank temperature should rise too high, Pump 4 brings ground water into the hot tank to reduce its temperature. The valve is set so as to close the loop from ground to the hot water tank (AB-B).

In the winter sequence, the compressors only operate based on a demand from the hot tank. If the cold tank temperature should drop too low, Pump 3 brings ground water into the cold tank to increase its temperature. The valve is set so as to close the loop from ground to the cold water tank (AB-A).

Auxiliary heat is enabled in the winter sequence only, when the setpoint in the hot tank has not been reached after a configurable delay (default 60 min) of constant compressor operation has expired. At this point, both auxiliary heat and the compressor will operate until the setpoint is reached. On the next call for heat, the compressor will activate alone again.

Auxiliary heat will also be used in the winter sequence when no proof of pumps 1 and 2 are obtained despite a request for compressor.

Pump 5 activates based on a call for auxiliary heat.

Input and Output Identification

All the inputs and outputs of the PL-M2000 use pluggable screw type terminal blocks with elevator style clamping, which make connections easier and more secure.

For incoming communication from a remote computer or network controller, dual RJ45 type connectors are available ***in parallel*** with screw type terminal blocks. The RJ45 connectors allow the use of premade CAT5 cables for simple plug-and-play RS485 communication. These RJ45 connectors follow the Modbus pinout specification for RS485 communication.

The I/O profile for the ***Dual Recovery Sequence*** is as follows:

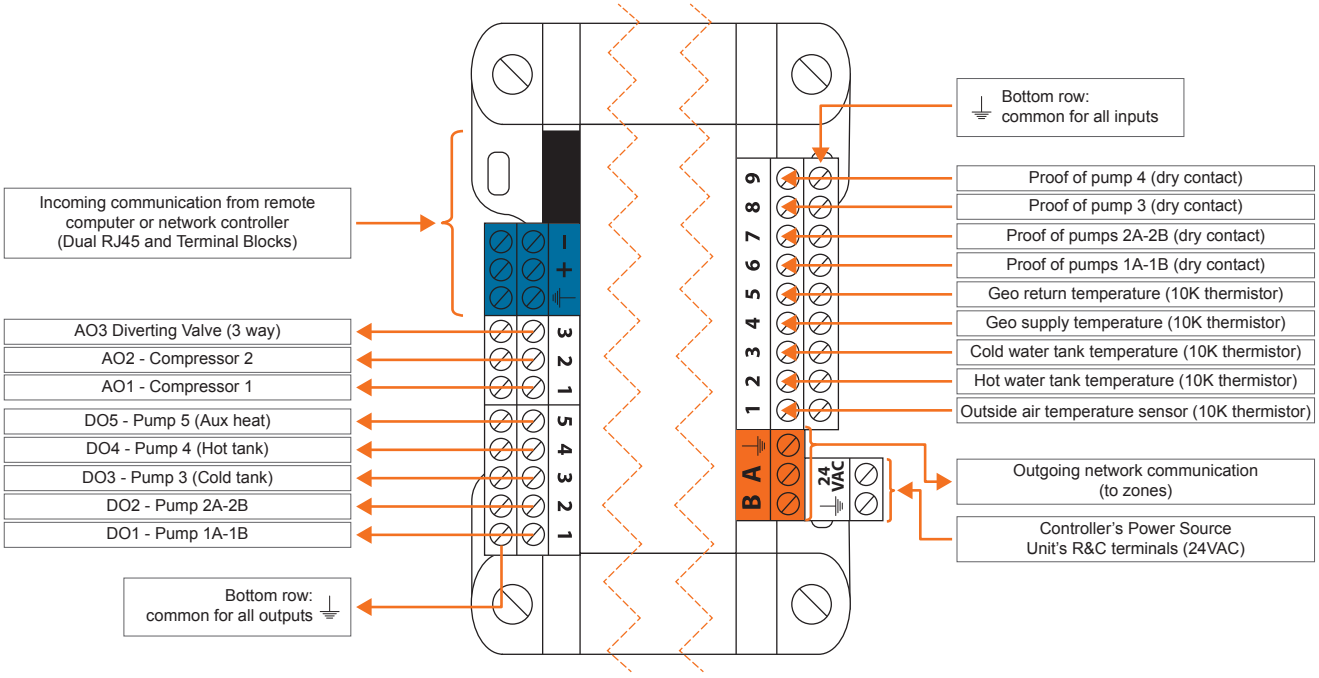


Figure 21 - Input and Output Identification (Dual Recovery)

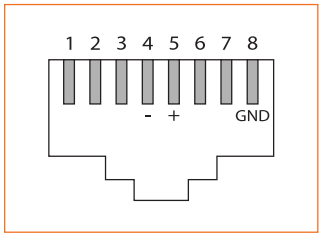


Figure 22 - RJ45 Pinout

Dual Energy Boilers Sequence

The description of the Dual Energy Boiler sequence used by the PL-M2000 Hydronic controller is as follows:

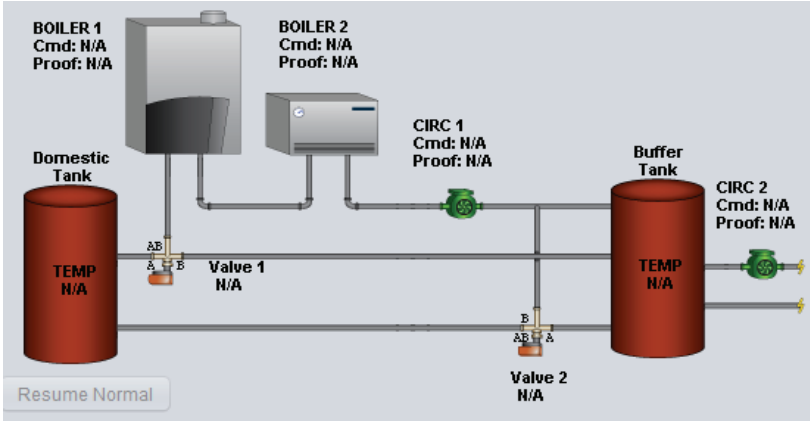


Figure 23 - Dual Energy Boiler Sequence

This system is comprised of two hot water tanks: one that stores the domestic hot water for everyday use, while the other is a buffer tank used for building heating purposes. The domestic hot water tank is maintained at a fixed temperature year-round, while the buffer tank's setpoint follows an outdoor temperature reset scale. The buffer tank will not request heating in the summer season.

Heating action comes in the form of two boilers, one that is combustion based (Boiler 1) and one that is electric (Boiler 2). The boiler to be used is determined by an external contact (Bi-Energy or other connected to the PL-M2000, which is used to obtain a preferential rate on the electrical bill. When the contact is closed, the electric boiler is used. Otherwise the combustion boiler is used.

Pump 1 is activated on a call for heat from either boiler. Pump 2 is activated based on an external contact closing which, when connected to the PL-M2000, represents a call for heat coming from the building.

The Valves 1 and 2 will direct hot water to where it is needed, either into a single tank, or to both tanks.

Both boilers will be activated on a call for auxiliary heat. Auxiliary heat is requested when the setpoint in either tank is not reached after a configurable delay, or if the demand from the building (zones) is too high for a configurable interval of time.

Input and Output Identification

All the inputs and outputs of the PL-M2000 use pluggable screw type terminal blocks with elevator style clamping, which make connections easier and more secure.

For incoming communication from a remote computer or network controller, dual RJ45 type connectors are available ***in parallel*** with screw type terminal blocks. The RJ45 connectors allow the use of premade CAT5 cables for simple plug-and-play RS485 communication. These RJ45 connectors follow the Modbus pinout specification for RS485 communication.

The I/O profile for the ***Dual Energy Boilers Sequence*** is as follows:

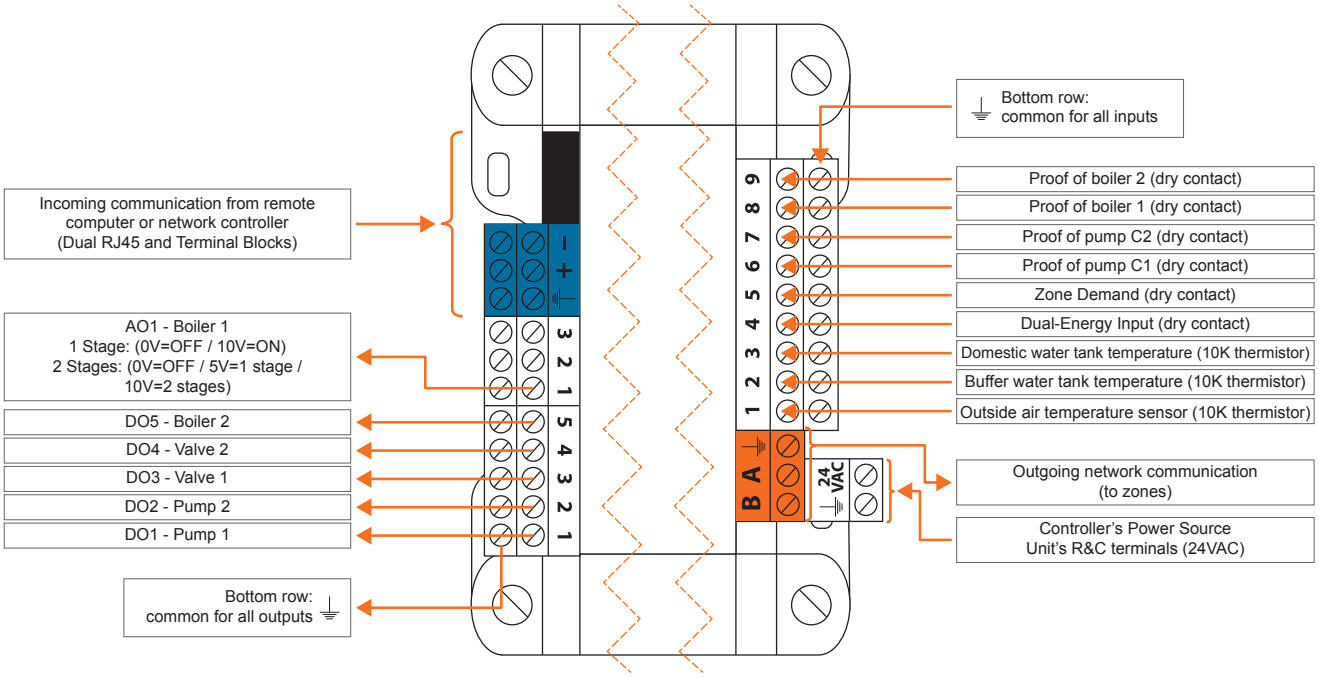


Figure 24 - Input and Output Identification (Dual Energy Boilers)

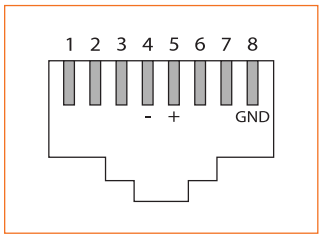


Figure 25 - RJ45 Pinout

Inputs

Temperature Sensors

The PL-M2000 Hydronic controller has various analog inputs that can monitor air and water temperatures depending on the sequence, and will integrate these readings into its control sequence. The sensors used are standard 10k type 3 thermistors that share a single common connection. See Figure 26 for typical wiring of thermistors (NOTE: the input and function used by each thermistor will vary depending on the sequence).

The outside air temperature can be also be provided by an alternate source. If a network controller is present on the network, it can retrieve the outside temperature reading from one controller and distribute it to any other controllers on the network.

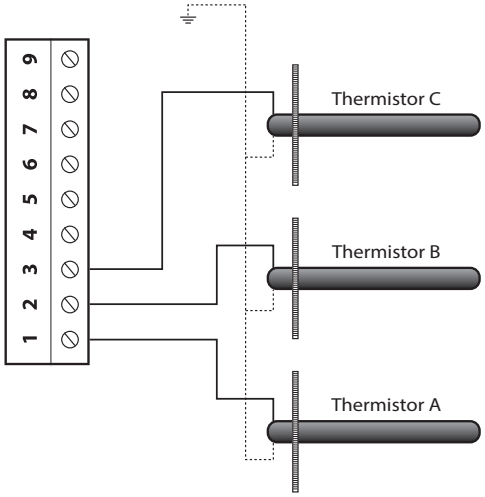


Figure 26 - Wiring Example of Temperature Sensors

Proof of Operation

The PL-M2000 Hydronic controller has various analog inputs that can monitor the proof of operation signals (pump, boiler, etc…) depending on the sequence, and will integrate these readings into its control sequence. To indicate proof of operation, the contact must be closed. See Figure 27 for typical wiring of proof of operation signals

(***Note***: the input and function used by each proof of operation will vary depending on the sequence).

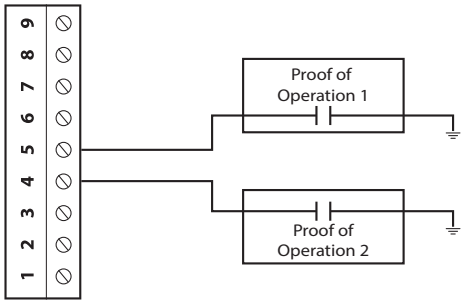


Figure 27 - Wiring Example of Proof of Operation

Output

The PL-M2000 Hydronic controller has 8 customizable outputs; five triac ON/OFF outputs (24VAC) and three analog outputs (0-10VDC). Output configuration is performed via the Prolon Focus software and is dependent on the sequence chosen.

An integrated resettable fuse protects each of the outputs of the PL-M2000 against current surges and short circuits. This protection will cut the current to the output as soon as an overload condition is detected. The fuse is a round, yellow-
coloured PTC that will change to orange and heat up on an overload condition. Once power has been removed from the PL-M2000, the fuse will cool down and automatically reset. Fix the faulty wiring and you will be able to activate the output once again.

Output Specifications

Output	Type	Action
DO 1	Triac source 24VAC, Max Current: 300 mA	On-or-Off
DO 2	Triac source 24VAC, Max Current: 300 mA	On-or-Off
DO 3	Triac source 24VAC, Max Current: 300 mA	On-or-Off
DO 4	Triac source 24VAC, Max Current: 300 mA	On-or-Off
DO 5	Triac source 24VAC, Max Current: 300 mA	On-or-Off
AO 1	0 to 10 VDC Max Current: 40 mA	On-or-Off
AO 2	0 to 10 VDC Max Current: 40 mA	On-or-Off
AO 3	0 to 10 VDC Max Current: 40 mA	On-or-Off

Triac Outputs 1 to 5

On the PL-M2000 hydronic controller, all triac outputs produce a 24 VAC live voltage when activated. Note that all output voltages originate from a single voltage supply: the equipment's transformer. Consequentially, only the live side of the output connections are usually needed; these are on the top row (see Figure 28). The bottom row is the common (GND).

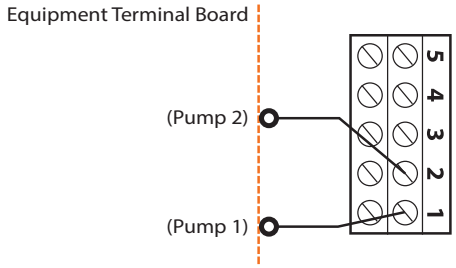


Figure 28 - Wiring Example of Digital Outputs 1 and 2

Analog Outputs 1 to 3

For all analog outputs, the common is found on the bottom row terminal blocks, and the active signals are found on the top row terminal blocks (see Figure 29). Analog output 1 is configured to control a 10 VDC On/Off relay. Analog outputs 2 and 3 can only modulate a DC load (0-10 VDC, 2-10 VDC, 0-5 VDC).

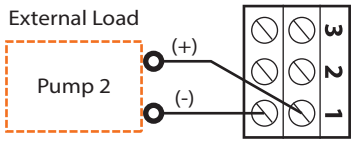


Figure 29 - Wiring Example of Analog Output 1

UMX-4 Connection on Digital Output 2 for 2, 3 or 4 Stage Compressor

When 2, 3 or 4 stages of compressor are required (Hot and Cold Tank sequence only), the PL-M2000 Hydronic controller must be equipped with a UMX-4. The UMX-4 PWM input is connected to Digital Output 2 on the PL-M2000 Hydronic controller.

The UMX-4 must be configured to "Single Unit UMX Control" in "Output Expander with PWM Input" with a PWM minimum of 0.5 sec. This can be achieved by setting the dipswitches as follows:

Switch	1	2	3	4	5	6	7	8
State	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF

The "Input Selection Jumper" needs to be set to "PW / 0-5VDC".

The UMX-4 output are then connected to the equipment (see figure 30). Each of the UMX-4 outputs have connections for "Normally Closed" and "Normally Open" operation, so use the connection that is compatible with your equipment. For more information on the UMX-4, consult the Specification Sheet and the Installation Guide for the UMX-4.

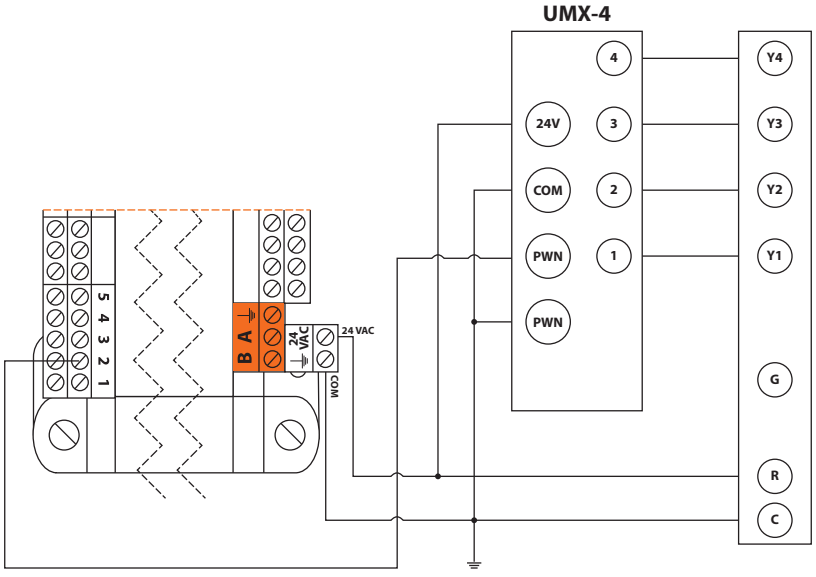


Figure 30 - Connecting the UMX-4 (Powered by PL-M2000)

DMUX-4J Connection on Digital Output 2 for 2, 3 or 4 Stage Compressor

When 2, 3 or 4 stages of compressor are required (Hot and Cold Tank sequence only), the PL-M2000 Hydronic controller must be equipped with a DMUX-4J. The DMUX-4J input is only connected to Digital Output 2 on the PL-M2000 Hydronic controller. The DMUX-4J must be configured to "Individual Relay Control" with a 0.5 second pulse resolution. The "Triac Input Selection" jumper must be set to normal signal input and the "Power Type Selection" jumper must be set to AC power. The DMUX-4J output are then connected to the equipment (see figure 31). Each of the DMUX-4J outputs have connections for "Normally Closed" and "Normally Open" operation, so use the connection that is compatible with your equipment. For more information on the DMUX-4J, consult the Specification Sheet and the Installation Guide for the DMUX-4J.

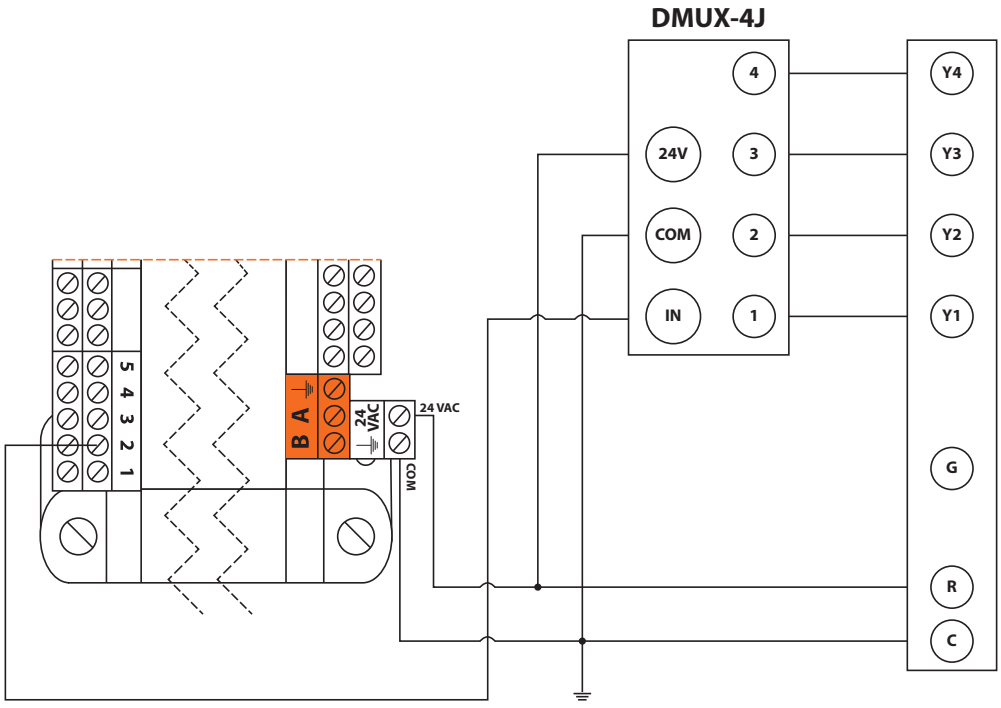


Figure 31 - Connecting the DMUX-4J (Powered by PL-M2000)

Power Source

The PL-M2000 controller is powered by a 24 VAC power supply (class 2) by connecting the common (''C'' wire) to the "COM" terminal and the live (''R'' wire) to the "24 VAC" terminal (see Figure 32). The common for all inputs and outputs is the same as the power source's common. All output power sources also originate from the source transformer.

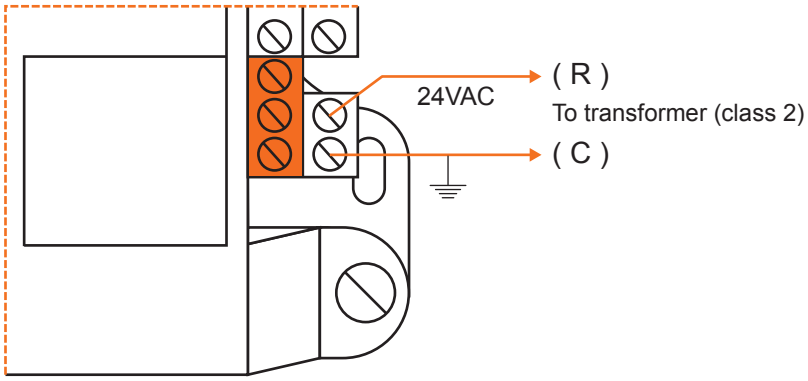


Figure 32 - Connecting the 24VAC Power Source

Network Communication

The Prolon PL-M2000-HYD controller is designed to work with the Prolon zone controllers). When they are networked, the PL-M2000 and zone controllers all communicate in real-time. The network connections are made using the network terminal block located on the PL-M2000 controller (see Figure 33).

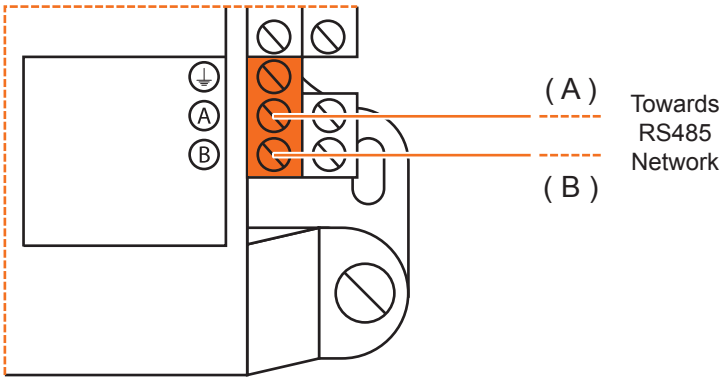


Figure 33 - Connecting to the Network

Technical Specifications

Supply: 24 VAC ±10%, 50/60 Hz, Class 2

Power: 5 VA (Consumption), 40 VA (Input)

Inputs: 9 configurable analog inputs (thermistor / dry contact / 4-20mA / 0-5 VDC)

Digital Outputs: 5 triac outputs, 10-30 VAC source, 300 mA max (resettable fuse)

Analog Outputs: 3 x 0-10 VDC outputs, 40 mA max (resettable fuse)

Indication lights (LED): State of each output / Communication / Power / State of microprocessor

Microprocessor: PIC18F6722, 8 bits, 40 MHz, 128KB FLASH memory

Casing: Molded ABS, UL94-HB

Communication: Modbus RTU (RS485) up to 127 nodes

Baud Rates: 9600, 19200, 38400, 57600, 76800, 115200

Connection: Removable screw-type terminal blocks (max 16 AWG) and RJ45 modular jacks

Dimensions: 5.39" x 4.41" x 2.25" (137 mm x 112 mm x 57 mm)

Weights: 1.05 lbs (0.48 kg)

Environment: -4 to 122 °F (-20 to 50 °C) Non-Condensing

Certification: UL916 Energy Management Equipment, CAN/CSA-C22.2, RoHS, FCC part 15: 2012 class B

The performance specifications are nominal and conform to acceptable industry standards. Prolon Inc. will not be liable for damages resulting from misapplication or misuse of its products.

- cULus Listed; UL 916 Energy Management Equipment, File E364757, Vol.1
- CAN/CSA-C22.2 No. 2015-12, Signal Equipment
- FCC Compliant to CFR47, Part 15, Subpart B, Class B
- Industry Canada (IC) Compliant to ICES-003, Issue 5: CAN ICES-3 (B)/NMB-3(B)
- RoHS Directive (2002/95/EC)

FCC User Information

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, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Caution: Any changes or modifications not approved by Prolon can void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Industry Canada

This Class (B) digital apparatus meets all the requirements of the Canadian Interference-Causing Equipment regulations.

Cet appareil numérique de la Classe (B) respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

Overall Dimensions

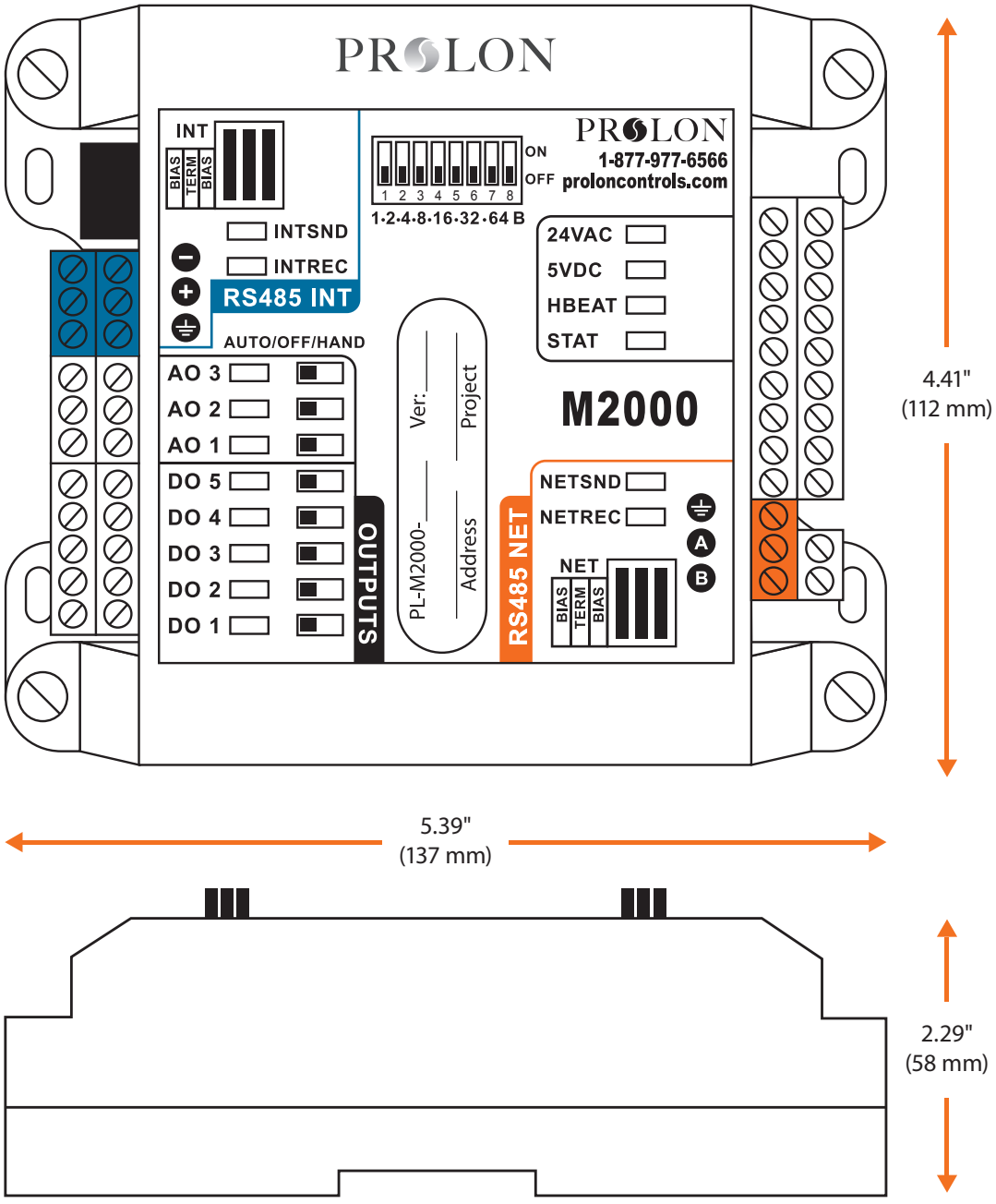


Figure 34 - PL-M2000 Size Diagram

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