# PROLON

# HARDWARE GUIDE

## Water Loop Controller C1050 Series

Specifications and Operational Guide

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## PL-C1050 Water Loop Controller

### Description

The PL-C1050 Water Loop controller is designed to control a water loop system comprised of a boiler and a water tower with an internal pump. The built-in microprocessor offers precise digital control to maximize performance. The available control sequences are fully configurable, either locally or remotely with free software. The C1050 offers a variety of functions such as bypass valve control, cooling tower damper control and more.

### General Behaviour

The C1050 Water Loop controller has a single output dedicated to heating, while the remaining four outputs are all dedicated to various cooling actions.

When the supply water temperature drops below a configurable setpoint, the heating output (Output 1), which is connected to a boiler, activates.

When the supply water temperature rises too high, the following actions can take place, in any configurable order: a damper at the top of the water tower opens (Output 2), a spray pump activates (Output 3), the cooling tower's first stage (or permission) activates (Output 4), and finally the cooling tower's second stage activates (Output 5). Output 5 can either be ON-OFF or modulating proportional. The setpoints and differential bands for each output are configurable, as well as the minimum value for Output 5.

Alternatively, Output 2 can control a bypass valve that diverts the return water into the cooling tower when it gets too hot, instead of directly going to the boiler. Note that this is the only sequence that makes use of the return water temperature.
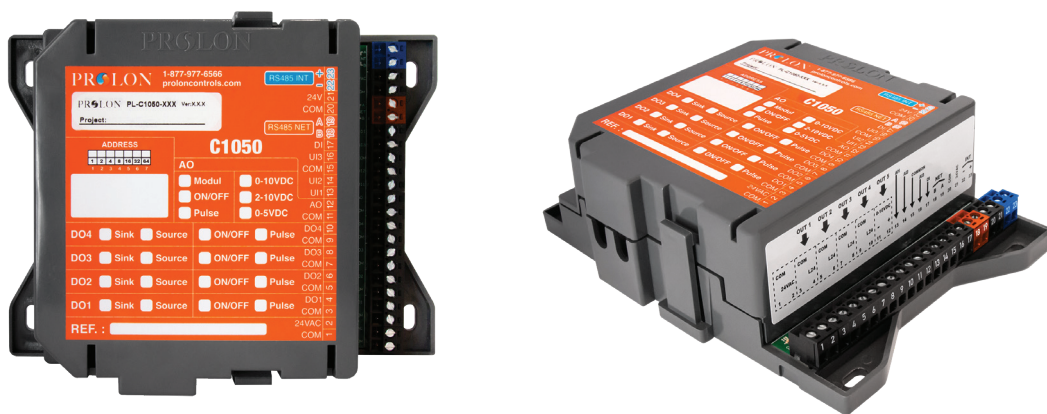
# Components

## Component Identification
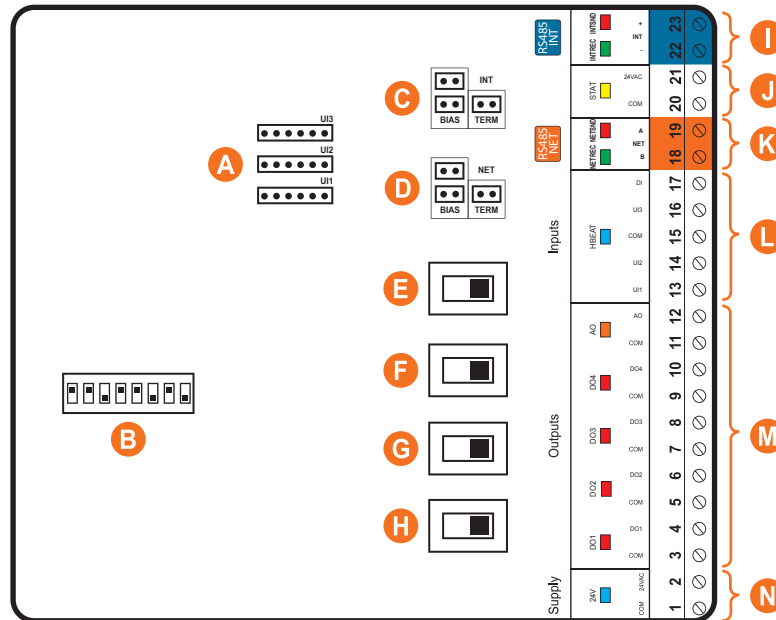


**Figure 1 - Component Identification**

*Legend:*

**A** - Analog Input Signal Mode Jumpers

**B** - Addressing dipswitch

**C** - Jumpers for terminating and bias resistors for the INT port (see **I**)

**D** - Jumpers for terminating and bias resistors for the NET port (see **K**)

**E** - SOURCE/SINK dipswitch for Output 4

**F** - SOURCE/SINK dipswitch for Output 3

**G** - SOURCE/SINK dipswitch for Output 2

**H** - SOURCE/SINK dipswitch for Output 1

**I** - INT port for RS485 communication (terminal block)

**J** - Alternate terminal blocks for 24 VAC (provides power to an optional digital sensor)

**K** - NET port for RS485 communication (terminal block)

**L** - Inputs (4 total)

**M** - Terminal Blocks for Outputs 1 to 5

**N** - Terminal Blocks for 24 VAC

## LEDs

The C1050 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.

Green light: Reception from INT port — Red light: Sending to INT port

Red light: Sending to NET port
Green light: Reception from NET port

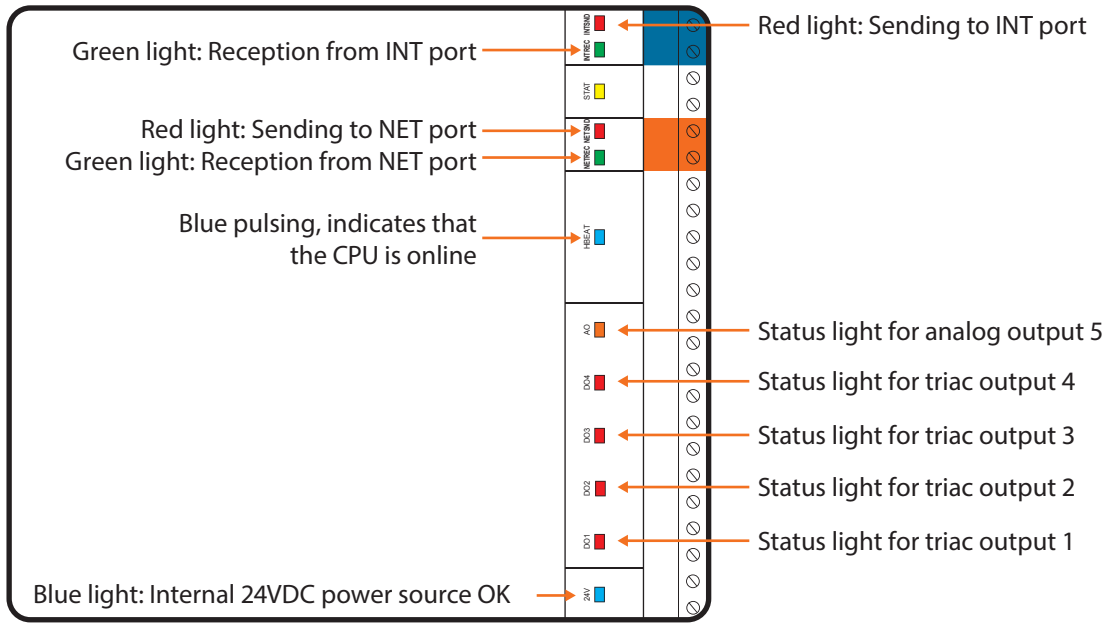Blue pulsing, indicates that the CPU is online

Status light for analog output 5

Status light for triac output 4

Status light for triac output 3

Status light for triac output 2

Status light for triac output 1

Blue light: Internal 24VDC power source OK

**Figure 2 - LEDs Identification**

## Address Configuration for Networking

A unique address on each controller must be configured 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, 64 respectively). The value of each switch that is in the ON position is added together to form the numerical address of the controller.

The example on Figure 3 shows the switches 1, 2 and 4 on the ON position. So the corresponding values are 1, 2 and 8, giving an address sum of 11. (1+2+8=11)

The Prolon network allows a maximum of 127 addresses, therefore 127 controllers.
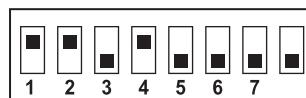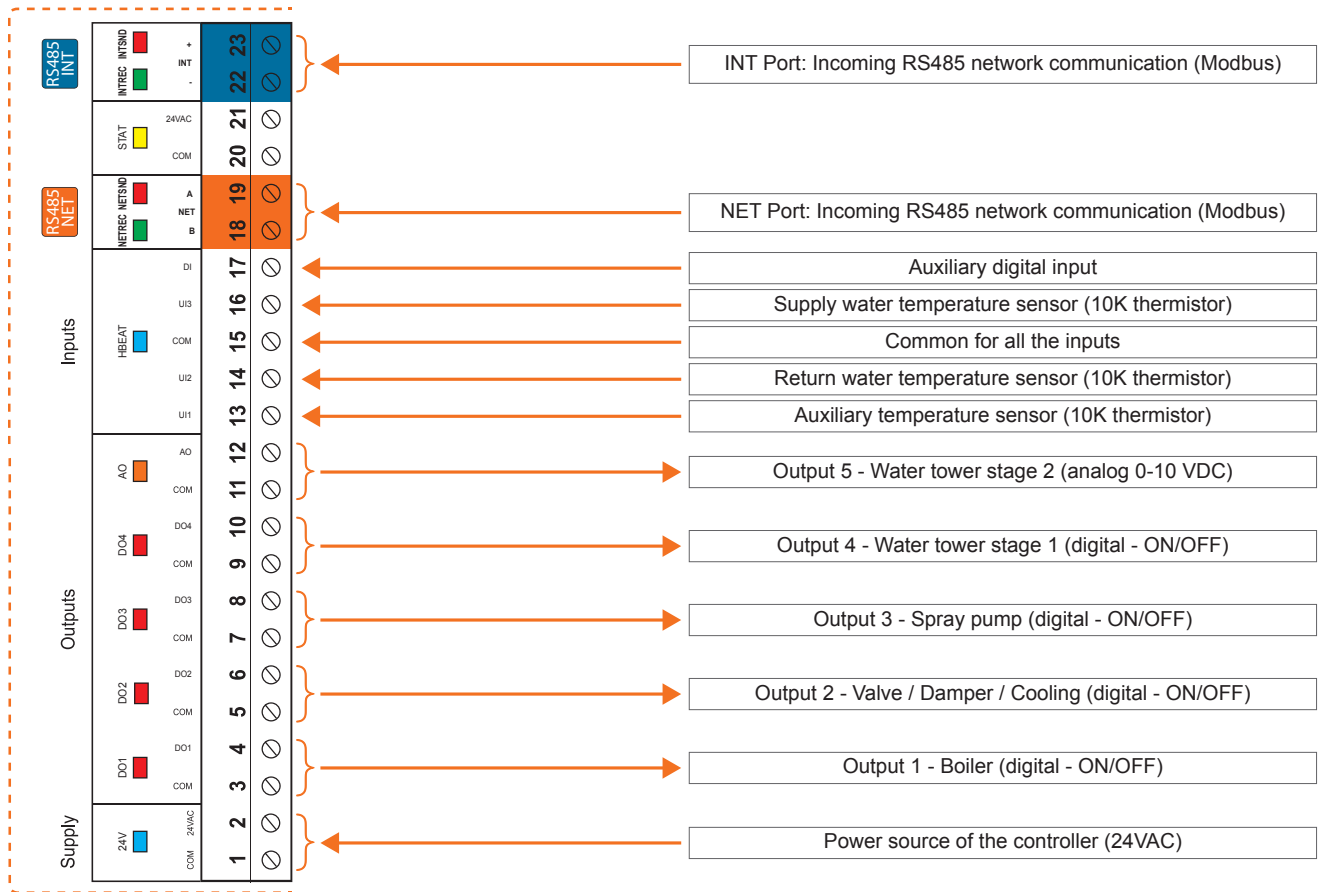
**Figure 3 - Addressing Dipswitches**

# Input and Output Identification

All the inputs and outputs of the C1050 use pluggable screw type terminal blocks with elevator style clamping, which make connections easier and more secure.

The C1050 Water Loop Controller has 2 separate communication ports offering the same functionality on each. Both act as ports for incoming Modbus communications from other Prolon devices or interfaces, such as a Network Controller or remote computer with Prolon Focus software.



| Terminal | Description |
|---|---|
| INT Port | Incoming RS485 network communication (Modbus) |
| NET Port | Incoming RS485 network communication (Modbus) |
| 17 | Auxiliary digital input |
| 16 | Supply water temperature sensor (10K thermistor) |
| 15 | Common for all the inputs |
| 14 | Return water temperature sensor (10K thermistor) |
| 13 | Auxiliary temperature sensor (10K thermistor) |
| Output 5 | Water tower stage 2 (analog 0-10 VDC) |
| Output 4 | Water tower stage 1 (digital - ON/OFF) |
| Output 3 | Spray pump (digital - ON/OFF) |
| Output 2 | Valve / Damper / Cooling (digital - ON/OFF) |
| Output 1 | Boiler (digital - ON/OFF) |
| Supply | Power source of the controller (24VAC) |

**Figure 4  -  Input and Output Identification**

# Inputs

## Analog Input

The C1050 series controllers are equipped with three general purpose analog inputs. These inputs can be configured to receive signals of the following types:

- Thermistor (Ω)
- 0-5V
- 4 -20mA
- 0-10V

When a thermistor is used, the thermistor must be 10KΩ TYPE 3.

Each C1050 analog input is equipped with a fast-switching barrier diode to protect against surges and short circuits.

By default, the C1050-WLC analog inputs are set up for thermistor mode. The input signal mode can be changed by setting jumpers U1, U2 and U3, situated inside the casing, in the desired position:
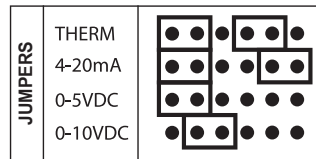


**Figure 5  -  Analog input**

## Temperature Sensors

The C1050 Water Loop controller has an analog inputs dedicated to monitoring the supply and return water temperatures and will integrate these reading into its control sequence. An auxiliary temperature sensor input in also available (for visualisation purposes only) and will not affect the sequence. The sensors used are standard 10k type 3 thermistors.
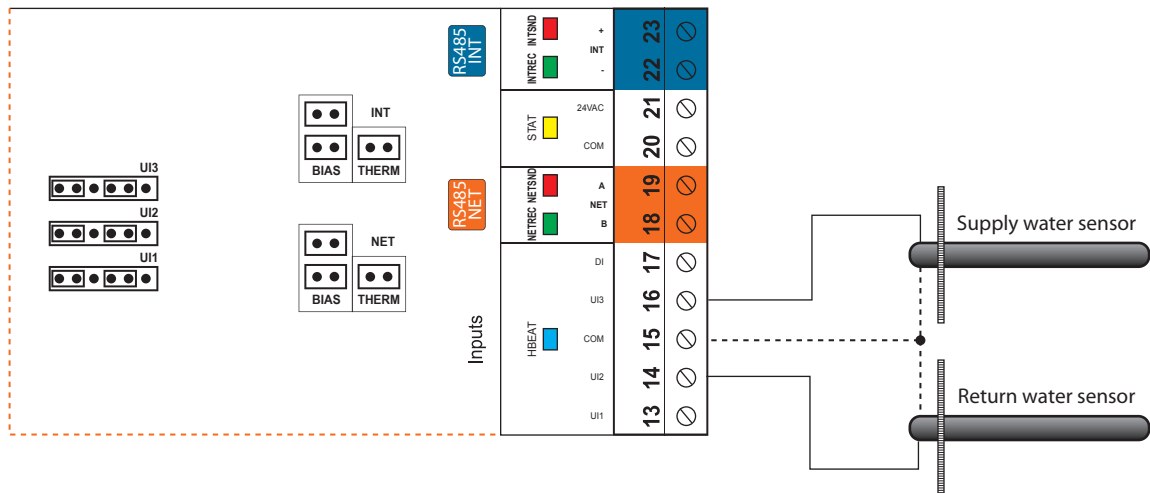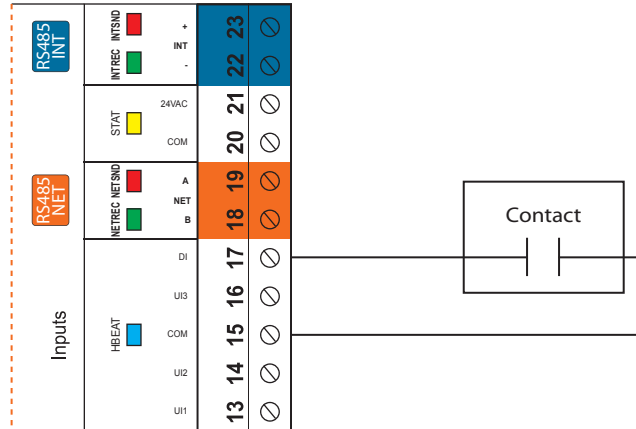


**Figure 6  -  Connecting the Water Temperature Sensors**

# Auxiliary Digital Input

The C1050 Water Loop controller has a digital input that used for visualisation purposes only. It can detect an open or closed contact. The status of the input does not affect the sequence in any way.



**Figure 7  –  Connecting the Auxiliary Digital Input**

# Outputs

The C1050 Water Loop controller contains 5 configurable outputs. The first 4 outputs are ON-OFF triac outputs. Output 5 is an analog 0-10VDC ON-OFF or modulating output, fully customizable via the Prolon Focus software.

An integrated resettable fuse protects **each** of the outputs of the C1050 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 round and yellow-colored which, upon a short circuit condition, will heat up and change to orange. When the faulty wiring or circuit is fixed, the fuse will automatically reset and allow current to flow through the output again.

## Output Specifications

| Output | Type | Action | Applications |
|---|---|---|---|
| 1 | Triac Source: 24VAC<br>Max Current: 300 mA | On-or-Off | Boiler |
| 2 | Triac Source: 24VAC<br>Max Current: 300 mA | On-or-Off | Bypass /<br>Damper /<br>Cooling |
| 3 | Triac Source: 24VAC<br>Max Current: 300 mA | On-or-Off | Pump |
| 4 | Triac Source: 24VAC<br>Max Current: 300 mA | On-or-Off | Cooling Tower Stage 1 |
| 5 | Analog Output<br>0 to 10VDC<br>Max Current: 40 mA | Modulating Proportional /<br>On-or-Off | Cooling Tower Stage 1 |

## Configuration of Digital Outputs 1 to 4

The digital triac outputs are configurable (SOURCE/SINK) via a switch located on the board. Simply move the switch to obtain either a SOURCE active output (1) or a SINK passive output (2).

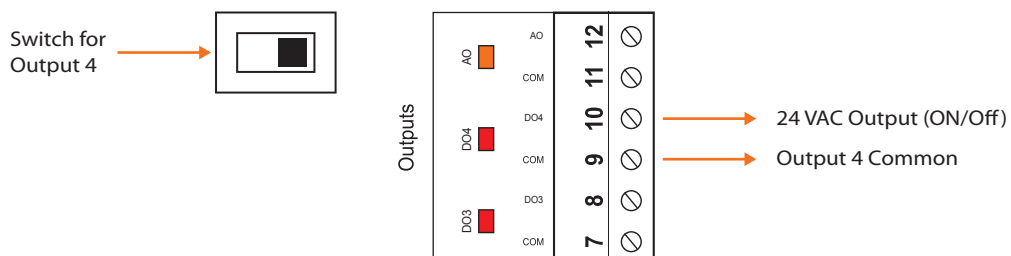**1)** Switch position to obtain a SOURCE **active output**:



**Figure 8  -  Output in SOURCE mode**

**2)** Switch position to obtain a SINK *passive output*.
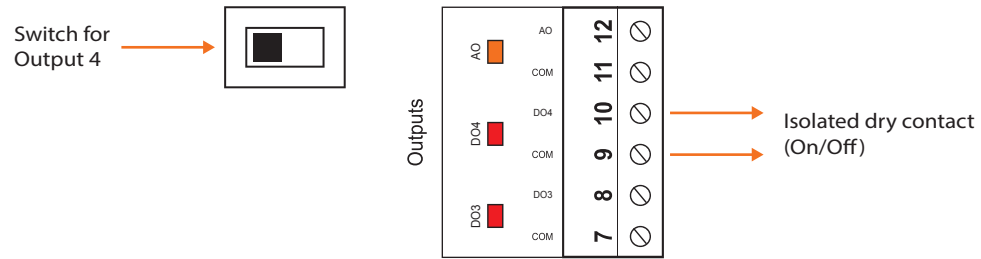
Switch for
Output 4



**Figure 9 - Output in SINK mode**

## Typical Connection of Digital Outputs 1 to 4

Two types of configurations are possible:

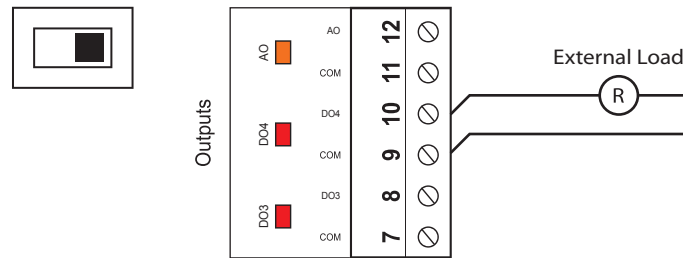**1)** Active output (SOURCE). The C1050 is actively powering the load.



External Load

**Figure 10 - Connection of Active Outputs 3 and 4**

**2)** Passive output (SINK). The C1050 opens and closes a contact to allow an external source to power the load.



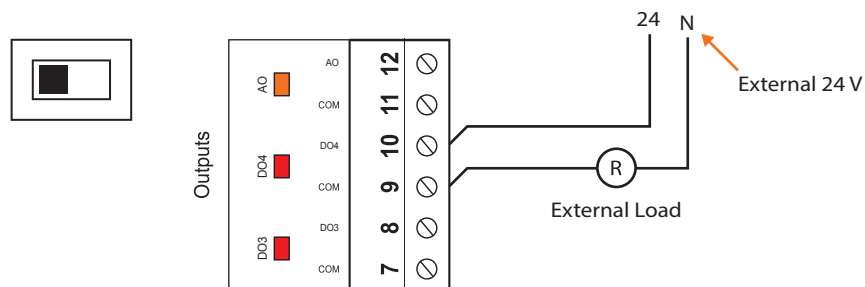24   N

External 24 V

External Load

**Figure 11 - Connection of Passive Output 3 and 4**

# Typical Connection of Analog Output

Two types of configuration are possible:

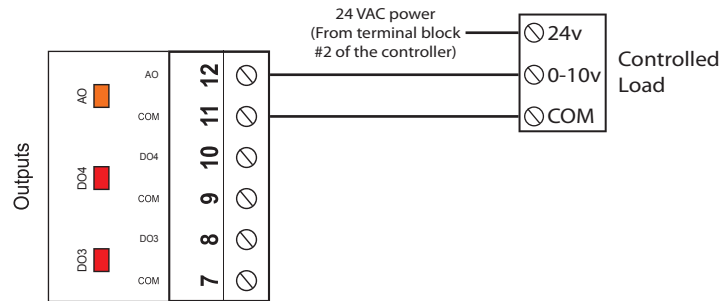**1)** The C1050 powers the load and provides a control signal.



**Figure 12  -  Connecting the Analog Output (Controller Powered)**

**2)** The C1050 only provides the control signal to the load, which is powered by an external source.
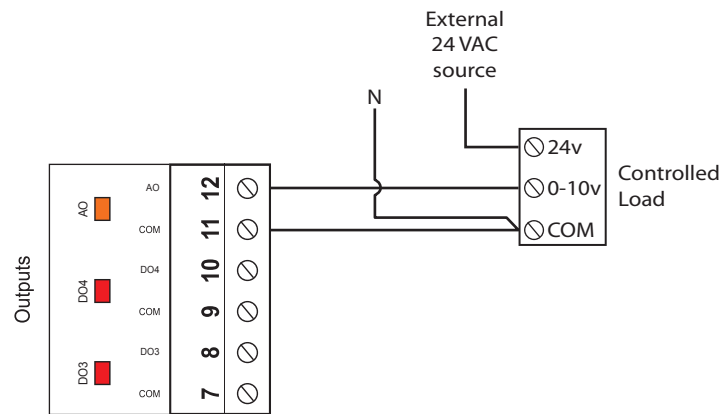


**Figure 13  -  Connecting the Analog Output (External Power)**

# Power Source / Network

## Power Source

The Prolon C1050 controller is powered by a 24 VAC power source connected using the "COM" terminal and the "24 VAC" terminal (see Figure 14). The common for all inputs and outputs are the same as the power source's common (exception: when an output is set to passive, the common for this output will not correspond to the power source common). All output power sources also originate from the controller's power source.
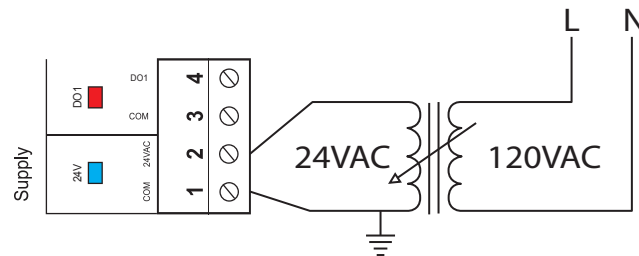


**Figure 14 - Connecting the 24VAC Power Source**

## Network Communication

The Prolon C1050 controller works autonomously or networked. When networked, it will communicate in real-time with other controllers. The C1050 controller's default communication protocol is Modbus RTU over RS485. The addressing is done with the addressing dipswitch located on the C1050 card (see Figure 3). The network connections are made using the NET terminal block located on the Prolon C1050 controller.
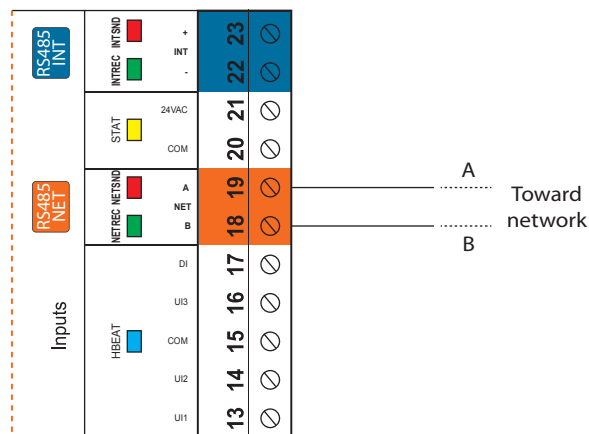


**Figure 15 - Connecting to the Network**

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

**Consumption**: 2 VA (Consumption), 32 VA (Input)

**Inputs**:
- Supply water temp – thermistor 10K
- Return water temp – thermistor 10K
- Auxiliary temp – thermistor 10K
- Auxiliary digital input – dry contact

**Digital outputs**: 4 triac outputs, 10-30 VAC source or dry contact, 300 mA max (resettable fuse)

**Analog output**: 1 output 0-10 VDC, 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 rate**: 9600, 19200, 38400, 57600, 76800, 115200

**Connection**: Removable screw-type terminal blocks (16 AWG max)

**Dimensions**: 6.5" x 5.3" (165mm x 135mm)

**Weight**: 0.85 lbs

**Environment**: -4 to 122 ºF (-20 to 50 ºC) 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.*

# Compliance

- 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 Réglement sur le matériel brouilleur du Canada.

**Figure 16 - C1050 Size Diagram**
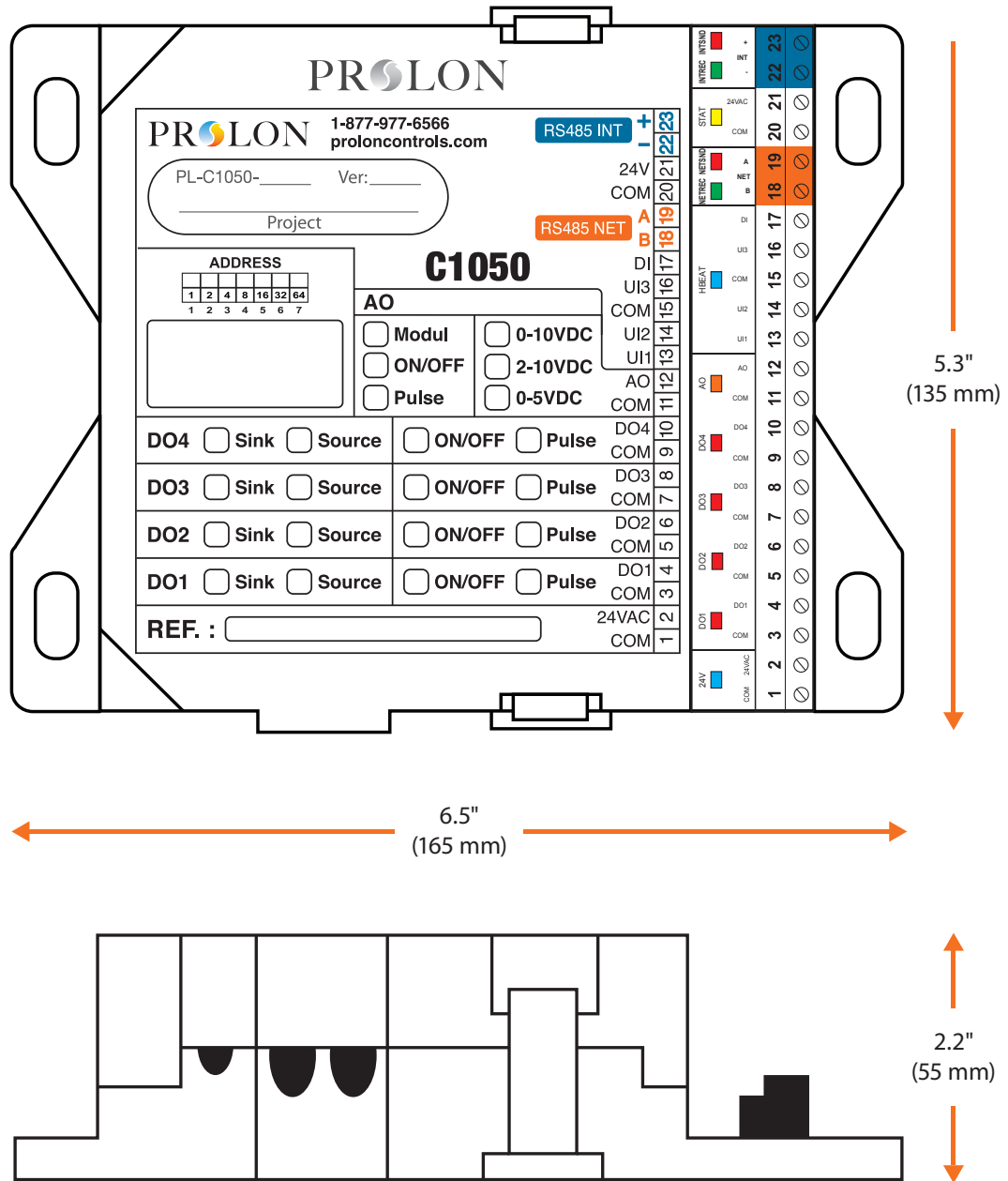
REV. 7.3.2

PL-HRDW-WLC-C1050-C/F-EN