PROLON

HARDWARE GUIDE

Water Loop Controller C1000 Series

Specifications and Operational Guide

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PL-HRDW-WLC-C1000-C/F-EN

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PL-C1000 Water Loop Controller

Description

The PL-C1000 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 C1000 offers a variety of functions such as bypass valve control, cooling tower damper control and more.

General Behaviour

The C1000 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

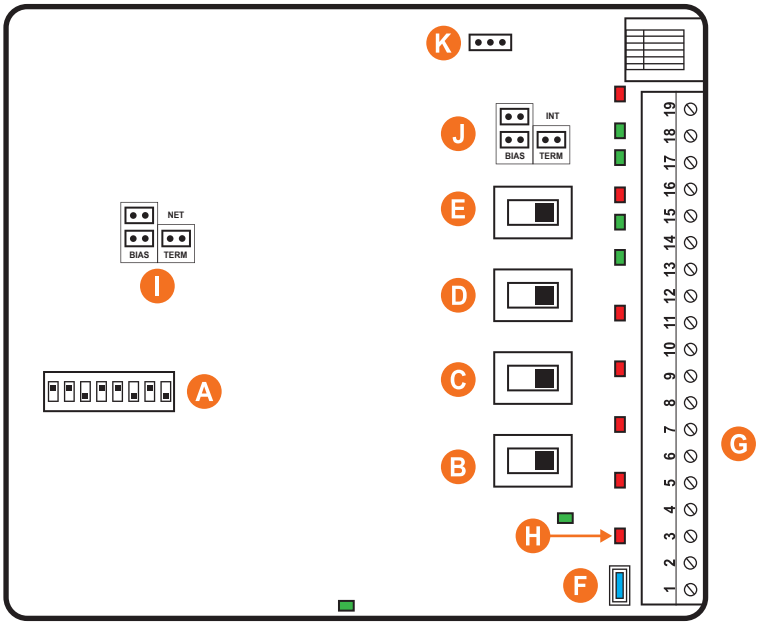

Figure 1 - Component Identification

Legend:

A - Addressing Dipswitch
B - Output 1 Dipswitch
C - Output 2 Dipswitch
D - Output 3 Dipswitch
E - Output 4 Dipswitch
F - Master reset button
G - Terminal Blocks for Inputs and Outputs
H - LEDs
I - Jumpers for terminating and bias resistors for the NET port
J - Jumpers for terminating and bias resistors for the INT port
K - Jumper to supply voltage to INT port (RJ45 jack)

LEDs

The C1000 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.

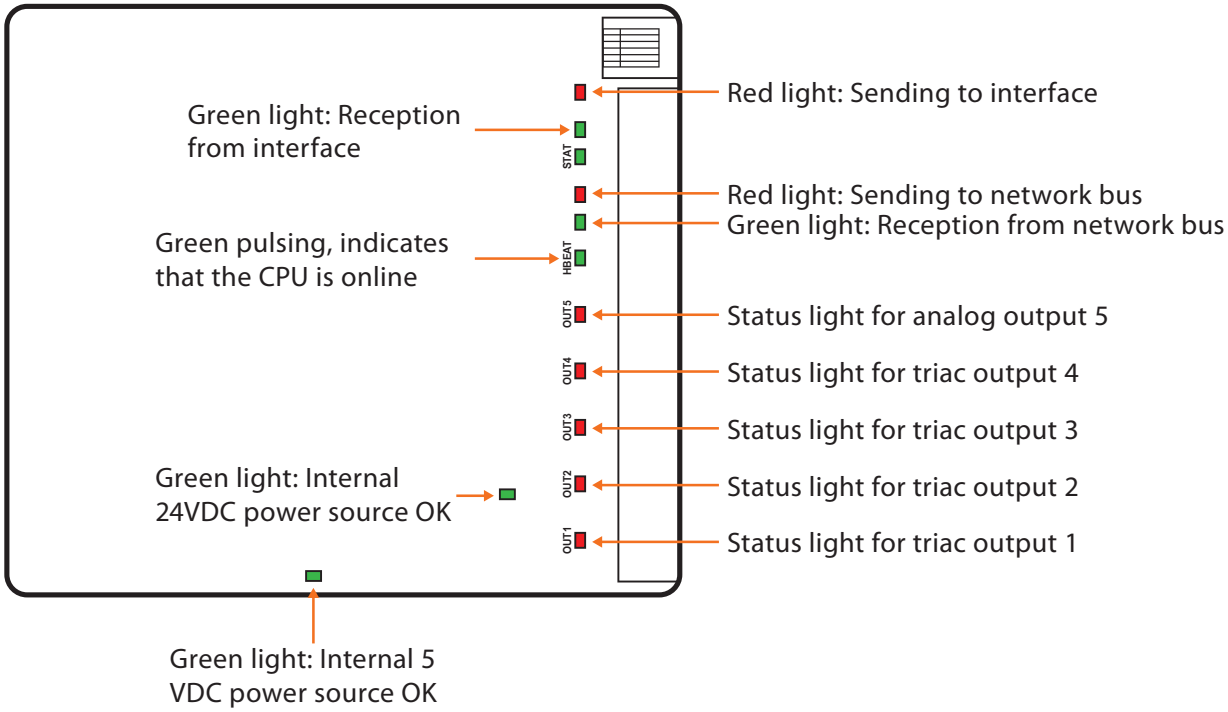

Figure 2 - LEDs Identification

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

Jumper to Supply Power to the RJ45 Plug

The RJ45 jumper lets the user select the voltage that will appear on pin #7 of the RJ45 plug. This can be used to power a device attached to the RJ45 plug, such as the digital sensor or interface. NOTE: If multiple C1000 controllers are connected together through the RJ45 plug, only one C1000 should be supplying power onto the RJ45, otherwise you will be mixing your supply sources and possibly cause damage. The jumper setups are as follows:

Figure 4 - Jumpers

Input and Output Identification

All the inputs and outputs of the C1000 use pluggable screw type terminal blocks with elevator style clamping, which make connections easier and more secure.

The C1000 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.

The "INT" Port (see below) uses an RJ45 type connector. The RJ45 connector allows the use of premade CAT5 cables for simple plug-and-play RS485 communication. This RJ45 connector follows the Modbus pinout specification for RS485 communication.

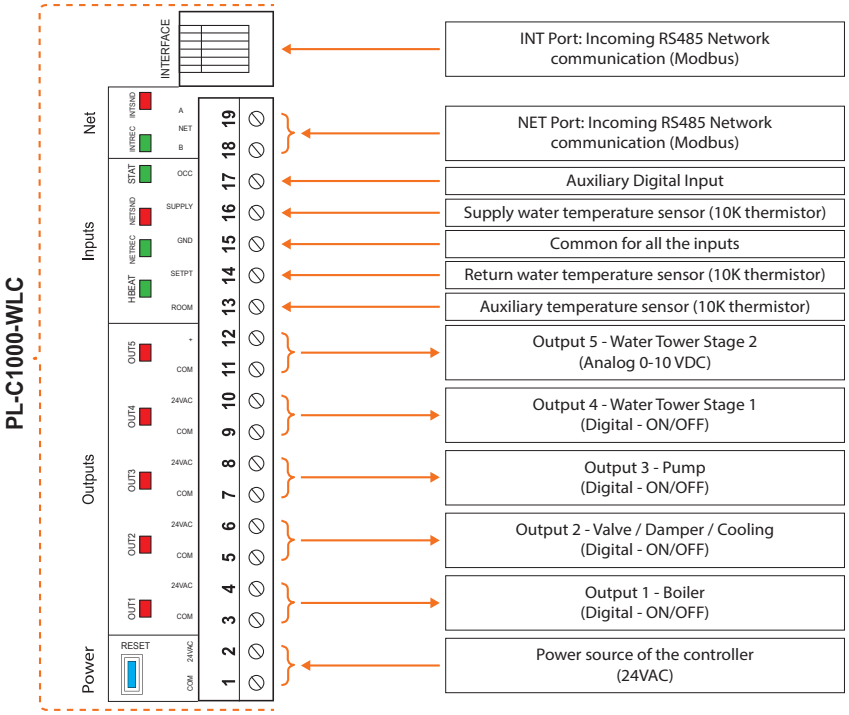

Figure 5 - Input and Output Identification

Inputs

Temperature Sensors

The C1000 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.

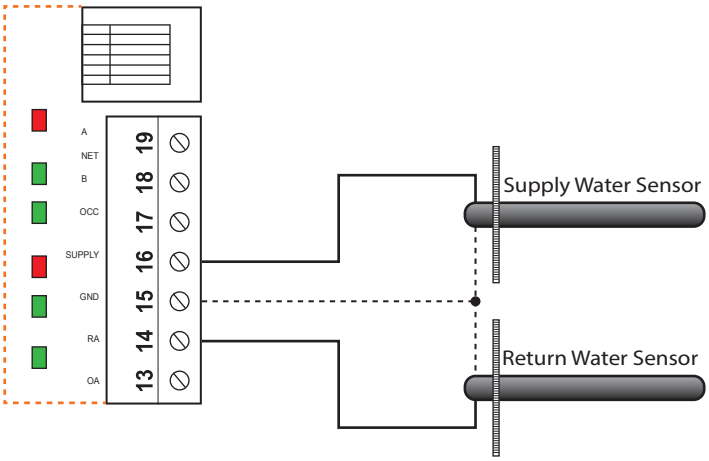

Figure 6 - Connecting the Water Temperature Sensors

Auxiliary Digital Input

The C1000 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.

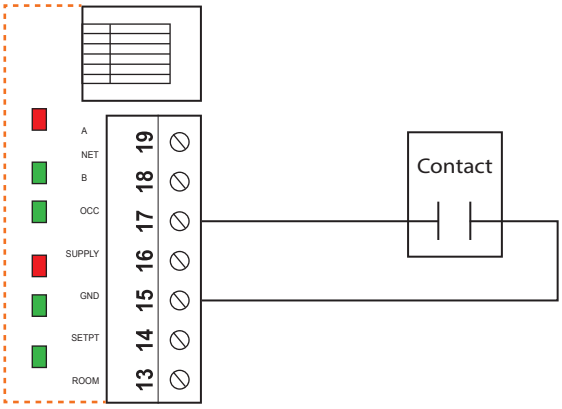

Figure 7 - Connecting the Auxiliary Digital Input

Outputs

The C1000 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 C1000 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 Max Current: 300 mA	On-or-Off	Boiler
2	Triac Source: 24VAC Max Current: 300 mA	On-or-Off	Bypass / Damper / Cooling
3	Triac Source: 24VAC Max Current: 300 mA	On-or-Off	Pump
4	Triac Source: 24VAC Max Current: 300 mA	On-or-Off	Cooling Tower Stage 1
5	Analog Output 0 to 10VDC Max Current: 40 mA	Modulating Proportional / 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*** (see Figure 8):

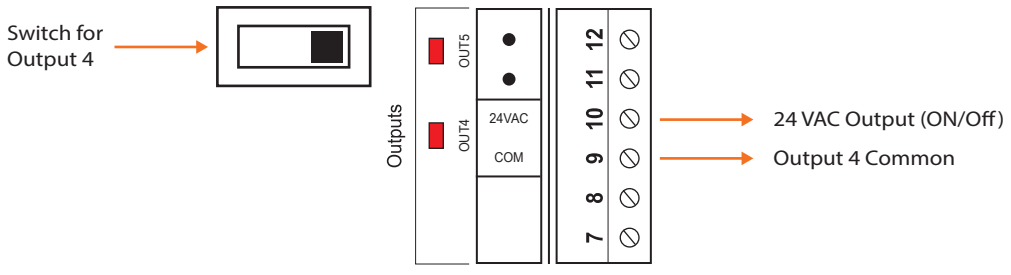

Figure 8 - Output in SOURCE mode

2) Switch position to obtain a SINK ***passive output*** (see Figure 9):

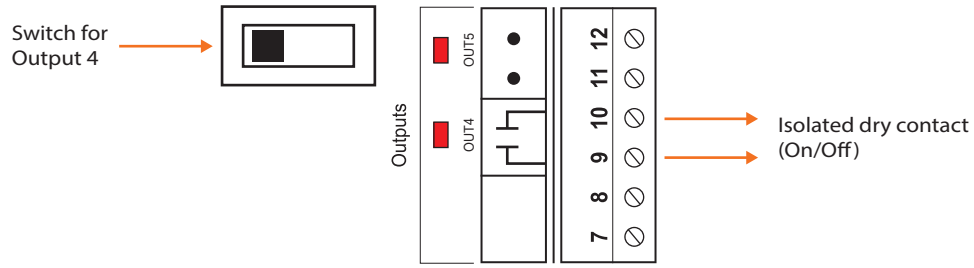

Figure 9 - Output in SINK mode

Typical Connection of Digital Outputs 1 to 4

Two types of configurations are possible:

1) Active output (SOURCE). The C1000 is actively powering the load (see Figure 10).

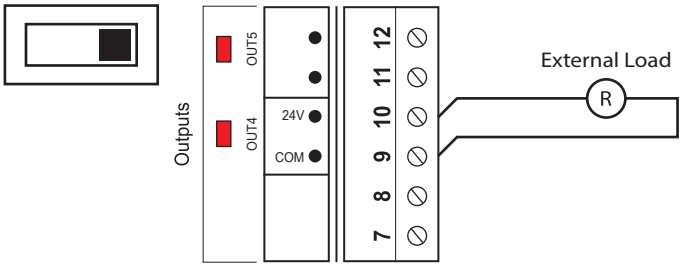

Figure 10 - Connection of Active Outputs 3 and 4

2) Passive output (SINK). The C1000 opens and closes a contact to allow an external source to power the load (see Figure 11).

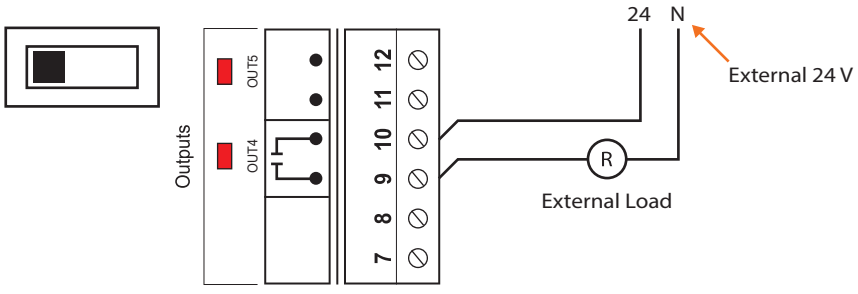

Figure 11 - Connection of Passive Output 3 and 4

Typical Connection of Analog Output

Two types of configuration are possible:

1) The C1000 powers the load and provides a control signal (see Figure 12).

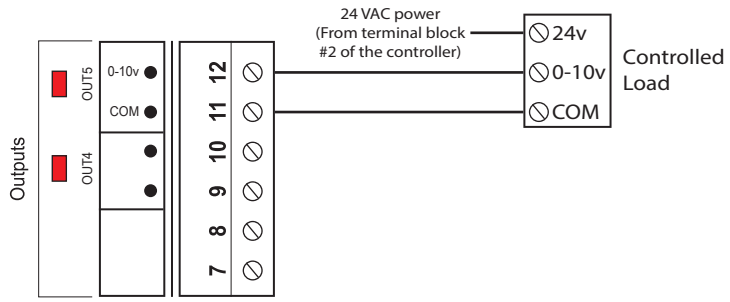

Figure 12 - Connecting the Analog Output (Controller Powered)

2) The C1000 only provides the control signal to the load, which is powered by an external source (see Figure 13).

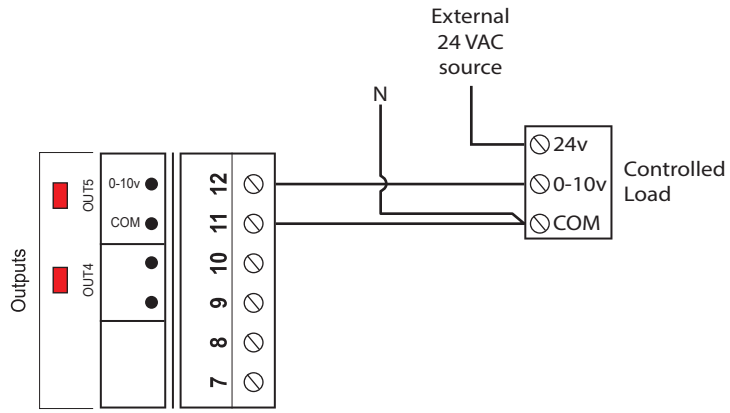

Figure 13 - Connecting the Analog Output (External Power)

Power Source / Network

Power Source

The ProLon C1000 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.

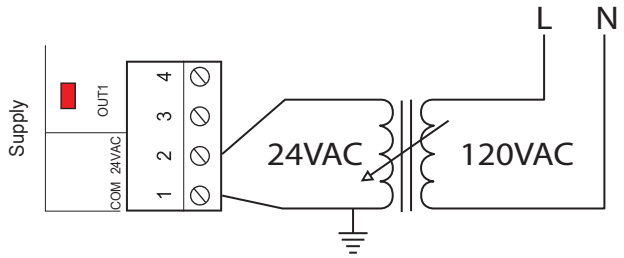

Figure 14 - Connecting the 24VAC Power Source

Network Communication

The ProLon C1000 controller works autonomously or networked. When networked, it will communicate in real-time with other controllers. The C1000 controller's default communication protocol is Modbus RTU over RS485. The addressing is done with the addressing dipswitch located on the C1000 card (see Figure 3). The network connections are made using the NET terminal block located on the ProLon C1000 controller (see Figure 15).

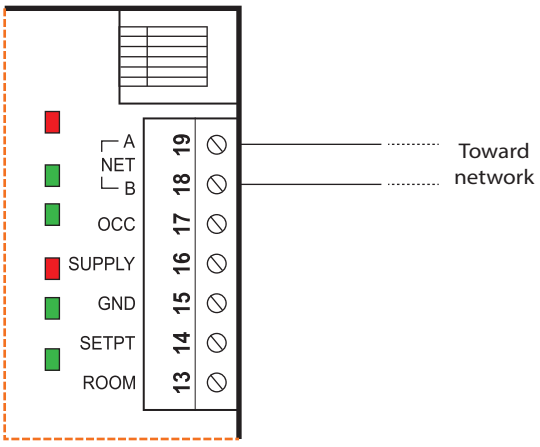

Figure 15 - Connecting to the Network

Technical Specifications

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

Consumption: 2 VA (Consumption), 5 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) and RJ45 modular jack

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

Weight: 0.85 lbs

Environment: 32-122 ºF (0-50 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.

Overall Dimensions

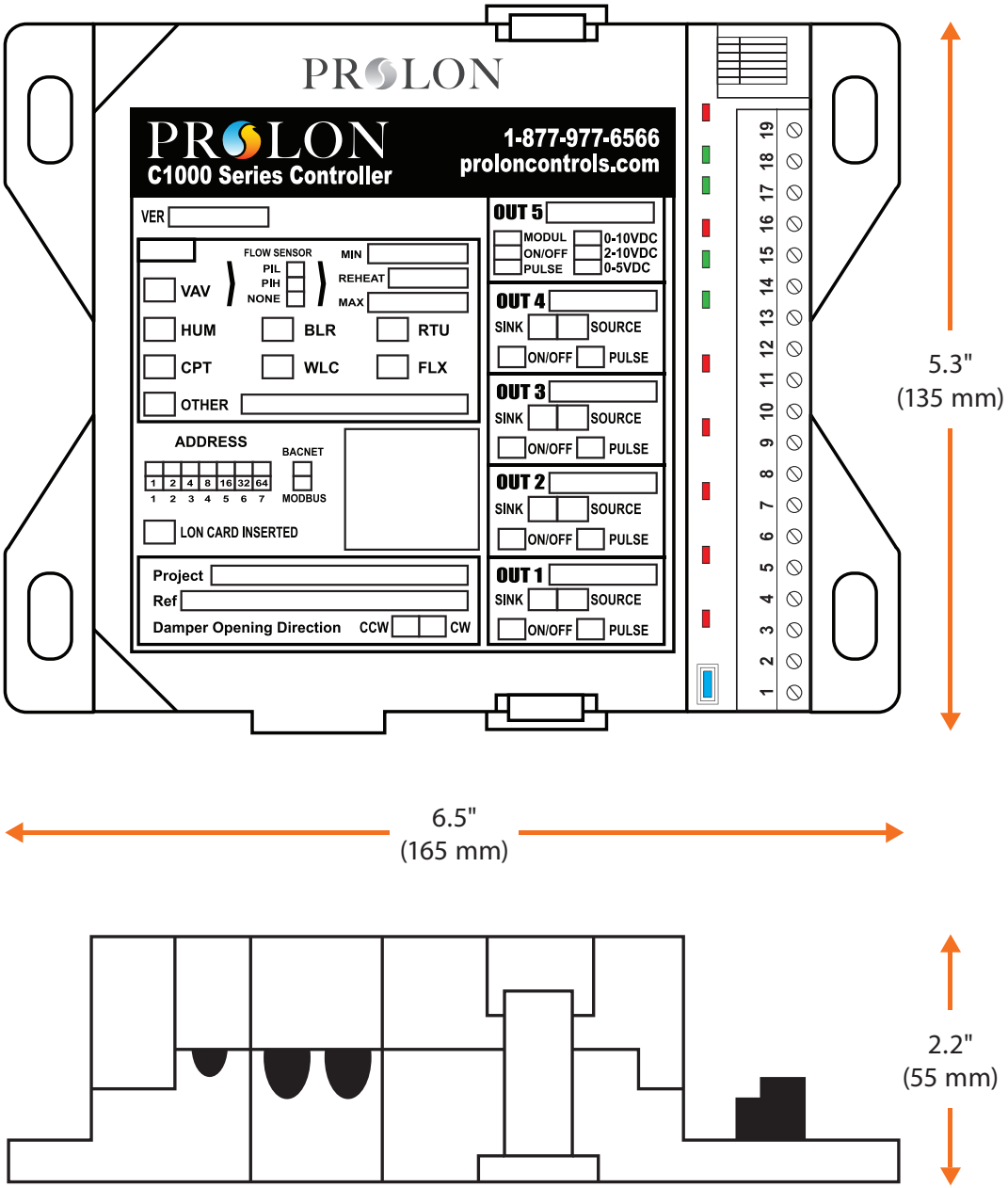

Figure 16 - C1000 Size Diagram

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