



# HARDWARE GUIDE

## Rooftop Controller C1050 Series

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Specifications and Operational Guide

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## PL-C1050 Basic Rooftop Controller

### Description

The Proton C1050 Basic Rooftop is a microprocessor-based controller designed to operate rooftops or other mechanical HVAC systems. It acts as a master when used on a network with other Proton zone controllers.

### General Behaviour

Although fully programmable, the Proton C1050 Basic Rooftop controller uses pre-established control sequences or "profiles" to operate specific HVAC equipment with dedicated output functions. Those can be fully optimized to obtain the best results for each type of system. Numerous parameters enable the modification or fine tuning of the fan, the cooling outputs, the action of the heating outputs (On-or-Off / pulsed / modulating), 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 unoccupied mode settings, morning warm-up and supply air pre-heating sequences as well as each zone weight and network demand control strategy best suited for the building space it is controlling. All these parameters can be accessed by using the Proton Focus software.





## Operating Sequence

### General

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The Proton C1050 Basic Rooftop controller receives readings from three temperature sensors located outside, in the return duct and in the supply duct. Also, as a Master device, it receives data from the zone controllers sent on the network bus. A dry contact originating from an external timer signals the occupancy status (optional) to the Master. The controller then analyzes all the data and demands sent by the zones and commands the appropriate outputs to respond accordingly, within parameters set by the temperature sensors and other safety limits. The Master sends back information on its network such as supply air temperature, occupancy status and other relevant data for the zone controllers to use.

### Occupied Mode

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The controller operates the fan. When there is a cooling demand from the zones, the Rooftop controller will activate the cooling outputs as long as all temperature limits, delays and other related parameters are respected. Once the demand is satisfied, the outputs are deactivated within the prescribed minimum on/off time delays.

When there is a heating demand from the zones, the Rooftop controller will activate the heating outputs as long as all temperature limits, delays and other related parameters are respected. Once the demand is satisfied, the outputs are deactivated within the prescribed minimum on/off time delays.

When there is no cooling or heating demand from the zones, only the fan is enabled. If the heating equipment permits, a supply air pre-heating sequence may be enabled. This allows cold mixed air to be heated to a more comfortable level for subsequent use by the zones for ventilation.

### Unoccupied Mode

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The fan can be configured to operate in intermittent mode. When there is a cooling or heating demand from any single zone, the Rooftop controller will activate the fan and the cooling outputs as long as all temperature limits, delays and other related parameter are respected. Once the demand is satisfied, the fan and cooling outputs are deactivated within the minimum on/off time delays set.

During the unoccupied period, the Rooftop controller can be driven by the highest demand on the network and will operate the fan and relevant outputs accordingly.



## Component Identification

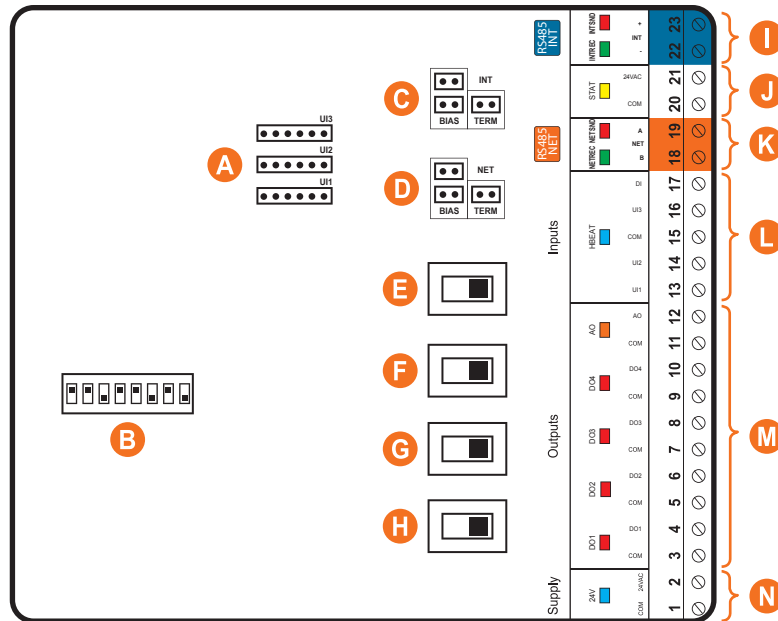


Figure 1 - Component Identification

### 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.

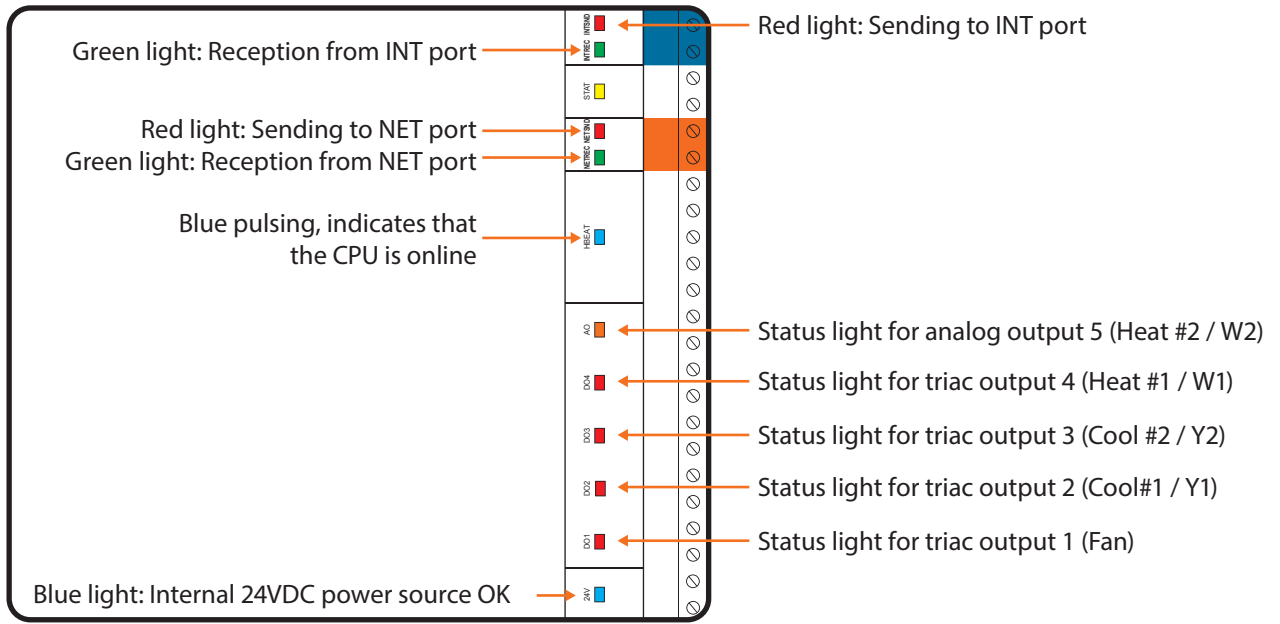


Figure 2 - LEDs Identification

## 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 Proton network allows a maximum of 127 addresses, therefore 127 controllers.

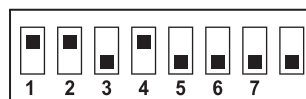


Figure 3 - Addressing Dipswitches



## 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 Rooftop Controller has two separate communication ports offering the same functionality on each. Both act as ports for incoming Modbus communications from other Proton devices or interfaces, such as a Network Controller or remote computer with Proton Focus software.

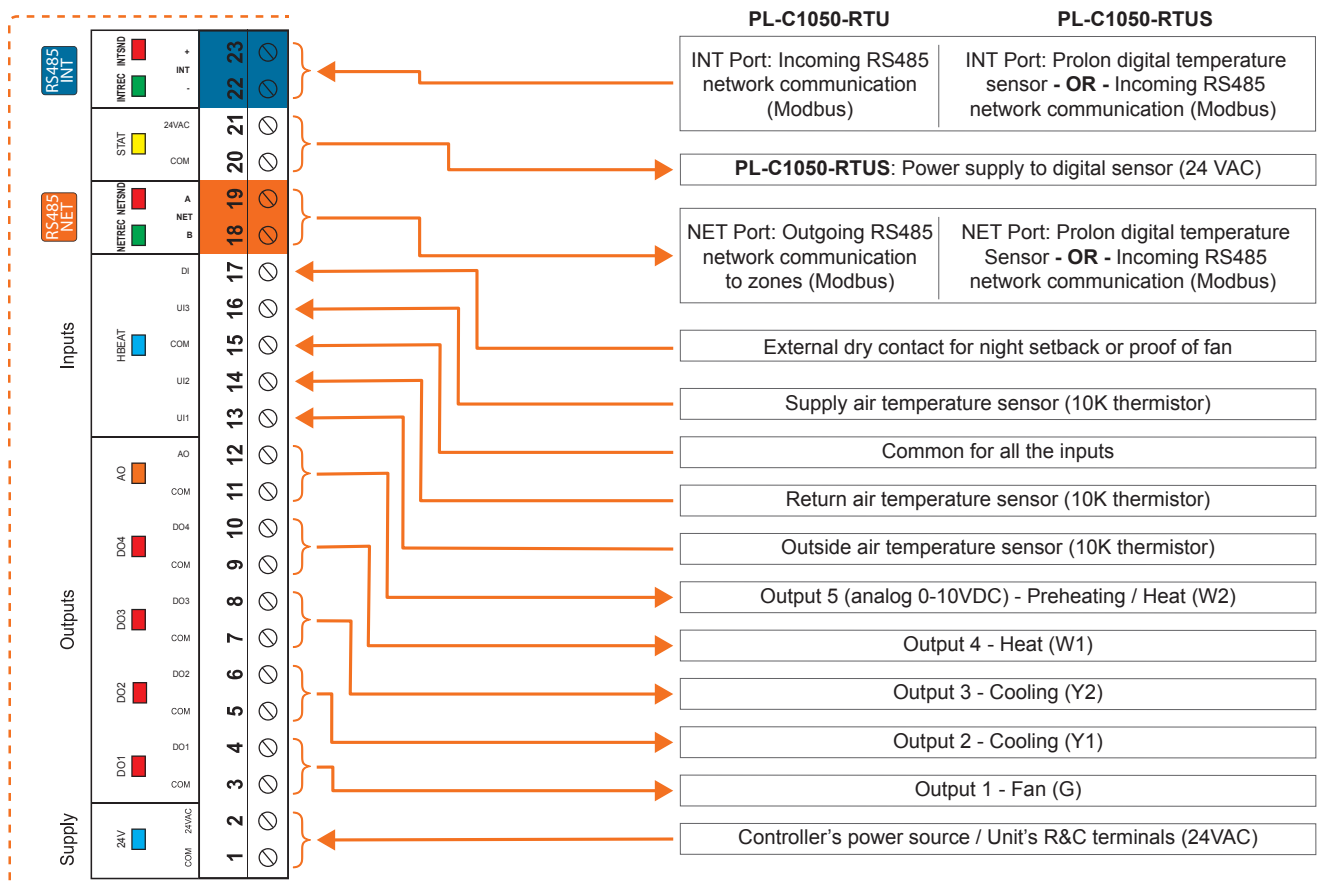


Figure 4 - Input and Output Identification





# 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 ( $\Omega$ )                      • 0-5V
- 4-20mA                                      • 0-10V

When a thermistor is used, the thermistor must be 10K $\Omega$  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-RTU 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:

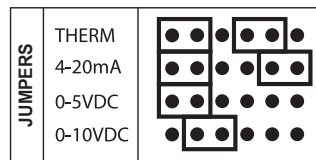


Figure 5 - Analog input

## Temperature Sensors

The C1050 Rooftop controller has three analog inputs that monitor outside air, return air and supply air temperatures and will integrate these readings into its control sequence. The sensors used are standard 10k type 3 thermistors that share a single common connection.

Alternatively, the supply air temperature can be retrieved from a zone controller that has its own supply sensor and belongs to the C1050's network.

The outside air temperature can 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.

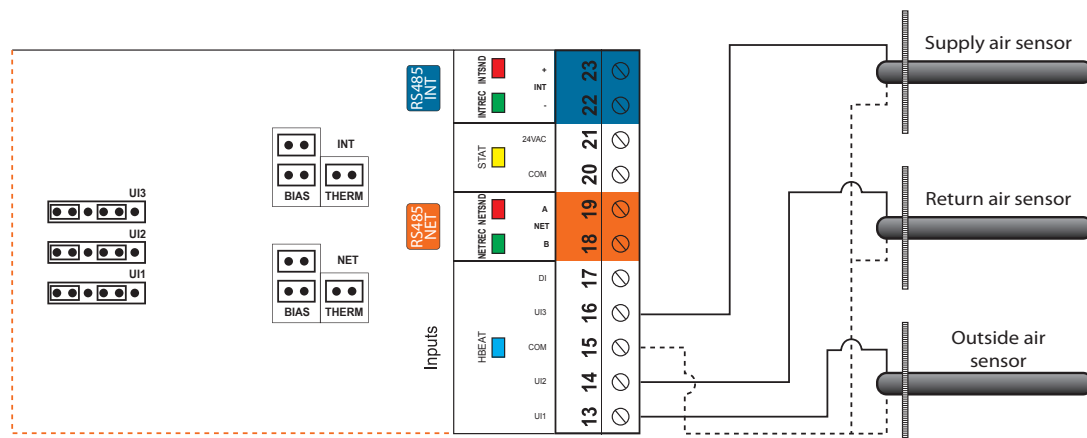


Figure 6 - Connecting the Sensors



## Occupancy Mode (Night Setback)

Temperature setback savings can be obtained by using a dry contact originating from an external timer to switch the controller from occupied to unoccupied mode. The timer contact used must be connected to the "OCC" and the "GND" terminals. To indicate occupied mode, the contact must be open. To indicate unoccupied mode, the contact must be closed. As a network Master, the Rooftop controller will then send the occupancy status to all known slaves on his network.

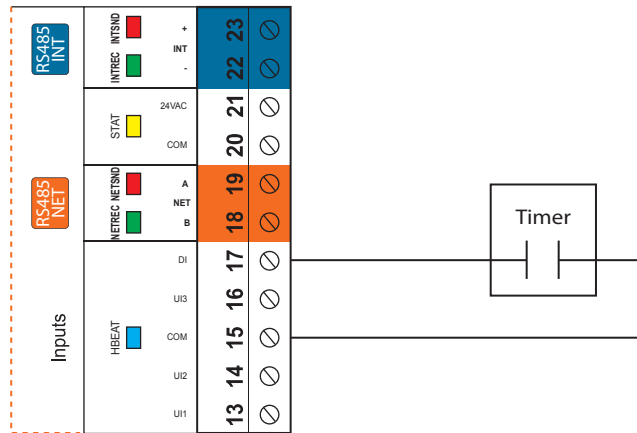


Figure 7 - Night Setback Contact Connection

## Proof of Fan

The C1050 has a digital input that can be used to receive the proof of fan signal. Please refer to Figure 8 to see how to correctly connect it. To indicate proof of fan, the contact must be closed.

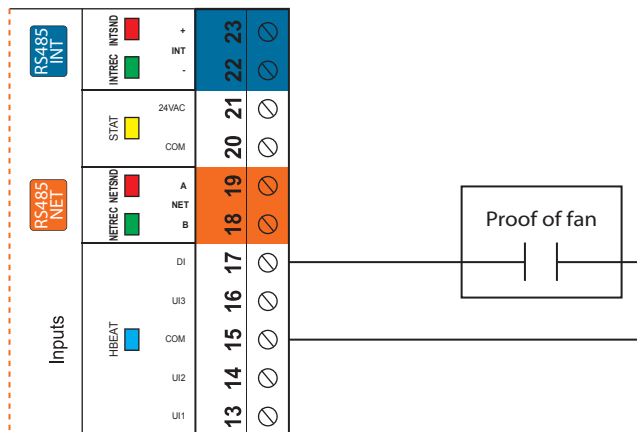


Figure 8 - Connecting the Proof of Fan Contact to the Controller



## Outputs

The C1050 Basic Rooftop controller contains 5 customizable outputs, 4 being Triac type switch outputs and one being 0-10Vdc analog modulating / pulsed / On-or-Off output. Some outputs are configurable and follow a proportional and integral algorithm (PI) to ensure precise adjustment of the device. All configurations are performed 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 a round, yellow-coloured PTC that will change to orange and heat up on an overload condition. Once power has been removed from the C1050, 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	Application
1	Triac source 24VAC, Max Current: 300 mA	On-or-Off	Fan
2	Triac source 24VAC, Max Current: 300 mA	On-or-Off	Cooling (1st Stage)
3	Triac source 24VAC, Max Current: 300 mA	On-or-Off	Cooling (2nd Stage)
4	Triac source 24VAC, Max Current: 300 mA	On-or-Off	Heating (1st or 2nd Stage) / Preheat Permission
5	Configurable Analog Output: - 0 to 10 VDC - 2 to 10 VDC - 0 to 5 VDC Max Current: 40 mA	Modulating Proportional / Pulse / On-or-Off	Preheating only / Preheat + Heating / Heating (1st or 2nd Stage)



## Typical Connection of the Triac Outputs 1 through 4

On the C1050 Rooftop controller, all triac outputs must be set to SOURCE mode because they all share a single source supply: the equipment's transformer. All triac outputs have a SOURCE / SINK configuration switch; they must be set to "SOURCE" (move switch towards terminal blocks). Only the terminal blocks marked 24 VAC are used for each output.

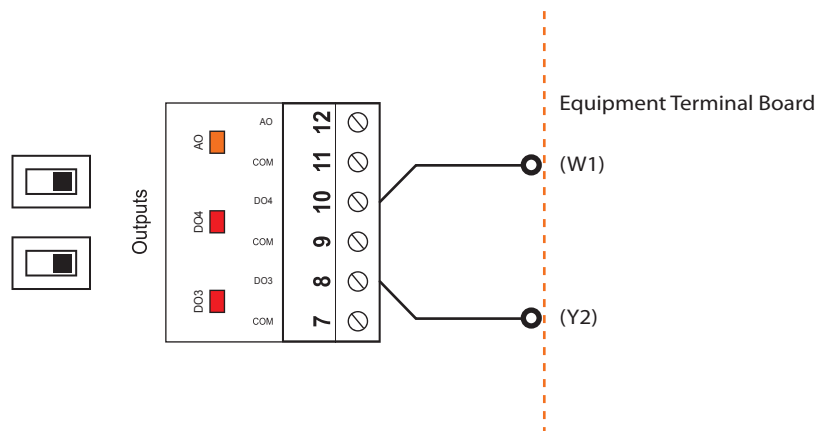


Figure 9 - Connection of Outputs 3 and 4

## Typical Connection of Output #5

Output 5 is an analog output 0-10 VDC. It can be configured to modulate a 0 to 10 VDC load, to pulse a 0 or 10 VDC Triac relay or to control a 10 VDC On/Off relay.

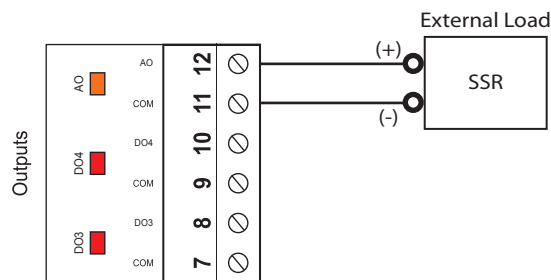
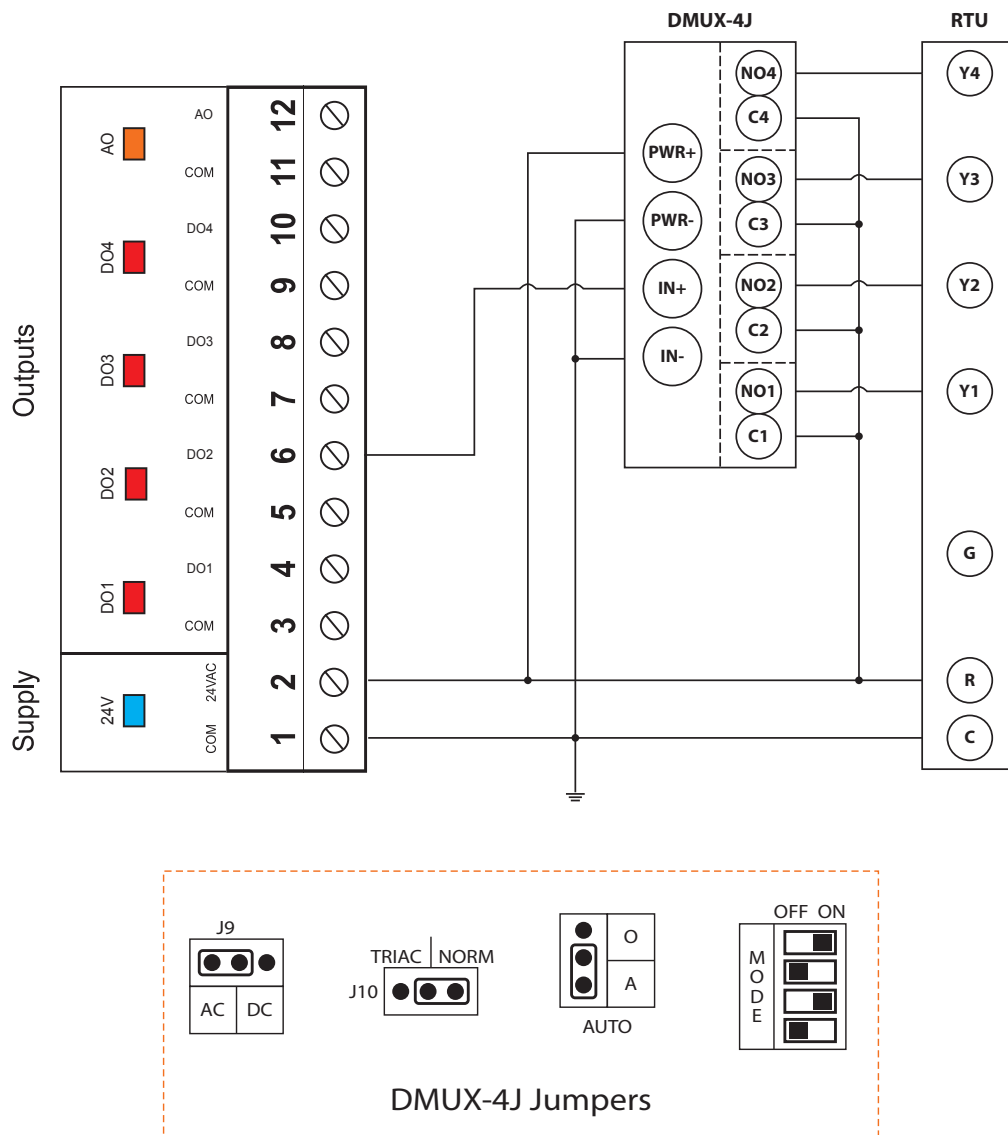


Figure 10 - Connecting the Analog Output (External Power)



## DMUX-4J Connection on Output 2 for Stage 3 or 4 Cooling

When 3 or 4 stages of cooling are required, the C1050 Rooftop controller must be equipped with a DMUX-4J. The DMUX-4J input is only connected to Output 2 on the C1050 Rooftop controller. The DMUX-4J must be configured to “Sequenced Relay Control” with a 1 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 outputs are then connected to the rooftop unit. Each of the DMUX-4J outputs have connections for “Normally Closed” and “Normally Open” operation, so use the connection that is compatible with your rooftop unit. For more information on the DMUX-4J, consult the Specification Sheet and the Installation Guide for the DMUX-4J.



**Figure 11 - Connecting the DMUX-4J (Powered by C1050)**



## PTA2 Connection on Output 2 for Analog Cooling

When analog cooling is required, the C1050 Rooftop controller must be equipped with a PTA2 v.1. The PTA2 input is connected to Output 2 on the C1050 Rooftop controller. The input pulse range must be set to 0.1-10 sec. For more information on the PTA2, consult the Specification Sheet and the Installation Guide for the PTA2.

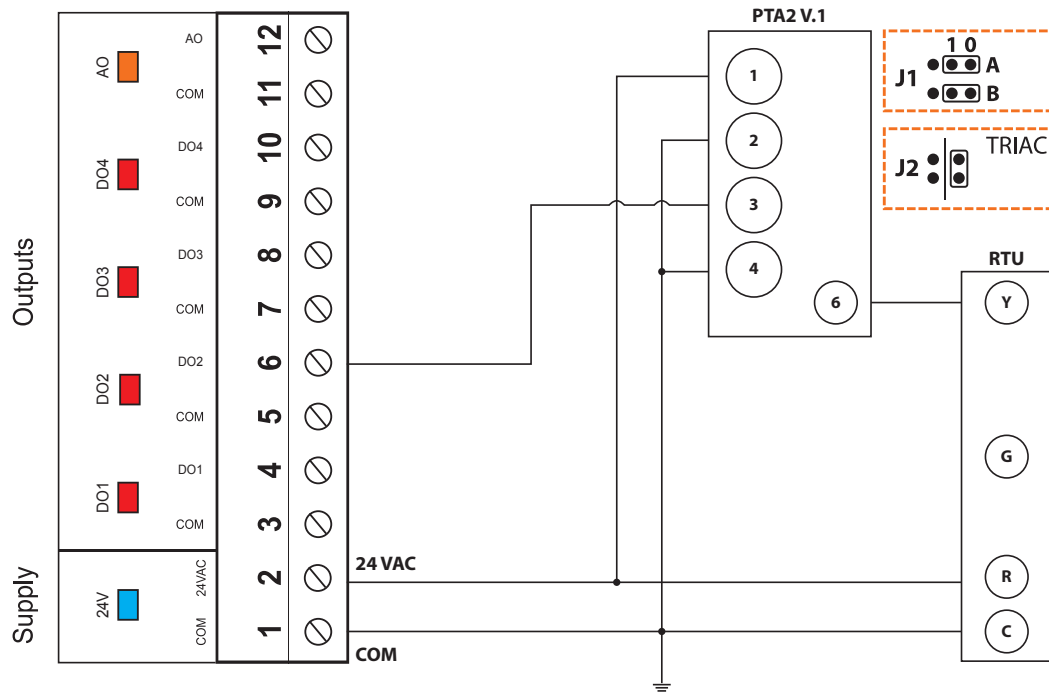


Figure 12 - Connecting the PTA2 (Powered by C1050)



# Power Source & Network

## Power Source

The C1050 controller is powered by the HVAC equipment's 24 VAC power supply by connecting the common ("C" wire) to the "COM" terminal block and the live ("R" wire) to the "24 VAC" terminal block. The common for all inputs and outputs is the same as the power source's common. All output power sources also originate from the controller's power source.

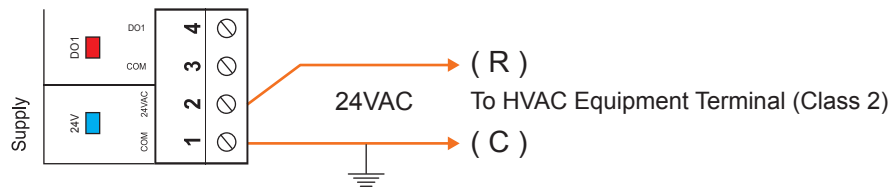


Figure 13 - Connecting the 24VAC Power Source

## Network Communication

The Proton C1050 Rooftop controller is primarily designed to work with Proton zone controllers. When they are networked the Rooftop and zone controllers all communicate in real-time. The network connections are made using the network terminal blocks located on the C1050 controller.

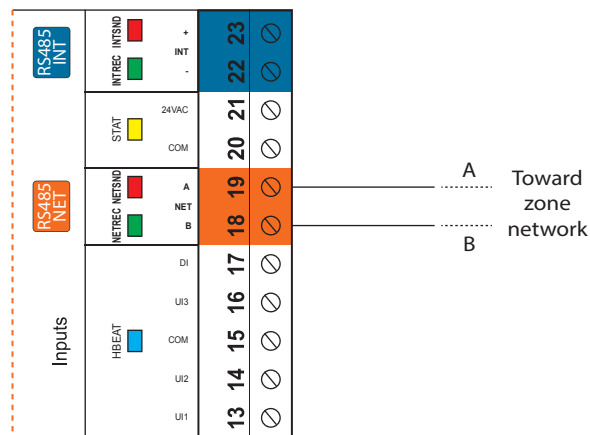


Figure 14 - Connecting to the Network



## Technical Specifications

**Supply:** 24 VAC  $\pm$ 10%, 50/60 Hz, Class 2

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

**Inputs:**

- Outdoor – thermistor 10K
- Return – thermistor 10K
- Supply – thermistor 10K
- External clock or Proof of fan– dry contact

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

**Analog output:** 1 output 0-10 VDC / 2-10 VDC / 0-5 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:** 6.2" x 5.2" x 2.5" (157 mm x 132 mm x 64 mm)

**Weight:** 0.85 lbs (0.39 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.*





## 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

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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

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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.

