

## SOLSTICE MULTI-HEAT PUMP STAGING CONTROLLER



### **Codes and Electrical Requirements**

- This product must be installed in accordance with all applicable codes. Where instructions in this manual differ from specific local requirements, defer to the local codes.
- The electrical installation must also comply with the latest edition of: in the U.S. — National Electrical Code ANSI/NFPA No. 70; in Canada — CSA C22.1 Canadian Electrical Code Part 1. Wiring must be N.E.C. Class 1. Use only copper wire, rated for 194°F (90°C) and sized for the load listed in this manual.
- Electrical shock hazard — Disconnect all electrical power before servicing the unit. Also, the unit must be grounded in accordance with the Electrical Code listed above.

### **Introduction and Overview**

The pCO5 Compact PLC is an electronic logic controller intended exclusively for the purpose managing a bank of Solstice Heat Pumps (SCM series or LAHP48), up to 10, operating on a common hydronic loop, while maintaining a preset temperature in either heating or cooling operation. The pCO5 will stage the heat pumps to match the load of the system, and ensure approximately equal run hours (or optionally, number of starts) among them. Additionally, the pCO5 can be connected to as few as one heat pump to act as a portal to a BMS or EtherNET connection. (With additional interface components)

The pCO5 Compact PLC also acts as a remote, central interface that can access, read and/or adjust operating conditions and parameters of each Heat Pump.

The installation of the pCO5 Compact PLC requires the installation of a communication adapter, and minor reconfiguration of the Carel  $\mu\text{C}^2$  Controller located within each Heat Pump.

All materials specific to the pCO5 Compact PLC and Carel  $\mu\text{C}^2$  Controller are available from SpacePak, at quantities below based upon the number of Heat Pumps (1-10).

Additionally, the pCO5 Compact PLC requires 24VAC power, of at least 30VA capacity. This may be provided by a dedicated Class 2 transformer, or a source shared with other 24VAC components as long as sufficient VA capacity is available and correct polarity is maintained.

The Multi-Heat Pump Staging Controller Kit is ordered as 45460-WG1049-XX, where XX is replaced by the number of Heat Pumps in the system, 01 through 10.

## Installation of the pCO<sub>5</sub> Compact controller for use with SpacePak SCM-036, SCM-060, or LAHP48 reverse cycle heat pumps

### Components Included in Kit 45460-WG1049-XX

1. pCO<sub>5</sub> Compact PLC, 45460-WG1048-01, one per common bank of heat pumps (up to 10)
2. RS485 Network adapter, W55-WG0607-01, one per individual heat pump.
3. Terminal Kit, W55-WG0608-01, one per pCO<sub>5</sub> Compact PLC
4. Temperature Sensor, W55-WG0609-01, three per pCO<sub>5</sub> Compact PLC
5. Terminal block, 3 pin 1.5mm, W55-WG0610-01, one per individual heat pump.
6. 35mm DIN rail, 4" long, W11-WG1054-01, one per pCO<sub>5</sub> Compact PLC.

Additionally, the installation requires a 24VAC power supply with a minimum capacity of 30 VA.

### Mounting the Controller

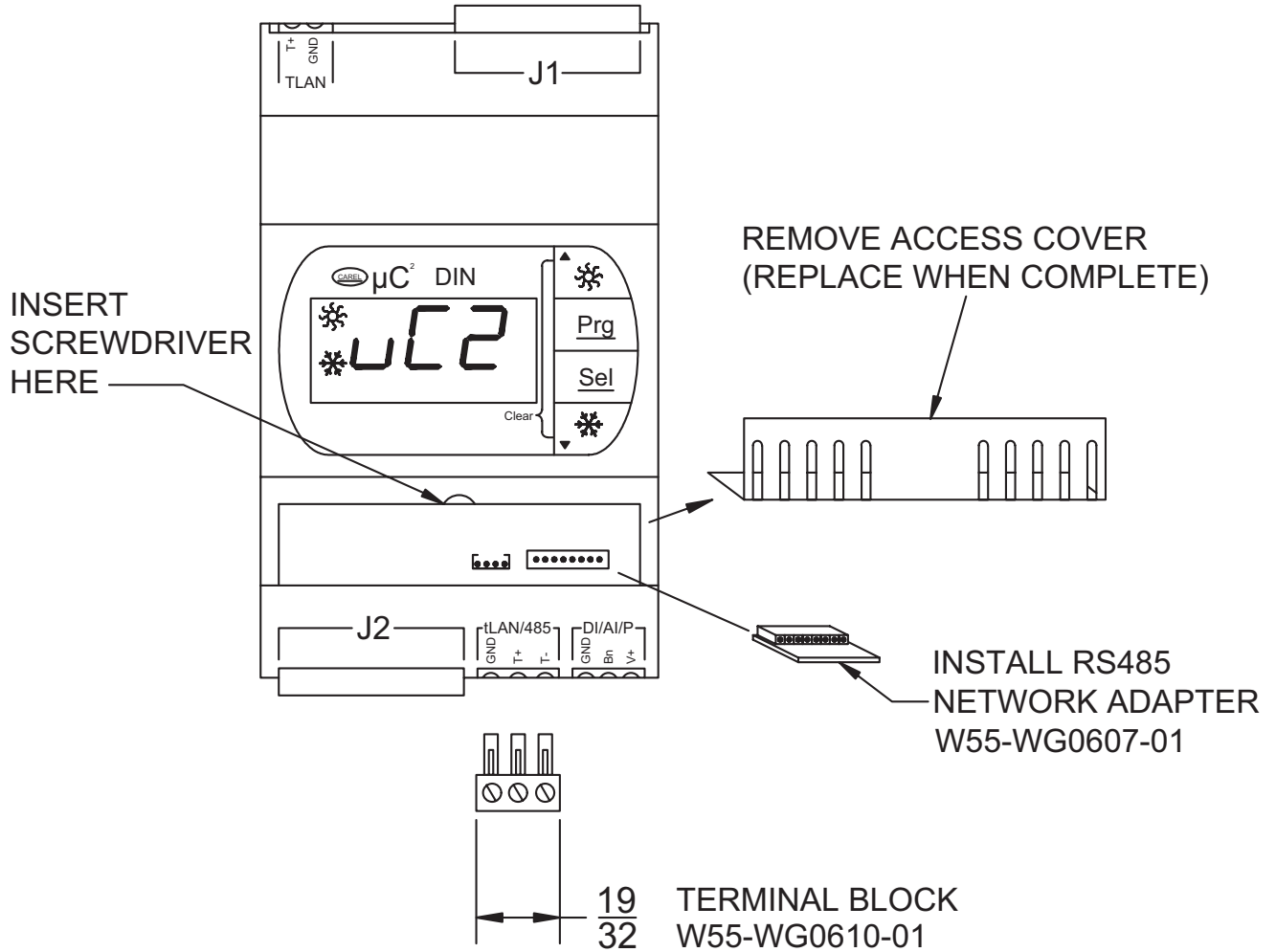
1. Identify a mounting location for the **pCO<sub>5</sub> Compact PLC, 45460-WG1048-01** that is weather protected, in close proximity to the supply and return portions of the water circuit, and has available uninterrupted electrical power. Note: if the controller is located outside, it must be placed in a suitable enclosure, NEMA 3R or better. If located inside, such as a mechanical room, it can be mounted directly to a wall in any clean dry area.
2. Affix 4" of 35mm DIN rail W11-WG1054-01 to the wall or back panel of the enclosure. Insure it is relatively level (horizontal) and has a minimum of 3" of clear space above and below to make connections.
3. Provide a Class 2 transformer with a minimum 30VA capacity to step down from local voltage to 24VAC. (Typical control/thermostat transformers meet this requirement)

### Preparing the Heat Pump

1. Remove power from one or more heat pumps (at the circuit breaker or local disconnect). This can be done one heat pump at a time if it is desired for the balance of the system to remain on-line.
2. Using the appropriate tools, remove the electrical access panel. Locate the  $\mu\text{C}^2$  controller (with green LED display) inside the electrical enclosure.
3. With a small screwdriver, take off the access panel located directly below the LED display of the  $\mu\text{C}^2$  controller.
4. Locate the 8 pin connector in the extreme lower right of the access opening.
5. Hold the RS485 Network adapter, W55-WG0607-01, with the terminal block pointed inward and upward (label on top) and press it firmly onto the 8 pins of the connector.
6. Replace the access cover by snapping it into place.

7. Identify the **3 pin 1.5mm Terminal block, W55-WG0610-01**, which fits onto the tLAN/485 connection of the  $\mu\text{C}^2$  controller. Note: this connector is very similar, but not identical to, other 3 pin connectors supplied. This is slightly larger, at about 19/32" wide, and they are not interchangeable. Ensure the connector fits into the tLAN/485 connection point on the  $\mu\text{C}^2$  controller.
8. Install control wires from the pCO<sub>5</sub> controller to the first (nearest, or otherwise most logical) heat pump, then from that heat pump to the next, and so on until you reach the last heat pump. Each heat pump will have two wire runs, one in from the previous, and one out to the next, except for the last. Note: the wire routing has no effect on behavior or performance of the heat pumps; the installer is free to rout wires based upon ease of wiring and minimum run lengths. Note: the control wires can be run through any of the existing openings of the heat pump structure, but should not be run along with the main A/C power input as this may cause interference.
9. Thermostat wire is ideal for these connections, as they are single strand conductors with color coding for easy identification. A minimum of two conductors must be run to each heat pump.
10. Select a particular color for T+ and T-, and maintain this throughout the installation. Holding the connector so that the screw heads are facing you, install the wires into the sockets that correspond with the T+ and T- marked on the  $\mu\text{C}^2$  controller. On all but the last heat pump, two wires (of the same color) will be inserted into both the T+ & T- sockets. The GND socket is not used.
11. Insert the wired connector into the  $\mu\text{C}^2$  controller, ensuring that the wire is routed cleanly within the cabinet and away from any possible pinch points.
12. Power can be returned to the heat pump at this point, and it can operate while other heat pumps are being worked on.
13. When all heat pumps have been wired and returned on-line, each must be assigned a unique serial address to allow them to communicate individually with the pCO<sub>5</sub> controller.
14. At this point, select which heat pump will be number 1, number 2, number 3 etc. This numbering is completely arbitrary, each heat pump will behave exactly as the others, and the controller will sequence the heat pumps to accumulate approximately equal run times. The identification is only for the purpose of communication, and can be used for trouble-shooting if any error or alarm messages occur.
15. On each chiller, change the parameters H06 and H07 to a value of 00.
16. With the selected heat pump powered and on-line, configure parameter H10 to the appropriate address, 01, 02, 03 etc, until each heat pump has its unique number installed.

CAREL mC2 CONTROLLER  
LOCATED WITHIN EACH HEAT PUMP

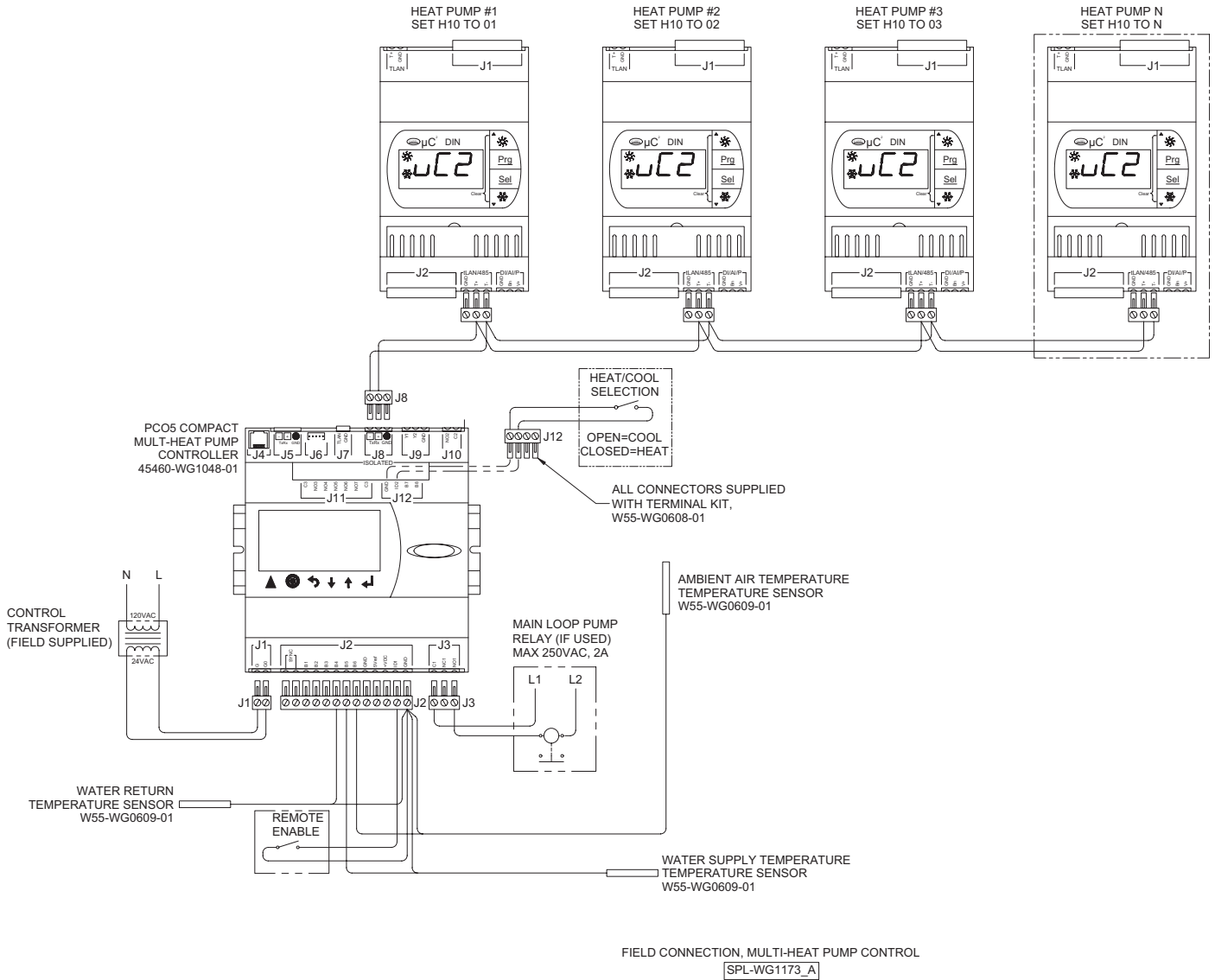


PREPARATION, INDIVIDUAL HEAT PUMP CONTROL

SPL-WG1174\_A

### **Wiring the pCO5 controller**

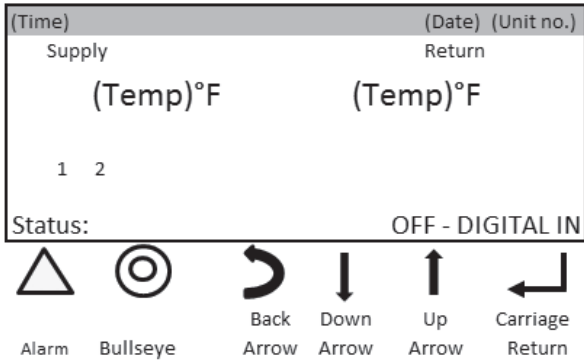
1. Identify the three **Temperature Sensors, W55-WG0609-01**, and place them appropriately. One at the supply, ideally in a well located within the buffer tank. One at the return, at the closest point before the single pipe branches out to the individual heat pumps, and the third at a convenient point to read ambient air temperature.
2. This is where the location of the controller is important. The sensors should remain fairly close to their connection point. Though up to 10 meters, 33 feet, is allowed, it is best if the thermistors can be wired directly to the controller without extending the wires.
3. When attaching the thermistors to the plumbing, it is critical that water temperatures are read as accurately as possible. A bulb well extending directly into the water flow is best, but if that is not possible, each sensor must be attached firmly to a clean area on the surface of the pipe, surrounded with a generous coating of heat transfer paste, covered and insulated. The insulation must extend, at a minimum, 1 foot before and after the sensor.
4. Locate the ambient air thermistor in a location where it is exposed to the outside air. It should be shielded from direct sunlight, but open to allow natural air movement.
5. All steps below making connections to the pCO5 controller use components from the **Terminal Kit, W55-WG0608-01**.
6. Connect the thermistor wires to the controller. Hold the 13 position connector with the screw heads facing you, and identify the connection points as marked on the lower portion of the pCO5 controller. Insert the white wire from the return temperature sensor, to the socket corresponding to B4, the white wire from the supply sensor to B5, and the white wire from the ambient sensor, to B6. Connect all three red wires to the socket corresponding to GND.
7. Connect the communication wires. Locate the three pin connector that fits the socket marked J8 at the upper portion of the pCO5 controller. (Note: this is different, slightly smaller, than the three pin connector used at the heat pumps)
8. Insert the wire (identified by color) from the heat pump T- to the socket corresponding to the - of J8. Insert the wire (identified by color) from the heat pump T+ to the socket corresponding to the + of J8. The GND socket is not used.
9. The pCO5 controller may be used to control a main loop pump (as opposed to individual circuit pumps which may be controlled by the heat pumps). This is done through the contacts identified as J3.
10. Connections C1 and NO1 are a normally open switch that closes to enable the pump. This signal occurs whenever there is a call for heating or cooling.
11. The pump control has no power output, but can switch a signal up to 250VAC and/or 2A. This is sufficient power to energize most common power relays, but the contacts should never be used to carry actual pump power.
12. Power supply. Connect the secondary, 24VAC, side of the control transformer to the power input, J1. Connect 24V to the socket corresponding to G, and Com to G0.



## Changing the Quantity of Heat Pumps in the System

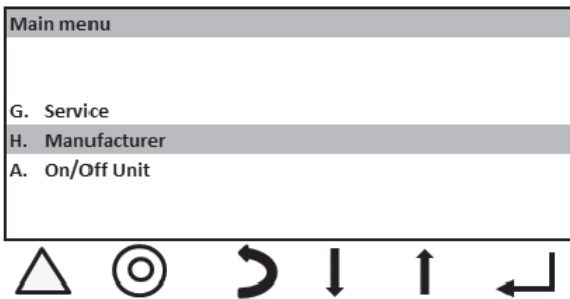
When delivered, the pCO5 module is configured for (3) individual heat pumps.

**Note:** it is best to make all electrical connections before adjusting the parameters. If this is not possible, the Module will sound an audible alarm each time it “discovers” an expected component is not responding. To silence the alarm and proceed, double-press the Alarm button for each alarm that appears.

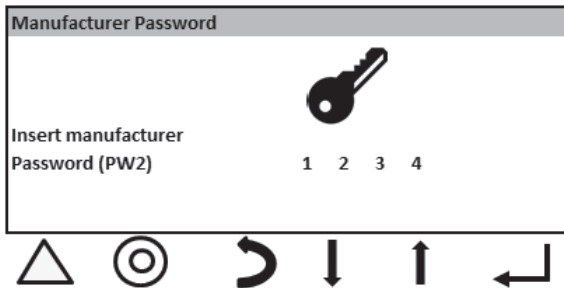


To change this value, Press the Bullseye symbol below the display to access the main Menu.

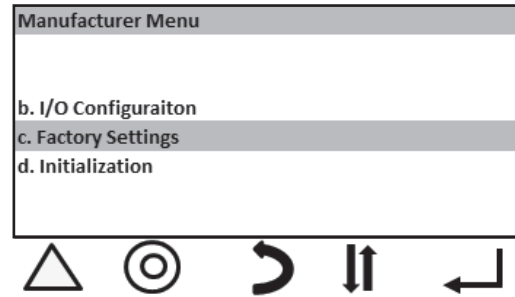
Scroll up or down using the up or down arrows, and select **H. Manufacturer** using the Carriage return symbol.



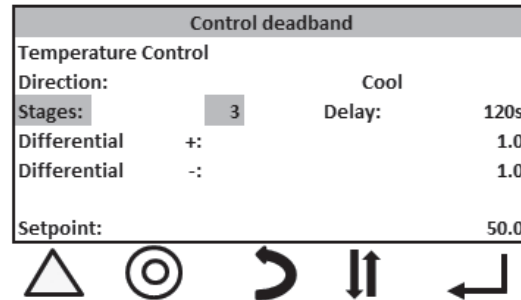
Enter the Password 1 2 3 4 by using the Carriage Return to select the digit, and the Up & Down arrows to change the value.



Scroll up or down using the up or down arrows, and select **c. Factory Settings**.

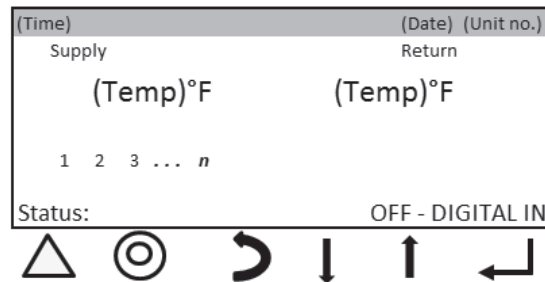


Using the Carriage Return, scroll among the parameters to reach **Stages: 3**



Use the Up or Down arrow to adjust the number of stages.

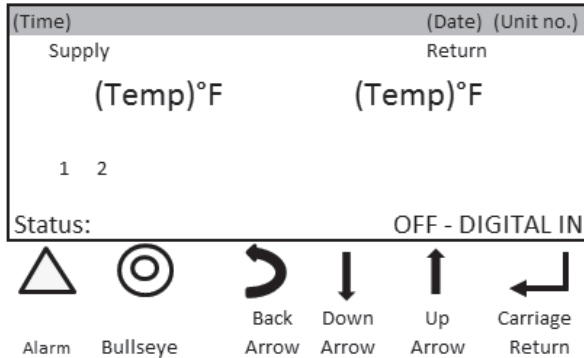
Use the Back arrow to return to the main menu. The digits corresponding to the number of active heat pumps will now be displayed (1 through the n)



## Changing Temperature Set Points

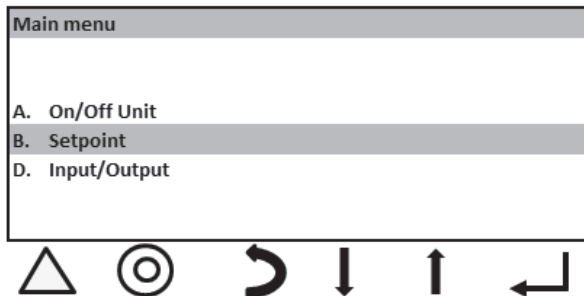
When delivered, the pCO5 module is configured to deliver 120°F water in heating operation, and 50°F water in cooling operation. The system differentials are set to 1°F in both heating and cooling, based upon a minimum system volume of 80 gallons.

**Note:** it is best to make all electrical connections before adjusting the parameters. If this is not possible, the Module will sound an audible alarm each time it “discovers” an expected component is not responding. To silence the alarm, double-press the Alarm button for each alarm that appears.

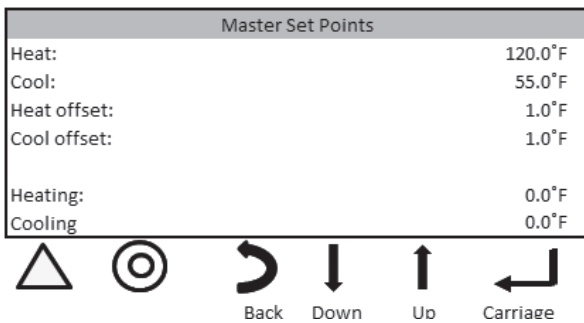


To change this value, Press the Bullseye symbol below the display to access the main Menu.

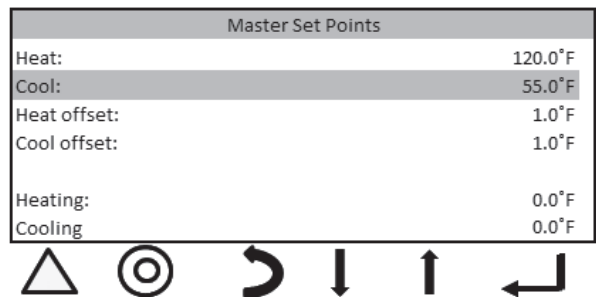
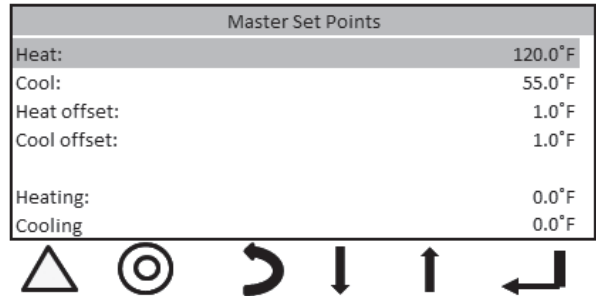
Scroll up or down using the up or down arrows, and select B. Setpoint using the Carriage return symbol.



The Master Set Points menu will appear

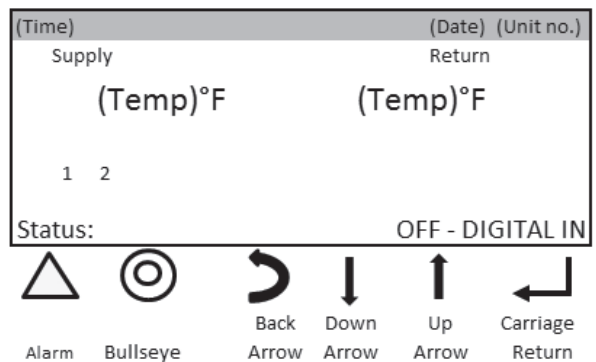


Using the Carriage Return, scroll among the parameters to reach the temperature and Differential set points. Use the Up or Down arrow to adjust the values of each.



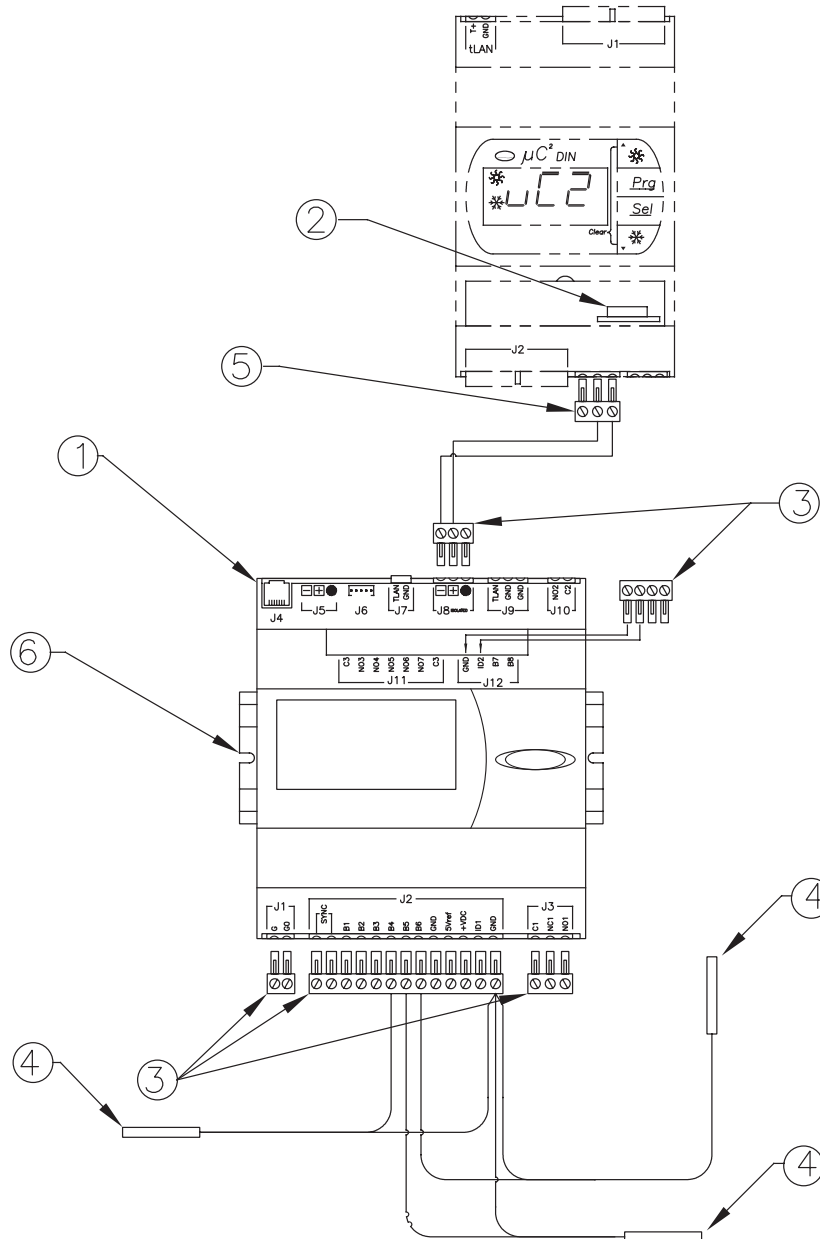
Note, the **Heating:** and **Cooling:** values are read-only, and will display 0 unless the system is in operation.

Use the Back arrow to return to the main menu.



# Replacement Parts

PART NUMBER	DESCRIPTION	USAGE	
1	460-WG1048-01	HP Control, Programmed	1 per bank of 1-10 heat pumps
2	W55-WG0607-01	RS485 network adapter	1 per individual heat pump
3	W55-WG0608-01	Terminal kit	1 per PLC
4	W55-WG0609-01	Temperature sensor	3 per PLC
5	W55-WG0610-01	Terminal block	1 per individual heat pump
6	W09-WG1054-01	Mounting rail, 35mm DIN	1 per PLC



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 IN CANADA: 7555 TRANMERE DRIVE, MISSISSAUGA, ONTARIO, L5S 1L4 (905) 670-5888 / FAX (905) 670-5782