# CAPTAIN

# Ventilation controller

Version 116

AutoVent
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# Section 1 – Electrician's Guide for

# The CAPTAIN System

Thank you for purchasing the CAPTAIN System. It is designed for easy installation and operation. The system is designed to control vents, heaters, and fans

## Main Features

The CAPTAIN System is designed for the unique challenges of greenhouse facilities.

- Temperature DIFs with manual overrides
- Wind speed sensor option
- Humidity option
- Battery backed Clock
- 6 or 10 relay outputs
- Adjustable temperature settings
- Touch screen display
- Manual overrides

# - Installing the CAPTAIN

Consider the following before installing the Captain:

- Protect the enclosure from moisture—mount it in a secure and dry place.
- <u>Important:</u> Only drill holes in the bottom of the enclosures.
- <u>Condensation runs downhill. Drilling holes into the top or upper sides of the enclosure voids the warranty.</u>

# - Wiring the Temperature Sensor

Place the temperature sensor in the middle of the building or in a location that represents the building's average temperature.

- It is important to not allows sensors to come into contact with direct sunlight

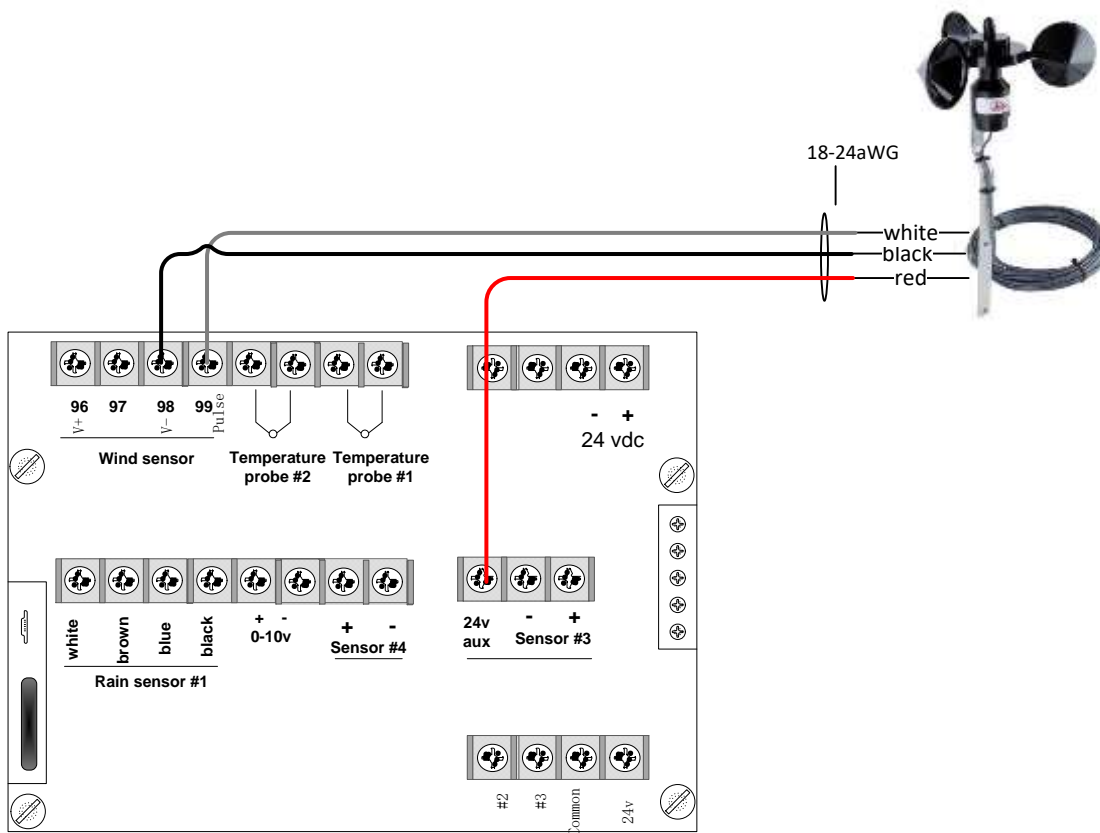Connect the temperature sensor to sensor #1 terminals.  Polarity is not important.
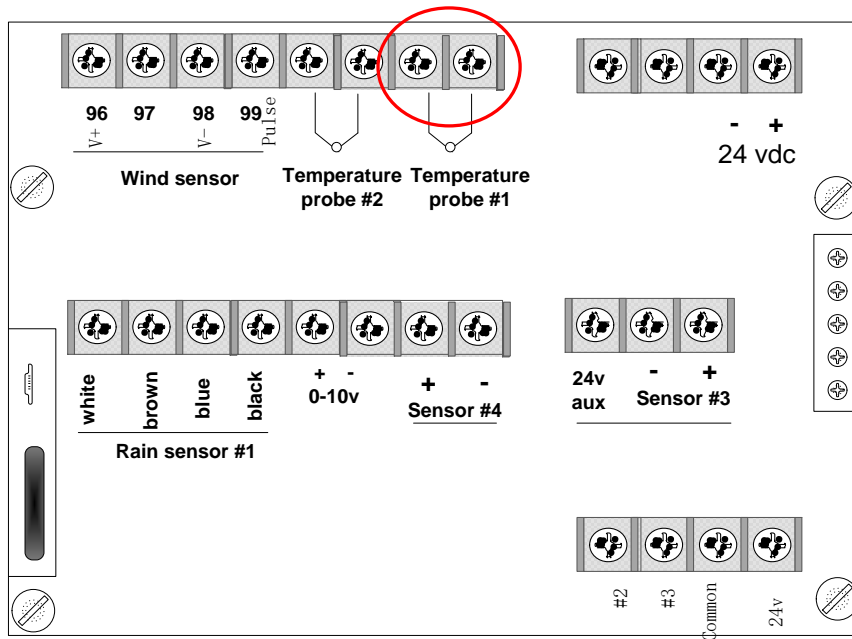


*Extending the temperature sensor:*

1. Run 18-22 AWG wire (twisted or shielded wire if possible) from the sensor to the Captain. Keep the sensor wire away from high voltage wire by at least 1 foot. Specifically, keep it away from the VFD output wires.

2. Solder or use gel-filled crimps to connect your wires to the temperature sensor.
   Pro – a Probe can be connected to Sensor #4 if jumper #1 is put to position T

# Connecting wind meter

The windmeter is used to close vents in high wind conditions.

18-24aWG

white
black
red

96 97 98 99 Pulse
V+ V-

Wind sensor

Temperature probe #2  Temperature probe #1

- +
24 vdc

white  brown  blue  black
Rain sensor #1

+ -
0-10v

+ -
Sensor #4

24v aux

- +
Sensor #3

#2  #3  Common  24v

# Captain wind meter connections:

The red wire connects to 24v+
The white wire connects to  terminal #99
The black wire connects to  terminal #98

# Mounting the windmeter

Locate the sensor outside.

Have it exposed to the wind from all directions.

Mount it upright. .. stem down, rotating cups on the top.
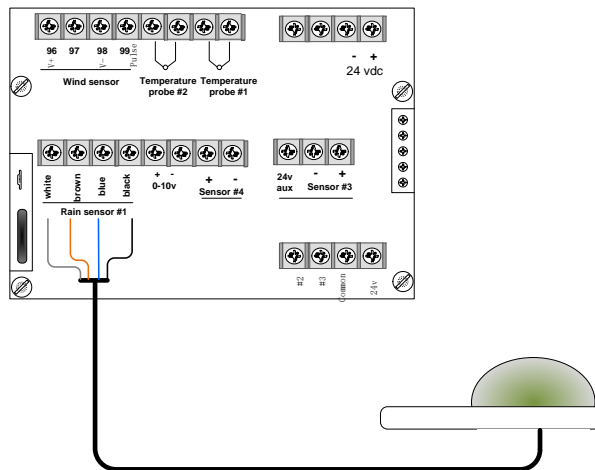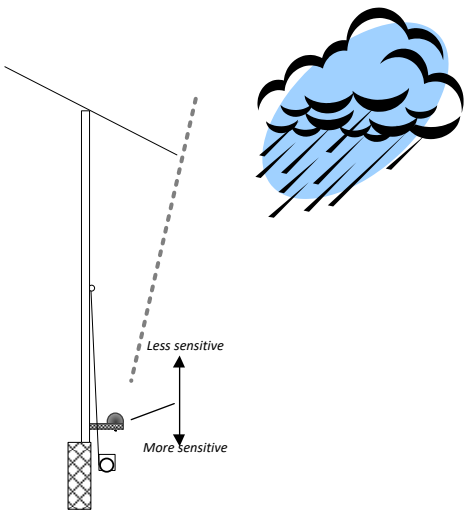
# Connecting a rain sensor

You can connect a rain sensor to the system. The rain sensor closes select vent motors when it's raining. The system supports 1 rain sensor.

If you connected a rain sensor the controller needs to know it.   Setup parameters P40 & P41 assign the sensor to the vent motors.

## *Installing the rain sensor*
When you are installing the wires, keep the rain sensor cord 6 inches away from high voltage wires.

The vent motor's close signal is activated when the sensor is wetted. The position of the sensor versus the sky dictates the response.



## *Rain sensor #1*
The wire colors are marked on the board and match the sensor's cord.
Wire by connecting the colors.

# Rain sensitivity

The rain sensitivity can be adjusted. However, it does require that you take the rain sensor apart. Take the 4 screws out that hold the sensor together to access the switches inside. Adjust the switches as noted below. Be careful to keep the gasket in place when reassembling.



Dip switch table

8 -must be off
7-must be off
6-must be off
5-must ON
4-must be off
3- off-
2 -sensitivity -default ON
1-sensitivity default off

Dip switches

On

Off
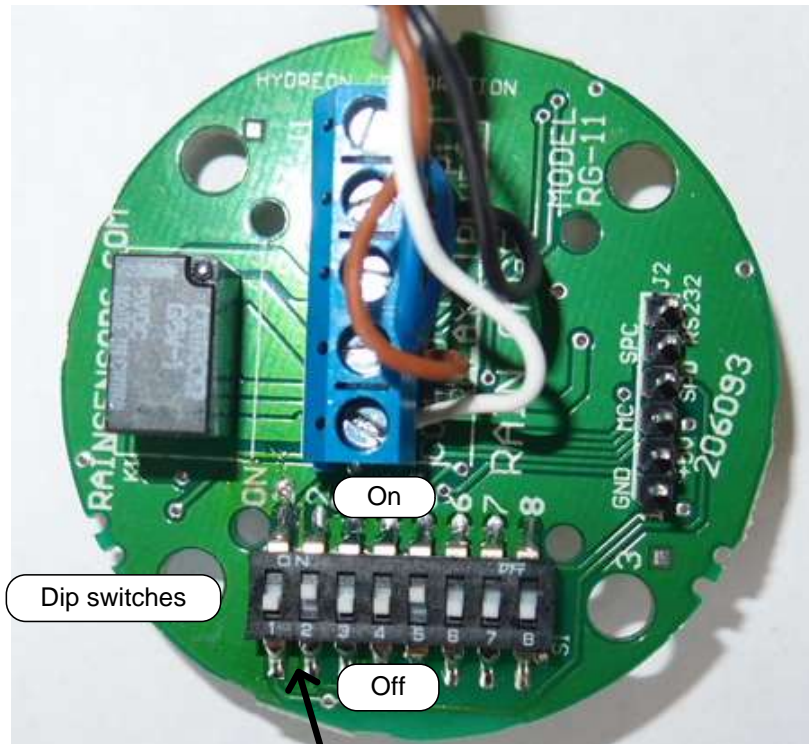
**Sensitivity settings:**
The sensor has 4 sensitivity settings. Dip switches 1&2 set the rain detect threshold..

*First drop detection:*
1 &2 off -very sensitive will be on at first drop of rain. Our experience is this might close a vents too quickly. Potential exists for False alarms.

*.1 inch per hour setting*
1 on, 2 off . Sensitive-about right for some buildings.

*.25 inch per hour setting*
1 off, 2 on – Moderate response. This works well for most general applications.

*1 inch per hour setting*
1&2 on – This will have everything soaked before closing

**15 minute delay after it stopped raining:**
Normally the vent needs to reopen after it stopped raining.
If you want it to stay closed for a while after the rain, Set dip switch3 on.
Normally we want #3 off ,so vents re- open sooner..

# Connecting a humidity sensor

The humidity sensor allows you to monitor and control the humidity. If humidity is too high a vent can open or a fan can start.

If you connect a humidity sensor, it needs to be activated. Activate it by selecting humidity for Setup parameter P10

## *Location of the humidity sensor*

Mount in a central location.  Keep the sensor away from heaters or you will get a low reading when the heater is running.

## *Installing the humidity sensor*

Route humidity sensor wires 6 inches away from high voltage wires.
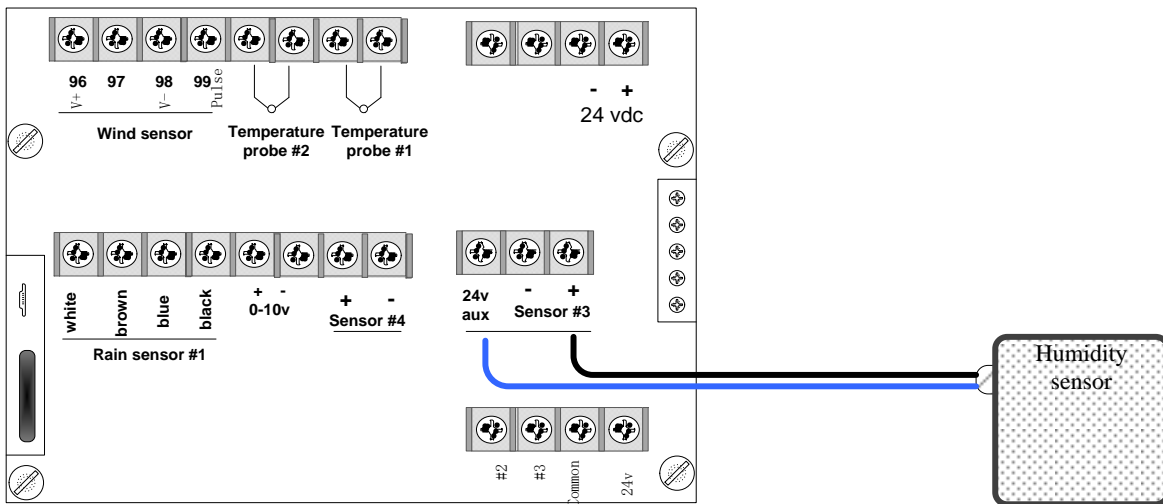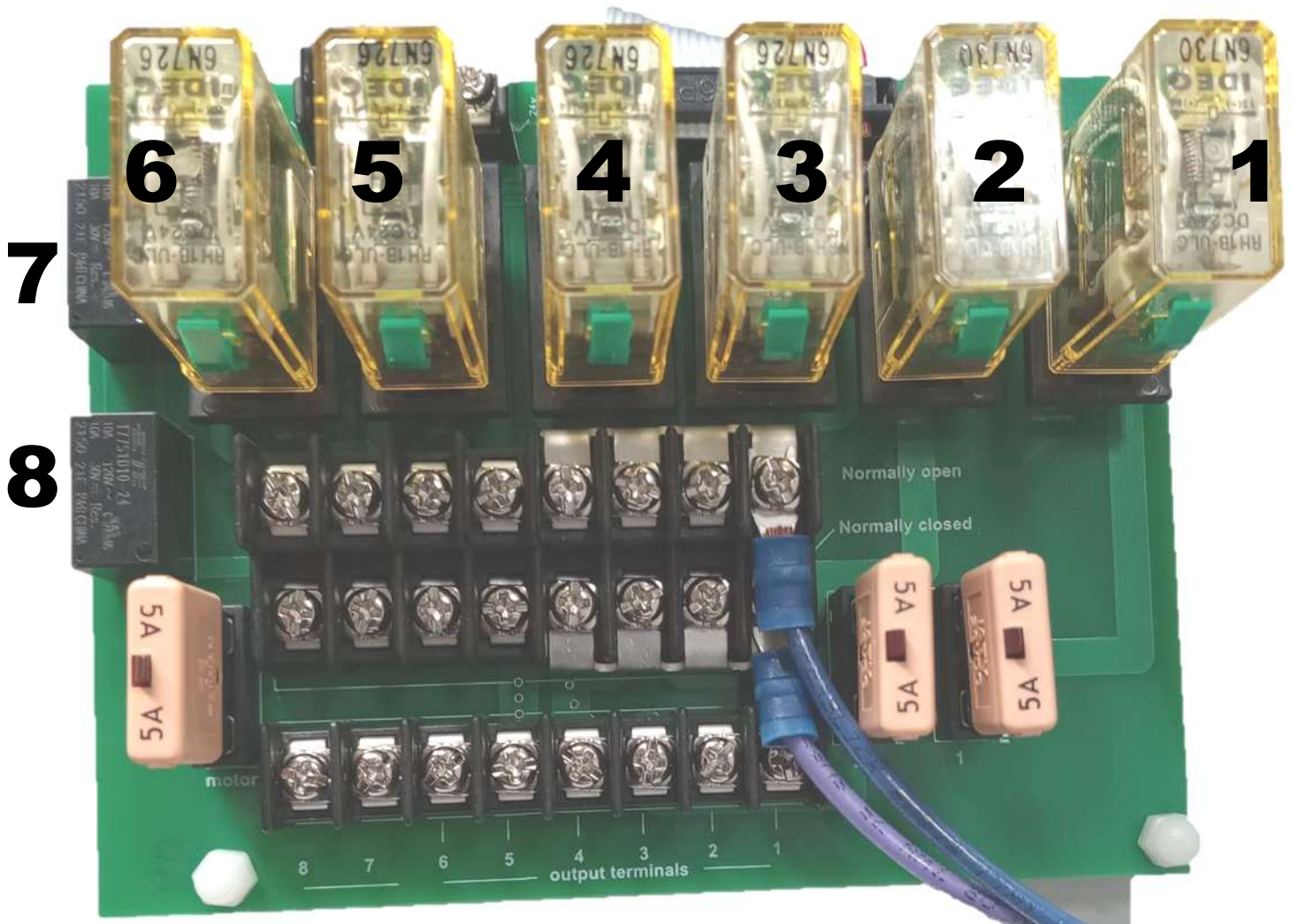


To use a Humidity sensor:

Connections:
The blue wire connects to Power 24v+

# Powering the Captain

AC versions come with a power cord. Plug it into a 120v outlet.  Requires   120V 5amp

DC versions are either 12 or 24vdc. Check the voltage labeled on your unit.

# Controller relay outputs



There are 8 output relays on the Captain8

The first 6 are replaceable and have NO & NC contacts.  Max of 0.3hp or 7.5 amps whichever is less. They also have a green mechanical test button . This is used to manually activate the contacts.

The last pair 7&8, are smaller, only NO contact and not field replaceable. Max of 3 amps. No motor loads.

Each button on the screen and  output terminals   are associated the corresponding  relays above.

Please search YouTube for AutoVent Captain for  videos to better explain the process.

# Motor connector bus bars

The motor connector bars are for low voltage motors only. By default the Captain8 includes busbars for the first 6 relays / 3 vents. If you want to repurpose any of the 6,5,4,3, 2 or 1 outputs for another app (remapping), the busbars must be removed from the remapped outputs. This is done by removing the busbar entirely, snipping with a pliers and reinstalling it on the correct outputs.



Vent motor power
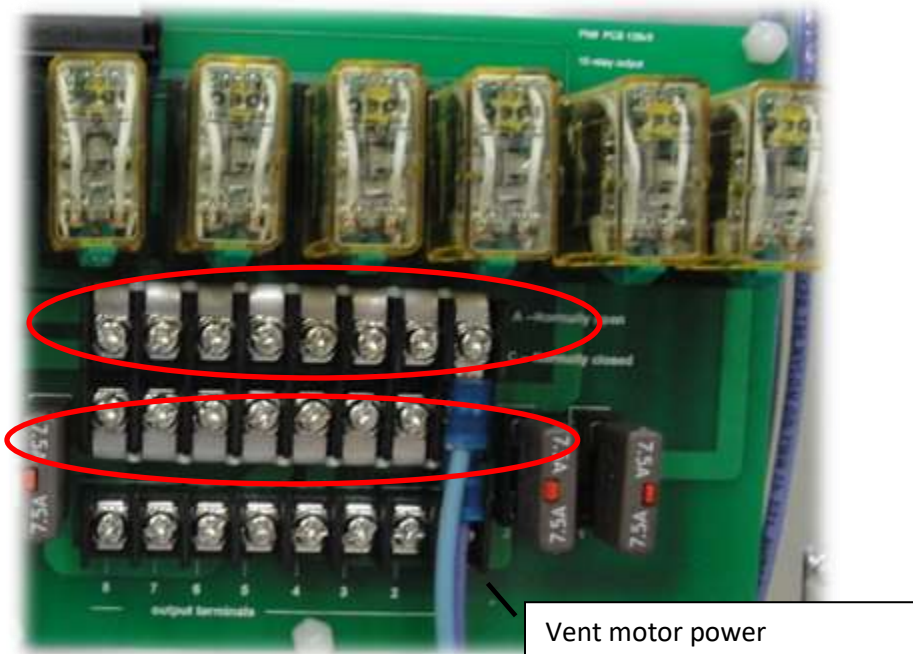
Bus can be reduced or removed to allow fans, heaters, or lights to be connected instead of vent motors. To shorten them, remove the connector completely then use pliers to snip it to length.
With  the bus bar removed, the outputs become  dry contact.

# Connecting fans

Fans can be controlled but you need contactors to switch the fans' electricity. Outputs 7&8 are dry contact.

AutoVent contactor boxes are available for easy wiring.
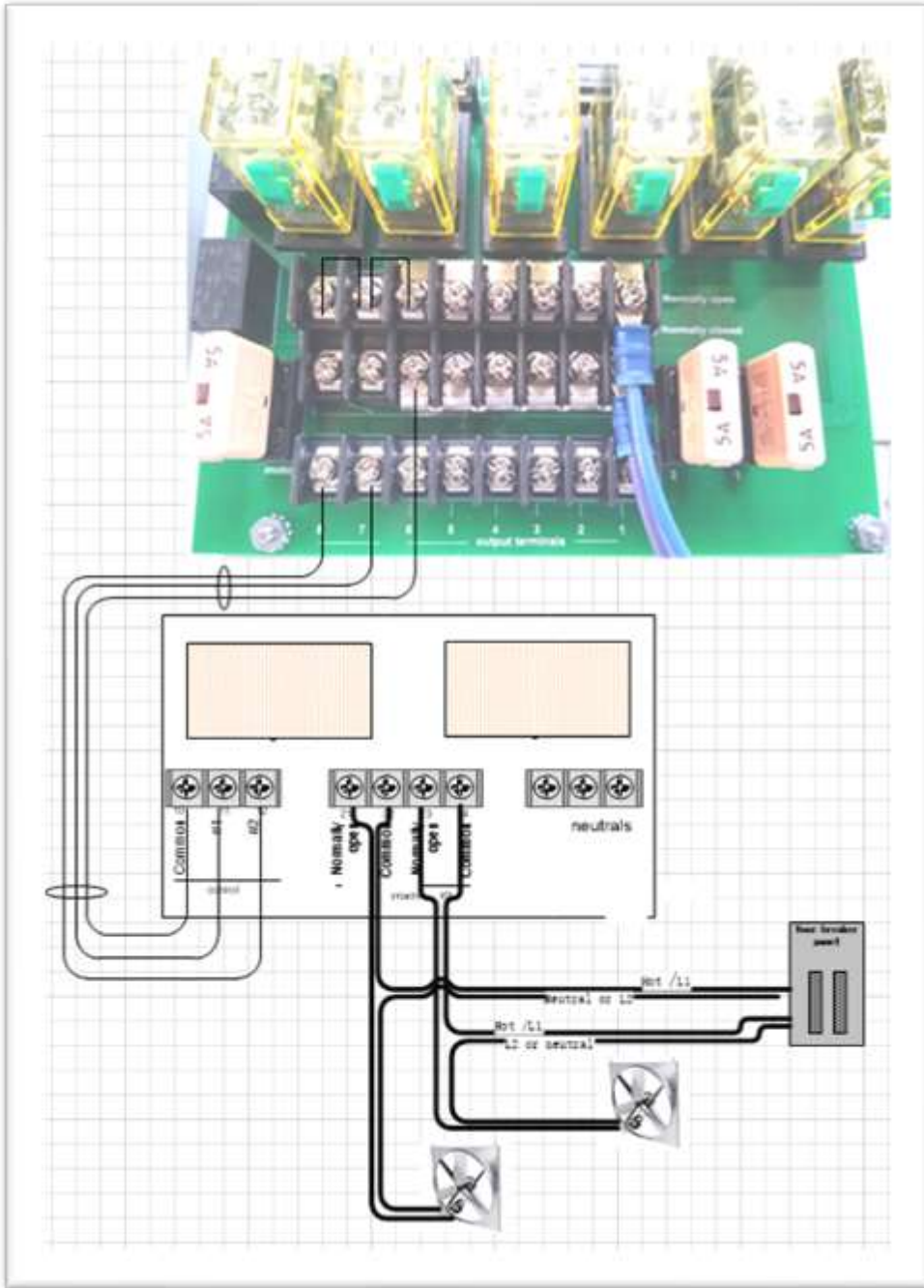
# Connecting 2 vents, 1 cooling, 2 heat.

Relays 6 or less can be remapped from their default of low voltage vents. If remapping #6 or less, the aluminum busbar must be shortened.



Configuration needed to match this diagram:

P0 - Number of vents =2
P1 - Curtain starting relay =1

P2 - Number of fans =1
P3 - fan starting relay =5

P4 - Number of heaters =2
P5 - Heater starting relay =7

120v shutter
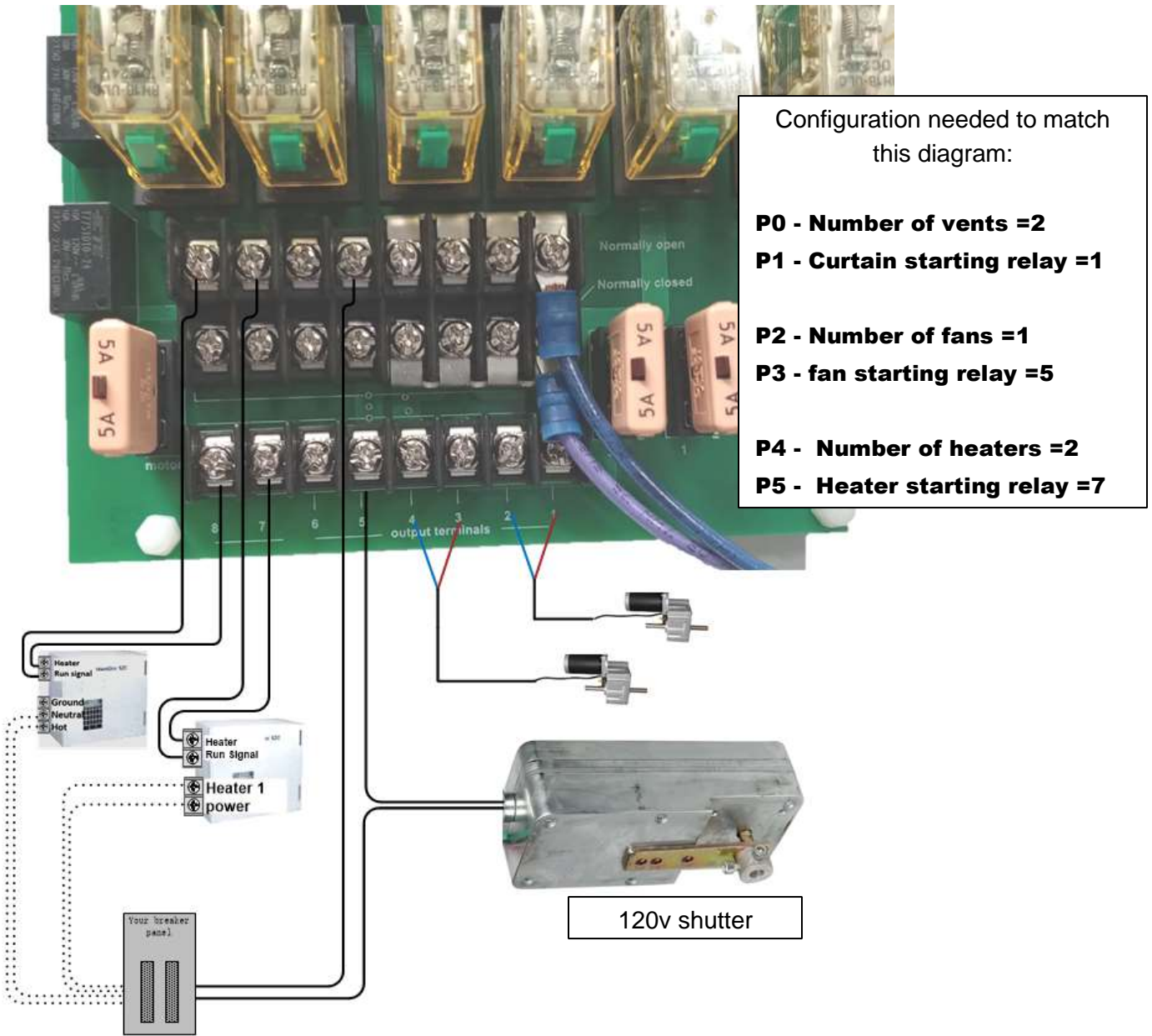
Grounds not shown.
Always wire per NEC or authority having jurisdiction

# Connect to heaters

Several zones of heaters can be connected. Use output relays 7&8 for heaters or fans. Connect the heater's signal wires can be wired to the controller as shown below.



Configuration needed to match this diagram:

**P0 - Number of vents =0**

**P2 - Number of fans =0**

**P4 -  Number of heaters =2**
**P5 -  Heater starting relay =7**
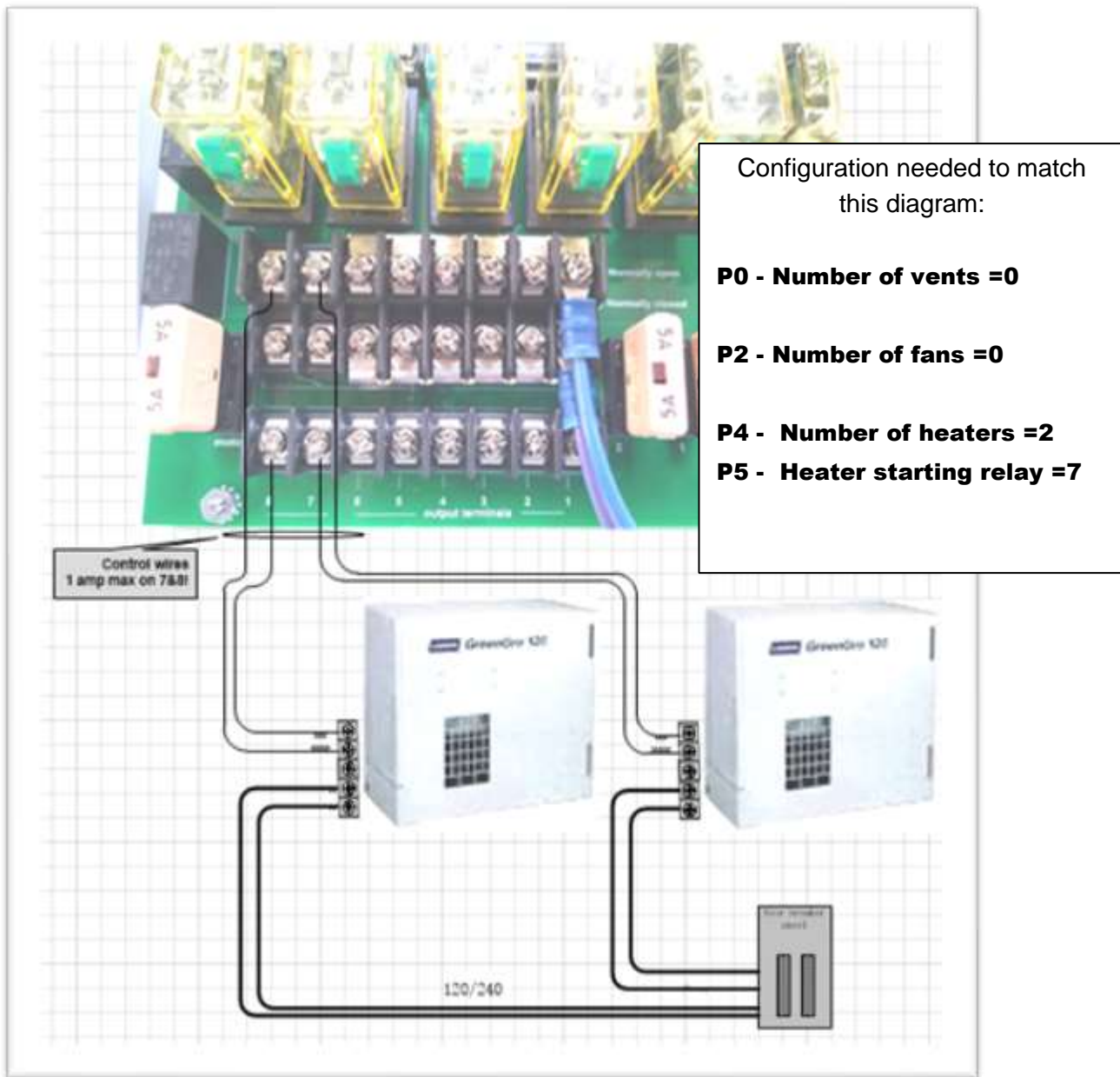
# Connecting DC motors

If the controller has a PS suffix on the part number, it includes a 24v motor supply. PS models are prewired to run several DC vents motors.   Connect motors directly to the board as shown. (Connector bars installed).

Pro tip! If the vent motor rotates in the wrong direction, swap the vent motor's blue & brown wires.
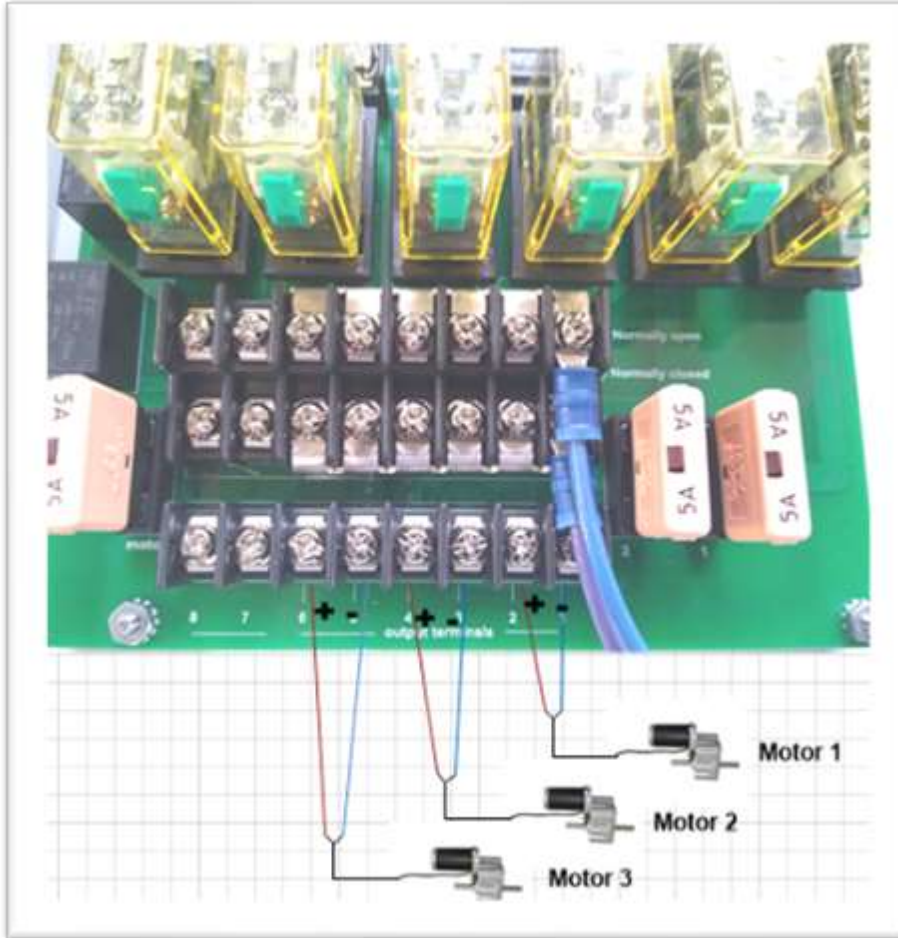


Configuration needed to match this diagram:

**P0 - Number of vents =3**

**P1 - Curtain starting relay =1**

**P2 - Number of fans =0**

**P4 -  Number of heaters =0**

## *Vent motor circuit breakers*

There are several vent motor breakers. Each of them protects a motor. If a motor's amps go too high, the center tab trips out. Press tab in to reset.
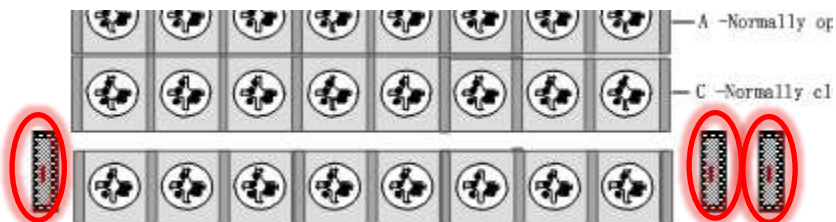
# Overview of the Controller screen

The screen shows you what is happening. You can see the temperature and the status of the relays.
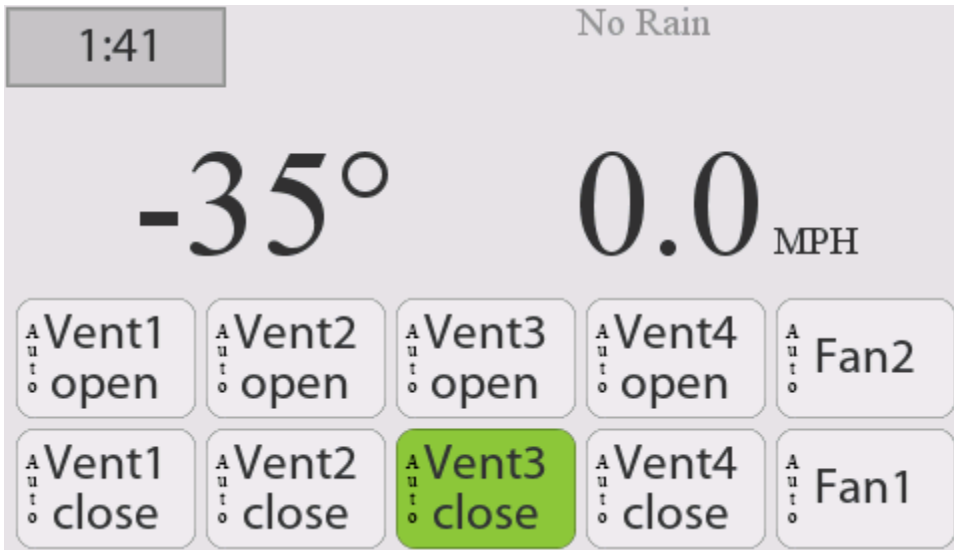


Press on the temperature to go to your settings
Press the bottom row of buttons to manually overrides

# Overrides



The overrides allow you to force an output. In Auto, it will operate automatically. Selecting Off or Forced allows you to avoid the control system.  The app's temperature is shown. All contributing probes are highlighted.
 To exit press the blank space on the sides.

# Temperature DIFs

Temperature DIFs allow you to change the setpoint of the heating/cooling equipment thought the day. DIFs are used to drop the humidity in the mornings or trap heat late in the day.

The DIF status is displayed below. The screen will show you the status and if you left it forced on.
Press on the clock to change the DIF settings.
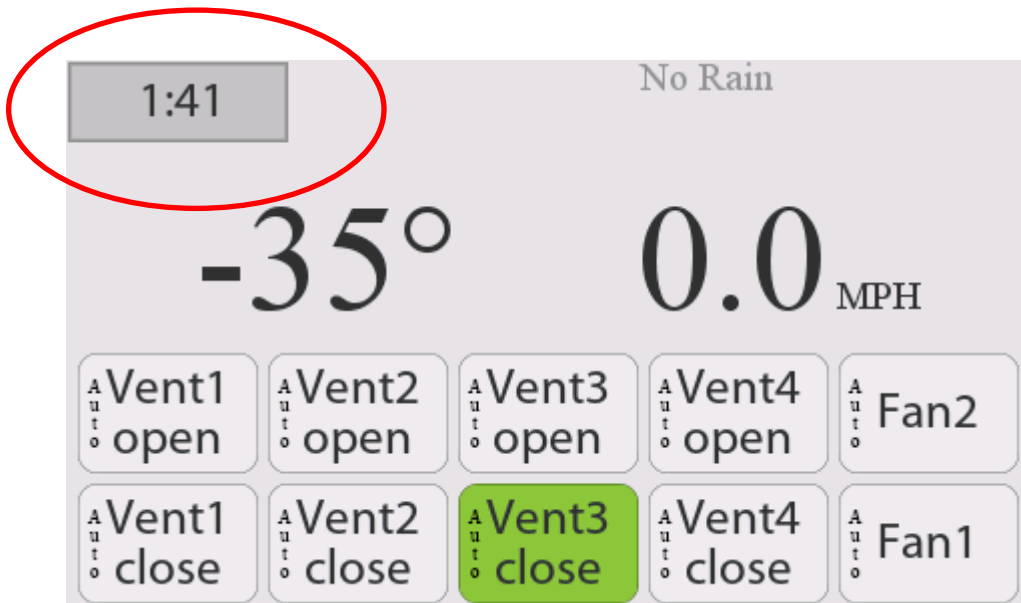


DIF override buttons allow you to manually override any clock settings.

# Parameters

There are parameters that you can change. The parameters are labeled P1, P2 …. These parameters are the temperature setpoints and values you can adjust.

Scroll to other Parameters

Parmeter

Parameter ID

| Prior | -- | 65 | + |

**summer start°**

P31 | Fan will start at this temperature for summer mode

Next

| Exit menu | Save |
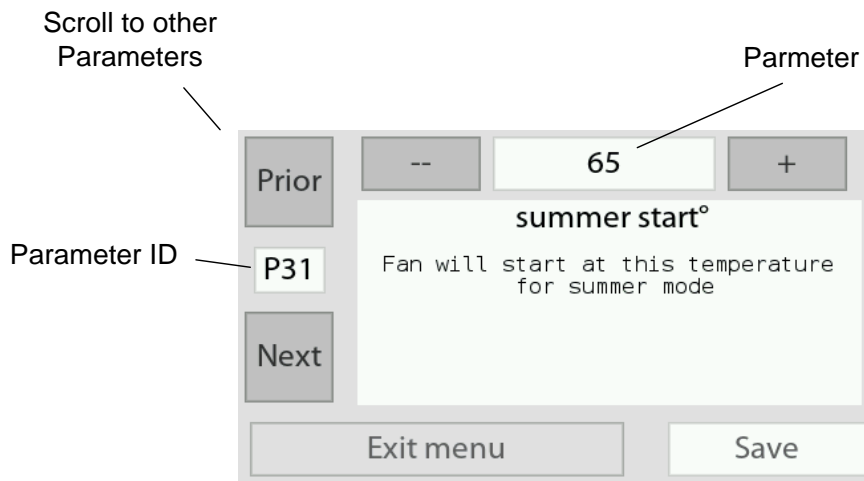
## Vent Parameters

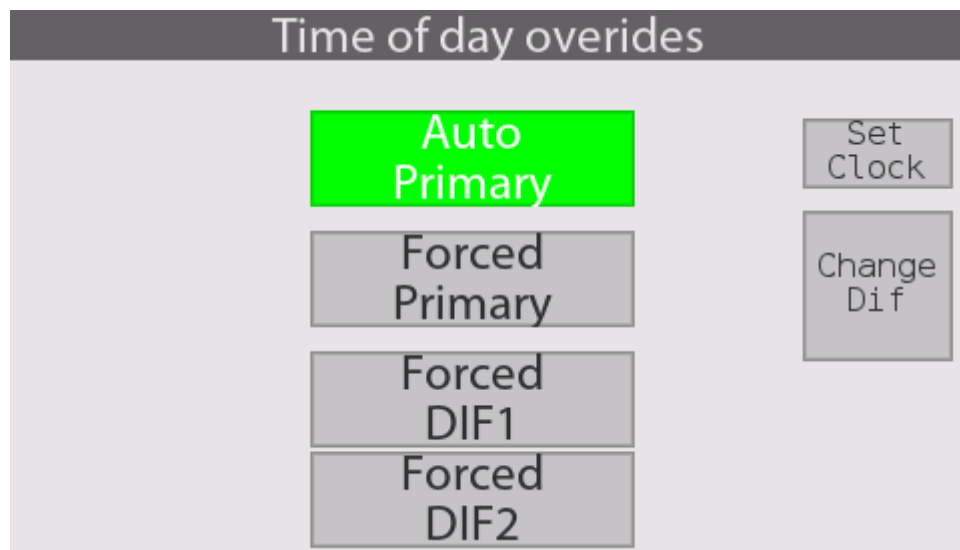| ID | Description | Default | Min | Max |
|---|---|---|---|---|
| P101-P110 | Open temperature for Vent#1 – Vent#10 | 60° | 1° | 99° |
| P111-P120 | Vent #1 – Vent#10 's DIF1 temperature | 61° | 1° | 99° |
| P121-P130 | Vent#1 – Vent#10 's DIF2 temperature | 62° | | |
| P131-P140 | Vent#1 – Vent#10 's run seconds. How many seconds the vent will run per interval. | 15 | | |
| P141-P150 | Vent#1 – Vent#10, pause minutes. The time the vent waits between intervals | 50 | | |
| P151-P160 | Vent#1 – Vent#10 ventilation temperature gap. The difference between open and shut temperature | 50 | | |
| P170 | Vent Motor's max humidity, Humidity at which the vent will open to dry things | 95 | | |
| P171 | How many seconds the vent will open for the humidity event | 10 | | |
| P172 | Humidity limits temperature. Humidity will be disregarded if it's too cold | 32 | | |
| P173 | Which Vent is used for humidity? | | | |

| ID | Description | Default | Min | Max |
|---|---|---|---|---|
| P181-P190 | Vent#1 – Vent#10 sequence. If vent should wait on another vent to close first from rain or high wind. | 0 | | |
| P191-P200 | Vent#1 – Vent#10   How long does it take for the vent to shut. Closing seconds for rain or high wind events. | 100 | | |
| P201 | High wind Vents- which Vents should shut from wind | 0 | | |
| P202 | High wind MPH | 53 | | |
| P203 | Wind override clear MPH | 50 | | |
| P500 | DIF1 start time. When DIF1 starts. | 0 | | |
| P501 | DIF1 end time. When DIF1 ends | 0 | | |
| P502 | DIF1 "2$^{nd}$" start time. When DIF1 "2$^{nd}$" starts. | 0 | | |
| P503 | DIF1 "2$^{nd}$" end time. When DIF1"2$^{nd}$" ends. | 0 | | |
| P504 | Dif2 on time. When Dif2 starts. | 0 | | |
| P505 | Dif2 off time. When DIF2 ends. | 0 | | |
| P506 | DIF2 "2$^{nd}$" start time. When DIF2 "2$^{nd}$" starts. | 0 | | |
| P507 | DIF2 "2$^{nd}$" end time. When DIF2"2$^{nd}$" ends. | 0 | | |

# Fan temperature Parameters

The temperature parameters control the starting temperature.
The fans are used for cooling. They will turn on above the temperature setpoint.

If humidity is connected, fan # 1 can be set to clear out the high humidity.

| ID | Description | Default | Min | Max |
|---|---|---|---|---|
| P301-P310 | Start temperature for Fan#1 – Fan#10 | 0° | 1° | 99° |
| P311-P320 | Fan#1 – Fan#10 's DIF1 start temperature | 0° | | |
| P321-P330 | Fan#1 – Fan#10 's DIF2 start temperature | 70° | 1 | 99° |
| P331 | Fan temperature Gap. Difference between on and off | 0.3 | | |
| P341 | Fan Max MPH- If a wind sensor is connected, MPH at which fans will stop | 0 | | |
| P342 | MPH dead span | 0 | | |
| P350 | Fan #1 Max humidity. If a humidity sensor is installed, when fan #1 will start to dry out the building. Set to 101% to disable humidity function) | 99%RH | | |

| ID | Description | Default | Min | Max |
|---|---|---|---|---|
| P351 | Fan humidity hysteresis – | 5% | | 101 |
| P352 | Fan humidity low-temperature limit | 32° | | |
| P354 | Fan assigned to humidity. If Humidity is high these fans will activate. Green-fan activated | none | none | 8 |
| P361-P370 | Fan#1 – Fan#10 's high-temperature limit | 0 | | |

## Variable fan Parameters

| ID | Description | Default | Min | Max |
|---|---|---|---|---|
| P401 | Low-speed temperature for variable fans | 50° | 1° | 99° |
| P402 | High-speed temperature for variable fans | 85° | | |
| P403 | Low speed for variable fans | 20 | | |
| P404 | Manual speed for variable fans | 11 | 1 | 99° |

## Heater Parameters

The parameters control the starting temperature. The heaters can be controlled by the DIF function.

| ID | Description | Default | Min | Max |
|---|---|---|---|---|
| P601-P610 | Heater 1 – Heater 10 's setpoint° | 60° | 1° | 100° |
| P611-P620 | Heater 1 – Heater 10 's DIF1 setpoint° | 61° | 1 | 100° |
| P621-P630 | Heater 1 – Heater 10 's DIF2 setpoint° | 62° | 1 | 100° |
| P631 | Heater Hysteresis | 2.0° | | |

## Dehumidifier Parameters

| ID | Description | Default | Min | Max |
|---|---|---|---|---|
| P440 | Dehumidifier start temperature | 60° | 1° | 100° |
| P441 | Dehumidifier hysteresis | 61° | 1 | 100° |

# Light Dep Parameters

The parameters control the light Deprivation settings

The light DEP logic allows you to close shades and vents when DEP is activated. Afterward, the vents will wait 2 minutes in the reopen sequence.

| ID | Description | Default | Min | Max |
|---|---|---|---|---|
| P530 | Light Dep on Time | 5:00 | 0:00 | 23:59 |
| P531 | Light Dep off time | 14:00 | 0:00 | |
| P532 | Light Dep 2$^{nd}$ on time | 0:00 | 0:00 | |
| P533 | Light Dep 2$^{nd}$ off time | 0:00 | 0:00 | |

Configuration parameters related to Light DEP.

Light DEP /shades only move when the shade time has elapsed.  If the vents are set to respond with the light DEP, they will close as well.

| ID | Description | Default | Min | Max |
|---|---|---|---|---|
| P8 | Light DEP enabled? | No | No | Yes |
| P50 | Light DEP motor activation minutes, | 150 | 1 | 20 |
| P51-P59 | Is vent #1 – vent #9 affected by Light DEP, (Does it need to close so light DEP can close) | No | No | |

# Grow Light Parameters

The parameters control the grow light settings

| ID | Description | Default | Min | Max |
|---|---|---|---|---|
| P560 | Grow Light on Time | 5:00 | 0:00 | 23:59 |
| P561 | Grow Light off time | 14:00 | 0:00 | |
| P562 | Grow Light 2$^{nd}$ on time | 0:00 | 0:00 | |
| P563 | Grow Light 2$^{nd}$ off time | 0:00 | 0:00 | |

# Sensor Share-  Developer feature as of 1/20/22

Sensor sharing is a when multiple Captain controllers use the Master's wind and rain sensors. This is allows you to have multiple houses operating without putting weather  sensors on each house.

Master configuration:
Set P38 to 1. This will cause the master to talk once per second with it's data. You still  must enable wind sensor P29 if you want to transmit the wind. Rain status  is always transmitted.

Slave configuration:
Set P38 to 2. This will cause the slave to listen. You still  must enable wind sensor P29 if you want to hear the wind. Rain status is always heard if its listening.

## *Controller connections*
Connect radios as shown. The controllers talk via radios once per second. The TX and RX lights will blink accordingly.
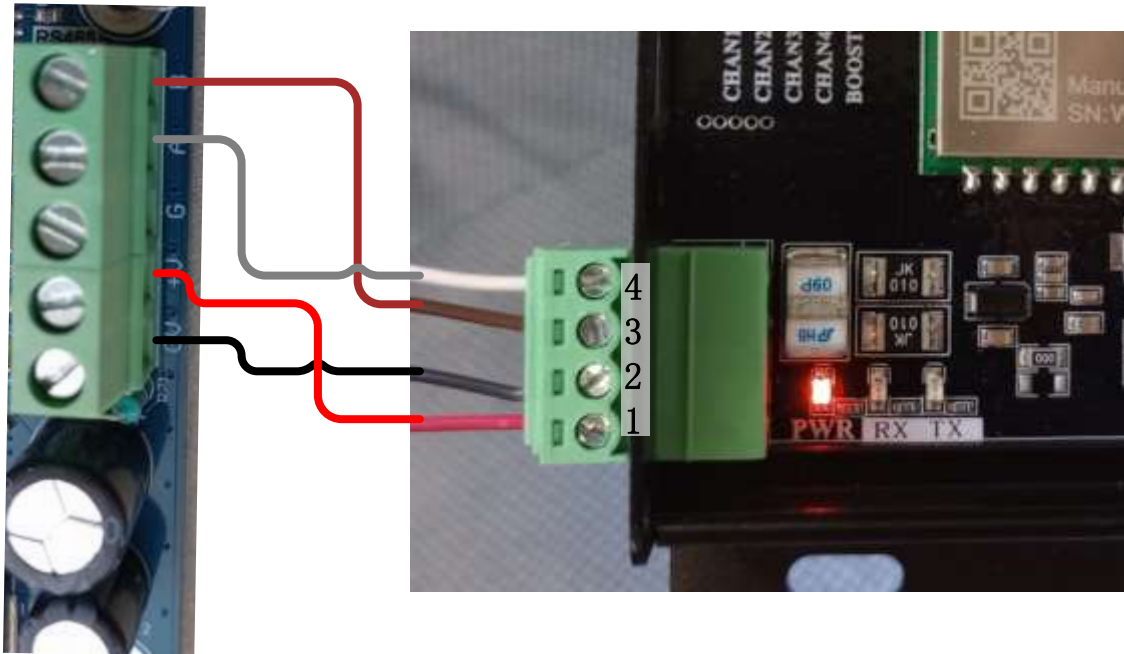


**Connections**

| Controller | | Radio |
|---|---|---|
| B ------brown---- | | 3 |
| A ----- white  --- | | 4 |
| +V ----- red    ----- | | 2 |
| 0v ---- black ------ | | 1 |

Diagnostics

PWR led needs to be on all the time
RX is when radio hears something
TX is when it talks.

If a slave never hears anything, check if Master TX light comes on once per seconds

# Wireless channels

The radio has a channel and power level selector.

## *Channel selection*
Dip switches 1 thru 4 sets which channel you are on. The default is 0, which is all switches off. But if you have more than 1 system within range, select an alternate channel for the new system.
Push a dipswitch to the ON position to select any of the first 4 channels.

If 4 channels are not enough, any combination of on/off switches is unique. Just use the same combination across the fans you want in the system. There is a maximum of 16 combinations.

## *Boost*
The boost switch increases the radio power. Don't use boost unless it is required for consistent communication. Boosted power increases the chances of interference with other devices. Boosted power may reduce the total possible life of the radio. The only time you would need the power boosted is if a unit seems to be out of range.  Range should be approx 800ft  line of sight. Metal siding or screens  will block the signal.



Slave connectivity indicator

Red "!!!" means it's a slave and no messages where heard in the last 3 seconds

"TX" means it's the master.

".:|" Mean its receiving messages

# Setup configurations

The setup allows you to change which apps are used within the controller.

Changing the apps is called remapping.

Remapping is done withing the setup menu and is an advanced function.

Search Youtube for AutoVent LLC Captain for videos on DIY remapping.

| ID | Description | Default | Min | Max |
|---|---|---|---|---|
| P0 | Number of vents | 2 | 0 | 5 |
| P1 | Vent Starting Relay | 1 | 0 | 1 |
| P2 | Number of fans in the systems | 1 | 0 | 6 |
| P3 | Fan Starting Relay | 5 | 0 | 10 |
| P4 | Number of heaters | 2 | | 9 |
| P5 | Heater Starting Relay | 8 | | 9 |
| P6 | Number of Grow lights | 0 | 1 | 10 |
| P7 | Grow lights Starting Relay | 25 | | 10 |
| P8 | Number of light DEP circuits | 0 | | 1 |
| P9 | DEP Starting Relay | 0 | | |
| P10 | Dehumidifier output | 0 | 0 | 10 |
| P15 | Is 2<sup>nd</sup> Temperature sensor enabled | 0 | | |
| P16 | Is the Humidity sensor enabled | 0 | | |
| P24 | Fahrenheit or Celsius | F | | |
| P25 | Is DIF enabled 0=no 1= 1 DIF  2= 2 DIFs | 0 | | |
| P26 | Is HVLS enabled 0-10v enabled | 0 | | |
| P27 | Wind response time | 3 | | |
| P28 | Anemometer calibration | 25 | | 2 |
| P29 | Windmeter enabled | 0 | | |
| P30 | Revert controller to defaults | 3 | 1 | 5 |
| P38 | Direct Share wind& rain. 0=no, 1= Master 2=Recipient | 0 | 0 | 2 |
| P39 | Is Voltage Monitor enabled (solar)0=no 1=yes | 0 | | |
| P41-P49 | Vent #1 – Vent #9 rain sensor uses input #<br>You select which input a vents rain sensor is connected to. | 0 | | |
| P60 | Fan high-temperature shutoff enabled? | 0=no | | 1=yes |
| P61-P70 | Turn fan 1 – fan 10 input off | 0 | | |
| P71-P80 | Per vent, which Temperature probes the vents use. If you want to average. Selecting none uses probe 1 | 0 | | |
| P81-90 | Per heater, probes used – see above | 0 | | |

| ID | Description | Default | Min | Max |
|---|---|---|---|---|
| P91-99 | Per fan, probes used – see above | 0 | | |

# Specifications

| | |
|---|---|
| Size of enclosure | 7" x10"x6" |
| Input voltage | 120VAC |
| Output | (6) NO/NC relays. 7.5 amps max 120v motor .25 hp max<br><br>(2) NO 3 amp outputs. Not rated for use with motors. |
| Temperature sensor | The 3-foot cord can be extended to 100 ft. |
| Warranty | 1 year |