Trio 20 Green Climate Controller

User Manual

Trio 20 Green

Climate Controller

P/N: 116930

Munters

Trio 20 Green Controller

User Manual

Rev 1.0, 02/2026

Product Software: Version 10.6

This manual for use and maintenance is an integral part of the apparatus together with the attached technical documentation.

Munters reserves the right to effect modifications to the apparatus in accordance with technical and legal developments.

Index

1 Introduction

1.1 Disclaimer

Munters reserves the right to make alterations to specifications, quantities, dimensions etc. for production or other reasons, subsequent to publication. The information contained herein has been prepared by qualified experts within Munters. While we believe the information is accurate and complete, we make no warranty or representation for any particular purposes. The information is offered in good faith and with the understanding that any use of the units or accessories in breach of the directions and warnings in this document is at the sole discretion and risk of the user.

1.2 Introduction

Congratulations on your excellent choice of purchasing a Trio 20 Green Controller!

In order to realize the full benefit from this product it is important that it is installed, commissioned and operated correctly. Before installation or using the controller, this manual should be studied carefully. It is also recommended that it is kept safely for future reference. The manual is intended as a reference for installation, commissioning and day-to-day operation of the Munters Controllers.

1.3 Notes

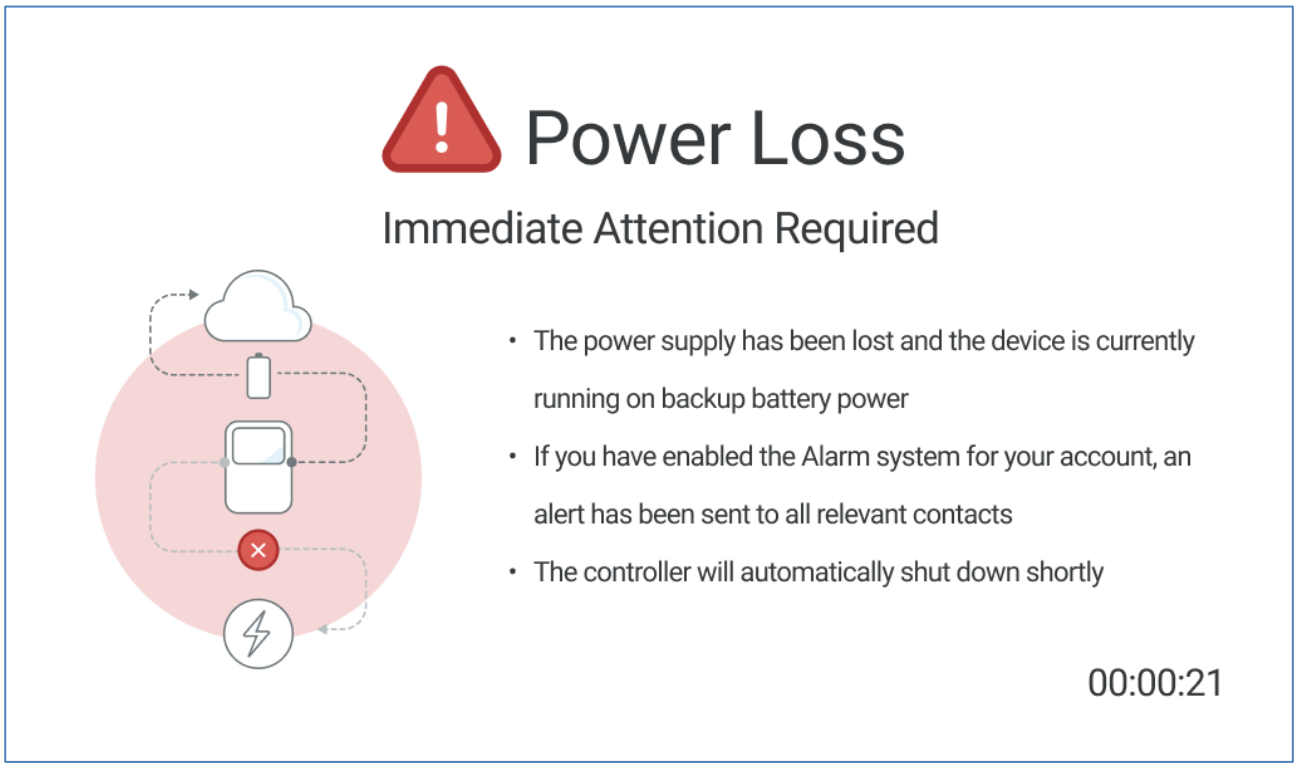
Date of release: Jan 2020

Munters cannot guarantee to inform users about the changes or to distribute new manuals to them.

2 Power Outage

2.1 Trio 20 Green Dashboard

In the event of a power outage, the following warning appears:



- Controller functions will cease
- The alarm will be delivered by all approved methods.
- Once power is re-applied, the controller resumes normal operations.

CAUTION *This warning only appears in units equipped with a backup battery. Refer to the Installation Manual for more details.*

2.2 TrioAir

In situations where no other internet services are available, farms subscribed to the TrioAir Premium package can receive an alarm via TrioAir. To enable this service, the Trio must equipped with a cellular modem and an integrated Munters SIM card. Refer to the TrioAir Zendesk for more details.

3 Using the Trio Touch Screen

- Icons
- Dashboard

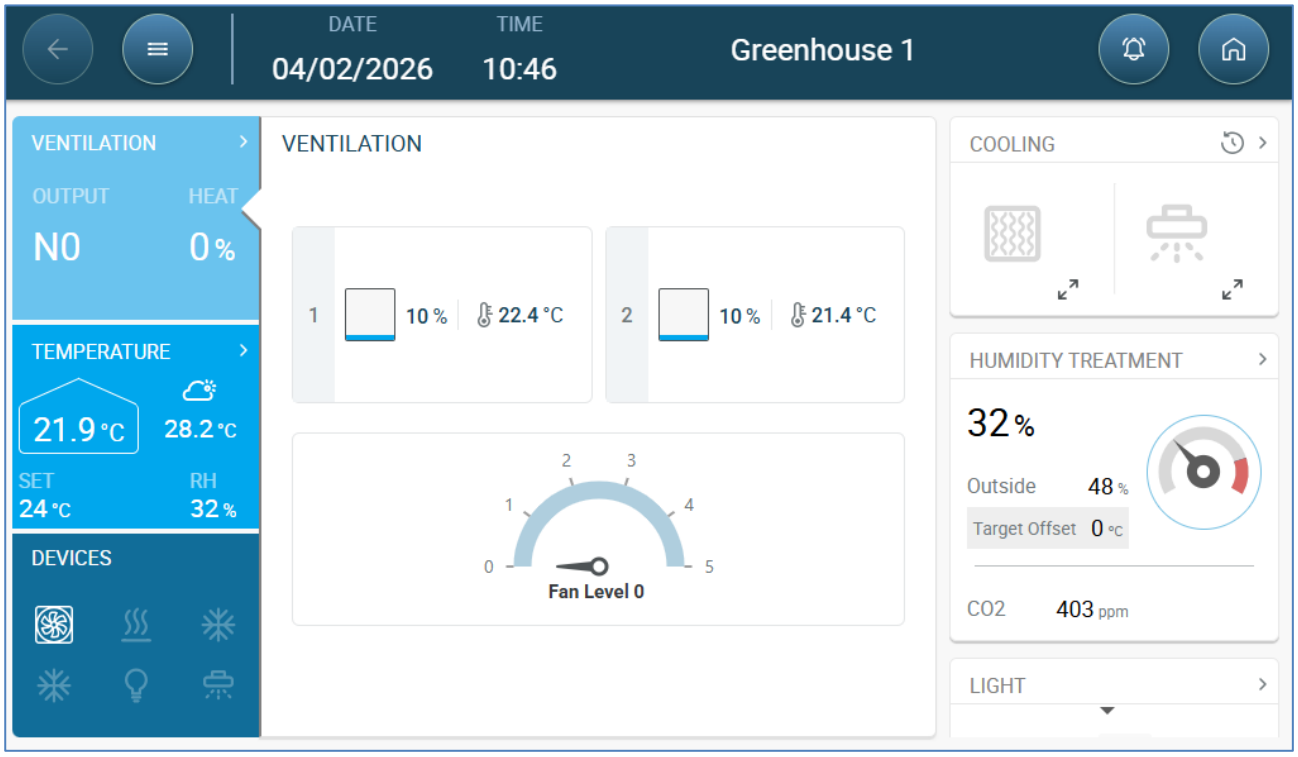
3.1 Icons

	Go back to the previous screen
	View the Main menus
	Choose language
	Trio 20 connected to internet via Wi-Fi. Click to view network settings.
	Trio 20 connected to internet via LAN. Click to view network settings.
	View alarms
	Go back to the main screen
	Settings icon
	Edit parameters
	Function settings

Testing	Function test
	Replace the dashboard battery with a standard 3V battery.
	Click this icon to delete data stored on that page.
Phone App	
	Click the circle containing the user name to edit personal preferences such as the language, units, name, and more.
	When a Trio 20 controls two or more rooms or there are two or more houses on a farm, Send to All enables editing certain select functions in more than one room or house. Edit the setting, click Send to All, and select the required Trios. The select rooms' or houses' settings are updated. Note: Send to All does not appear on every screen.

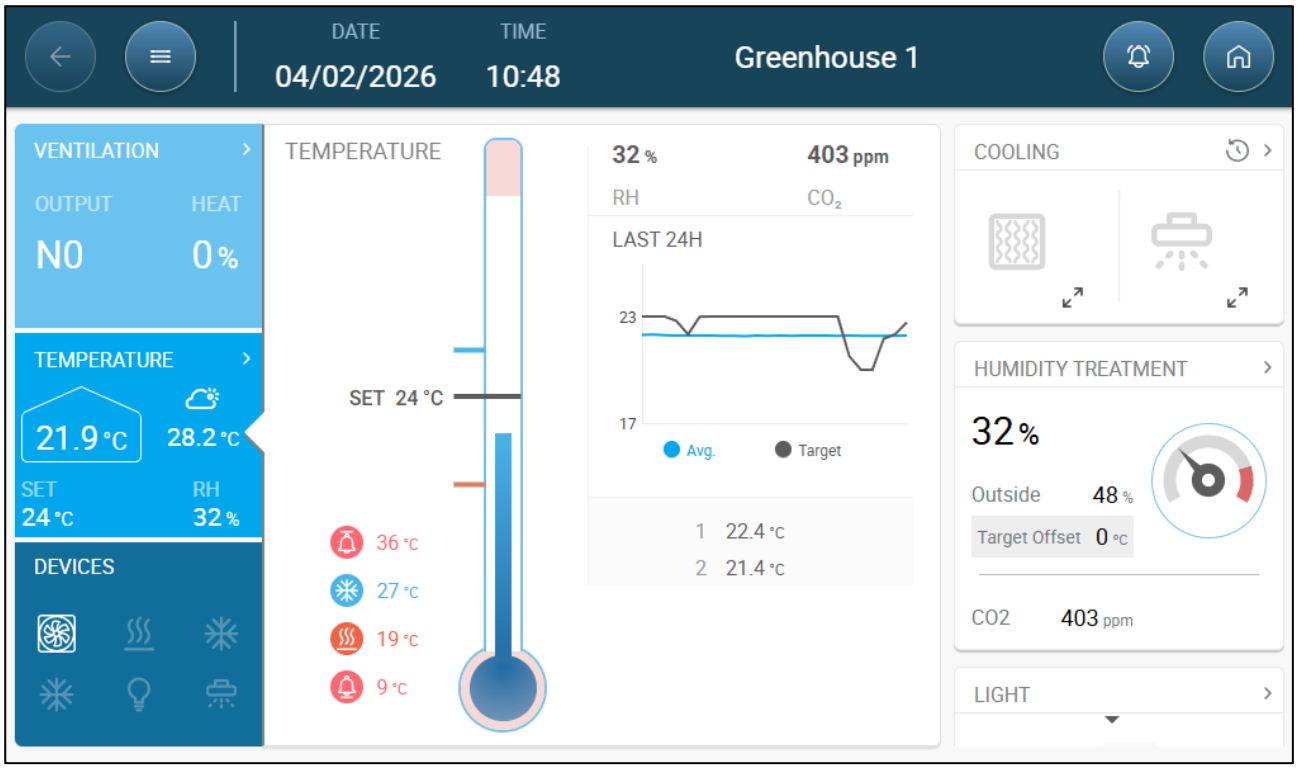
3.2 Dashboard

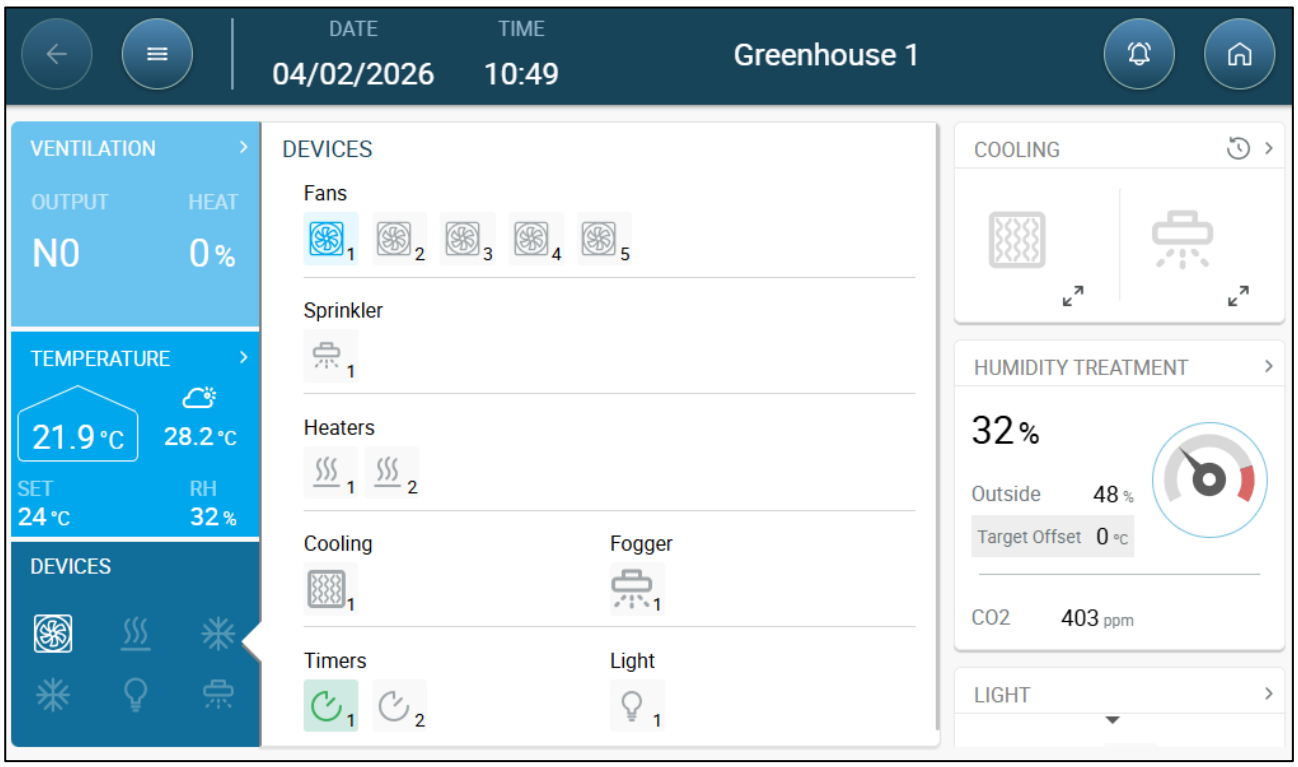
The Dashboard gives an overview of all Trio 20 functions.



- Version 8.3 displays the Service Light icon. Refer to Service Lights page 49 for details.
- Click on the > in each section to go to the relevant control page.

- Click on Ventilation, Temperature, or Devices squares to view the screen for those functions.





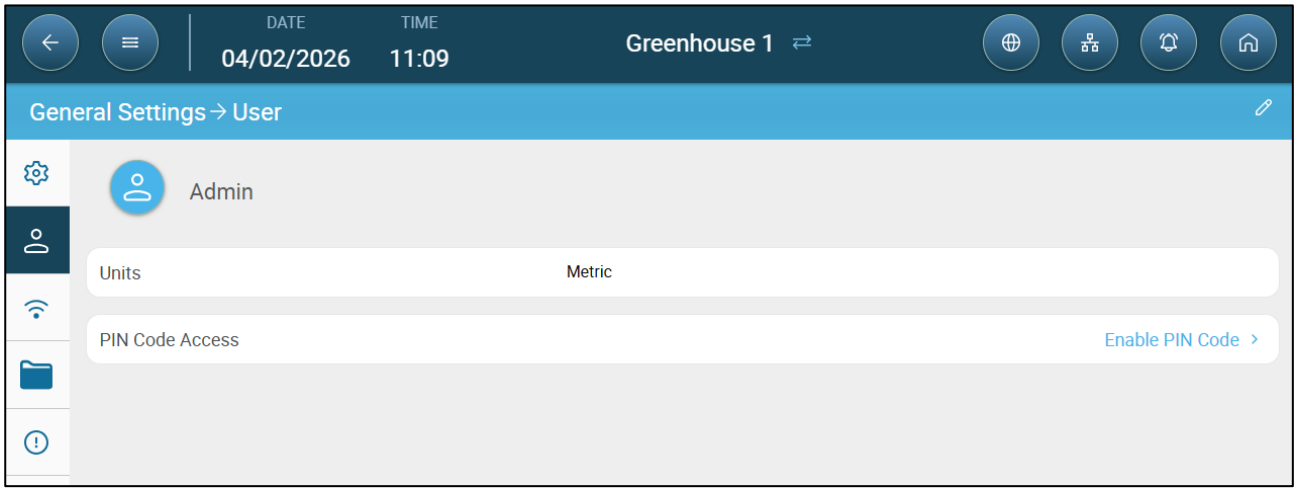
4 Basic Setup

The following section describes the initial steps to be performed after completing the physical installation.

- Defining the Preferences
- Crop Management

4.1 Defining the Preferences

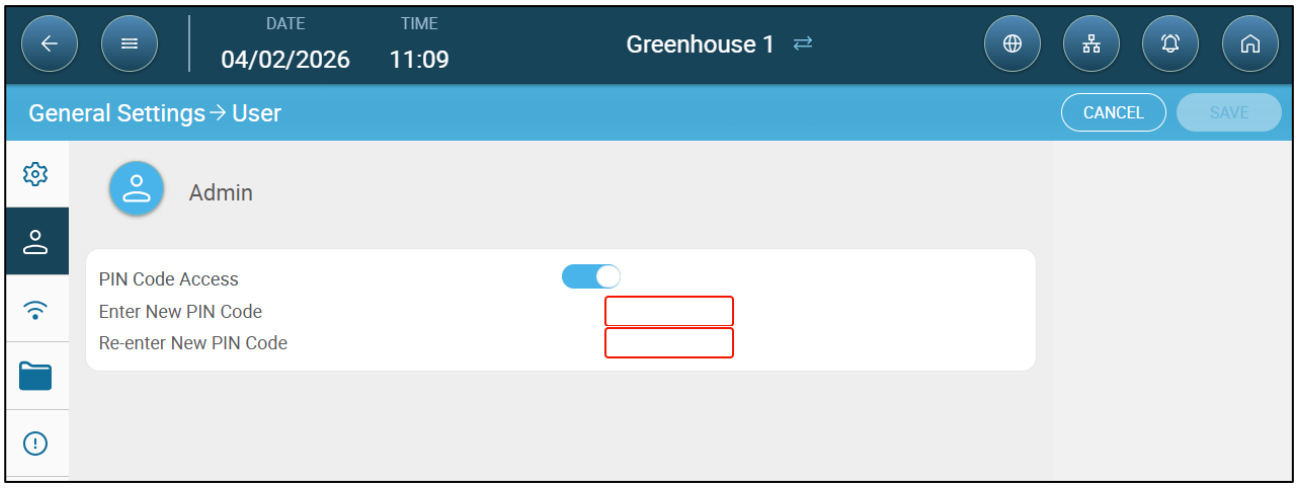
1. Go to System › General Settings › User  .



2. Define the units: There are two options:

- Define all units as metric or imperial.
- Define each unit. Click Edit › Customize and define:
  - Temperature: Celsius or Fahrenheit
  - Air Pressure: Pascal/Inches of Water
  - Weight: Kilogram/Pounds
  - Air Flow: Cubic Meter/Hour or Cubic Feet/Minute
  - Illuminance: Lux or Foot-Candle
  - Length: Meter or Foot
  - Water Pressure: Bar-cm or PSI-Inch
  - Air Speed: Meter/Second or Feet/Second

3. Enable/disable Pin Code Access: Pin Code Access is a security measure. Anyone wanting to edit the settings must have this code.



4.2 Crop Management

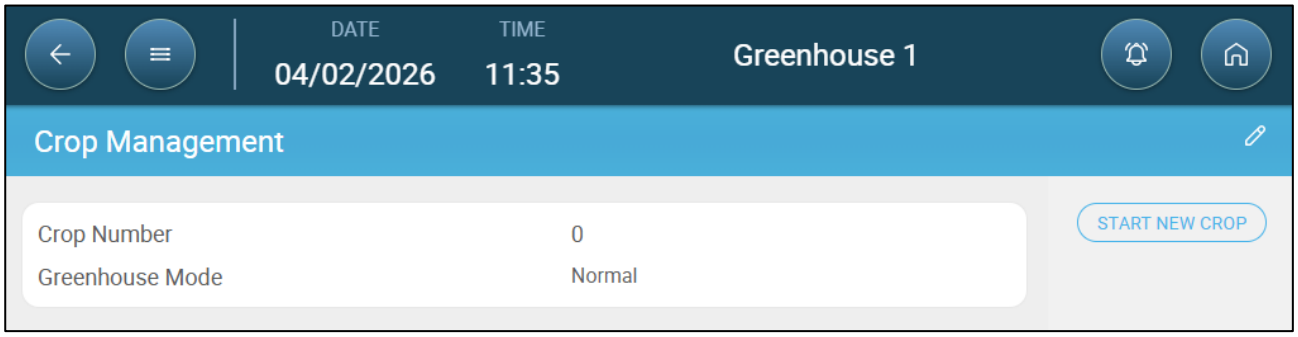
The Crop Management function defines data points used to define each crop. Define these settings at the beginning of a growth cycle. The Crop Management settings include:

- Crop number enables tracking each crop's production
- Greenhouse Mode: TBD

- Manual Set Up
- New Crop Wizard

4.2.1 MANUAL SET UP

1. Go to Season > Crop Management.



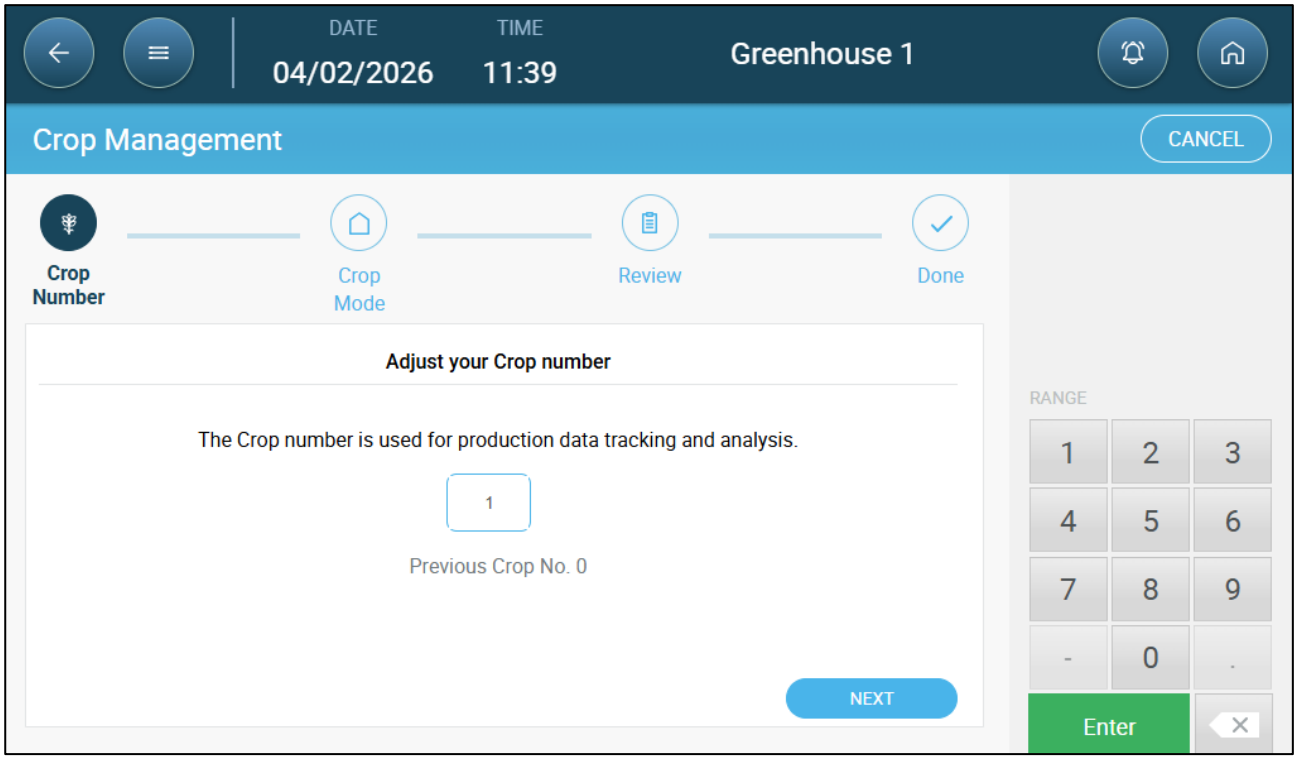
2. Define:
    - Crop Number: Give a unique number for each crop. This number is used to track the crop during production.
    - Green House Mode: This is defined as Normal.

4.2.2 NEW CROP WIZARD

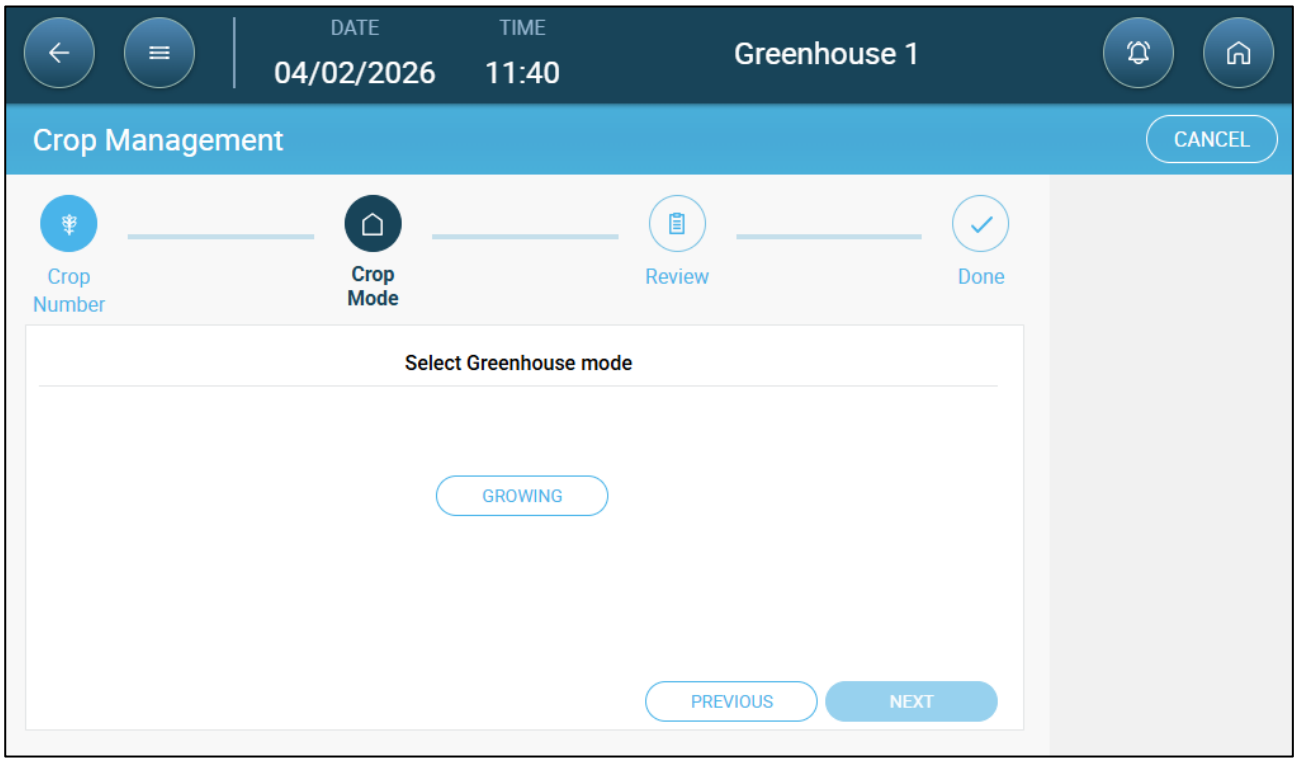
Trio 20 provides a simple to use wizard to set up the Growing mode. When starting a new crop, Trio 20:

- Erases historical data
- Increases the crop number by one
- Records a "New Crop" event

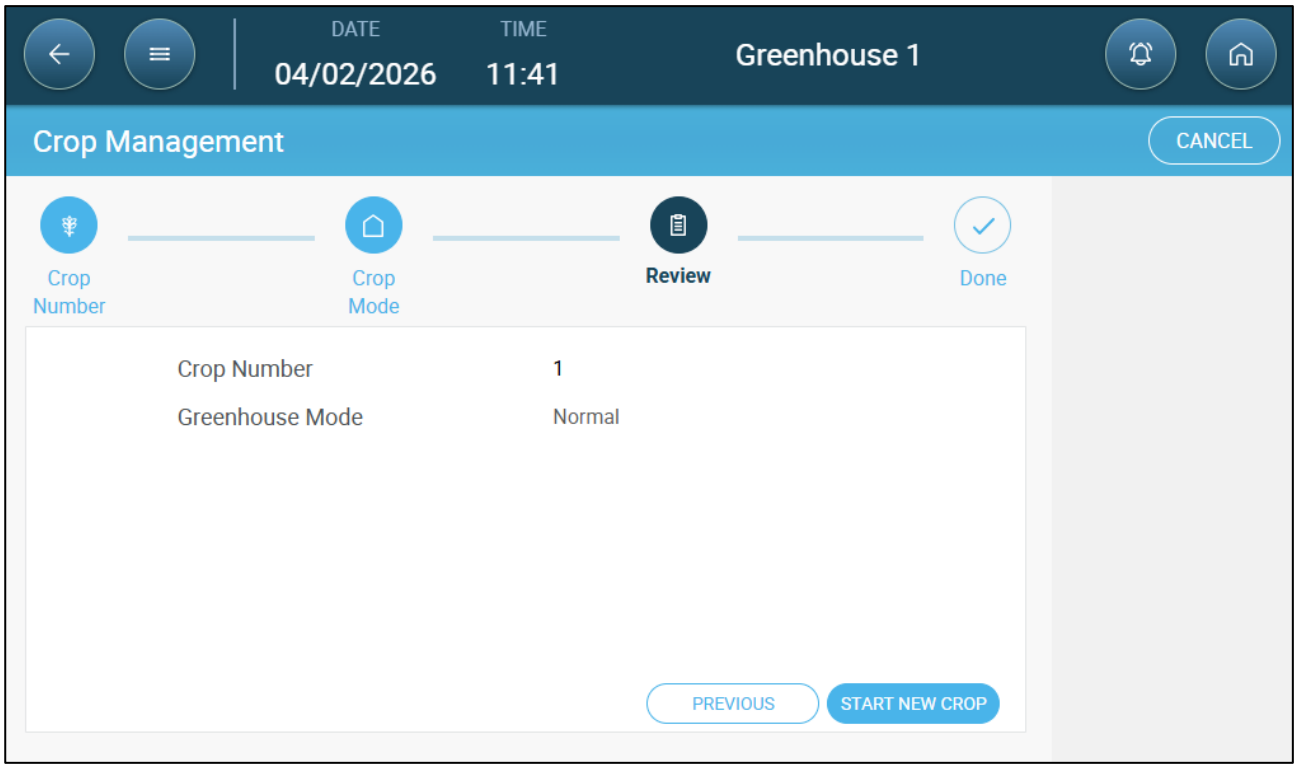
1. Click START NEW CROP.



2. Define the crop number and click **Next**.



3. Select **Growing** and click **Next**. You must select the option to continue.



4. Review the definitions and click **Start New Crop**.

5 Temperature Settings

- What are the Temperature Setpoints
- Temperature Setpoints
- Humidity Treatment
- Emergency Temperature Control

5.1 What are the Temperature Setpoints

As plants grow, the required air temperature changes. Trio 20 enables setting up a temperature chart in which you set the target temperatures for (up to) 10 days in the growth cycle. **Target temperature** is the ideal temperature for plants during the day. Trio 20 adjusts the ventilation and heating to get as close to the target temperature as possible.

In addition the Temperature Settings has secondary functions:

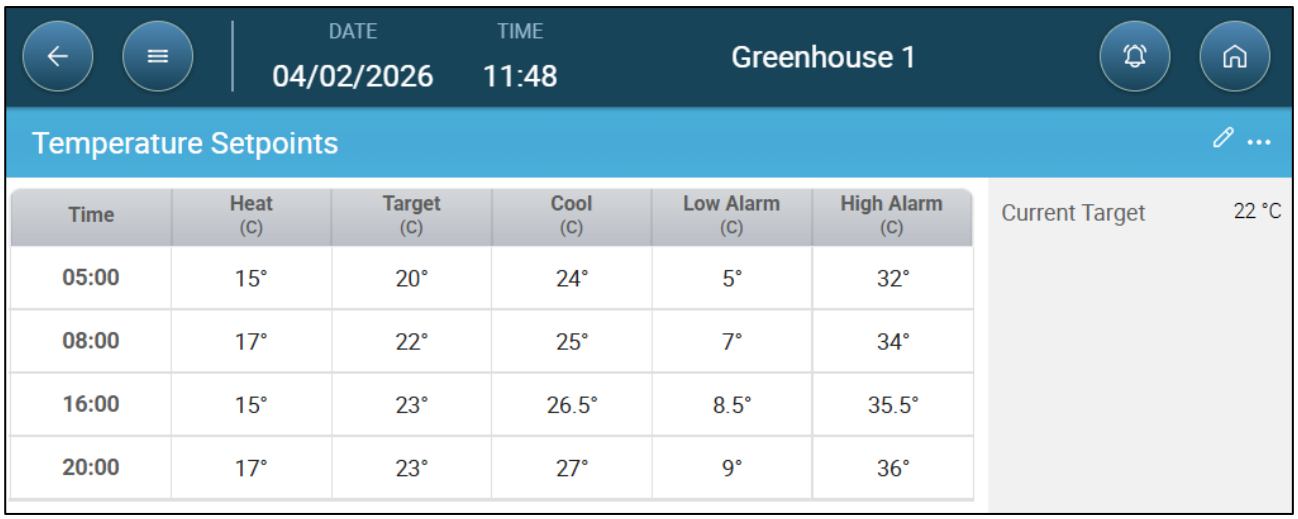
- Defines when heating begins in cases where the actual temperature drops below the target temperature (**Heat**).
- Defines when heating turns off.
- Defines the cooling and curtain control entries points
- Defines when an alarm is sent when temperatures are too low (**Low Alarm**)
- Defines when an alarm is sent when temperatures are too high (**High Alarm**)

5.2 Temperature Setpoints

- Defining the Temperature Setpoints
- Defining Temperature Setpoints Settings

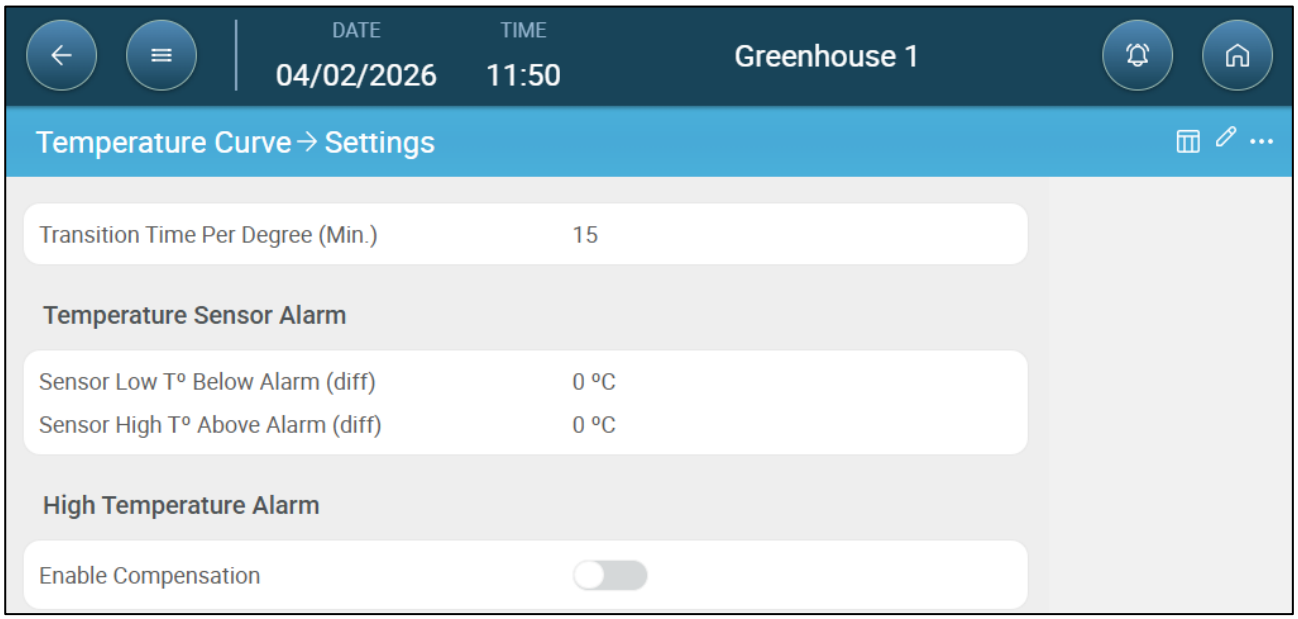
5.2.1 DEFINING THE TEMPERATURE SETPOINTS

1. Go to Climate › Temperature Setpoints.



2. Configure up to six time periods in the curve.
    - The current target temperature appears on the screen (27.5° in the illustration above).
3. Define:
    - Time: Define the time at which each temperature specification applies. Each day must have a unique number.
    - Heat: This parameter is the set point at which the heaters are activated. Range -40° to +90° C/-40° to +73.4° F.
        - Munters recommends defining the heat set point close to the target temperature.
        - Heat appears if a heater is defined in Devices and Sensors.
    - Target: Target temperature is the required temperature for the greenhouse. All ventilation calculations are based on this specification. Range -40° to +90° C/-40° to +194° F.
    - Cool: This parameter is the set point at which the heaters are activated. Range 23° to +90° C/73° to +194° F.
        - Cool appears if a cooling unit is defined in Devices and Sensors.
    - Low/High Temperature Alarm: These parameters are differentials from the target temperature at which Trio 20 sends an alarm. Range:
        - Low Temp Alarm: -40° to (Target – 0.5°)/
        - High Temp Alarm: (Target + 0.5°) to 90°C/194° F
4. Click  to view the curve history.

5.2.2 DEFINING TEMPERATURE SETPOINTS SETTINGS



- Define:
    - Transition Time Per Degree (Min.): Trio 20 gradually adjusts the target temperature between periods. When a new period begins Trio 20:

        - calculates the difference in temperature between the former period and the current period
        - gradually adjusts the target temperature (1 degree per minute)
        - For example if the difference between two periods is 5 degrees, the transition time is 15 minutes, then the actual transition time is 75 minutes.
    - Sensor Low T° Below Alarm: Set value below which the “Low temperature sensor” alarm is activated. **This is a differential.** Range 0.0° - 10.0°
    - Sensor High T° Above Alarm Diff: Set value above which the “High temperature sensor” alarm is activated. **This is a differential.** Range 0.0° - 10.0°
    - High Temperature Alarm. Enable if required.
        - Outside Temperature Compensation: High temperature set point = measured outside temperature + “outside temperature compensation”. Range: 0.0° – 10.0°
        - Absolute High Temperature: Set the critical temperature (maximum allowable). Range -40° to +90° C/-40° to +194° F.

5.3 Humidity Treatment

The Humidity Treatment adjusts the target temperature based on the current humidity. The user defines the adjustments, such that the target temperature is reduced for each humidity level.

➲ **Install and map one or two humidity sensors. Refer to the Installation Manual for details.**

- Sensor Operation
- Configuring the Treatment

5.3.1 SENSOR OPERATION

- Sensor Data
- Sensor Failure

5.3.1.1 Sensor Data

If two sensors are installed, Trio 20 Green makes all calculations based on their average.

- If a sensor fails, that data is ignored.
- An outside sensor can be installed, but that is used for recording humidity levels only.

5.3.1.2 Sensor Failure

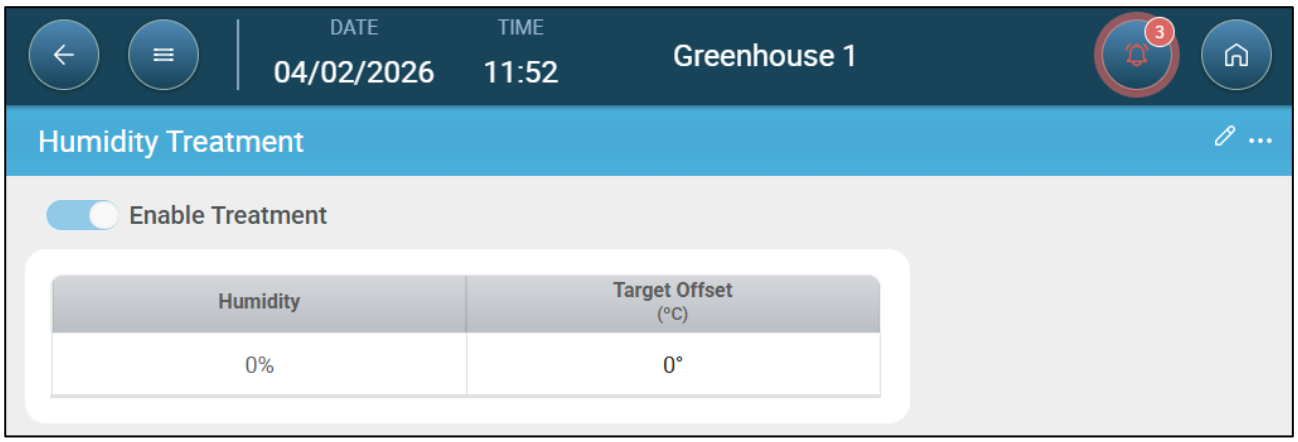
In the event of a sensor failure:

- Trio 20 Green uses the last reading for one minute. During that times, any humidity treatment continues normally.
- After the one minute period, an alarm is generated. The sensor is ignored.

- If the sensor begins to generate valid readings, Trio 20 Green automatically resumes treatment and clears the alarm.

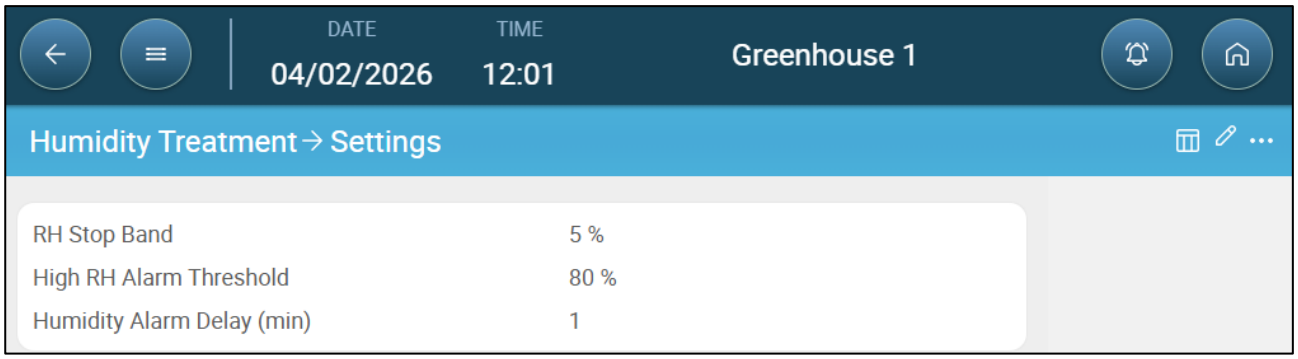
5.3.2 CONFIGURING THE TREATMENT

1. Go to Climate › Humidity Treatment.



2. Enable treatment.
3. Define the humidity level and target temperature offset.
   - Humidity level: Default 0%. Range 1 – 100%.
   - Target Offset: The target temperature is reduced by this differential. Default: 0.0° C. Range: -10 to 0.0° C.
4. Define up to five rows.

5. Go to Climate › Humidity Treatment › Settings.



6. Define:

- Relative Humidity Stop Band: When the humidity drops below the [set point – this differential] humidity treatment stops. Default: 5%. Range: 0 – 10%
- High Relative Humidity Alarm Threshold: Define the value at which Trio 20 Green generates a "High Humidity Level" alarm. Default: 80%. Range: 0 – 100%
- Humidity Alarm Delay (min): Define the amount of time that Trio 20 waits before generating a High Humidity Alarm. Default: 1. Range: 0 – 15 minutes.

5.4 Emergency Temperature Control

In the event that Trio 20 fails to receive a signal from the temperature sensor for an extended period of time, an alarm is triggered. Between the time that Trio 20 stops receiving a signal and when an alarm is triggered, ventilation remains at the current level. When an alarm is triggered:

- If there is an outside temperature sensor,
  - ventilation is adjusted.
  - Ventilation levels will not fall lower than the Minimum Ventilation
- If there is no outside temperature sensor
  - maintain the last known positive output (before the failure)
  - turn off negative output
  - Cooling and air quality treatment cease

6 Levels of Ventilation

The ventilation defines the amount of air to be supplied at each ventilation level. As the temperature increases, ventilation increases the amount of air supplied to maintain the temperature as close to the target temperature as possible

Fans controlled by relays are on/off. When they are on, they run at maximum speed. Variable fans' speed can be controlled, according to needs.

➲ Map at least one fan and one curtain before beginning. Curtains must be mapped and configured. Refer to Curtain Ventilation, page 23.

- Defining Ventilation
- Curtain Ventilation
- Stir Fan

6.1 Defining Ventilation

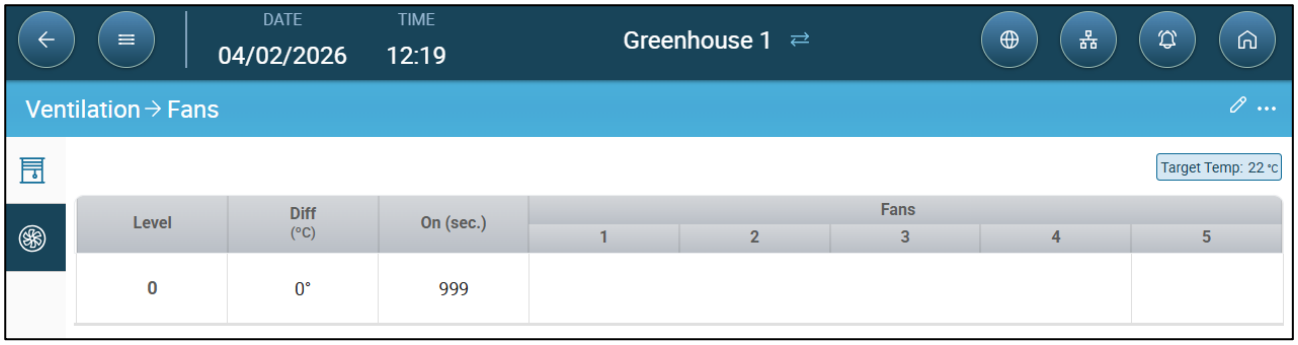
- On-Off Fans
- Analog Fans

6.1.1 ON-OFF FANS

In this configuration, Trio 20 raises the minimum ventilation from 10% at Level One to 100% at Level 10.

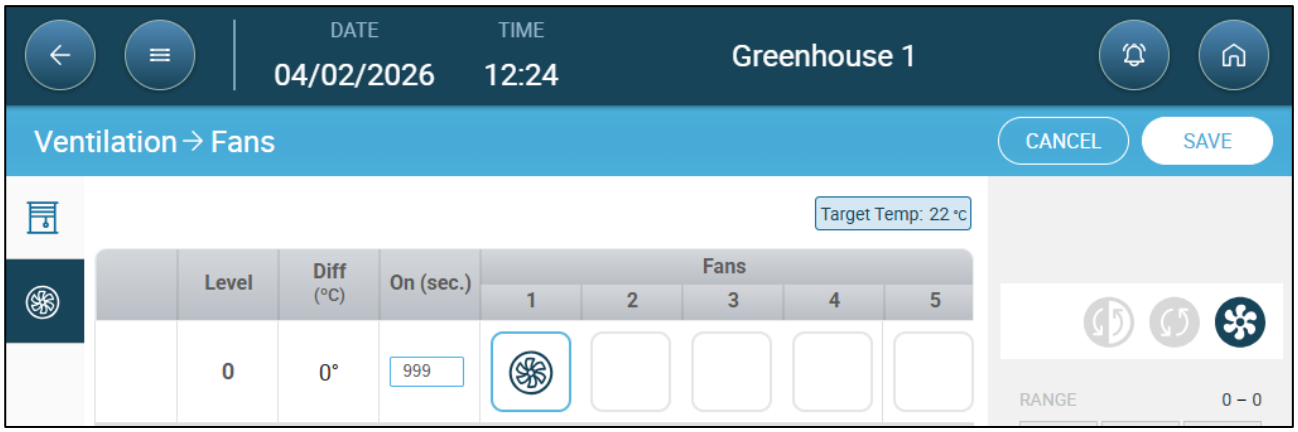
➲ In Devices and Sensors map relays to fans. Refer to the Installation Manual. Only mapped devices show up in the following screens.

1. Go to Climate › Ventilation › Fans.

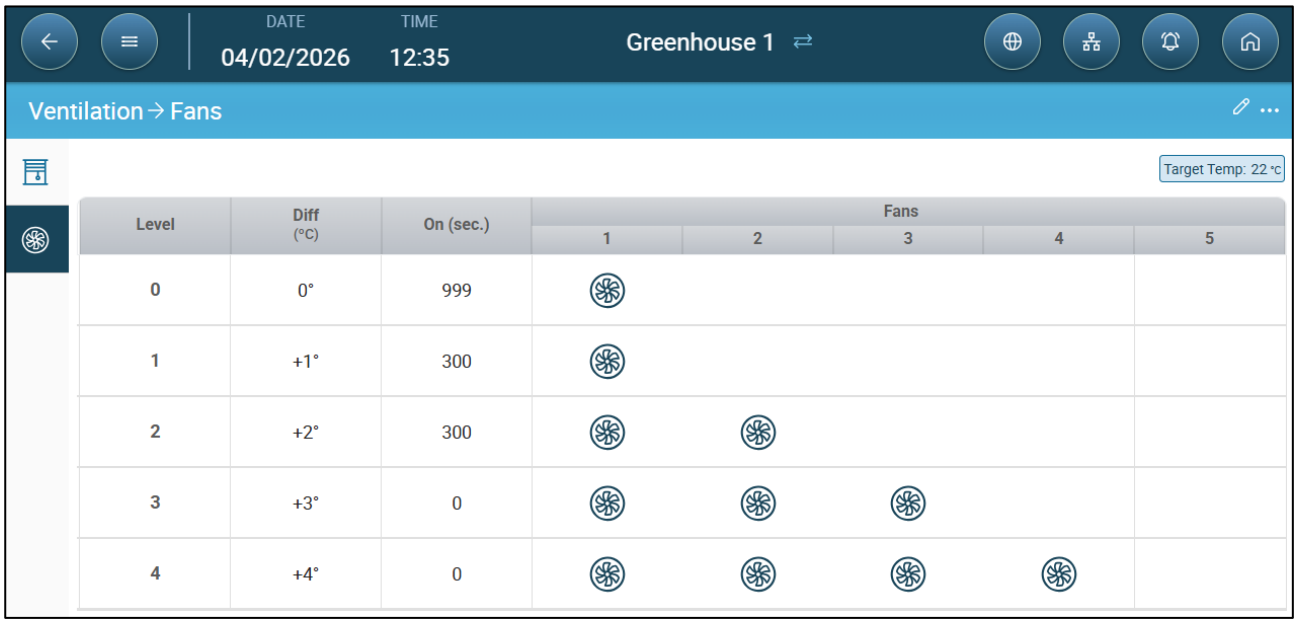


NOTE At this point, fans do not appear.

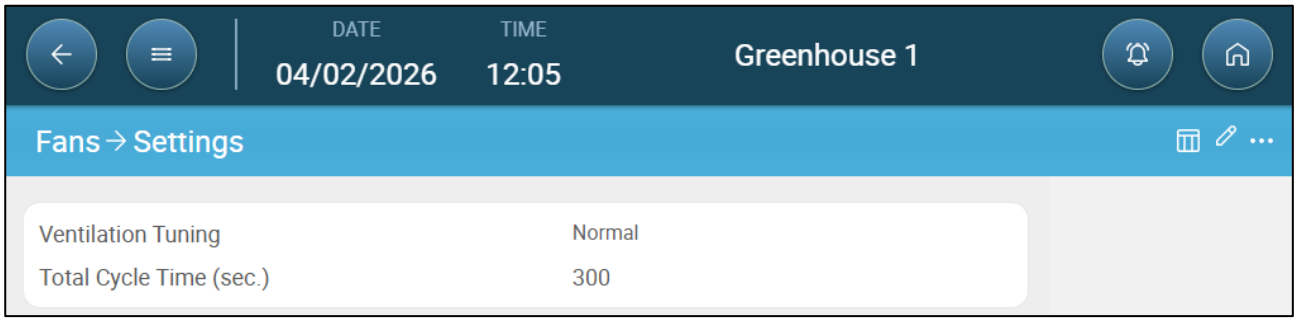
2. Double click on any fan to activate it.
3. Define the cycle ON time. Range: 0 – 999.



4. Click **Add Row** for additional levels.
5. For each new level, define the difference from the target temperature at which this level is activated. Level 0 is defined as 0°. Range: 0 - 15°.
6. Repeat steps 2 - 5 as required.



7. Go to Climate > Ventilation > Settings.



8. Define:
   - **Ventilation Tuning**: This parameter determines how aggressively the Trio 20 responds to differences between the measured temperature and the target temperature.

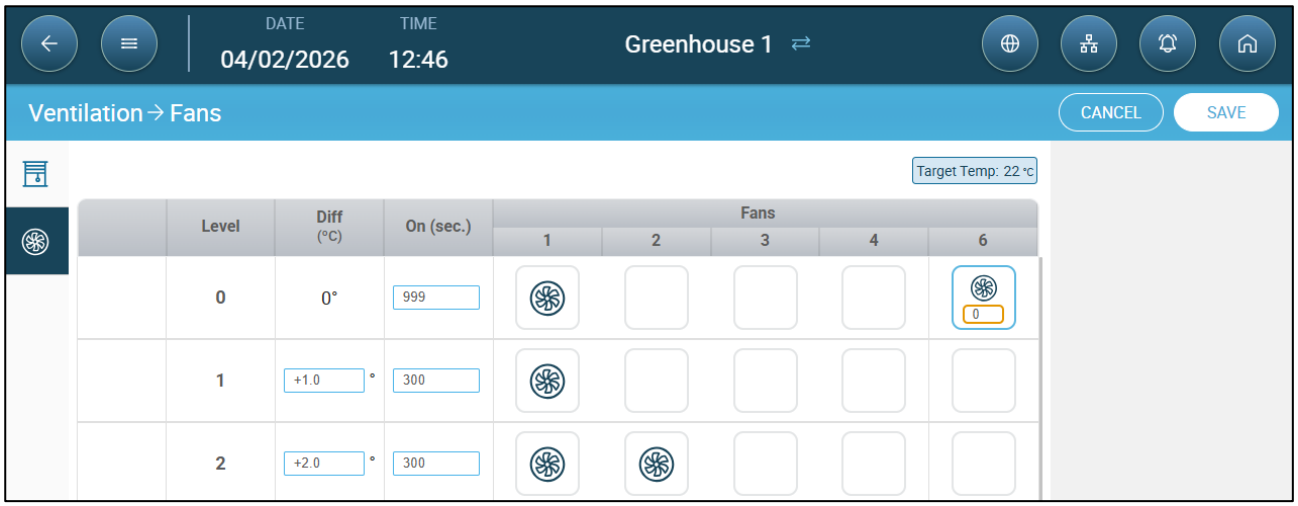
CAUTION *Munters recommends leaving this paramter at Normal.*

   - **Total Cycle Time (sec.)**: Total time in ventilation cycle.

6.1.2 ANALOG FANS

➲ In Devices and Sensors map analog ports to fans. Refer to the Installation Manual. Only mapped devices show up in the following screens.

1. Go to Climate › Ventilation › Fans.

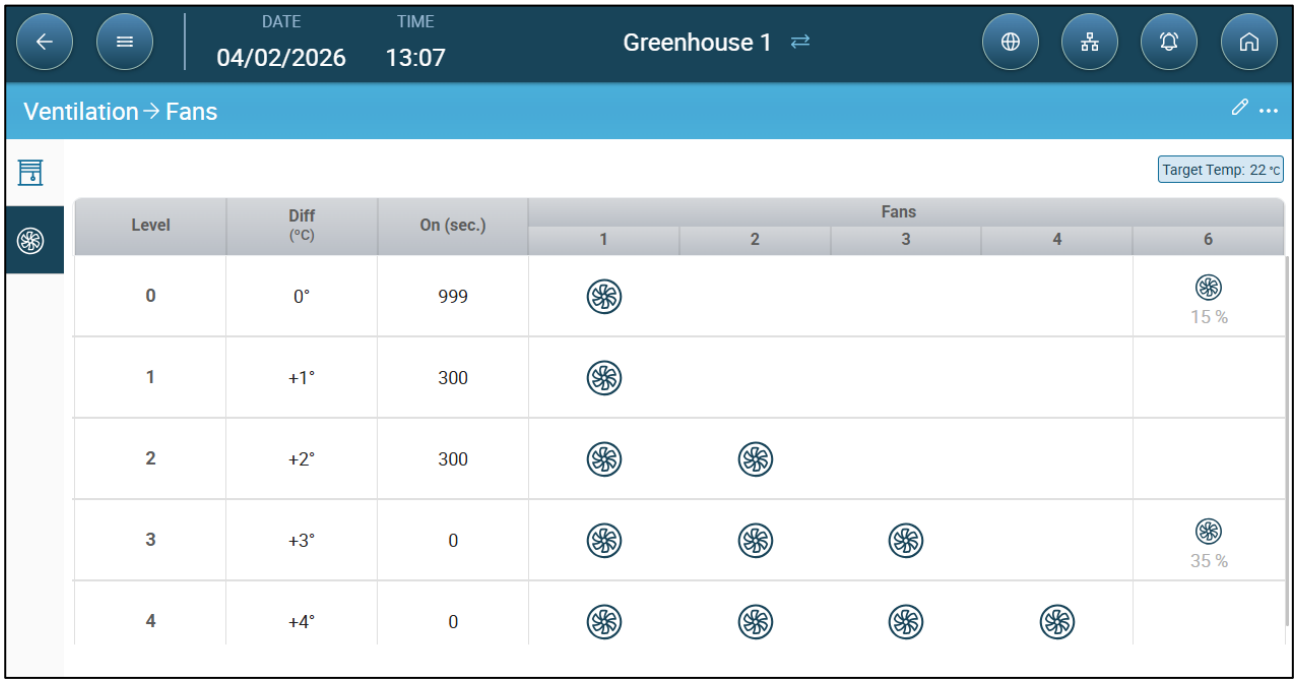


2. Double click on the analog fan to activate it.

Define the:

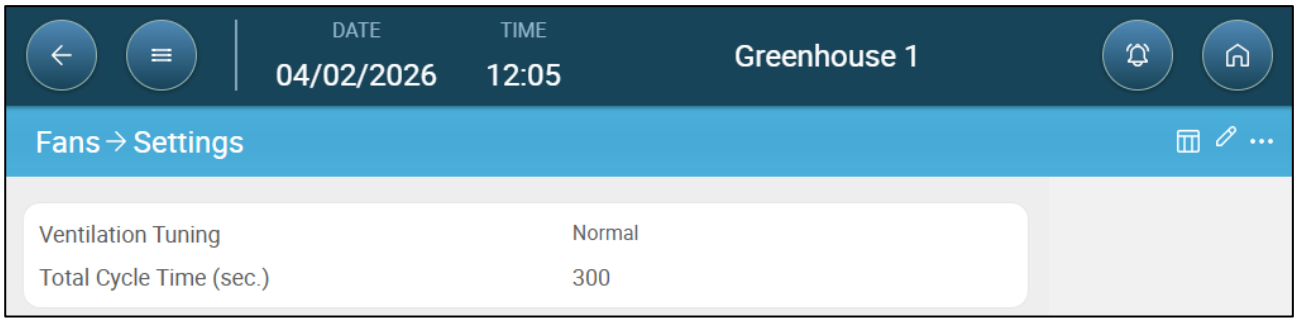
cycle ON time. Range: 0 – 999.

fan's maximum output.



At Level 2 (20% output of the total fan capacity), Fan 1 - 3 run at the designated maximum. Fan 4 runs at a maximum of 35%.

3. Go to Climate › Ventilation › Settings.



4. Define:
    - **Ventilation Tuning**: This parameter determines how aggressively the Trio 20 responds to differences between the measured temperature and the target temperature.

CAUTION *Munters recommends leaving this paramter at Normal.*

    - **Total Cycle Time (sec.)**: Total time in ventilation cycle.

6.2 Curtain Ventilation

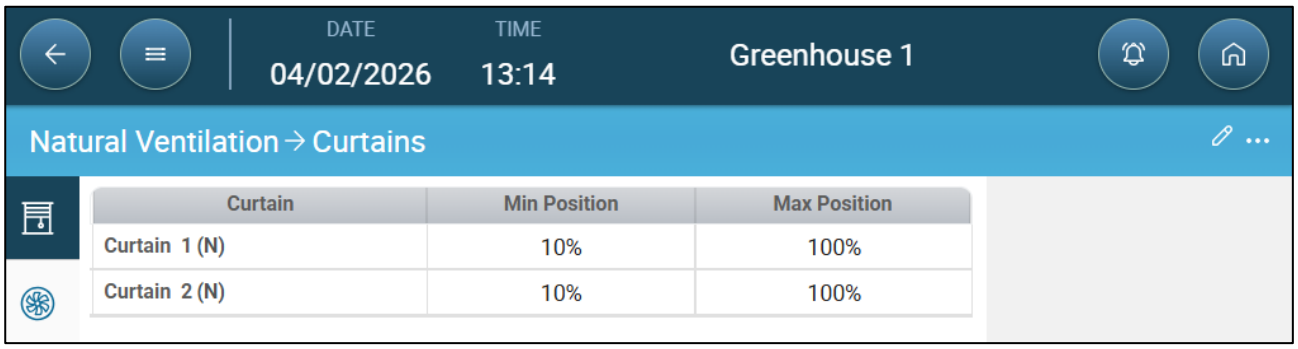
- Curtain Configuration
- Calibrating the Curtain

6.2.1 CURTAIN CONFIGURATION

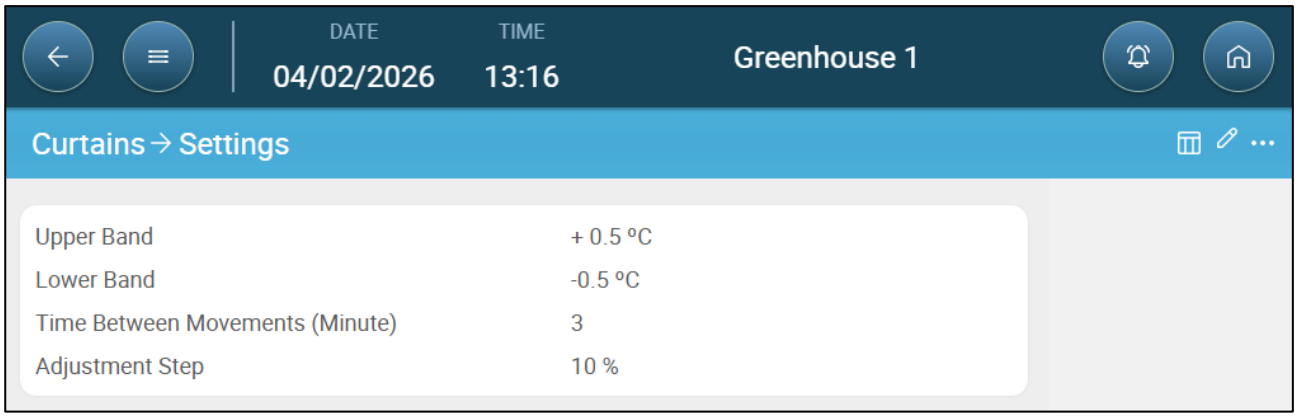
Natural Ventilation means supplying clean air without using fans (meaning using wind). By opening the greenhouse curtains according to the weather conditions (temperature, humidity, wind speed, and rain), the greenhouse owner can lower costs.

➲ Define relays or analog ports as curtains. Refer to the Installation Manual.

1. Go to Climate › Ventilation › Curtains. Each curtains displays its orientation (orientation is defined on the Devices & Sensors screen).



2. Define the minimum and maximum opening position.
3. Go to Climate › Curtains › Settings.



4. Define:

- Upper Band: Define the temperature at which the curtains begin to open. The parameters is the differential from the Target Temperature. Default: 0.2° C. Range: 0.2° to 5.0° C.
- Lower Band: Define the temperature at which the curtains begin to close. The parameters is the differential from the Target Temperature. Default: -0.2° C. Range: -0.2° to -5.0° C.
- Time Between Movements (Minute): Trio 20 waits this amount of time before re-evaluating the temperature. Trio 20 then adjust the curtains depending on the results. Default: 3 minutes. Range: 1 – 15 minutes.
- Adjustment Step: Define how much the curtain opens or closes per adjustment cycle. Default: 10%. Range 1 – 50%.

6.2.2 Calibrating the Curtain

To ensure that air circulation is carried out in the most efficient manner and according to the specifications, curtains must be positioned (opened) accurately. If used, a potentiometer can control the opening and closing with a high degree of precision.

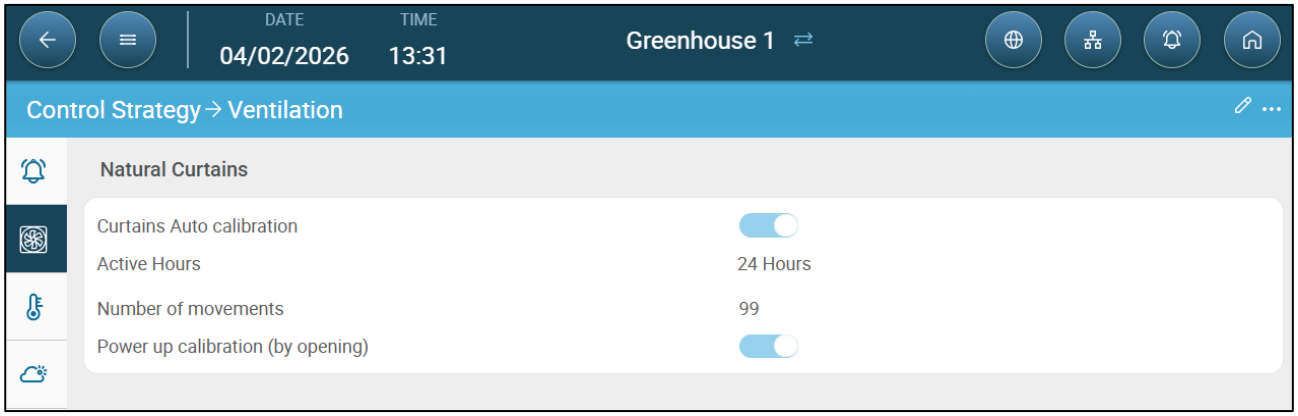
However when there is no potentiometer, positioning accuracy tends to degrade after the curtains go through several opening and closing cycles. The following section describes how to recalibrate the curtains, without a potentiometer.

During installation, the user enables auto-calibration in digital output curtains. Calibration automatically takes place after the number of curtain movements equals the number of movements required to start calibration.

Only curtain can be calibrated at a time.

- Relay open occurs when the target position is 100%.
- Relay close occurs when the target position is 0%.

1. Go to System > Control Strategy > Ventilation  .



2. Define:
    - (Option): Enable Curtains Auto Calibration. If this is enabled, the following parameters appear. Define:
        - 24 hours a day or a specific time frame.
        - Number of Movements: Define the number of movements (meaning when the opening changes from idle to open or to close) after which the curtains auto calibrates. The movement can be automatic or manual. Range: 5 – 99. Default: 99
    - Power Up Calibration (By Opening): Upon power up, the curtains are opened completely.

6.3 Stir Fan

Stir fans mix the air within the rooms. Because warm air rises and cool air falls, there can be a difference of several degrees in the temperature between the floor and the ceiling. By circulating the air, heating costs can be reduced while the environmental conditions are improved.

Stir fans can work continuously or in cycles.

- How do Stir Fans and Exhaust Fans Work Together?
- Stir Fan Configuration

6.3.1 How do Stir Fans and Exhaust Fans Work Together?

There are several rules guiding stir fan operation.

- An exhaust fan must be defined at the same level as a stir fan. The stir fan will not operate without an exhaust fan.

Figure 1: Valid Stir Fan – Exhaust Fan Configuration

Figure 2: Invalid Stir Fan – Exhaust Fan Configuration

- As the level of ventilation rises, the stir fan operates until there is a change in the exhaust fan configuration. At that point, the stir fan must be redefined or it will stop operating. In Figure 3, The stir fan operates at Level 0 and Level 1. At Level 2, when the exhaust fan configuration changes, the stir fan stops operating. Figure 4 illustrates how to define the stir fan to ensure continuous operation.

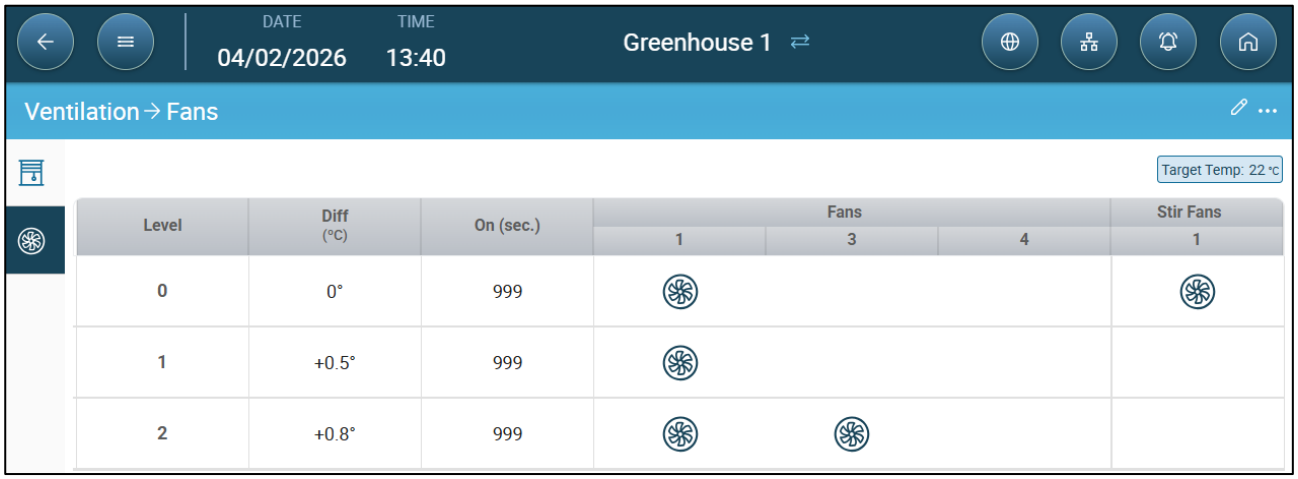


Figure 3: Change in Exhaust Fan – Stir Fan Stops Working

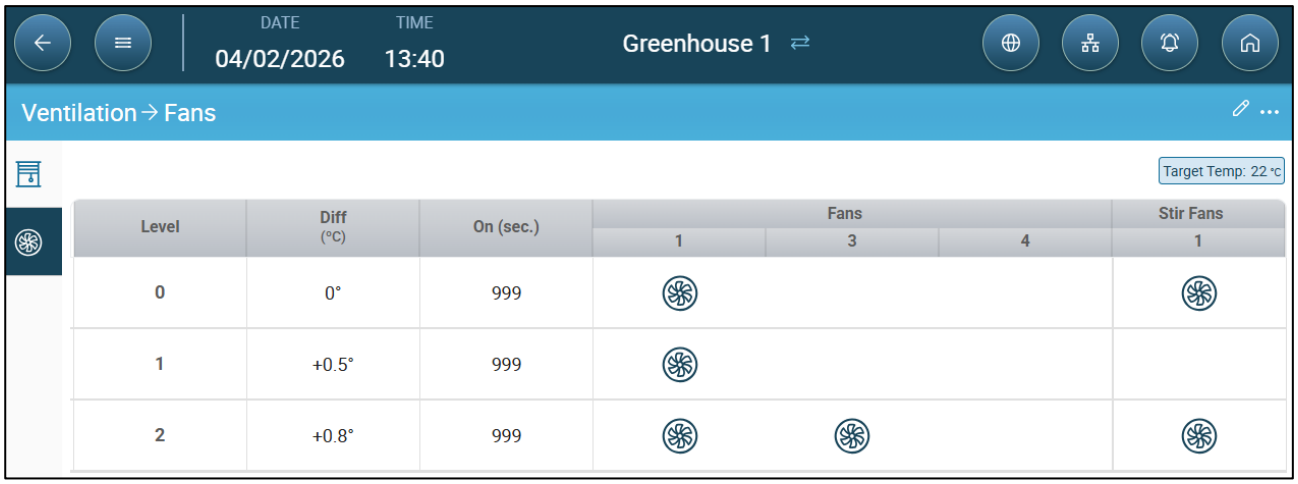


Figure 4: Change in Exhaust Fan – Stir Fan Continues Working

- Variable speed stir fans continue working at the same level until a new level is defined; there is no ramping. In Figure 5 the stir fan works at 25% from Level 0 to Level 1. At Level 2, it rises to 50%.

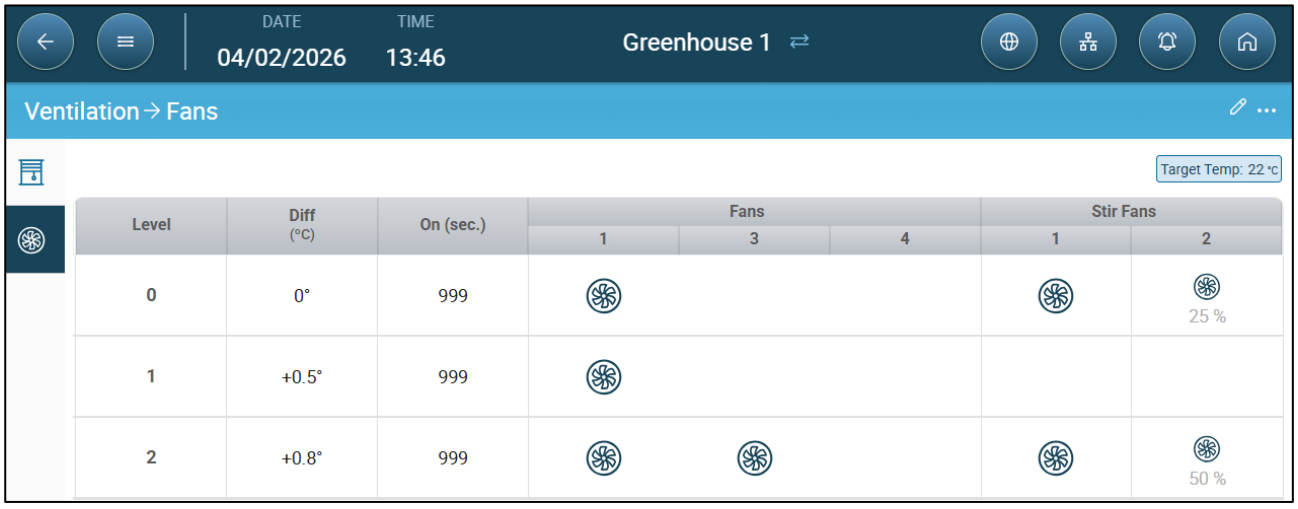


Figure 5: Variable Stir Fan Speed

- If the stir fans operate in a cycle, they can synchronize their on-time with exhaust fans that operate in a cycle (refer to Cycle Time Option). If the exhaust fans work continuously, the stir fans operating in a cycle work independently of the exhaust fans.

6.3.2 STIR FAN CONFIGURATION

NOTE Stir fan settings are defined for each fan individually.

- Operation Conditions
- Basic Configuration
- Cycle Time
- Operation Based on Temperature Difference

6.3.2.1 Operation Conditions

- Curtain Synchronization: If cycle mode stir fans operate during the **exhaust fans off cycle**, there is an option that enables stir fan operation only when the curtains are completely closed. This option does not allow any ventilation during stir fan operation.
    - Fans begin to operate **only** when the curtains reach their 0% position. This means that there can be a short delay between the time that exhaust fans are off and the stir fans begin to operate.
    - Opening an curtains manually during fan operation does not affect the stir fans.
    - Once curtains begin to open, stir fans cease to operate.
- Temperature input: As an option, Trio 20 can use temperature data to determine if the stir fans should operate. Two zones are mapped to specific temperature sensors (one zone can be mapped to the average temperature). When the difference between the zones' temperature reaches a certain threshold, stir fans begin to operate. Once the difference falls below that threshold, the stir fan ceases to operate.
    - The temperatures are continually monitored.
    - If one sensor fails or is disabled, the stir fan stops operating.
    - If variable speed stir fans are employed:
        - The fans' speed varies from the minimum to maximum.
        - The user defines the temperature difference (from the initial threshold temperature) at which the fan works at maximum speed.

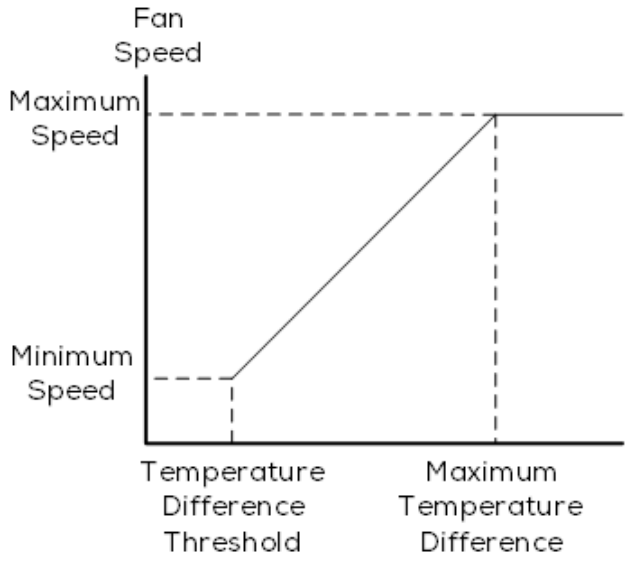
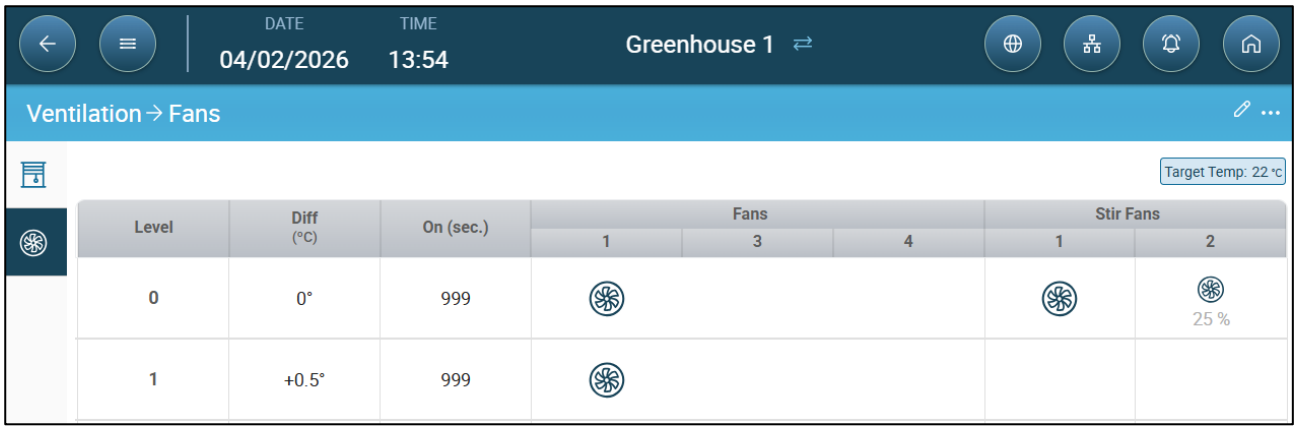


Figure 6: Variable Speed Stir Fan Speed vs Temperature

6.3.2.2 Basic Configuration

To define the stir fan functionality:

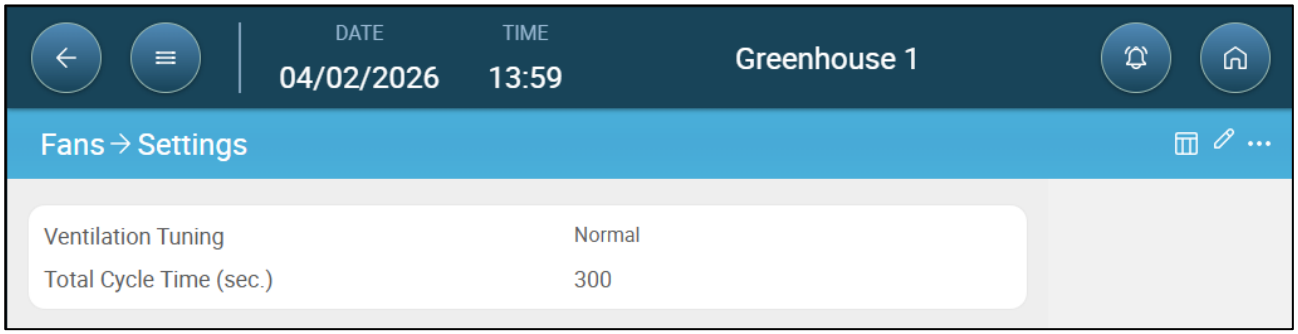
1. Define up to five relays or analog ports as a stir fan (refer to the Installation Manual).
2. Define the stir fan parameters (refer to the Installation Manual).
3. Go to Climate › Ventilation, enable the fan(s) and define the fan(s) parameters.



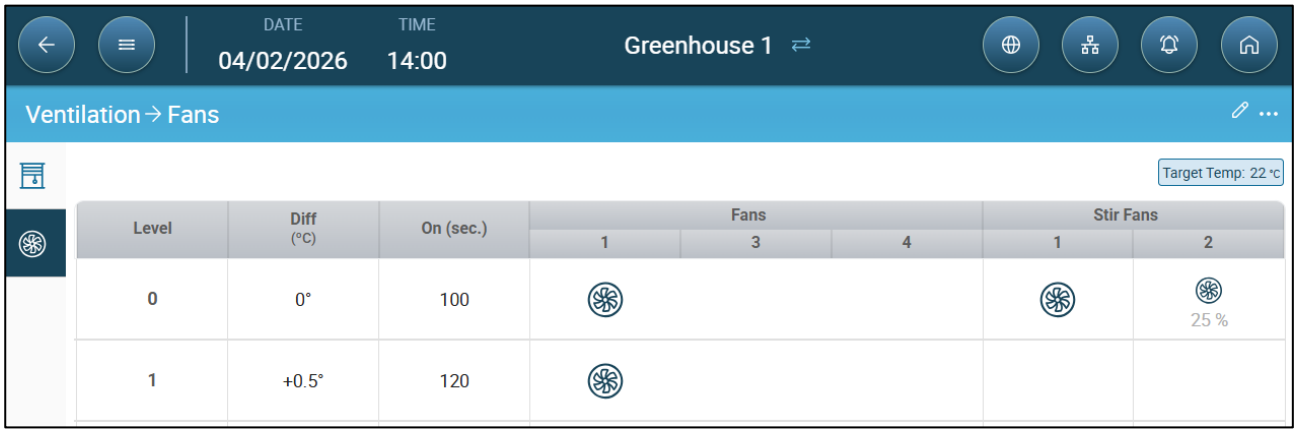
6.3.2.3 Cycle Time

To configure the cycle time:

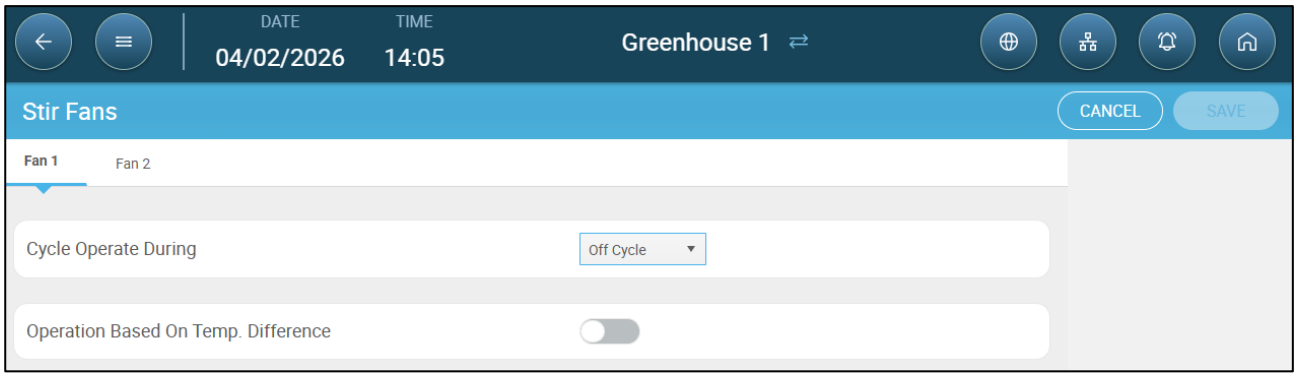
1. Go to Climate › Ventilations › Settings and define the cycle times.



2. Go to Climate › Ventilation and define the On Time.



3. Go to Climate › Ventilation › Stir Fans and define when the stir fan operates, during the cycle On or Off time.



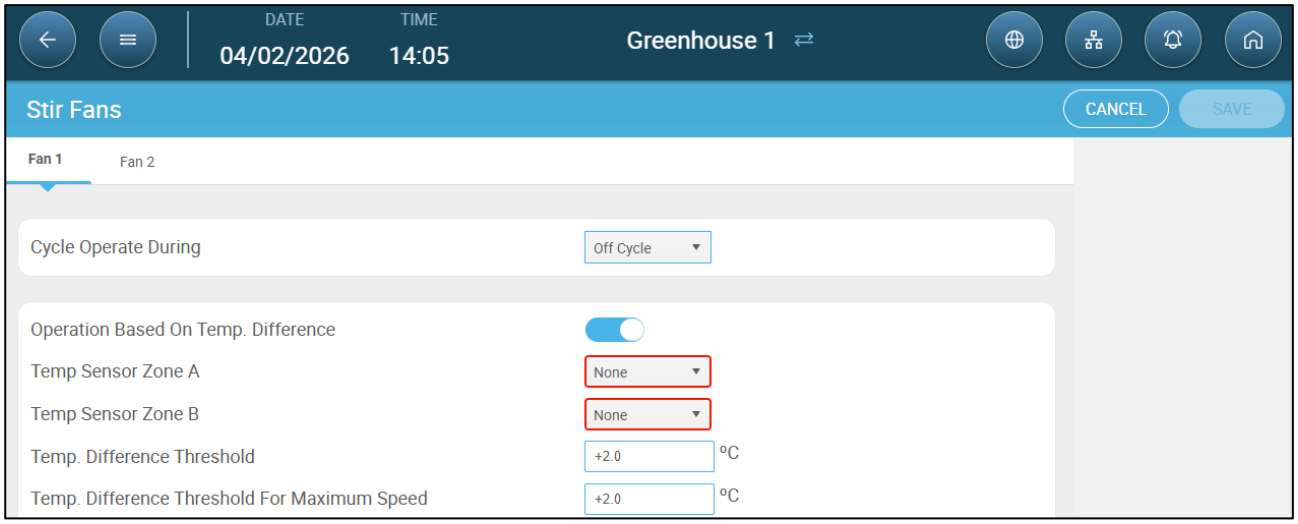
NOTE If the curtain cannot close, the stir fan will operate.

6.3.2.4 Operation Based on Temperature Difference

- On – Off Stir Fans
- Variable Speed Stir Fans

6.3.2.4.1 On – Off Stir Fans

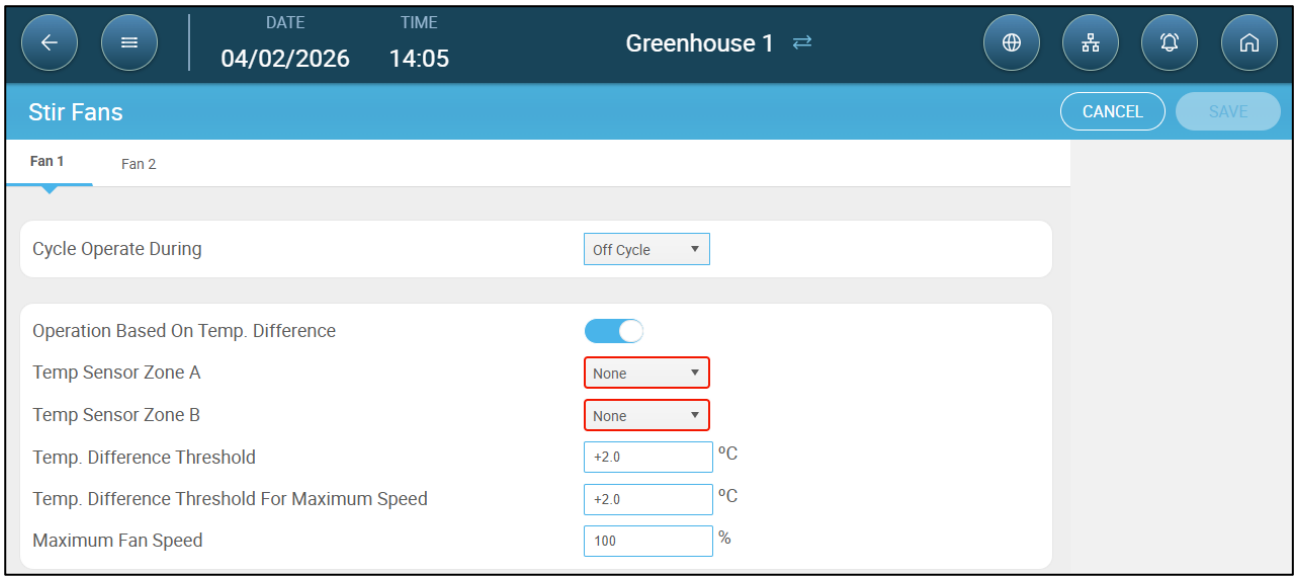
1. Go to Climate › Ventilation › Stir Fans and enable Operated Based On Temp. Difference.



2. Map each zone to a specific sensor.
    - One zone can be mapped to the average temperature (option).
    - Both sensors must be mapped. Selecting None disables the function.
3. Define the temperature difference threshold. Default: 2^{0}. Range 0.5^{0} - 10^{0}.

6.3.2.4.2 Variable Speed Stir Fans

1. Go to Climate › Ventilation › Stir Fans and enable Operated Based On Temp. Difference.



2. Map each zone to a specific sensor.
    - One zone can be mapped to the average temperature (option).
    - Both sensors must be mapped. Selecting None disables the function.
3. Define the temperature difference threshold. Default: 2°. Range 0.5° - 10°.
4. Define the Maximum Speed Temperature Band. The variable stir fan reaches its maximum speed when the temperature rises to the threshold plus this differential. Default: 2°. Range 0.5° - 10°
5. Define the Maximum Fan Speed: Define the maximum fan speed percentage. Default: 100%. Range: 0 – 100%.

NOTE The minimum speed is the speed defined in the stir fan table.

7 Cooling Functions

- Cooling Principles
- Selecting the Cooling Mode

7.1 Cooling Principles

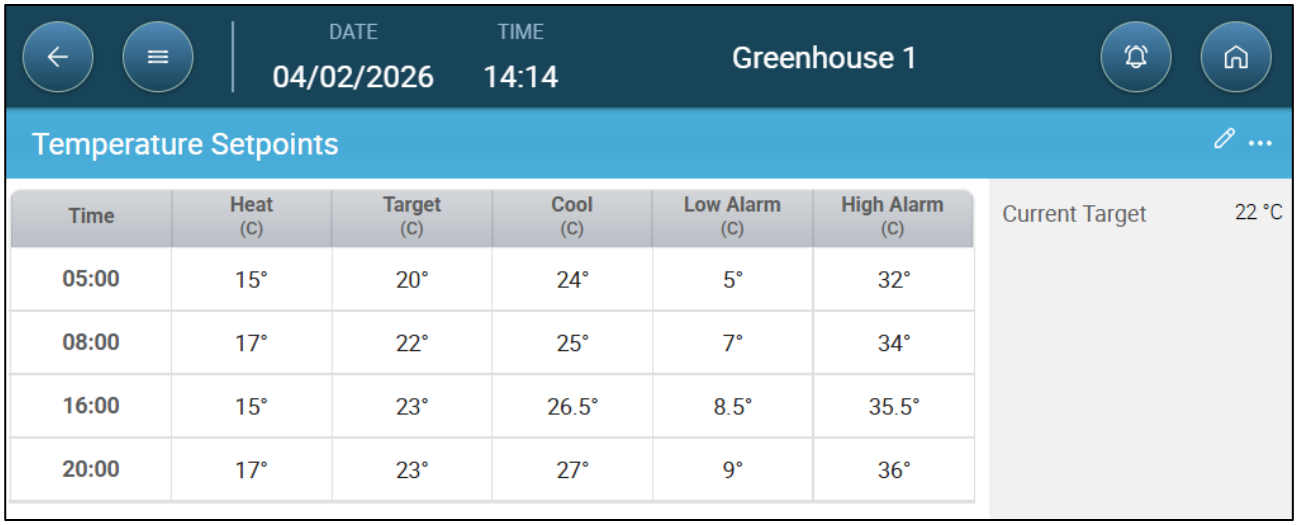
Trio 20 supports controlling up to two cooling devices (sprinklers or cooling pads). The devices can run separately or together.

The relative humidity directly affects plants' health, even when the temperature is the same (heat loss decreases in higher humidity rate causing heat stress). What is important to remember is that the cooling process adds moisture to the air; therefore it needs to stop when the relative humidity is too high.

- To enable limiting cooling according to the humidity, install a humidity sensor.
- Invalid humidity sensor readings are not taken into consideration.

To avoid causing the plants undo heat stress during periods of high relative humidity, Trio 20 employs the following rules:

- When the temperature reaches the Cooling Temperature in the Temperature Setpoints, cooling begins and continues until the temperature falls below this point. The Cooling Temperature must be higher than the Target Temperature.



Time	Heat (C)	Target (C)	Cool (C)	Low Alarm (C)	High Alarm (C)
05:00	15°	20°	24°	5°	32°
08:00	17°	22°	25°	7°	34°
16:00	15°	23°	26.5°	8.5°	35.5°
20:00	17°	23°	27°	9°	36°

- If the humidity level rises above the To Humidity parameter (plus the Humidity Band), cooling ceases.
- Cooling only takes place between the start and finish times.
- When the minimum OFF time = 0sec, and the temperature reached ON temp + Ramping range the cooling device operates continuously.
- While cycling, the minimum OFF time will never be less than 5 seconds.
- Cooling runs in all ventilation modes.

- To record the amount of water used during cooling: install, map, and define a water meter (refer to the Installation Manual).

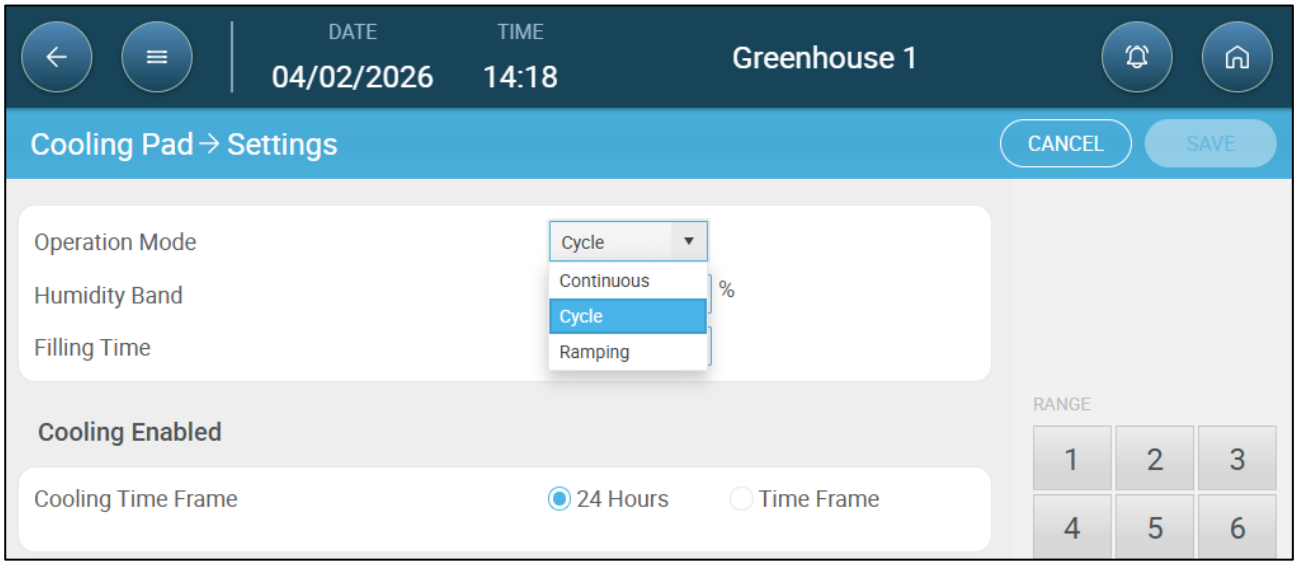
7.2 Selecting the Cooling Mode

Trio 20 enables running the cooling device in three different modes:

- Ramping: Cycle modulation, frequency depends on the error in °C, with respect to the cooling setting (target). Ramping is the default mode.
- Continuous: When activated, the cooling devices operate continuously.
- Cycle: When activated, the cooling device operates according to user-defined an on/off cycle.

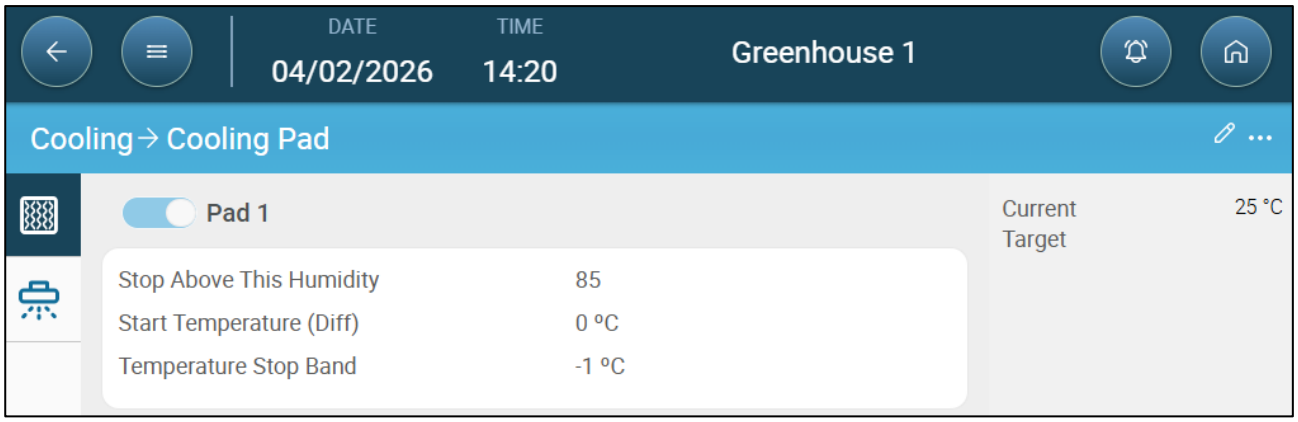
➲ Go to System › Devices and Sensors and set the relays as cooling (refer to the Installation Manual).

1. Go to Climate › Cooling.› Settings.



2. Define:
    - The operation mode.
    - Humidity Band: Set the humidity band to re-enable cooling outputs after the process ceases because of the high humidity level.
    - Filling Time: Define the amount of time required to distribute water over the pad.
    - Cooling Enabled: Define when cooling is enabled, 24 hours a day or time frames.
3. Go to Climate › Cooling. The screen that appears depends on the operation mode chosen.
    - Continuous Cooling
    - Cycle Cooling
    - Ramping Cooling

7.2.1 CONTINUOUS COOLING



- Define:
  - Status: Enable or disable a cooling device. Disabling a device is useful if there is a need to temporarily stop the operation.
  - Stop Above This Humidity: Stop cooling when the humidity level reaches the level defined in the Humidity settings.
  - Start Temperature (Diff From Cool Temp.): Sets the temperature differential from the cooling temperature (Temperature Setpoints) to activate cooling. Default: 0^{0}. Range: -10^{0} to – 10^{0}

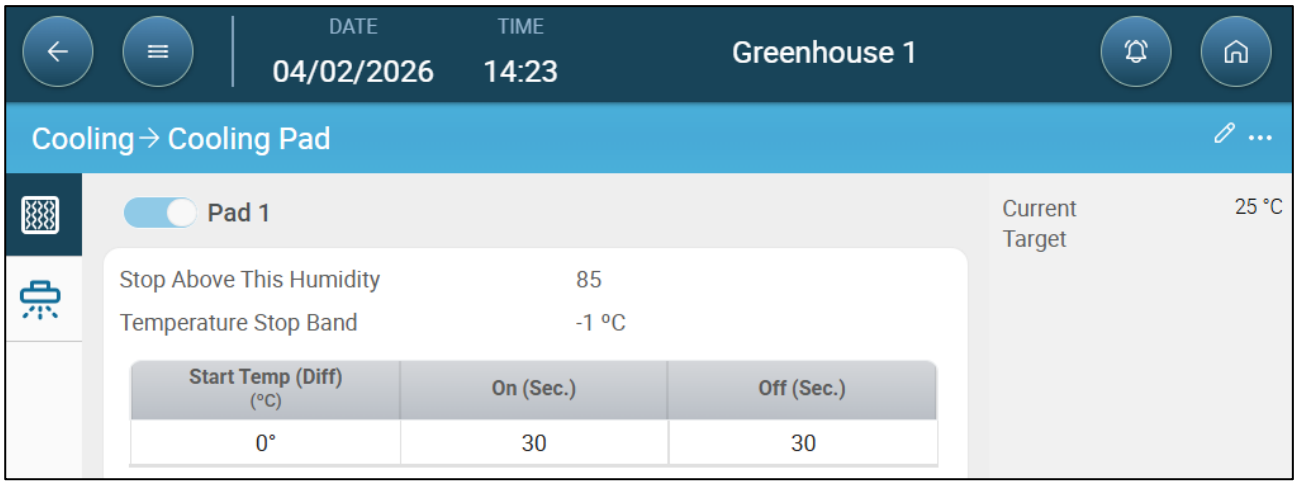
NOTE Each cooling device operates according to its own temperature (Equipment Mapping › Temperature Definition).

  - Temperature Stop Band: This parameter defines the temperature drop that must occur once cooling starts in order to turn off the cool pad. When the air temperature is below the [Start Temperature – Temperature Stop Band], cooling ceases. Default: -1.0. Range: -10.0 to – 0.1^{0}.

7.2.2 CYCLE COOLING

Cycle cooling means that the cooling pad runs according to a schedule. When the conditions are met, the cooling runs according to the user-defined on and off times (in seconds).

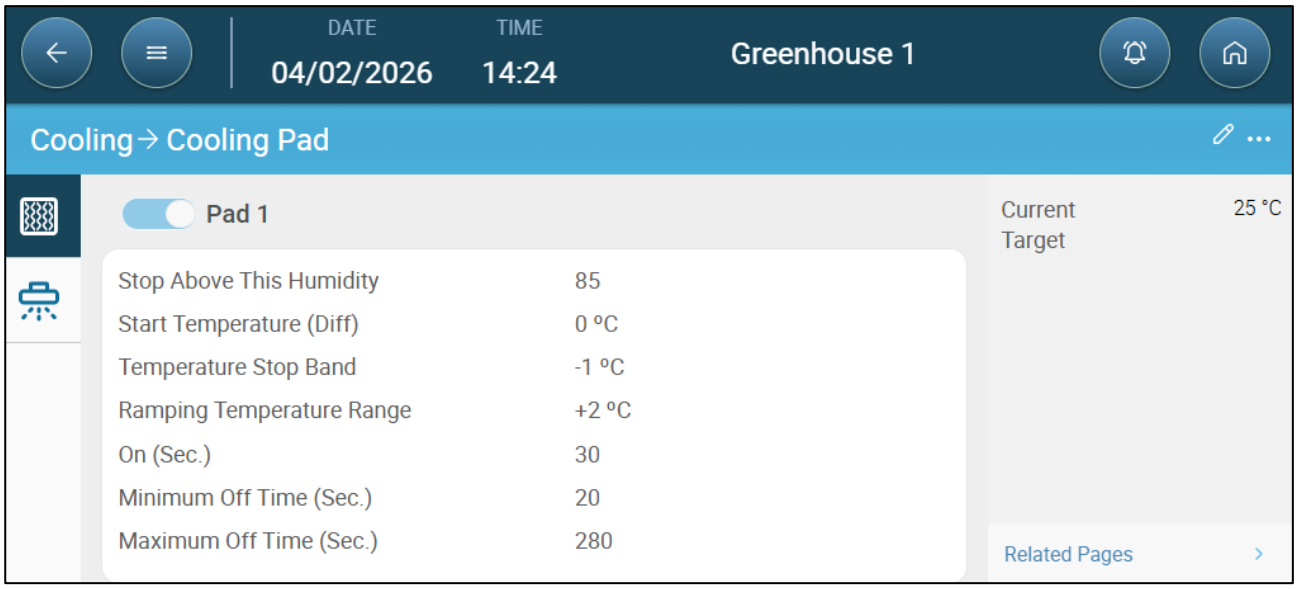
Version 9.0 enables defining up to eight cooling cycles, each with its own temperture definition and duration. Trio 20 continually measures the difference between the current temperature and cooling temperature. When the difference exceeds the threashold, the appropriate cycle is activated. Once a cycle starts, Trio 20 does not recheck the temperature until the cycle finishes.



- Click and define:
  - Status: Enable or disable a cooling device.
  - Stop Above This Humidity: Stop cooling when the humidity level reaches the level defined in the Humidity settings. If the humidity is too high, plant health can suffer. This parameter causes the cooling to cease when the humidity level reaches the level defined in the Cooling settings.
  - Temperature Stop Band: This parameter defines the temperature drop that must occur once cooling starts in order to turn off the cool pad. When the air temperature is below the [Start Temperature – Temperature Stop Band], cooling ceases. Default: -1.0. Range: -10.0 to – 0.1°.
  - For each cycle define:
    - Start Temp (Diff): Set the temperature differential from the cooling temperature (Temperature Setpoints) to activate the next cycle.
    - ON/OFF Time: Define the amount of time the cycle is ON and OFF, respectively.
      - On: Default 30 seconds. Range: 5 – 999
      - Off: Default 30 seconds. Range: 0 – 9,999
    - Click ADD CYCLE to define temperature differentials and cycle times.

7.2.3 RAMPING COOLING

Ramping Cooling uses a cycle, but decreases the off time as the temperature increases (within a temperature band).



- Define:
  - Enable: Enable or disable a cooling device. Disabling a device is useful if there is a need to temporarily stop the operation.
  - Stop Above This Humidity: Stop cooling when the humidity level reaches the level defined in the Humidity settings.
  - Start Temperature (Diff From Cool Temp.): Sets the temperature differential from the cooling temperature (Temperature Setpoints) to activate cooling. Default: 0°. Range: -10° to -10°

NOTE Each cooling device operates according to its own temperature (Equipment Mapping › Definition).

  - Temperature Stop Band: This parameter defines the temperature drop that must occur once cooling starts in order to turn off the cool pad. When the air temperature is below the [Start Temperature – Temperature Stop Band], cooling ceases. Default: -1.0. Range: -10.0 to – 0.1°.
  - Ramping Temperature Range: Sets a temperature range to modulate the cooling device off cycle. When cooling starts, the off time will be the maximum off time. As the temperature rises to the band maximum, the maximum off time decreases to the minimum.
  - Minimum/Maximum Off Time (sec): Define the maximum and minimum off time that cooling devices remain off after having operated during the ON time.
    - Maximum Default: 280. Range: 0 – 999. **Version 9.0** Range: 0 -9999.
    - Minimum Default: 20. Range: 0 – 999.

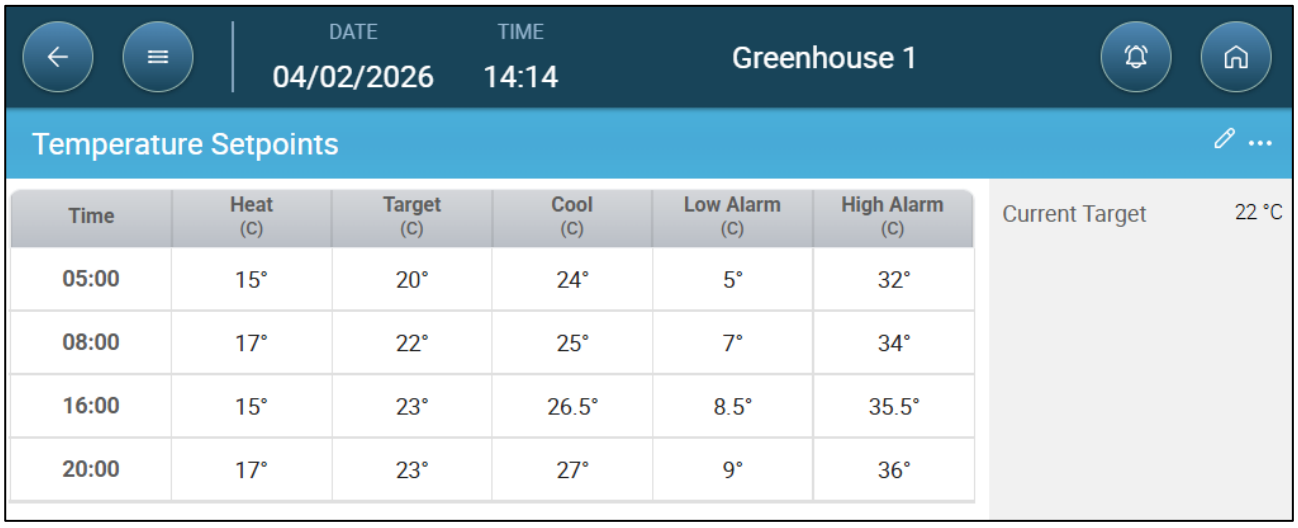
8 Heating Functions

The heating function ensures that plants are raised in optimal temperatures during winter months.

- Heating Functions
- Second Stage Heating
- Central Heaters
- Zone Heaters

8.1 Heating Functions

When the temperature reaches the Heat Temperature in the Temperature Setpoints, heating begins and continues until the temperature rises to this point. The Heating Temperature must be lower than the Target Temperature.



NOTE Munters recommends keeping the heat temperature close to the target temperature for the first two weeks and then lowering the temperature. Refer to Temperature Setpoints, page 15.

Trio 20 supports up to:

- six (6) on/off heating devices and variable heaters
- six (6) high heaters (relay controlled only)

To control the heat, Trio 20 has two different programs, one to maintain the target temperature in the entire house (Central Heaters). Central heaters are also known as forced-air space heaters. A second program controls separate heating zones using radiant heaters (Zone Heaters). In the case of the latter, each heater has a dedicated sensor and unique target temperature.

Trio 20 supports on/off and 0-10V analog heaters. In additions, heaters can run in cycles.

8.2 Second Stage Heating

- What is Second Stage Heating
- How do Heaters and High Heaters Work Together?

8.2.1 What is Second Stage Heating

Second stage heating (high heating) provides additional heat beyond the main heating system. Alternatively, second stage heating employs 2-stage heater (low/high fire). The second stage heating operates when the outside weather is so cold that the standard heaters cannot maintain the required temperature.

There must be a primary heater defined for the second stage heater to operate. For example if there is one primary heater and two secondary heaters, heater #1 and high heater #1 work together; the 2nd secondary heater will not operate. Refer to the Installation Manual for more information.

8.2.2 How do Heaters and High Heaters Work Together?

Heaters and high heaters can work together or the only the heater can operate (depending on the temperature). Each unit has a separate temperature definition.

- The basic heat temperature is defined in the Temperature Setpoints (refer to Temperature Settings, page 15)
- Heater and Higher Heater differentials are defined in the Heating program screen (click here for details).

The following table uses Heater 1 and High Heater 1 as models.

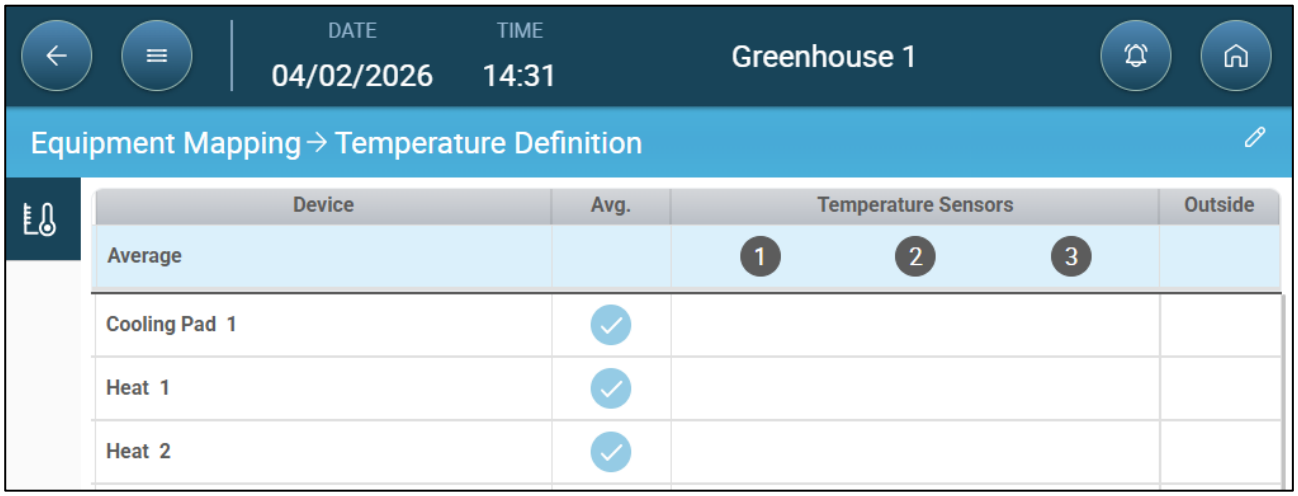
- Current Temperature:
  - Below Heat Temperature: The heater is currently on.
  - Above Heat Temperature: The heater is currently off.
  - Below High Heat Temperature: The high heater is currently on.
  - Above High Heat Temperature: The high heater is currently off.
- Heater Icons:
  -  : Both heaters are off
  -  : The heater is operating alone
  -  : Both the heater and the high heater are operating or the high heater is operating alone

NOTE When the heating method is defined as central heating, Trio 20 displays one icon on the dashboard. When the heating method is defined as zoned heating, Trio 20 displays an icon for each heater-high heater pair.

Heater: Current Temperature	High Heater: Current Temperature	Icon Displayed
Below heat temperature	Below high heat temperature	Both heaters are operating
Below heat temperature	Above high heat temperature	Only the heater is operating
Above heat temperature	Above high heat temperature	Neither heater is operating

8.3 Central Heaters

When using central heat, the heater output is defined by the average measured temperature of all temperature sensors.

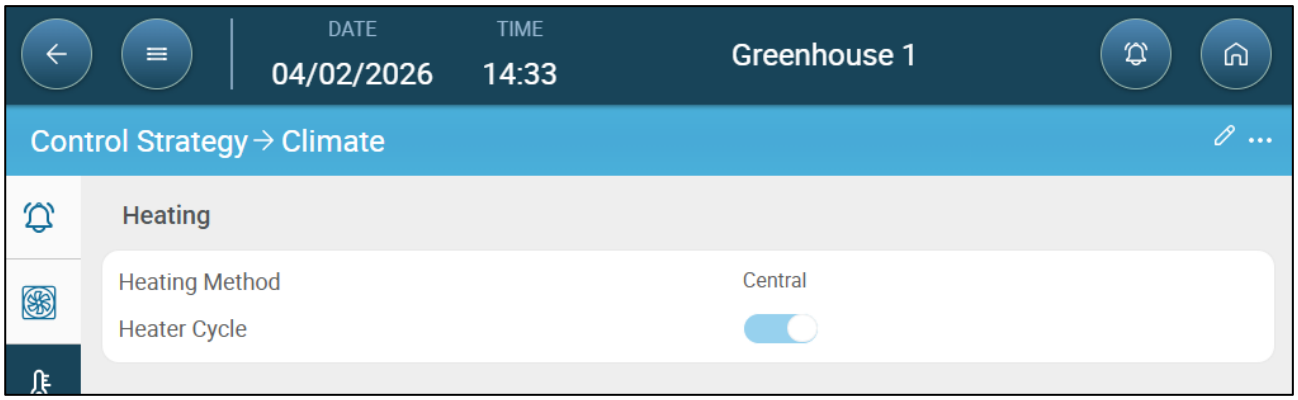


As temperature drops, Trio 20 reduces the amount of ventilation until it provides the minimum defined amount. If the temperature goes below the target temperature, Trio 20 continues to run at minimum ventilation. At the same time, heating begins when the temperature drops to a user defined temperature.

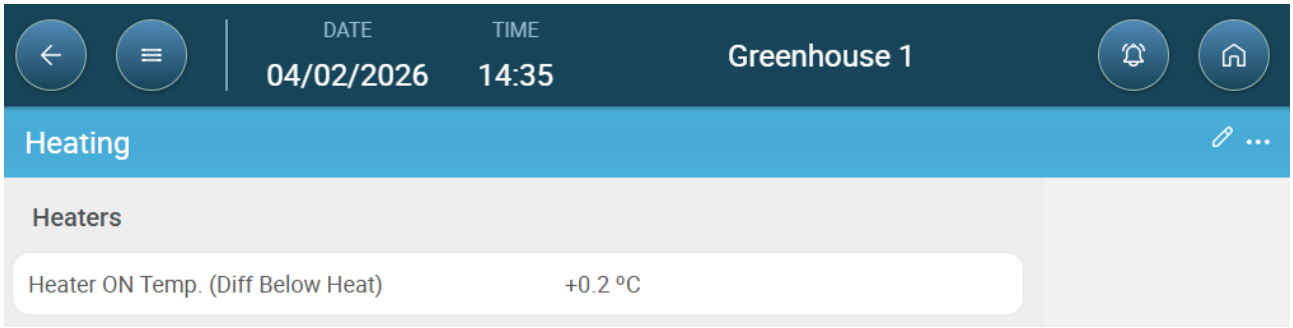
- Define relays as heaters in Devices and Sensors. Refer to the Installation Manual.
- In Temperature Setpoints, page 15 define the Heat parameter.

To define the central on/off heaters:

1. Go to System › Control Strategy › Climate .

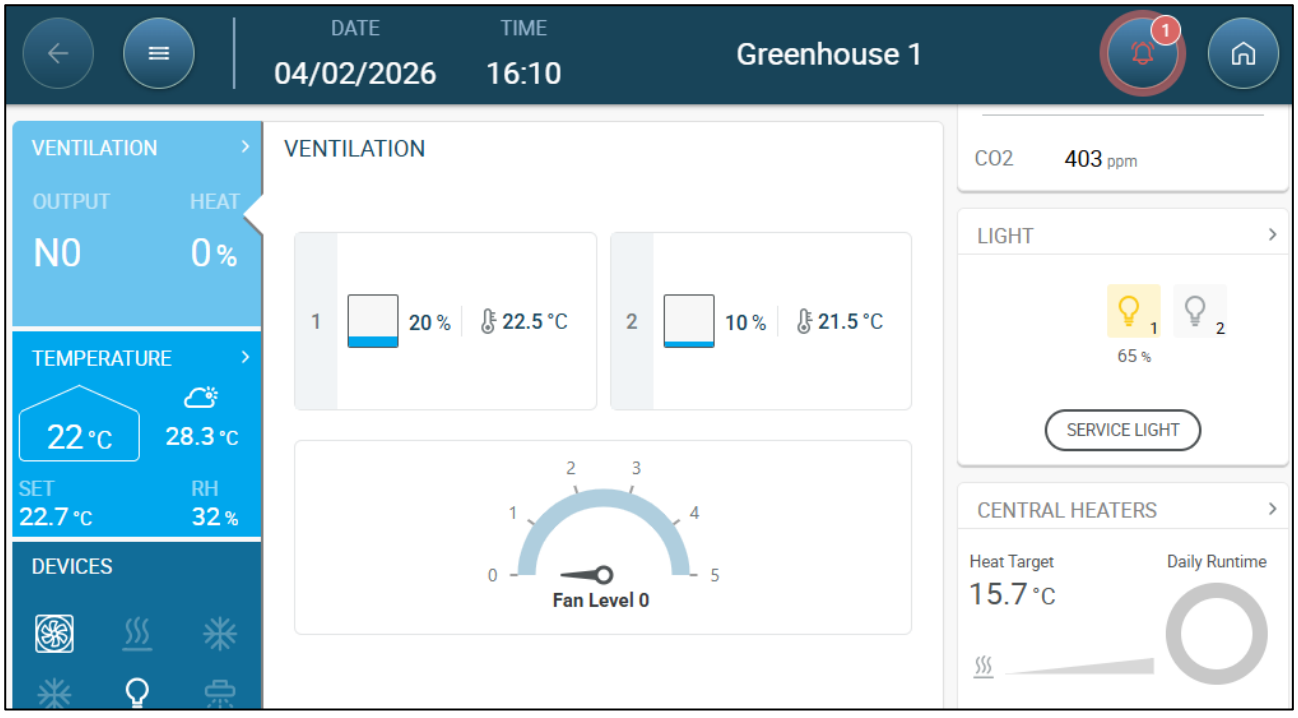


2. Define the Heating Method as Central.
3. Go to Climate > Heating.



4. Define:
    - Heater On Temp: Define the difference from the Heat target temperature at which the heaters turn on. Range: 0.2 - 5° C.

The central heaters appear on the dashboard.



Options:

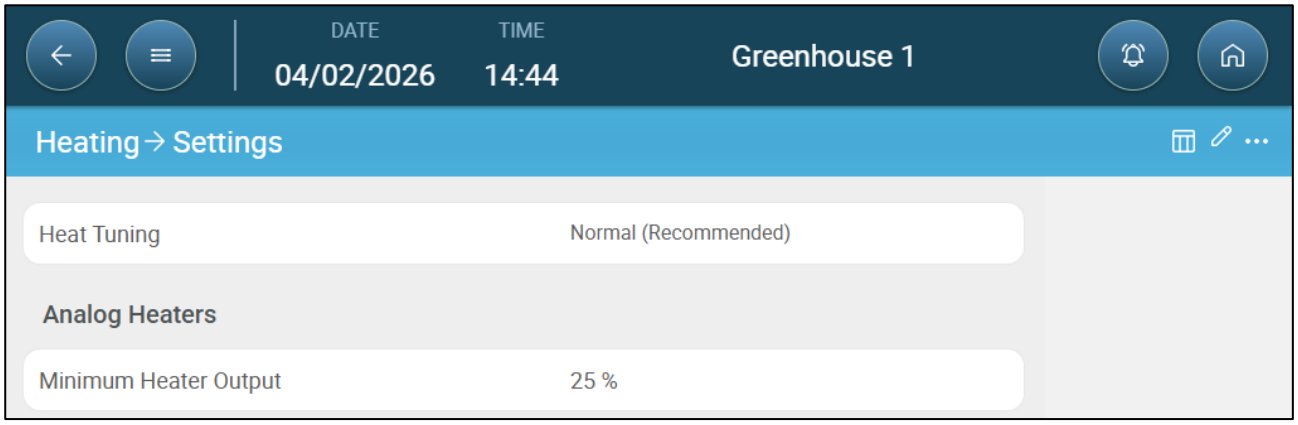
- Analogue Heaters
- Heat Cycles

8.3.1 ANALOGUE HEATERS

➲ Define analog ports as heaters in Devices and Sensors. Refer to the Installation Manual.

Define the analogue heaters using the same procedure as the on/off heaters. In addition:

1. Go to Climate › Heating › Settings.



2. Define:
   - Minimum Heater Output. Range: 0 – 100%
   - Heat Tuning: This parameter determines how aggressively the Trio 20 responds to differences between the measured temperature and the target temperature.

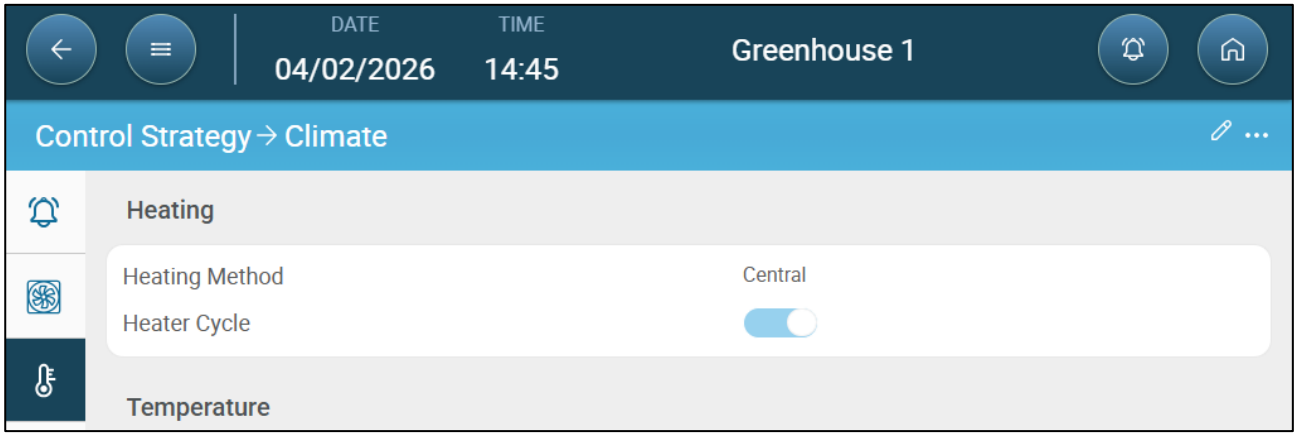
NOTE ***Munters strongly*** *recommends leaving this parameter at Normal.*

8.3.2 HEAT CYCLES

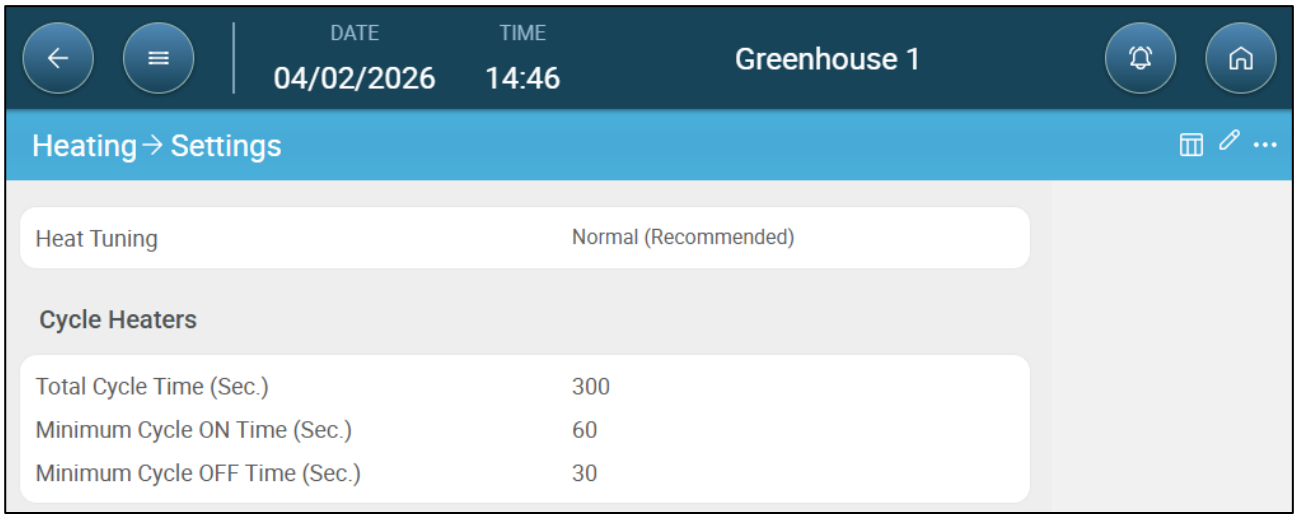
The paramaters define the cycle operation. The user defines the cycle time and minimum on/off times. Trio 20 continually adjusts the on and off times as the temperature rises or falls.

To enable running heaters in a cycle:

1. Go to System › Control Strategy › Climate .



2. Enable Heater Cycle.
3. Go to Climate › Heating › Settings.



4. Define:
    - Total Cycle Time (sec.): Range 5 – 600 seconds. Default 300 seconds
    - Minimum Cycle On Time (sec): Range 5 – 600 seconds. Default 30 seconds
    - Minimum Cycle Off Time (sec): Range 5 – 600 seconds. Default 30 seconds

8.4 Zone Heaters

A zone is an area in the green house. Each zone heater (radiant heater) can be mapped to specific temperature sensor(s) and operates according to that sensor's data output. The heat set point in the temperature setpoints is the same for all zones. Once a zone's heater is activated, it will work to maintain the temperature. All zone heaters work independently.

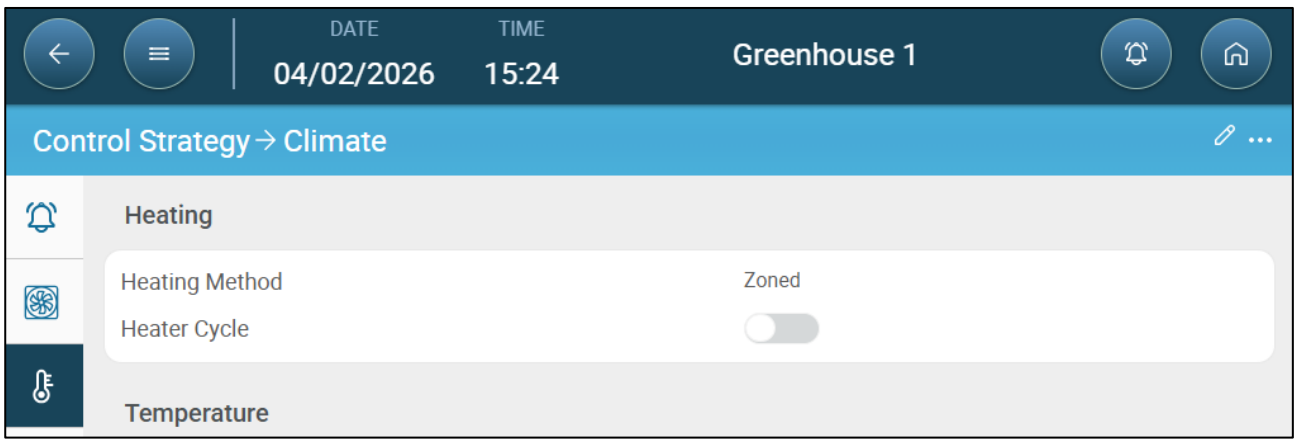
If a temperature sensor is inoperative, the heater is controlled automatically by the average temperature.

➲ Define relays output ports as heaters. Refer to the Installation Manual.

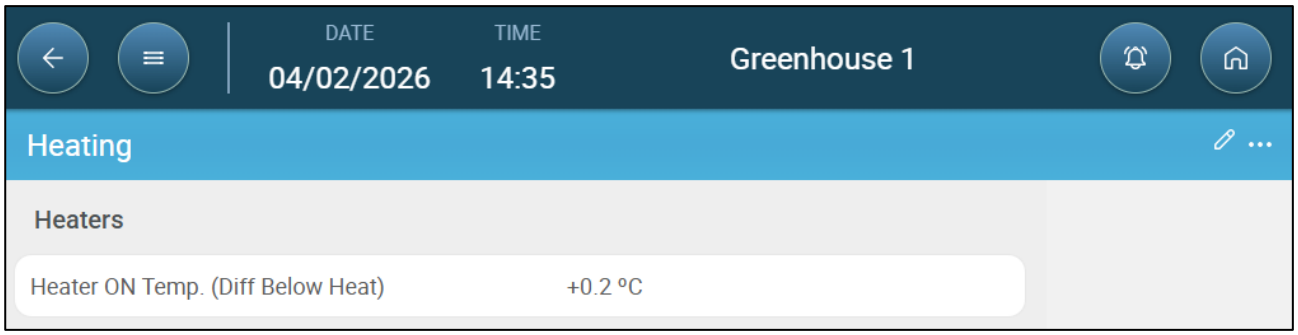
➲ In Temperature Setpoints, page 15 define the Heat parameter.

To define the zoned on/off heaters:

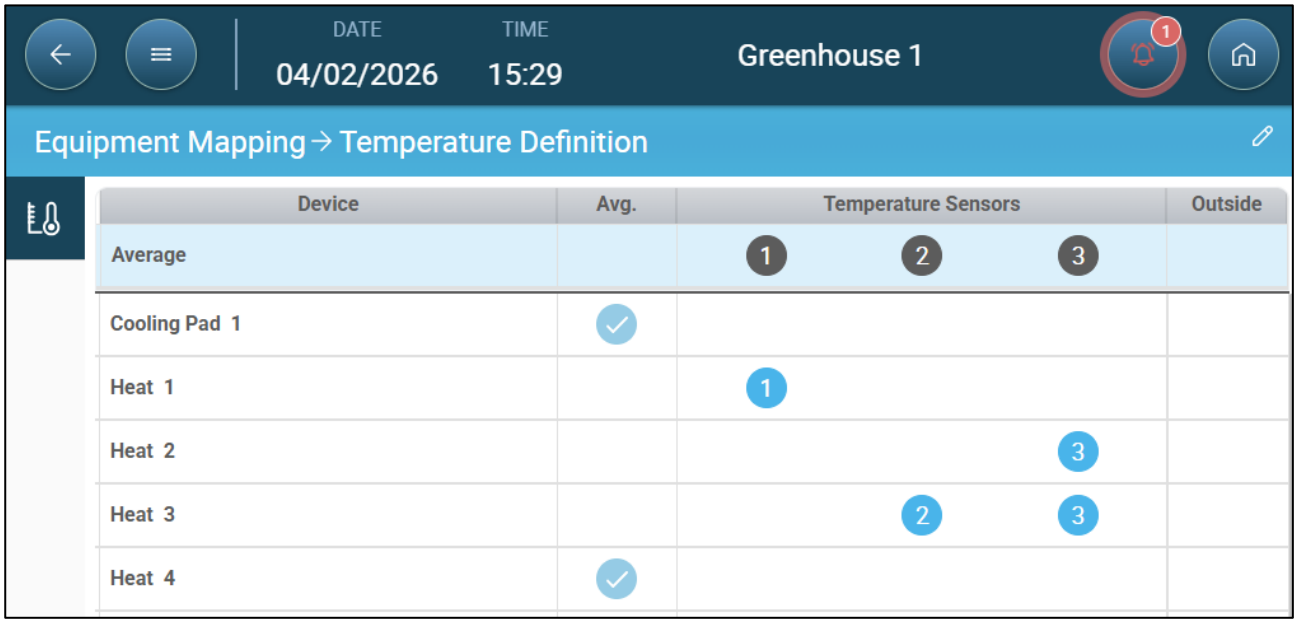
1. Go to System › Control Strategy › Climate .



2. Define the Heating Method as Zoned.
3. Go to Climate › Heating.

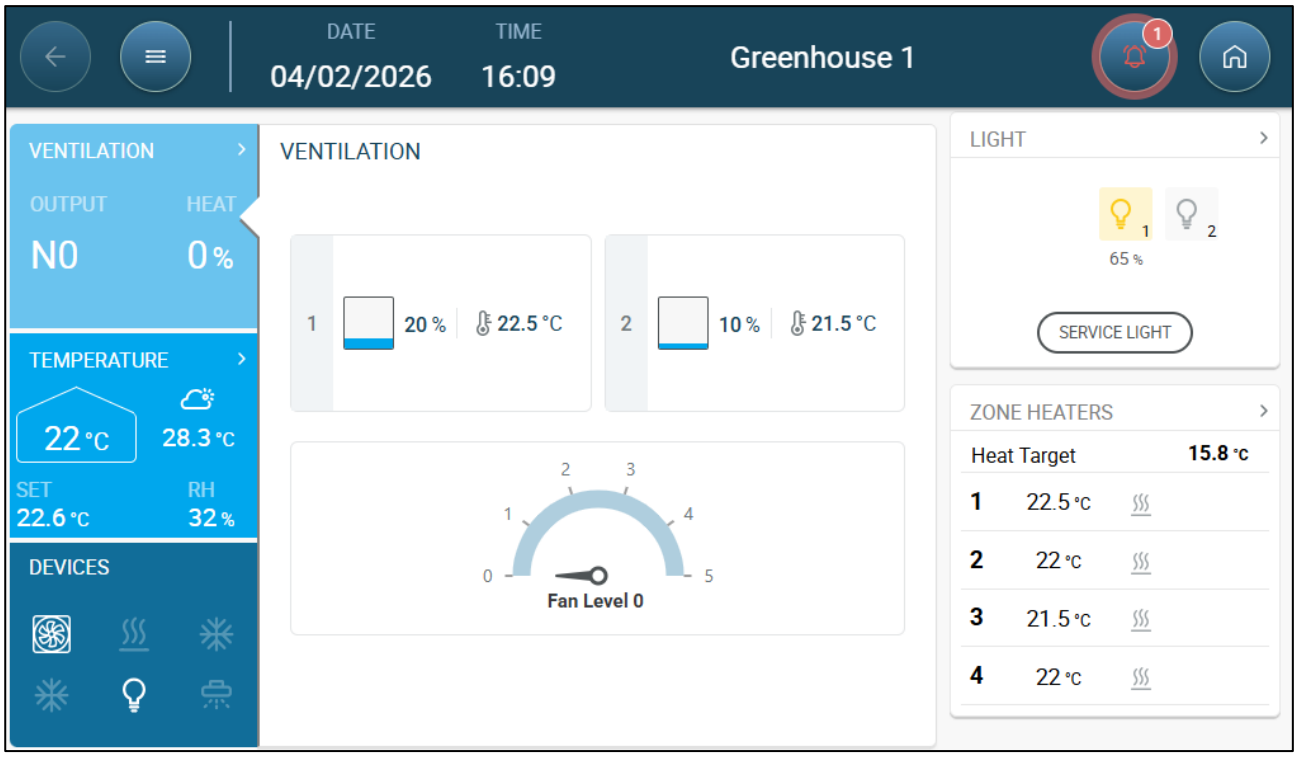


4. Define:
    - Heater On Temp: Define the difference from the Heat target temperature at which the heaters turn on. Range: 0.2 - 5° C.
5. Go to System › Equipment Mapping › Temperature Definition.



6. Map each heater to one or more temperature sensors (or the average).

The zone heaters appear on the dashboard.



- Options:
  - Analogue Heaters
  - Heat Cycles

9 Lighting Program

Trio 20 Green's lighting program ensure proper plant development and growth. Trio 20 Green supports up to four (4) independent light channels.

Trio 20 Green supports on/off (non-dimmable) lights and dimmable lights. In setting up the program, the following options must be defined:

- On/Off and/or 0 – 10 Volt Variable Lights (defined in Devices and Sensors; refer to the Installation Manual). A system can include both.
- Single line or multiline control: In single line control, all light lines have the same output. In multiline control, the user defines the value (on/off or intensity level) for each line.

NOTE At least two light relays must be mapped in Devices and Sensors to enable multiline control.

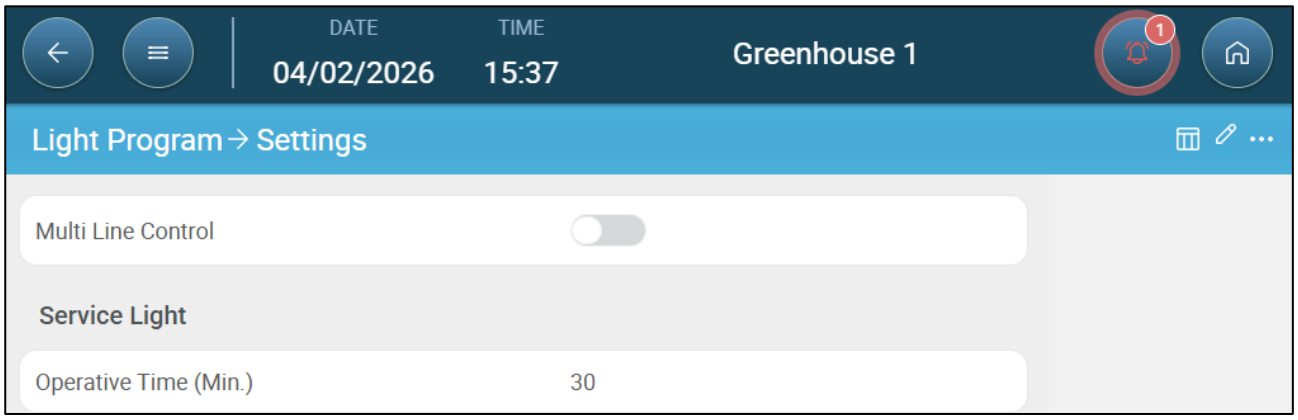
- Time: Starting time for each lighting event.
- If a light sensor is installed (optional), an alarm can be generated if the light goes below a certain intensity.

- On/Off Lights
- 0 – 10 Volt Variable Lights
- RLED 2.0
- Service Lights

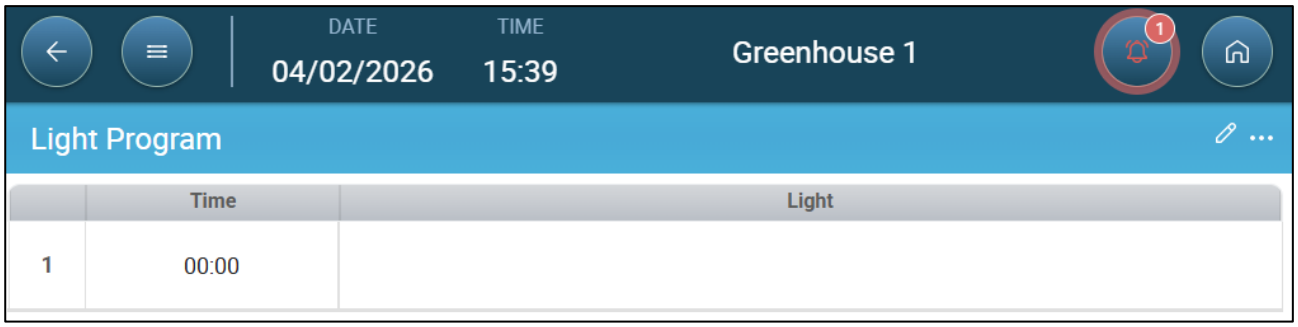
9.1 On/Off Lights

➲ In Devices and Sensors, define relays as Light.

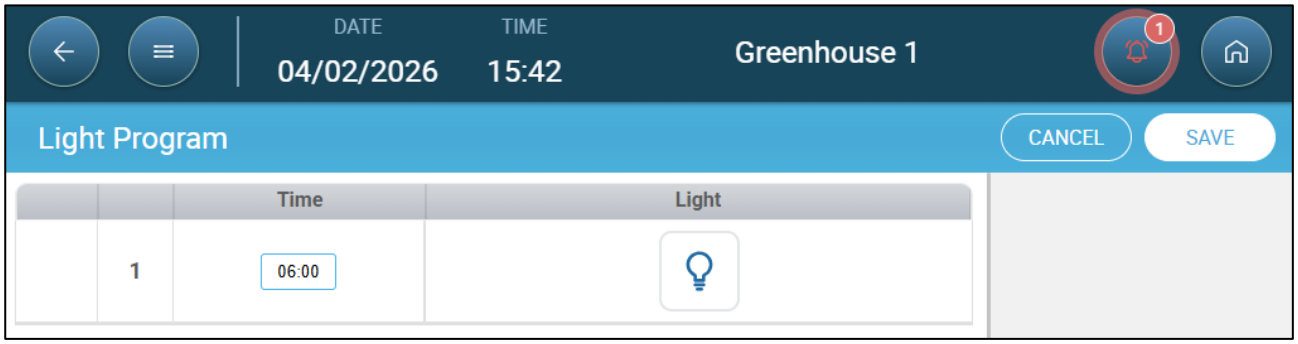
1. To enable multi line control, go to Control › Light › Settings and enable Multi Line Control (option).



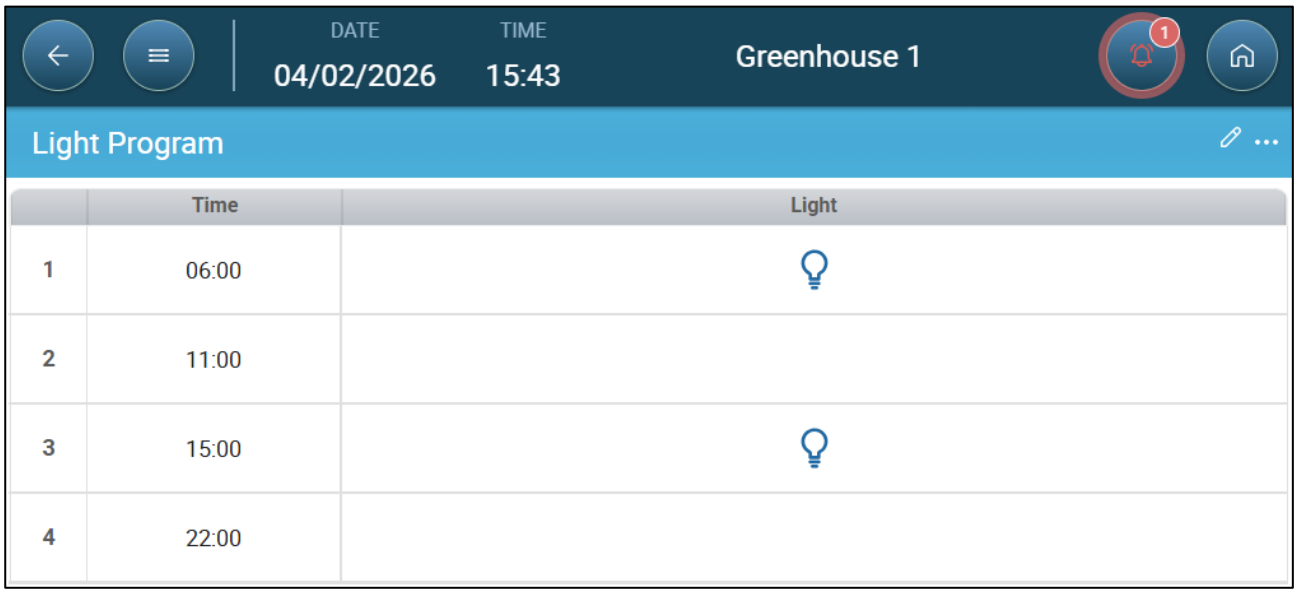
2. Go to Control › Light.



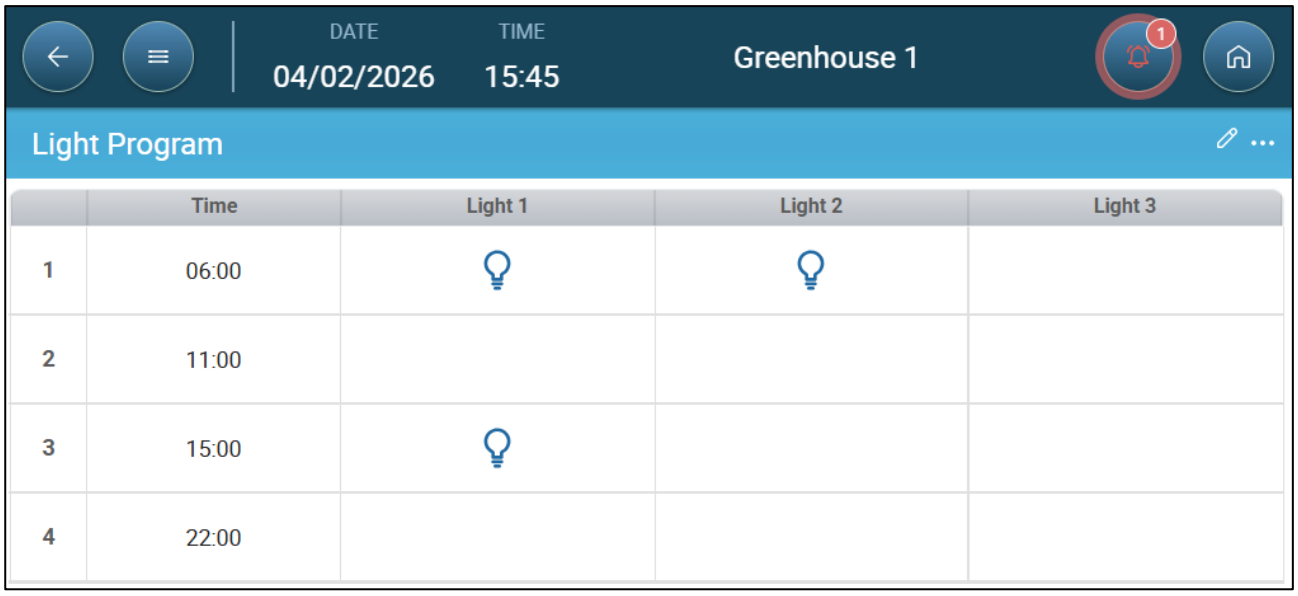
3. Define the time that the lights go on.
4. To enable lights:
    - In single line control, double click the light icon.
    - In multi-line control, double click the icon of each required line.



5. Add additional programming lines to define when the light lines go off and then on.
6. Click Save.



In the above scenario, all lights go on at 6:00, turn off at 11:00, turn on at 15:00, and turn off at 22:00.

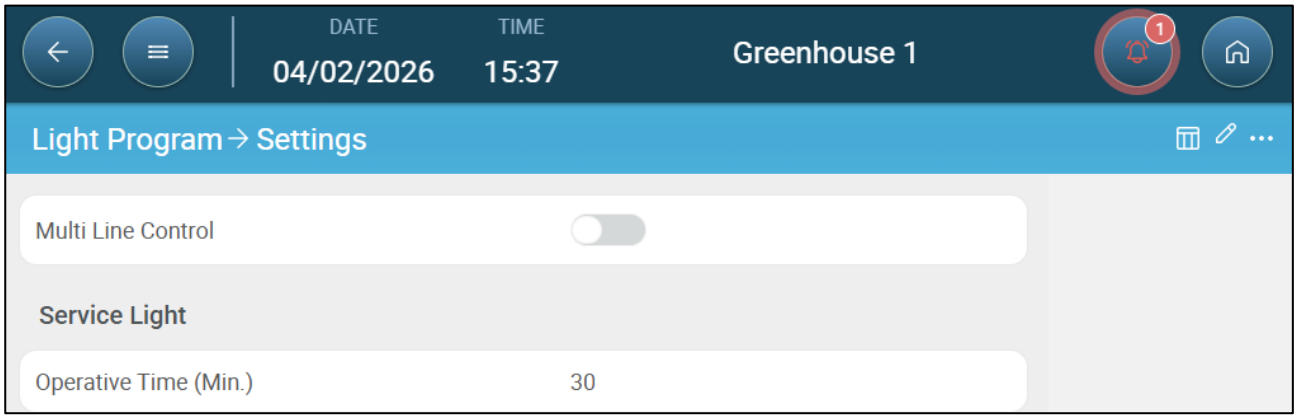


In the above scenario, Line 1 lights go on at 6:00, turn off at 11:00, turn on at 15:00, and turn off at 22:00. Line 2 lights go on at 6:00 and turn off at 11:00. Line 3 remains off.

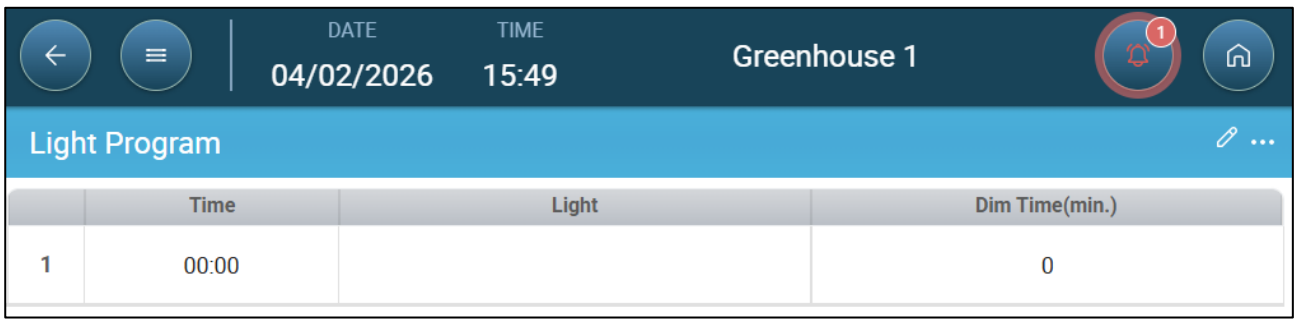
9.2 0 – 10 Volt Variable Lights

➲ In Devices and Sensors, define analog port(s) as Light.

1. To enable multi line control, go to Control › Light › Settings and enable Multi Line Control (option).



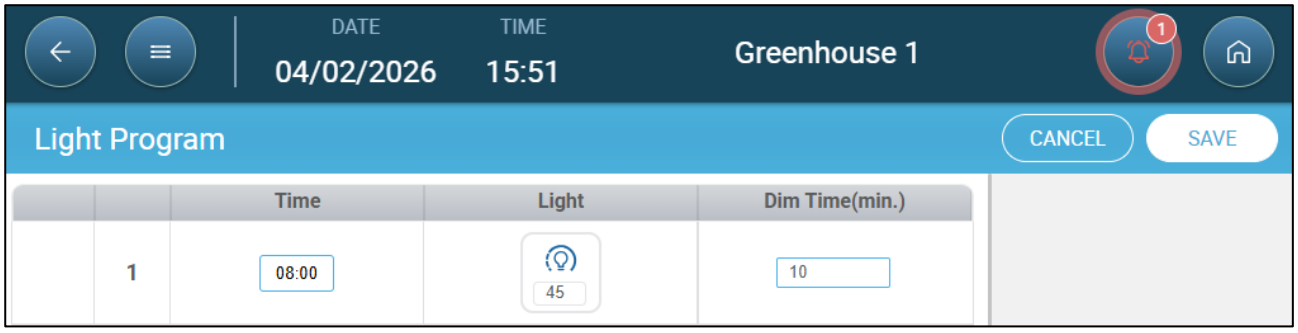
2. Go to Control › Light.



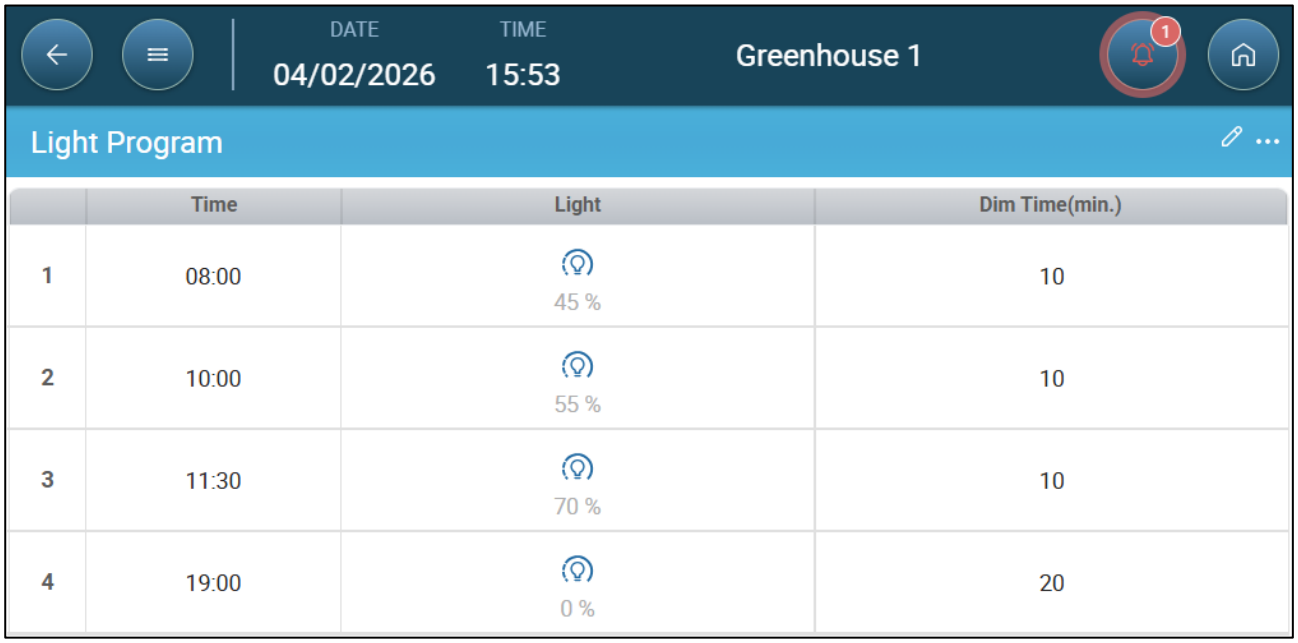
3. Define the time that the lights go on.

4. Enable the line(s)  .

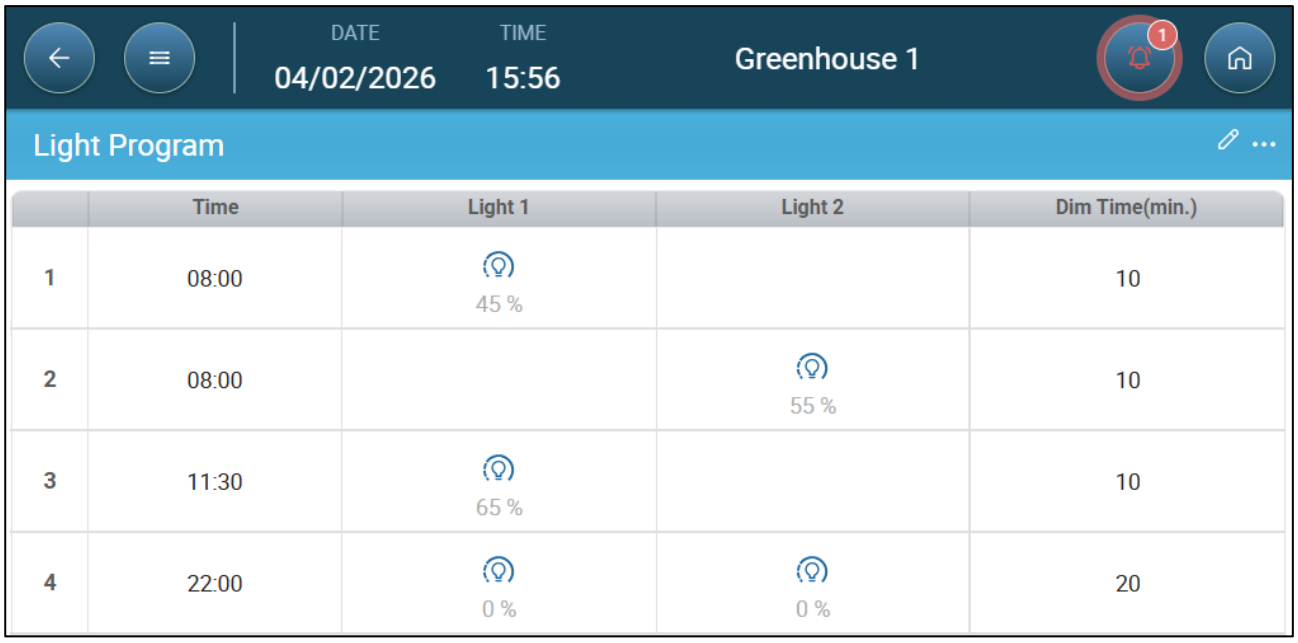
- In single line control, double click the light icon.
- In multi-line control, double click the icon of each required line.



5. Under each light icon, define the light intensity.
6. Under Dim Time, define the amount of time before the next lighting event that the lights begin to change their intensity.
7. Add additional programming lines.
8. Click Save.



In this scenario, the lights begin to turn on at 7:50. At 8:00, lights reach 45% intensity. At 9:50 light intensity begins to increase, reaching 55% at 10:00. At 11:20 light intensity begins to increase, reaching 70% at 11:30. At 18:40, lights begin to dim, reaching 0% at 19:00.



	Time	Light 1	Light 2	Dim Time(min.)
1	08:00	45 %		10
2	08:00		55 %	10
3	11:30	65 %		10
4	22:00	0 %	0 %	20

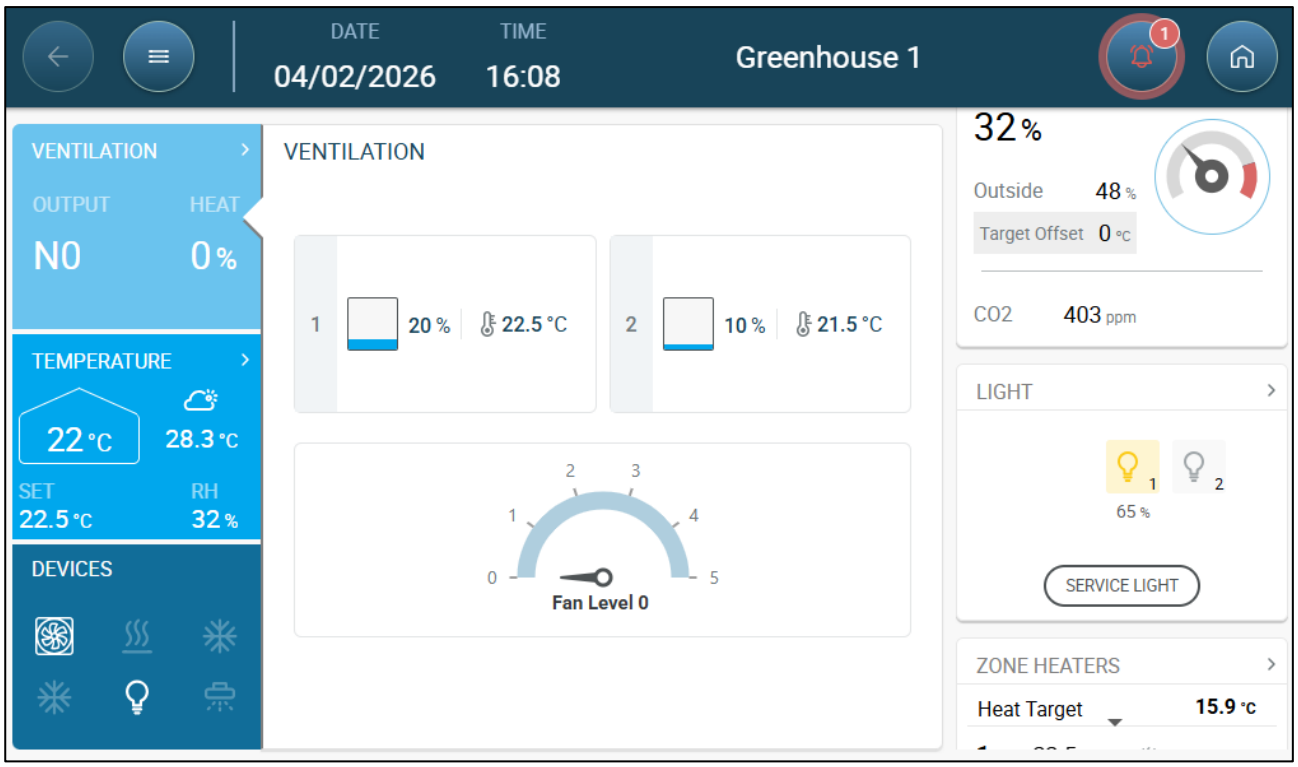
NOTE In multi-line mode devices may have different intensity settings; the dimming rate should be calculated for each line separately.

In this scenario, the Line 1 and Line 2 turn on at 7:50. At 8:00, Line 1 reaches 45% intensity and Line 2 reaches 55% intensity. At 11:20 Line 1 and Line 2 light intensity begins to increase, reaching 65% at 10:00. At 21:40, lights begin to dim, reaching 0% at 22:00.

9.3 RLED 2.0

Trio 20 Version 8.3 supports the RLED 2.0. For details on operating the RLED 2.0, refer to the relevant manual. When the RLED 2.0 is in auto-mode, Trio 20 controls the actual lighting parameters.

9.4 Service Lights

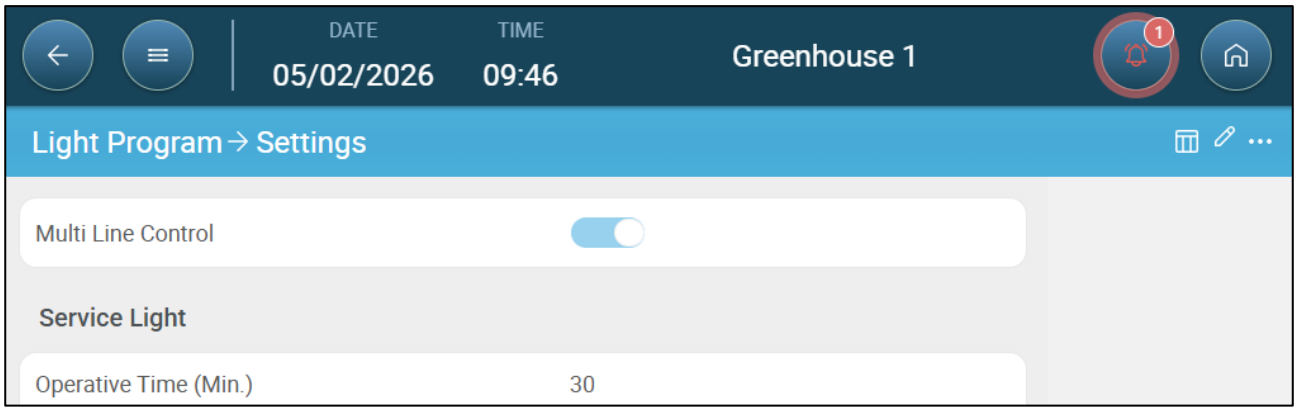


Service lights is a function that turns on the lights for a defined amount of time, temporarily overriding the programming. When the service light icon (which appears on the dashboard) is pressed, all lights are turned on.

- Turning the lights on:
  - 0 – 10 volt lights: When turned on, the lights gradually rise to the defined brightness. The time required for the lights to fully turn on is user-defined. If the light level is higher according to the programming than the level defined in the Service Light function, the lights remain at their programmed level.
  - On/Off lights: All lines turn on immediately.
- Turning the lights off: Lights turn off when the defined service time expires or the user presses the Turn Off icon.
  - 0 – 10 volt lights: When turned on, the lights gradually return to the defined brightness. The time required for the lights to turn off is user-defined.
  - On/Off lights: All lines turn off immediately.

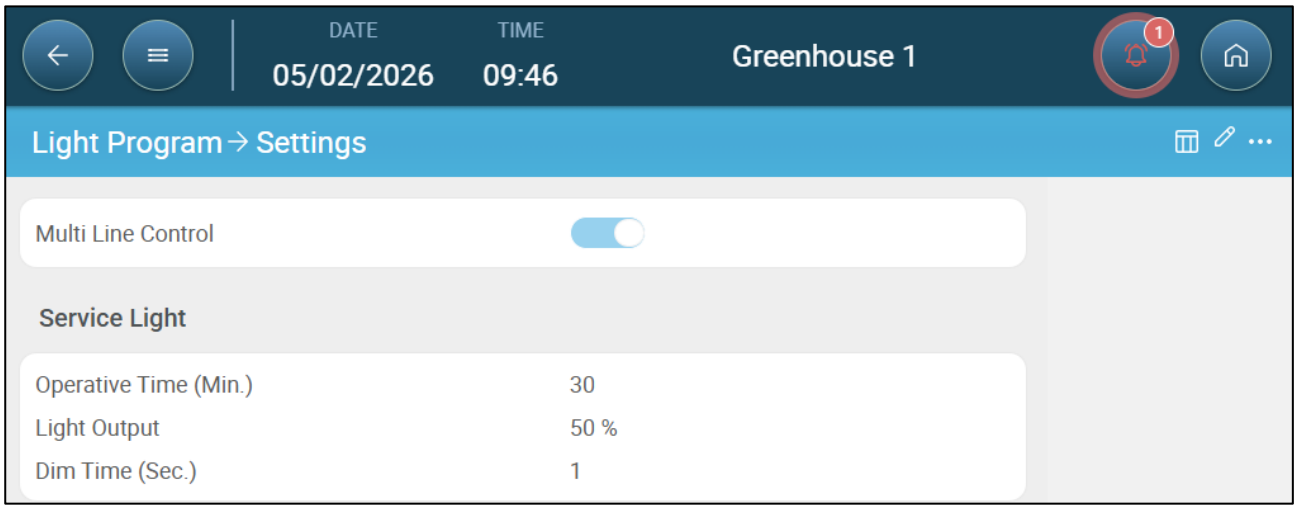
To define the Service Light functionality:

1. Go to Control › Light › Settings.
2. Define the parameters.
   - On/Off lights:



- Operative Time (Min.): Define the amount of time (in minutes) that the lights remain on. Range 1 – 120. Default: 30

- 0 – 10 volt lights:



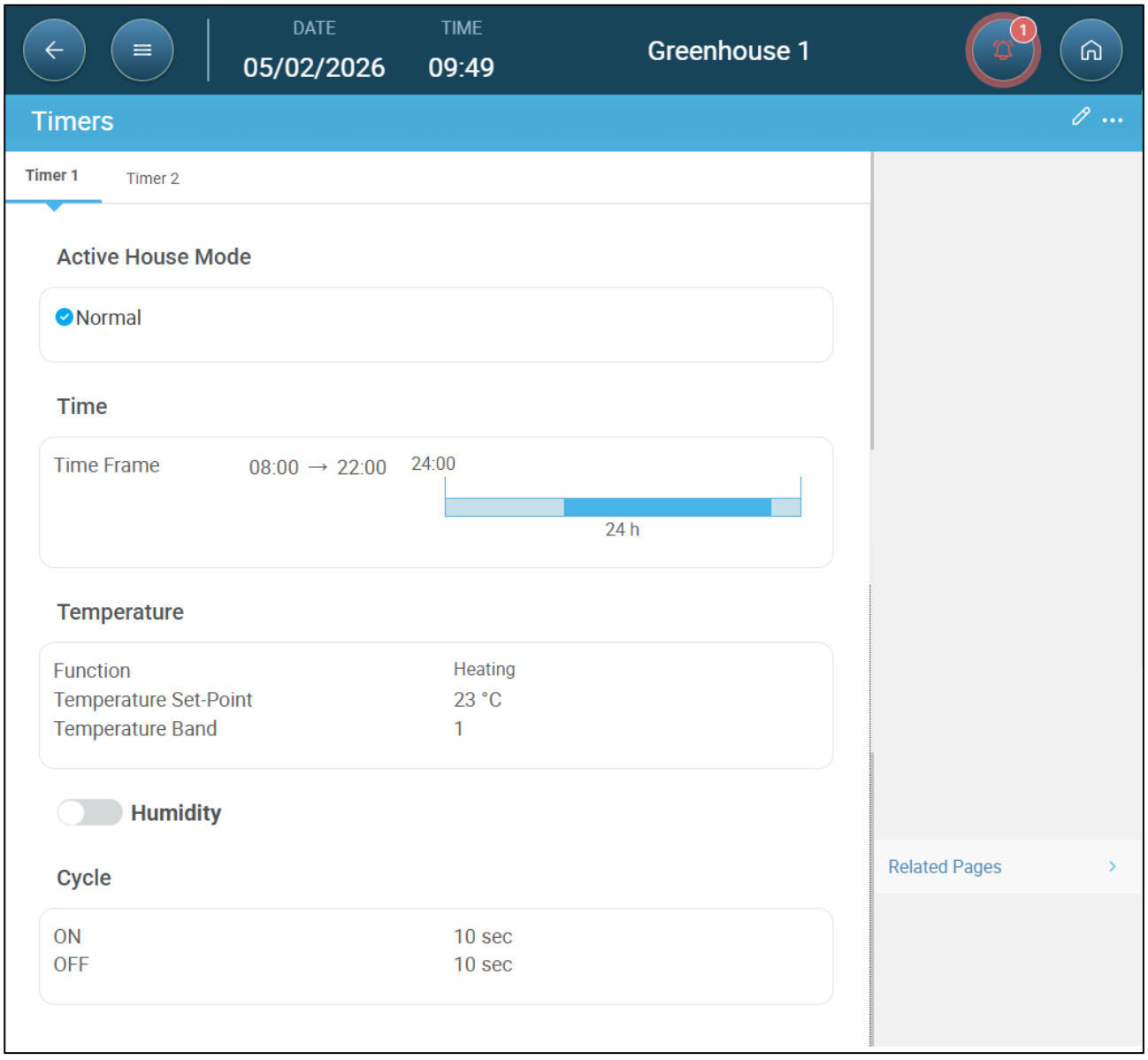
- Operative Time (Min.): Define the amount of time (in minutes) that the lights remain on. Range 1 – 120. Default: 30
- Light Output: Define the lights' output (in percentages). Range: 10 – 100. Default: 50
- Dim Time (Sec.): Define the amount of time that the lights require to power up to light output level and to power down to the programmed level.

10 Timers

Timers provide an additional method of controlling relay devices, namely setting a timetable in which the device can operate. In addition to the timetable, Trio 20 enables controlling device operation according to:

- time range
- temperature
- humidity
- time cycle

Trio 20 supports up to five timers.



10.1 Timer Configuration

➲ **Define at least one relay as a timer in Devices and Sensors.**

1. In Control > Timers, click edit, and define a timer as Active.

NOTE Disabling a timer is a useful tool when

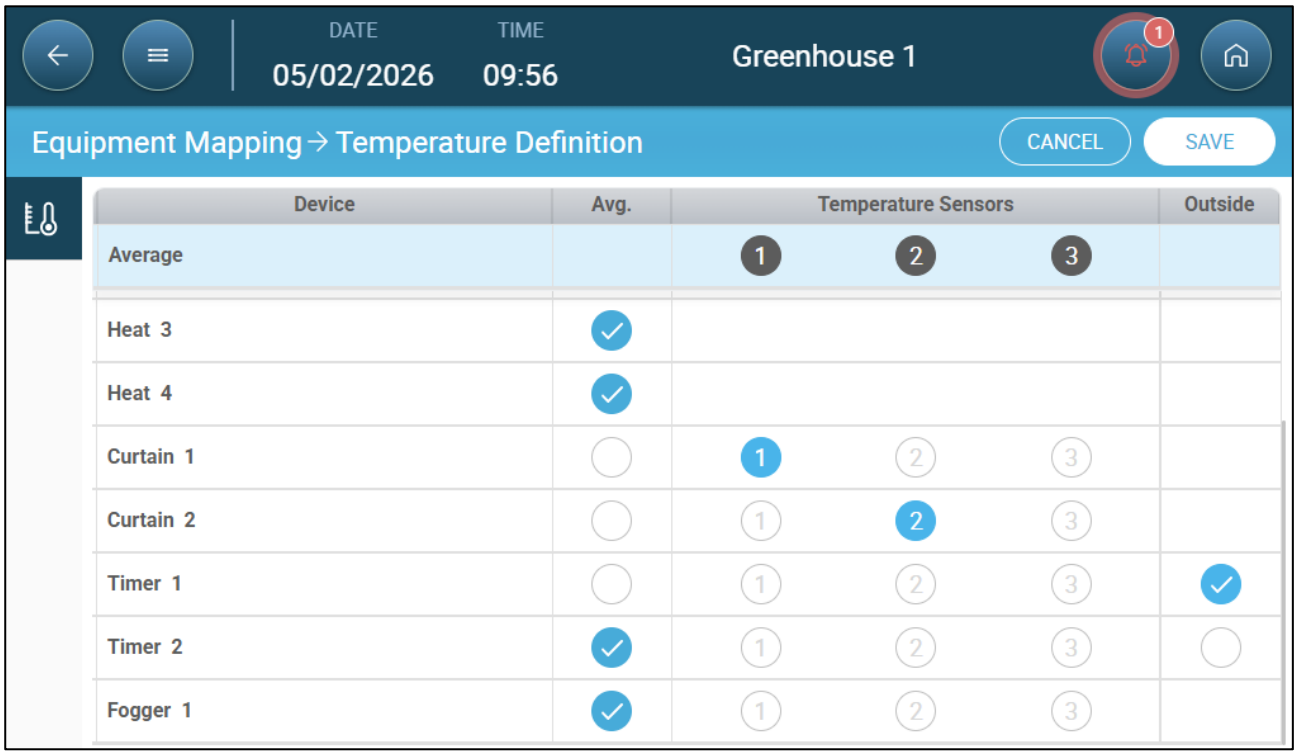
2. Define for each timer:
    - **Active House Mode**: Define in which mode each timer can operate.
    - **Time**: Timers can run 24 hours a day or in user-defined time frames. Define up to four time frames for each timer.
    - **Temperature (optional)**: This function enables controlling devices according to temperature. If enabled, define:
        - Function: Define the timer control mode:
            - Cooling: The timer operates when the temperature rises above the set point plus the band and continues to operate until the temperature drops below the set point. If the temperature set point is 23° and the set point is 5°, the timer operates when the temperature rises above 28° and stops when the temperature drops below 23°.
            - Heating: The timer operates when the temperature drops below the set point minus the band and continues to operate until the temperature rises above the set point. If the temperature set point is 23° and the set point is 5°, the timer operates when the temperature drops to above 18° and stops when the temperature rises to 23°.
        - Temperature Set-Point: Define the target temperature. Range: -40° to +90° C/ -40.0 to +193.0° F. Default 23° C/32.0° F
        - Temperature Band: The temperature band defines the range in which the timer operates. Range 0 to 10° F. Default 1° C/2° F.
    - **Humidity**: This function enables controlling devices according to humidity. If enabled, define:
        - Function: Define the timer control mode:
            - Dehumidify: The timer operates when the humidity rises above the humidity set point plus the band and continues to operate until the humidity drops to the set point. If the humidity set point is 60% and the set point is 2, the timer operates when the humidity rises above 62% and stops when the humidity drops below 60%.
            - Humidify: The timer operates when the humidity drops below the set point minus the band and continues to operate until the humidity rises to the set point. If the humidity set point is 60% and the set point is 2, the timer operates when the humidity drops below 58% and stops when the humidity rises to 60%.
        - Humidity Set-Point: Define the target humidity. Range: 0 – 100%. Default: 60%.

- Humidity Band: The humidity band defines the range in which the timer operates. Range 0 to 10%. Default 2%

- Cycle: If enabled, define the cycle times. The timer operates using the cycle defined here. Range: 0 – 999 seconds (optional). For the cycle to activate, other conditions (temperature/humidity/time) must be fulfilled.

10.2 Outside Temperature Sensor and Timers

As an option, timers can be mapped to an outside temperature sensor. Go to System › Equipment Mapping › Temperature Definition.



- If an outside temperature sensor is enabled, map the timer(s) to it (optional).

11Alarms

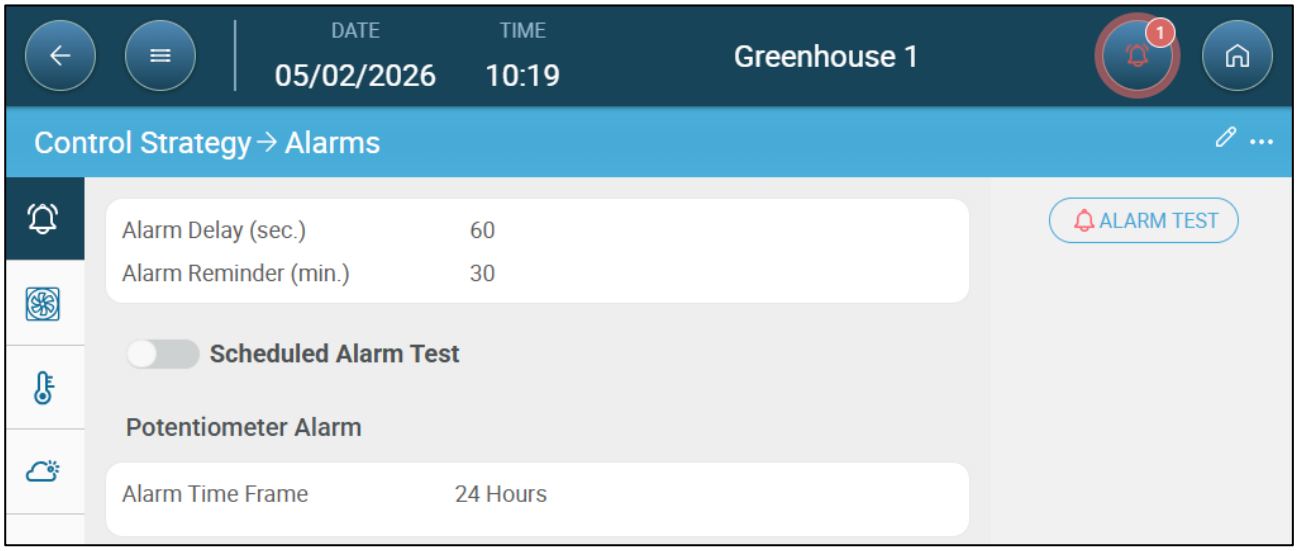
- Defining the Alarm Parameters
- Viewing the Alarms
- Defining the Auxiliary Alarms
- Sending a General Alarm

11.1 Defining the Alarm Parameters

- Alarm Definitions
- Alarm Test

11.1.1 ALARM DEFINITIONS

1. Go to System › Control Strategy › Alarms .



NOTE Potentiometer only appears if these devices are mapped. Refer to Devices and Sensors.

2. Define:
   - Alarm delay: After detecting that a parameter has gone above or below its specs, Trio 20 waits this amount of time before sending an alarm. This prevents sending alarms for short deviations. Range: 0 – 999 seconds.
   - Alarm Reminder: Trio 20 will resend an alarm after this amount of time if the alarm is not acknowledged. Range: 0 – 999 minutes.
   - Potentiometer: Enable Potentiometer Alarm: Trio 20 will send an alarm if potentiometer-controlled curtains are not opening to the required levels. Define the period in which the alarm is active, 24 hours a day or specific time frames.

11.1.2 ALARM TEST

The alarm test confirms that the alarm system is functioning properly. A test can be performed manually at any time or scheduled weekly or daily.

- Manual Test
- Scheduled Tests

11.1.2.1 Manual Test

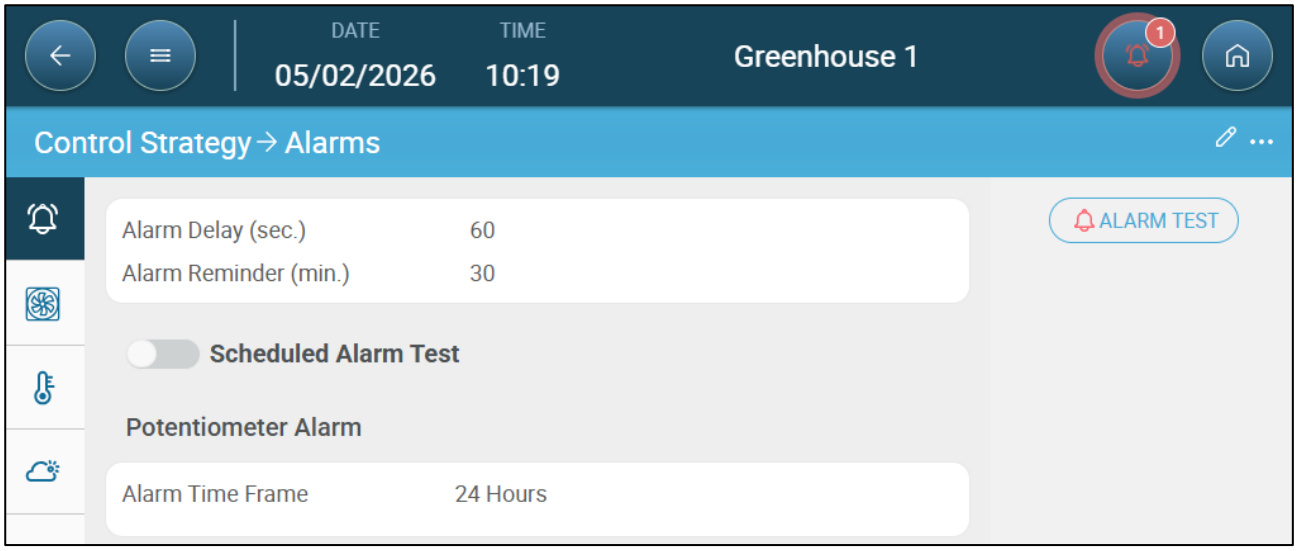
- Click 

. Stop the test as needed.

11.1.2.2 Scheduled Tests

Scheduled tests can be performed once a day only.

1. On the Alarm Screen, enable Scheduled Alarm Test.

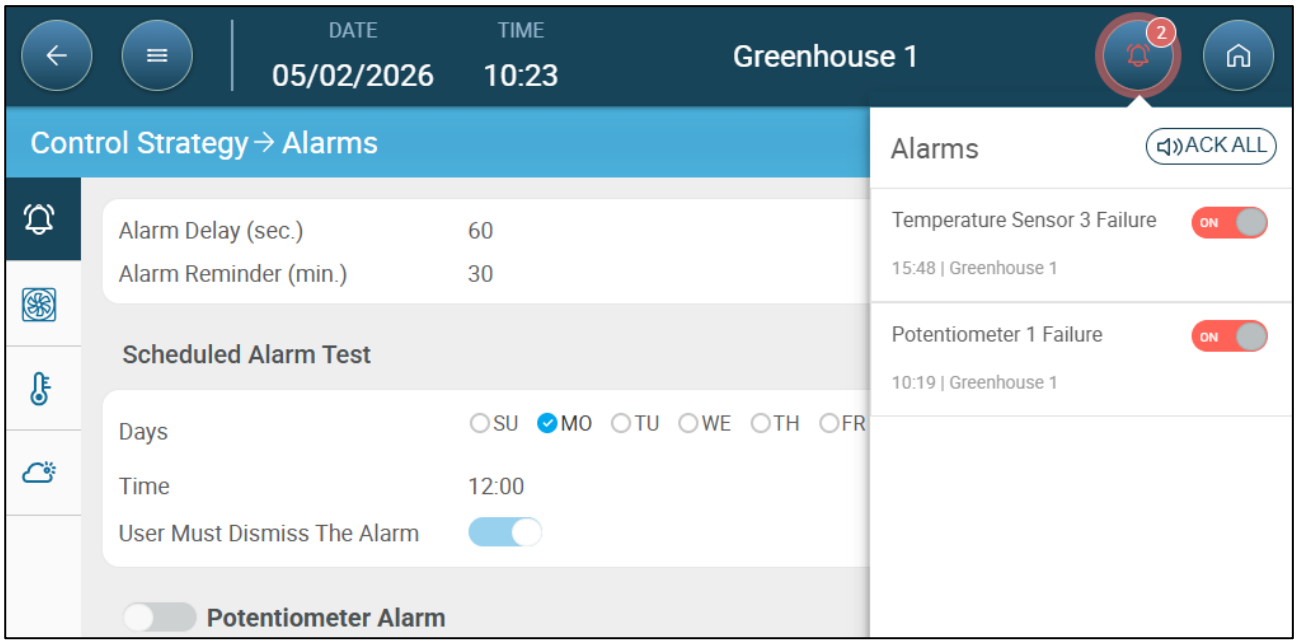


2. Define:
    - The day(s) and time at which the test is performed.
    - User Must Dismiss The Alarm:
        - When enabled, the user must acknowledge the alarm. The alarm remains active until acknowledged.
        - When disabled, the alarm stops after a specified amount of time (Self-Dismiss After (sec.).

NOTE Testing takes place at the scheduled time. If there is a delay for any reason (for example, a power outage), the test will not take place more than five (5) minutes after the scheduled time.

11.2 Viewing the Alarms

- On the Main Menu bar, click  .



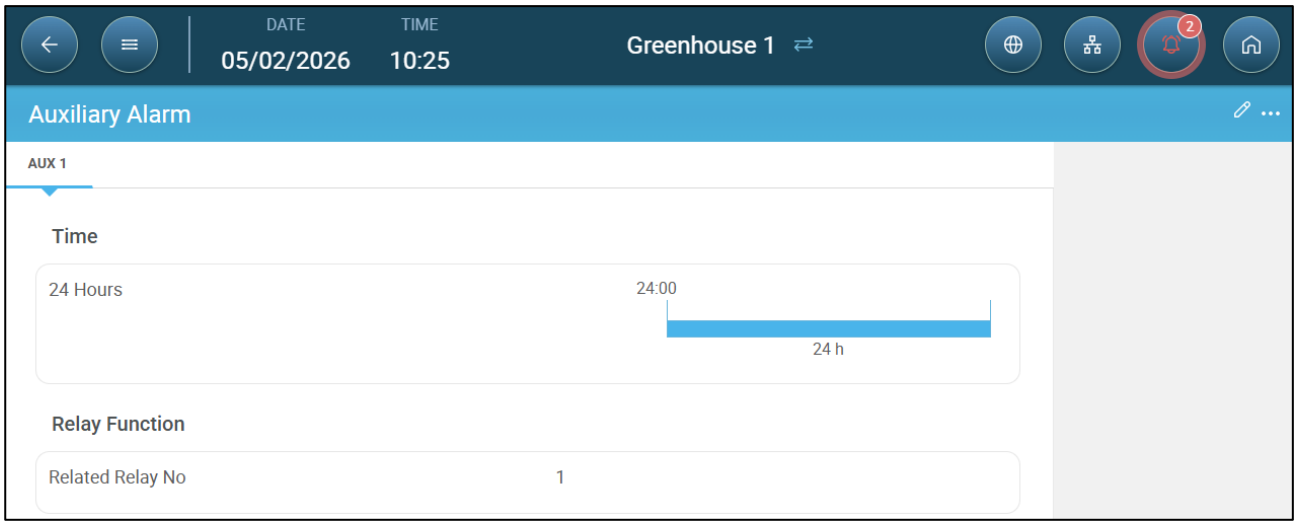
- Click  to acknowledge all alarms or acknowledge each one as required.

11.3 Defining the Auxiliary Alarms

The auxiliary alarm provides an additional method for adding alarm functions to specific relays. This function compares the relay's current state to its defined state (normally open, normally close). If the relay is not in its defined state, Trio 20 sends an alarm. You can define the auxiliary alarms to operate during specific time periods. Use this alarm for those relays controlling important functions.

➲ Define at least one sensor as an auxiliary input in Devices and Sensors.

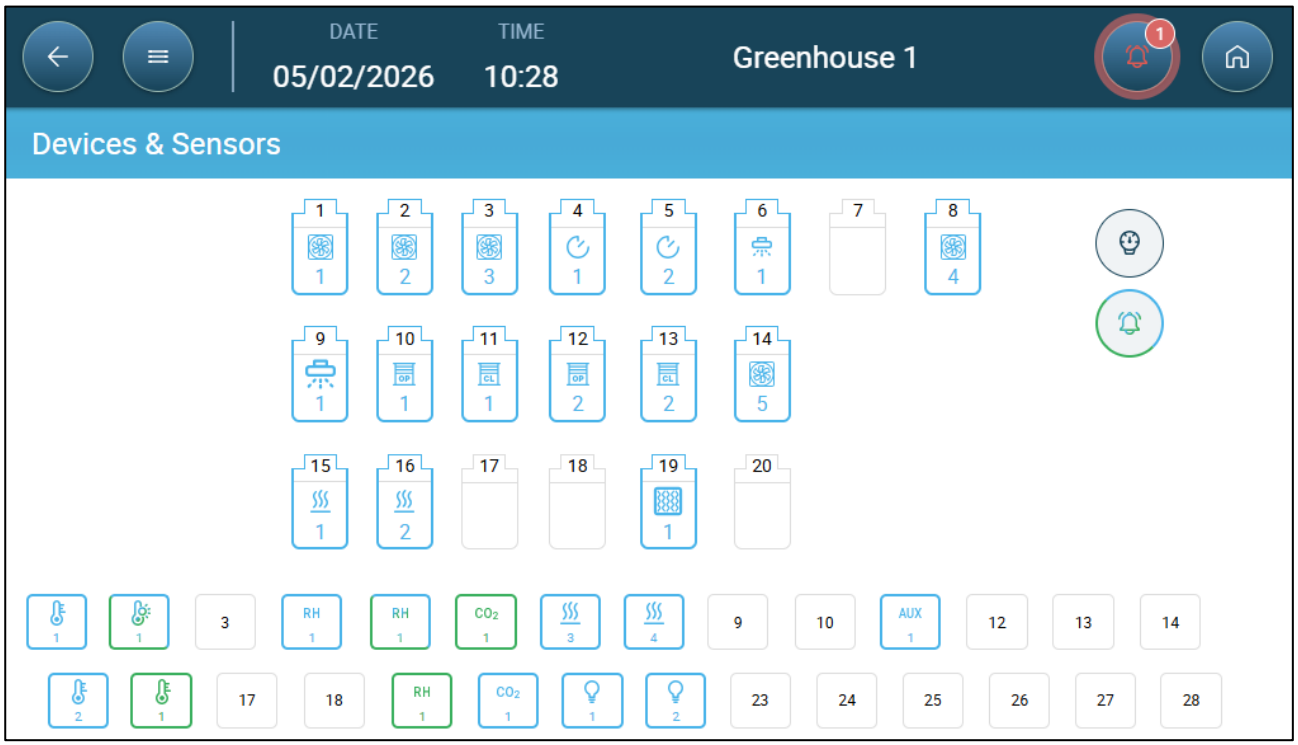
1. Go to Control › Auxiliary Alarm



2. In Control › Auxiliary Alarm, click edit, define an alarm as Active.
3. Define:
    - Time Frames: Define the time frame, either 24 hours a day or specific time frames.
    - Relay Function: Enable this function. Define the relay being monitored. When this relay is no longer in its defined state (normally open, normally closed) an alarm is sent.

11.4 Sending a General Alarm

1. Go to System › Device and Sensors.



2. Click  .

An alarm is sent to everyone on the contact list.

12 History

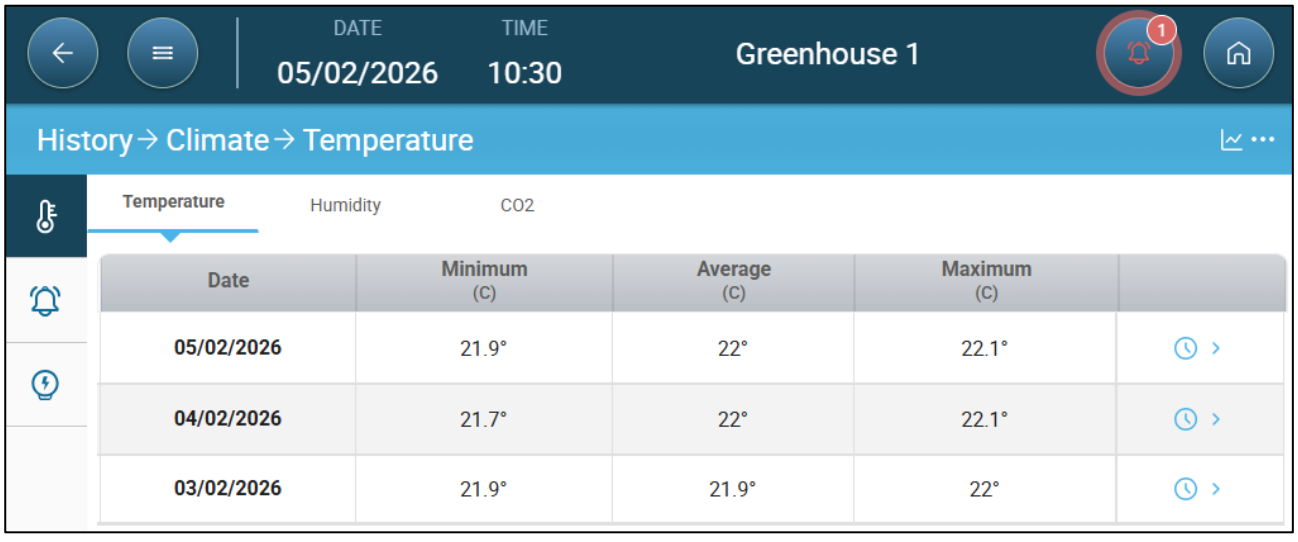
- A Trio 20 controller saves:
  - 150 growth days of history data (minimum).
  - Up to 365 growth days of history data (estimated maximum)
- TrioAir saves data on the server for an unlimited amount of time.
- Starting a new crop erases all history data.
- The alarm and events history table can store up to 2000 items.

- Climate and Air Quality
- Alarms and Events
- Heating and Cooling History
- Exporting History Data

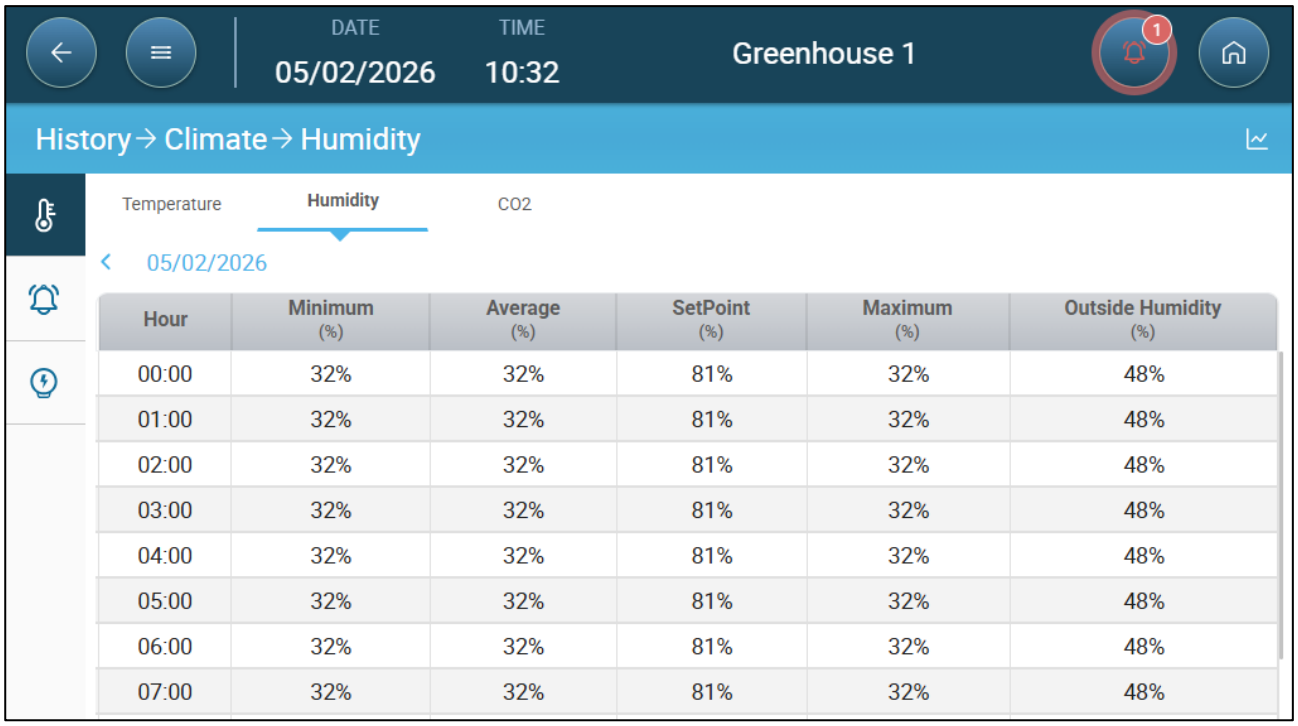
12.1 Climate and Air Quality

1. Go to Season › History › .
2. Click the relevant tab to see its history.

NOTE The History screen only shows the history of installed sensors.

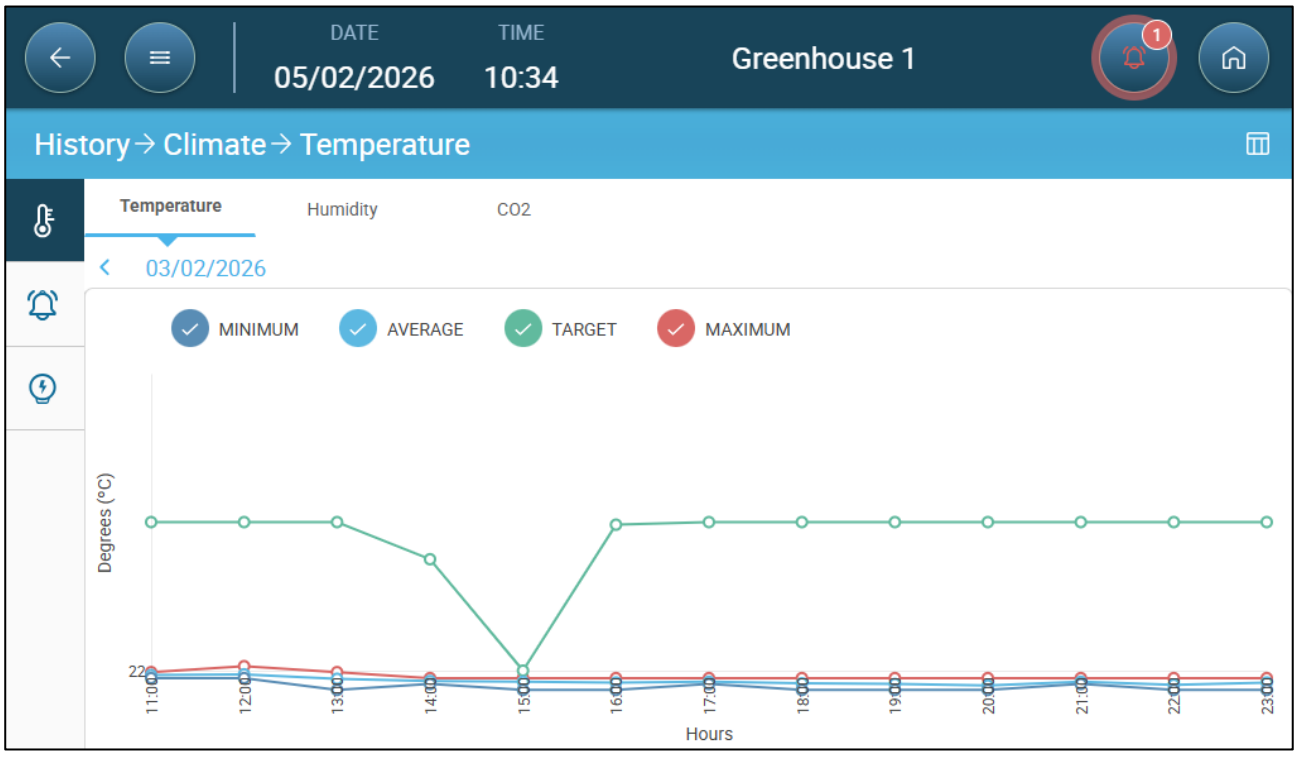


- Temperature History: Records the average, minimum and maximum temperature for each growth day every hour
- Humidity History: Records the average, minimum and maximum humidity for each growth day every hour.
- Co2 History: Records the average, minimum and maximum Co2 for each growth day every hour.
- Click the clock symbol ( ) to view the hourly breakdown.



Hour	Minimum (%)	Average (%)	SetPoint (%)	Maximum (%)	Outside Humidity (%)
00:00	32%	32%	81%	32%	48%
01:00	32%	32%	81%	32%	48%
02:00	32%	32%	81%	32%	48%
03:00	32%	32%	81%	32%	48%
04:00	32%	32%	81%	32%	48%
05:00	32%	32%	81%	32%	48%
06:00	32%	32%	81%	32%	48%
07:00	32%	32%	81%	32%	48%

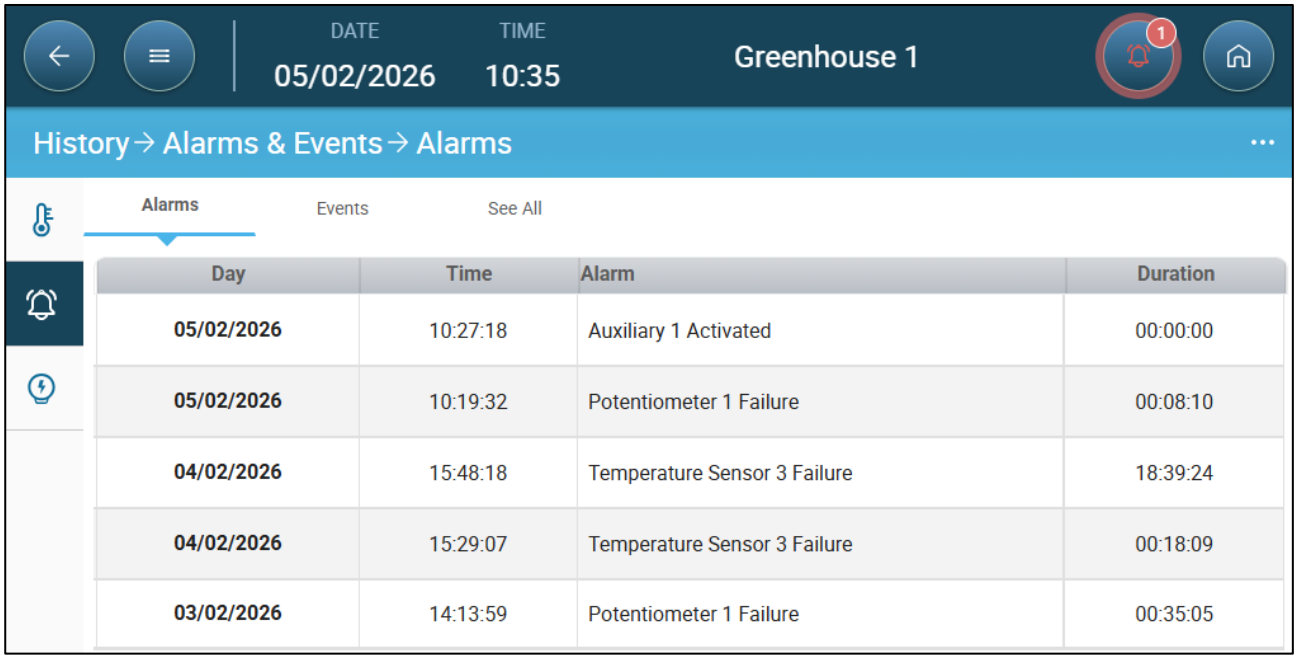
- In the above table, data points are displayed on an hourly basis.
- Click the Graph icon to view the data in a graph format. In these graphs data points are generated every 15 minutes (Version 9).



12.2 Alarms and Events

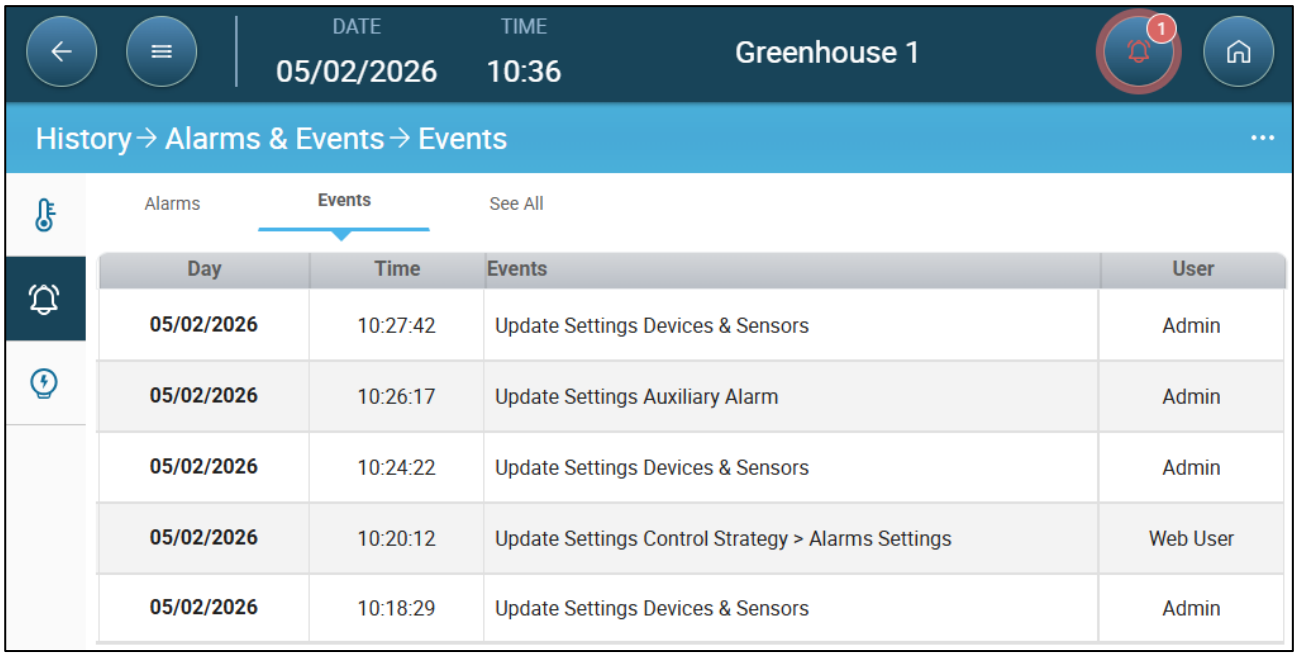
Go to this screen to view the last 999 alarms and events. Performing a Cold Start or Starting a new group clears the Alarm History.

1. Go to Season › History › .
2. Click the relevant tab.



NOTE History displays installed devices only.

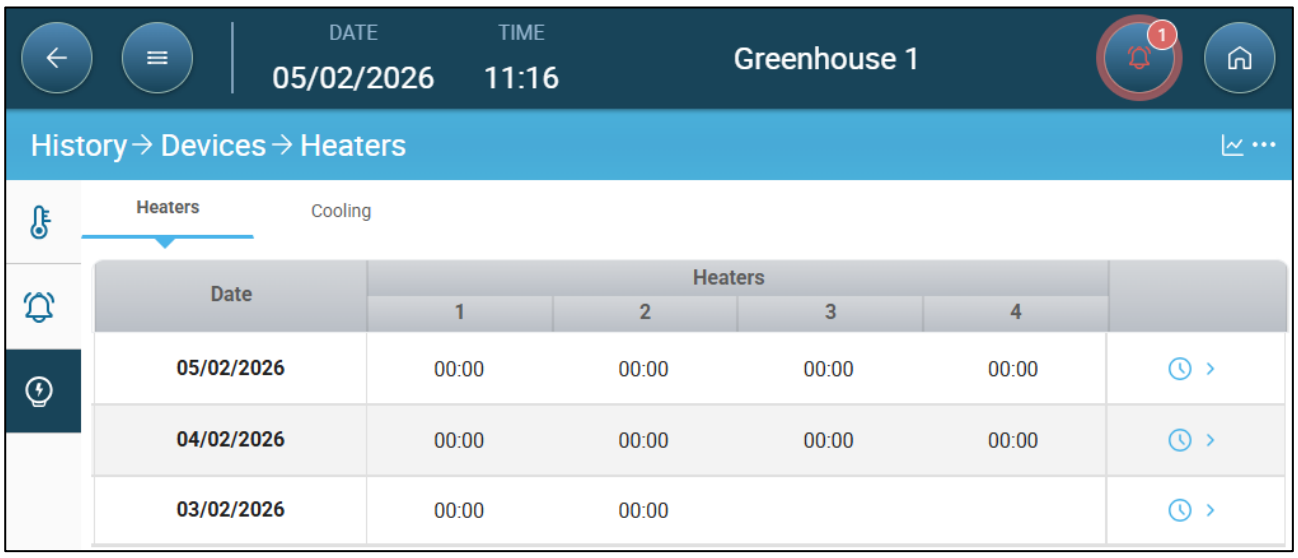
- Alarm Description
  - Unknown Alarm
  - High Temperature
  - Sensor # High Temperature
  - High Co2
  - Low Pressure
  - Water Overflow
  - Outside Temperature Failure
  - Humidity Sensor Failure
  - Ammonia sensor failure
  - Potentiometer # Failure
  - Alarm Test
  - CPU Low Battery
  - Low Temperature
  - Sensor # Low Temperature
  - High humidity
  - High Ammonia
  - High Pressure
  - Water Shortage
  - Temperature Sensor # Failure
  - Co2 Sensor Failure
  - Pressure Sensor Failure
  - Auxiliary # Activated
  - Insufficient Air Supply
  - Emergency Temperature



12.3 Heating and Cooling History

Records the heaters and cooling pad devices run time (in minutes) for each growth day in 24H resolution. This information gives the opportunity to investigate and verify if the runtime of a device performs as expected.

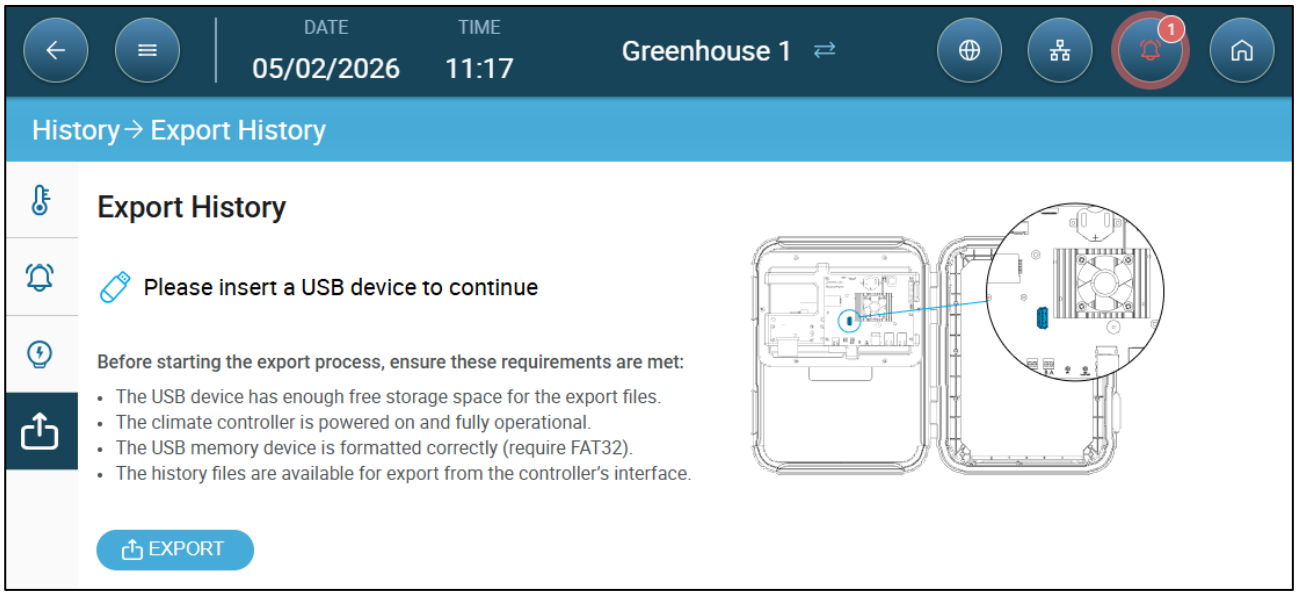
- Go to Season › History ›  .



12.4 Exporting History Data

Version 9.0 enables exporting history data to a USB device (flash drive). Data points are generated every 15 minutes.

1. Go to Season › History › Export History  . The following screen appears.



2. Insert a USB drive into the port as indicated and click **Export**.
3. Once the process is complete, remove the USB drive.

A directory containing excel files has been created on the drive.

13 Resetting, Saving and Loading Settings, Updating Software

Resetting means erasing the tables and current product definitions. Once the settings have been erased, the user can manually reconfigure the Trio 20 or load settings from a USB device.

- Resetting the Settings
- Resetting the Trio CPU and Sensor Connections
- Updating the Software
- Viewing the Log
- Updating the Software

13.1 Resetting the Settings

CAUTION *Do not disconnect the power while resetting the unit. Any disconnection can cause severe hardware damage.*

To reset the Trio 20:

1. Go to System > General Settings.
2. Click  .
3. Click 

.
4. Follow the on-line instructions. You have the option of backing up the settings.

13.2 Resetting the Trio CPU and Sensor Connections

There are two ways to reset the Trio 20 unit, depending on what is required.

- To reset the CPU and the user interface, press the button shown in Figure 7: CPU Reset Button.
- To reset the unit's connection to the sensors, press the button shown in Figure 8.

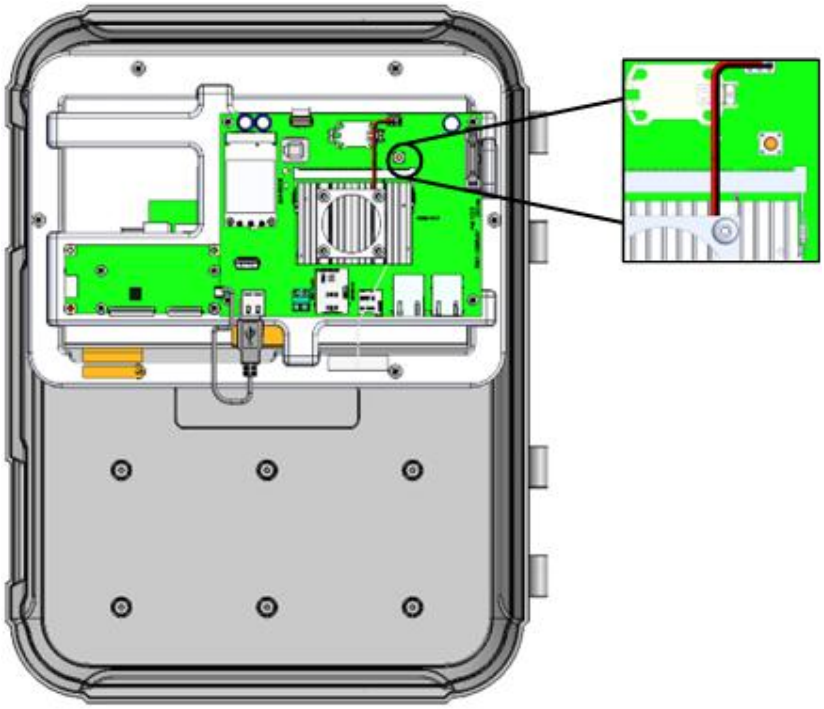


Figure 7: CPU Reset Button

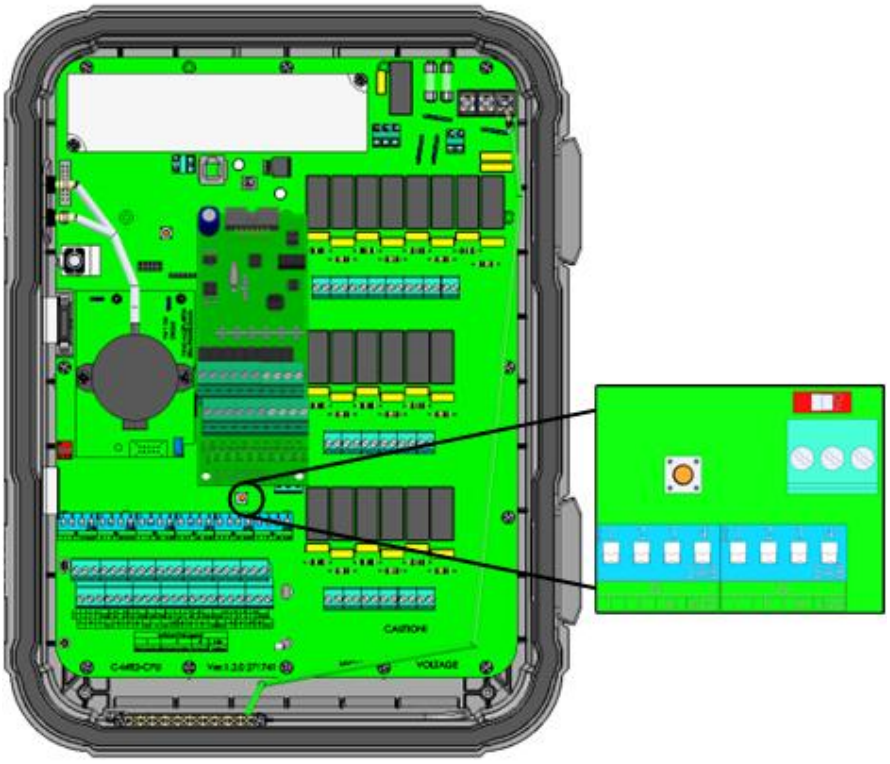
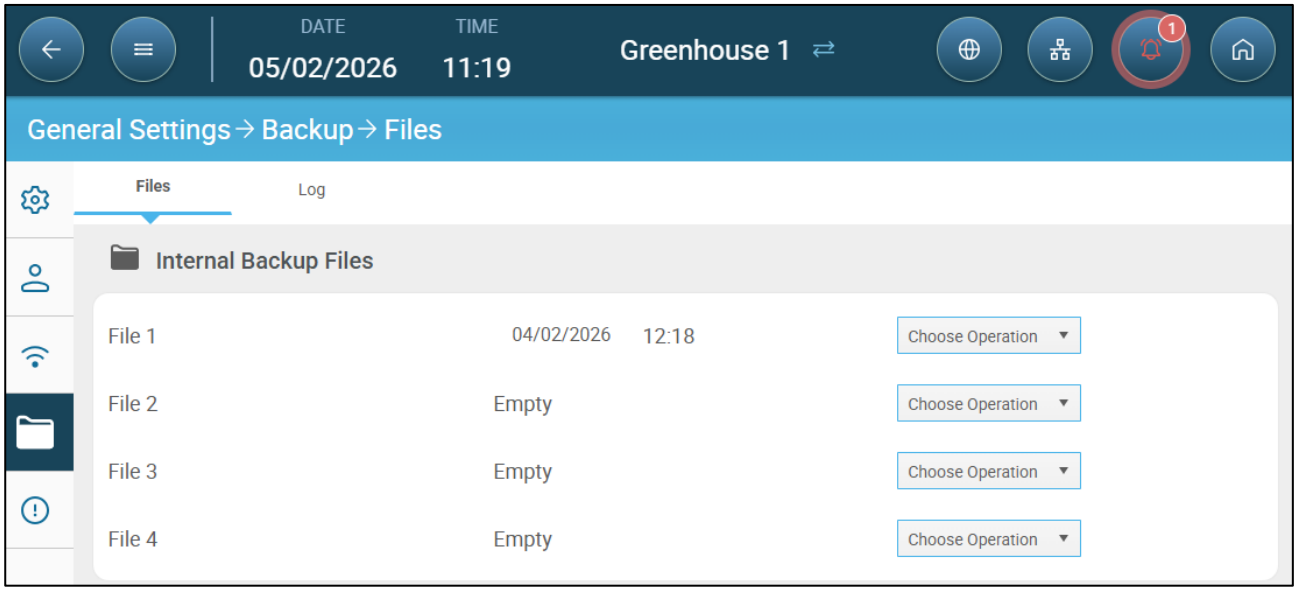


Figure 8: Connection to Sensors Reset

13.3 Saving or Loading the Settings

1. Go to System › General Settings › .

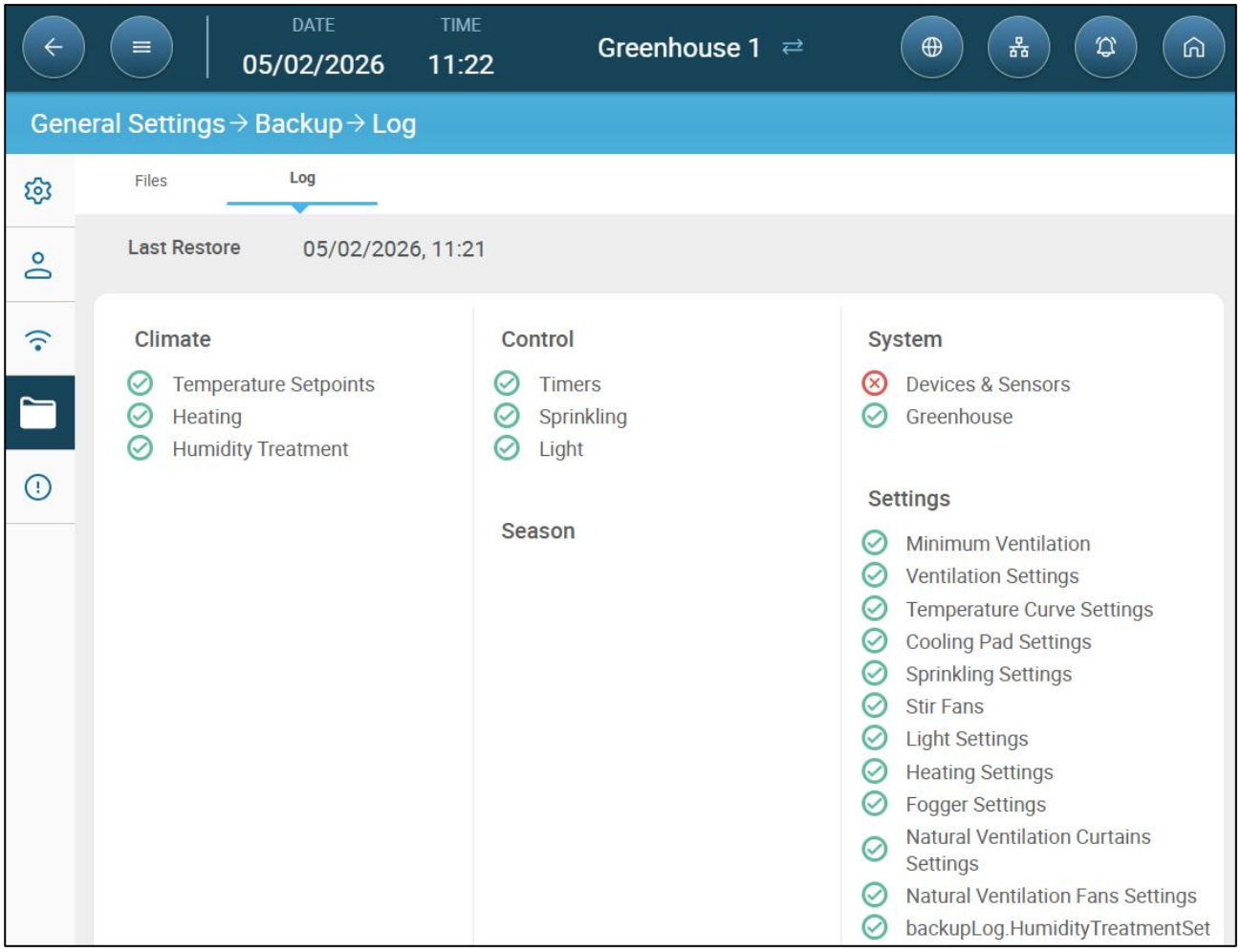


2. Click Choose Operation and select Load Settings, Save Settings, or Delete File.
3. Follow the instructions.

NOTE In Choose Operation, you can also delete a backed-up file.

13.4 Viewing the Log

The log displays which tables were successfully saved.



13.5 Updating the Software

CAUTION *Do not disconnect the power while updating the software. Any disconnection can cause severe hardware damage.*

To update the Trio 20 Software:

1. Go to System › General Settings.
2. Click  .
3. In Software Version, click **Update**.
4. Follow the on-line instructions.

14 Warranty

Warranty and technical assistance

Munters products are designed and built to provide reliable and satisfactory performance but cannot be guaranteed free of faults; although they are reliable products they can develop unforeseeenable defects and the user must take this into account and arrange adequate emergency or alarm systems if failure to operate could cause damage to the articles for which the Munters plant was required: if this is not done, the user is fully responsible for the damage which they could suffer.

Munters extends this limited warranty to the first purchaser and guarantees its products to be free from defects originating in manufacture or materials for one year from the date of delivery, provided that suitable transport, storage, installation and maintenance terms are complied with. The warranty does not apply if the products have been repaired without express authorisation from Munters, or repaired in such a way that, in Munters' judgement, their performance and reliability have been impaired, or incorrectly installed, or subjected to improper use. The user accepts total responsibility for incorrect use of the products.

The warranty on products from outside suppliers fitted to Trio 20 Green, (for example antennas, power supplies, cables, etc.) is limited to the conditions stated by the supplier: all claims must be made in writing within eight days of the discovery of the defect and within 12 months of the delivery of the defective product. Munters has thirty days from the date of receipt in which to take action, and has the right to examine the product at the customer's premises or at its own plant (carriage cost to be borne by the customer).

Munters at its sole discretion has the option of replacing or repairing, free of charge, products which it considers defective, and will arrange for their despatch back to the customer carriage paid. In the case of faulty parts of small commercial value which are widely available (such as bolts, etc.) for urgent despatch, where the cost of carriage would exceed the value of the parts, Munters may authorise the customer exclusively to purchase the replacement parts locally; Munters will reimburse the value of the product at its cost price.

Munters will not be liable for costs incurred in demounting the defective part, or the time required to travel to site and the associated travel costs. No agent, employee or dealer is authorised to give any further guarantees or to accept any other liability on Munters' behalf in connection with other Munters products, except in writing with the signature of one of the Company's Managers.

WARNING: In the interests of improving the quality of its products and services, Munters reserves the right at any time and without prior notice to alter the specifications in this manual.

The liability of the manufacturer Munters ceases in the event of:

- dismantling the safety devices;
- use of unauthorised materials;

- inadequate maintenance;
- use of non-original spare parts and accessories.

Barring specific contractual terms, the following are directly at the user's expense:

- preparing installation sites;
- providing an electricity supply (including the protective equipotential bonding (PE) conductor, in accordance with CEI EN 60204-1, paragraph 8.2), for correctly connecting the equipment to the mains electricity supply;
- providing ancillary services appropriate to the requirements of the plant on the basis of the information supplied with regard to installation;
- tools and consumables required for fitting and installation;
- lubricants necessary for commissioning and maintenance.

It is mandatory to purchase and use only original spare parts or those recommended by the manufacturer.

Dismantling and assembly must be performed by qualified technicians and according to the manufacturer's instructions.

The use of non-original spare parts or incorrect assembly exonerates the manufacturer from all liability.

Requests for technical assistance and spare parts can be made directly to the nearest Munters office.