AGROWTEK
Technology to Help You Grow

GrowControl™ GCX

Cultivation Control Systems

KEEP THESE INSTRUCTIONS

Contents

Glossary of Terms

Commonly used terms in this manual that are specific to the GrowControl™ system.

Address: Every GrowNET™ device that is added to the GCX system is assigned an "address" number (1, 2, 3, etc.) which is permanently saved in the device's memory. The device must be de-comissioned or reset (using the device's reset button) to erase the address from the device.

Analog: A signal that is variable in nature (0-5V, 0-10V, 4-20mA, etc.) and may be an input signal from a sensor or an output signal from a module to control light intensity or fan speed for exmple.

Bus: GCX+ controllers have two busses (bus 0 and bus 1). The right hand bus is 0, left hand bus is 1. Each bus can support up to 100 device addresses.

CAT5, CAT6: Type of cable used for Ethernet or GrowNET™ connections. This is commonly referred to as Ethernet cable or network cable. Category 5, 5E or 6 are acceptable cable types for GCX control systems.

Deadband: Amount of drift from a target set point that is allowed before the system takes corrective action.

Digital: A signal type which typically has a serial message protocol to communicate information between devices. For example: some light fixtures use digital communication instead of analog 0-10V signals for dimming or spectrum control.

Discrete: A signal that is either on or off in nature (true or false) and may be an input signal from a sensor (such as a float switch) or an ouput signal from a module to control a piece of equipment such as a fan or pump.

Function: Controls (control functions) tell the control system what to do. The user adds the desired control functions to the controls workspaces and then configures rules within the functions.

GrowNET™ Device: Agrowtek manufactured components that connect to GCX control systems such as relay modules, climate sensors, dosing pumps, etc.

GrowNET™ Network: Consists of a GCX controller, communication hubs, and GrowNET™ devices connected together using standard CAT5/RJ-45 cabling .

Output: A physical output (relay contact, dosing pump, etc.) that the system can operate from a control function.

Rule: A rule exists within a function. Many rules can be created within a single function in order to provide different set points through out the day or through out the growth cycle.

RJ-45: The type of cable connection that is used on GrowNET™ devices; commonly referred to as an Ethernet plug or jack. It is the same connection used for standard CAT5/5E/6 cables. The standard wiring on GrowNET connections is 568B.

Overview
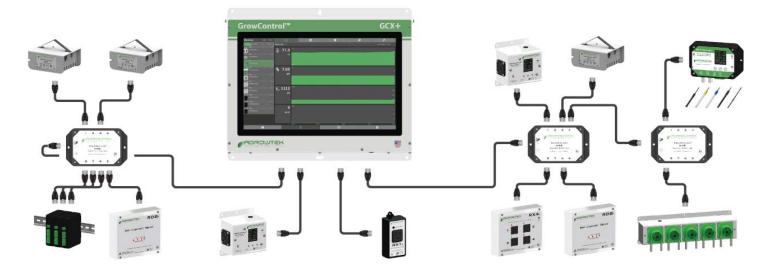
GrowControl™ GCX Cultivation Control Systems can manage nearly every aspect of a facility's environment and water management with extensive and intuitive programming capabilities. Sensors and inputs are monitored, control logic is executed, and output devices are operated. Alarm conditions can be set to notify users of a fault or problem condition by email or text message, and data logs are stored on the system that can be exported by email or USB.

GrowNET™ Devices

A large variety of 'GrowNET™' plug-and-play peripherals are available to sense and control the environment including:

- Environment Sensors (temperature, humidity, light, co2, etc.)
- Hydroponics Sensors (pH, conductivity, ORP, etc.)
- Peristaltic Dosing Pumps
- Control Relays
- DIN Rail I/O Modules

GrowNET™ devices connect using standard CAT5 Ethernet cable and RJ-45 connections. HX8 GrowNET™ Hubs expand one GrowNET™ port into eight more ports. HX8 hubs provide power to the devices from the hub ports, further simplifying installation. *Recommended maximum cable length is 1000ft.*

Standard Control Functions

- Clock Timers
- On/Off Delay Timers
- Cycle Timers
- Thermostats
- Humidistats
- Photostats/Light Dimming Controls
- CO2 Injection/Exhaust

- Motor Position Controls (Vents/Shades/Curtains)
- Irrigation Stage Timers
- Tank Level (Refill) Control
- Nutrient & pH Dosing
- Sensor Averaging
- Alarms
- Logic

Typical Room Equipment

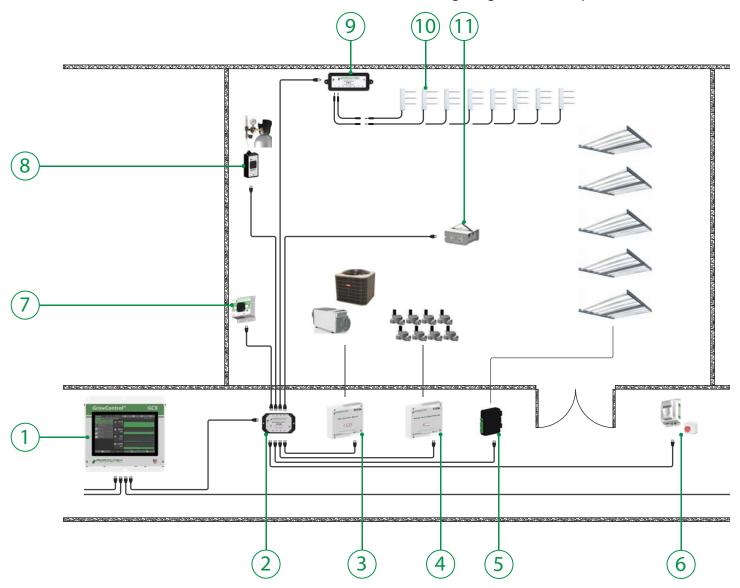A typical growing environment features sensors to bring information about the environment into the controller. User configured rules act on the sensor data to control equipment in the environment through output devices. A standard growing environment with climate control, CO2 injection and alarming, irrigation valve control with media moisure content sensors and dimmable lighting control is depicted below.

1. GCX Controller   One controller operates the entire facility in most cases.
2. HX8 Hub   HX8 hubs split the RJ-45 GrowNET connections from the controller to devices. One HX8 is usually located outside of each growing environment.
3. RD8i Dry Contacts   Dry contacts control HVAC, Humidifiers, Dehumidifiers and other equipment.
4. VX8i Valve Controller   Operates up to 8 irrigation valves with included power supply.
5. DXV4 or LXD   Lighting interface for 0-10V dimmable lights or digital lighting protocols.
6. AXG Gas Alarm   Horn Strobe module with purge button for CO2 gas alarming and room purge.
7. SXG Gas Sensor   CO2 Gas sensor for wall mounting near ground levels for CO2 alarming.
8. RX1i Outlet   Single outlet relay used for CO2 valves, fans and other misc. 120V equipment.
9. HXT hub   Teros 12 moisture sensor hub for eight (8) T12 sensors.
10. Teros 12   Soil moisture and conductivity sensors for crop steering.
11. SXC Climate Sensor   Integrated precision sensor for temperature, humidity, light, CO2 and IR.
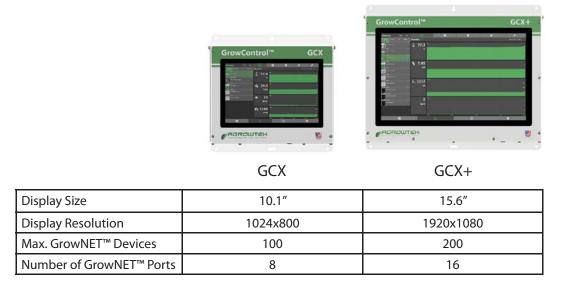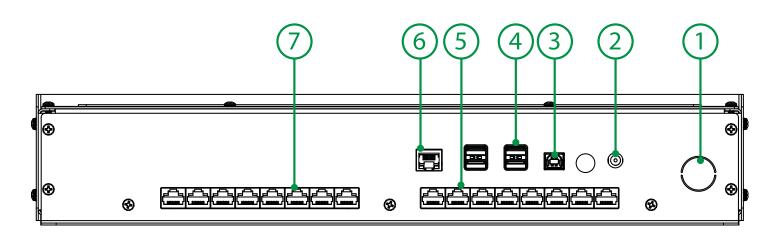
Physical Features

GrowControl™ GCX controllers are high performance Linux based systems with industrial flash hard drive for security and reliability. High performance quad-core processor with passive cooling technology means the system runs smooth and silent. High definition tempered glass touch screen offers brilliant resolution and excellent touch response.

GCX   GCX+

Display Size	10.1"	15.6"
Display Resolution	1024x800	1920x1080
Max. GrowNET™ Devices	100	200
Number of GrowNET™ Ports	8	16

Connections

1. Conduit Knock-Out   Knock-out for hard-wired DC power input connection.
2. Power Input Jack   Barrel jack connection for DC power input.
3. USB Slave Port   Slave port for boot loader; loading system firmware image from USB host.
4. USB Host Ports   USB Ports for WIFI, memory sticks, and other USB accessories (4 ports.)
5. GrowNET™ Ports   8-port, 100 device GrowNET™ bus 0 (RJ-45.)
6. Ethernet   10/100 Industrial Ethernet for Internet connection

GCX+ Only
7. GrowNET™ Ports   8-port, 100 device GrowNET™ bus 1.

Dimensions, GCX

11.92

3.27

11.05

10.42

10.50

Dimensions, GCX+

17.92

3.27

14.42

13.80

16.50

Installation Instructions

⚠ **READ & UNDERSTAND ENTIRE MANUAL PRIOR TO INSTALLATION OR OPERATION.**
Failure to read, understand and comply with warnings and installation requirements may result in property damage, personal injury or death.
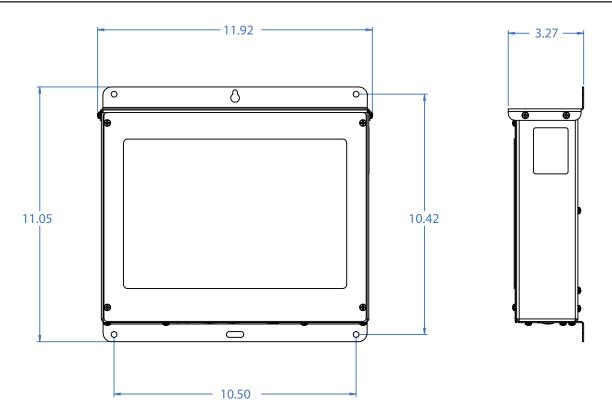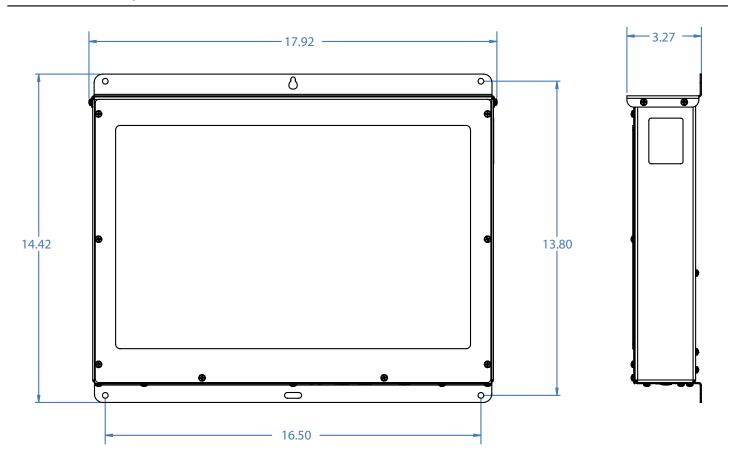
⚠ **THIS PRODUCT IS NOT INTENDED FOR LIFE SAFETY APPLICATIONS.**
Do not install in hazardous locations or rely soley on this equipment for control over life safety.

Warnings & Precautions

⚠ **INSTALL IN ACCORDANCE with all national and local plumbing and electrical codes.**

Information in this manual is intended for use by individuals possessing adequate backgrounds of electrical and mechanical experience and who comply with all federal, state, and local laws, rules, orders, or regulations related to the installation, service, or repair of electrical, HVAC and related equipment. Any attempt to install, service, or repair equipment may result in personal injury and/or property damage. The manufacturer or seller cannot be responsible for the interpretation of the information contained herein, nor can it assume any liability in connection with its use.

⚠ **DANGER: ELECTROCUTION HAZARD**
Disconnect power before maintenance or service on the system or system components to prevent equipment damage or electrical shock. Use caution when servicing plumbing to drain the system off away from electrical components and connections. Connect the system and components to GFCI fault protected energy sources to reduce risk of electric shock.

⚠ **INDOOR LOCATIONS ONLY**
This system is designed for indoor mounting only and must be protected from weather and direct sunlight.

⚠ **PREVENT OVER HEATING**
Keep air space around the system cool and ventilated to prevent overheating of system components.

Site Requirements

Electrical
The GCX system requires one 120Vac electrical outlet (GFCI fault protected recommended.) GCX systems are provided with low-voltage NRTL LISTED limited energy power supplies with a max power of 60W.

A hard-wire terminal block is available internally for connection to industrial power supplies.
Customer supplied power sources must be UL listed class-II / limited energy power supplies.

Battery Back-up
A Battery Back-up system is recommended to maintain power in the event of power interruptions and to provide clean power to the control system. Any components connected to the GCX controller's GrowNET™ ports will be powered by the controller (except dosing pumps and 120V outlet relays.)

Network
A 10/100 Ethernet connection is recommended if available. *WiFi is also available as an alternative to Ethernet.*

Mounting the Controller

The system should be securely mounted on an indoor vertical surface.

Follow these tips for the best results:
1. Locate the controller in a dry location away from direct sunlight and other heat sources.
2. Mount the location at a height that is easy to view and operate from a standing position.
3. Ensure the area around the controller can be kept clear and accessible.
4. Avoid locating the controller next to heavy electrical loads and equipment.

Use the holes in the top and bottom mounting flanges to secure the controller to the surface. It is recommended to trace the holes and drill pilot holes. Use a level to ensure the system is mounted straight.

⚠ **USE CAUTION** when installing screws and mounting the unit. Impacting the screen with a drill or screw driver or dropping the unit will cause serious damage to the unit.

⚠ **DO NOT OVER TIGHTEN** screws; enclosure is made out of corrosion resistant aluminum which can be bent easily. Use minimal toque when installing screws. Plastic washers are recommended to prevent damage to the paint.

⚠ **DO NOT DRILL HOLES** into the enclosure of any product. Damage to the unit may result and will not be covered under warranty. Only use the knock-outs provided in the bottom panel if necessary.

Device Connections

All GrowNET™ devices are connected using standard CAT5 Ethernet cable with RJ-45 connections (568B.)

Devices can be connected directly to the GrowNET™ ports on the bottom of the controller, or through HX8 GrowNET™ hubs. It is typical to simplify cabling by locating hubs centrally in hall ways and rooms allowing single runs from an 8-port device hub back to a central hub or back to the controller.

HX8 GrowNET ™ hubs can be daisy-chained to form a network of up to 100 devices per bus. Hubs provide up to 1A of power for operating sensors and most relays directly over the CAT5 cable. A DC jack on the hub provides 24Vdc power to the ports from the included wall power supply. A terminal block power option is also available.

⚠ **DIELECTRIC GREASE**
Dielectric grease is recommended on RJ-45 GrowNET™ connections when used in humid environments. Place a small amount of grease onto the RJ-45 plug contacts before inserting into the GrowNET™ port.
Non-conductive grease is designed to prevent corrosion from moisture in electrical connectors.
• Loctite LB 8423　　　　　• Dupont Molykote 4/5　　　　　• CRC 05105 Di-Electric Grease
• Super Lube 91016 Silicone Dielectric Grease　　• Other Silicone or Lithium based insulating grease
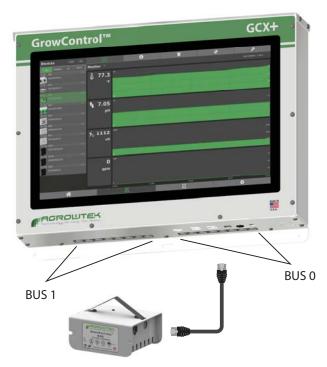
⚠ **NOTICE**
GrowNET™ ports use standard RJ-45 connections but are NOT compatible with Ethernet networks.
To prevent damage, do not connect GrowNET™ ports to Ethernet ports or network switch gear.

Addressing Devices

BEFORE YOU BEGIN INSTALLATION we recommend pre-addressing devices at the controller prior to mounting them in the final installation locations.

Each GrowNET™ device on the GCX controller must be assigned an address number before the controller can begin talking to it. All devices come from the factory without an address assigned and must be assigned by the GCX controller when first installed. **The device remembers it's address after it has been assigned.**

GCX systems are equipped with either a single bus (GCX) or a dual bus (GCX+.)
Each bus is capable of supporting 100 device addresses (1-100.)

BUS 0

BUS 1

⚠ **IMPORTANT** Each new device must be added one at a time.
Do not connect multiple un-assigned devices at the same time or devices will recive duplicate addresses.

How to Assign a Device Address:

1. Use a regular straight cable and connect only one new device to the GCX system.
 Note: If this is a GCX+ system, connect the device to the bus that it will be located on when installed.

2. Add the device using the 'Add Device' button on the device tab.
See "Add a Device" in the Device Management section of this manual.

3. Disconnect the device and prepare it for installation in the final location.
Mark the device in a discrete location with a non-permanent or temporary removable label if necessary.

4. Connect the next device to be assigned and repeat the process until all devices have been added to the device list on the GCX controller.

User Interface Introduction

The system is controlled by a 10.1" or 15.6" high resolution touch screen with easy to use graphical interface. The system uses familiar controls such as buttons, switches, check boxes, drop-down combo-boxes and text fields. Dynamic pop-up dialogs alert the user to faults or confirm important actions.

Swipe Gestures
Swipe Left/Right to change between tabs/pages.
Swipe Up/Down to scroll on pages.

Help Pages
Most pages include a help dialog that can provide reference information right at the screen.
Press the "?" button on the page header to display the help dialog.

Keyboard

The touch screen features a "pop-up" keyboard that will be displayed any time a text or numerical field is selected for editing.

Physical Keyboard & Mouse
If preferred, a physical USB keyboard and mouse can be connected to the GCX's USB ports.

USB Ports

Loader Screen

The Agrowtek Leaf logo appears while the system boots. Once the Linux operating system boots, the system loader screen appears which displays the status of the system memory, and searches for downloaded firmware updates, or for updates on USB memory. *See Firmware Updates for more information.*

1. Memory Status   System memory status, should read OK.
2. Memory Capacity   Capacity and free space on the system memory.
3. Message Buffer   Messages showing current actions of the loader.
4. System Recovery   Opens the system recovery options dialog.
5. Skip Button   The loader screen can be skipped if this button is pressed.
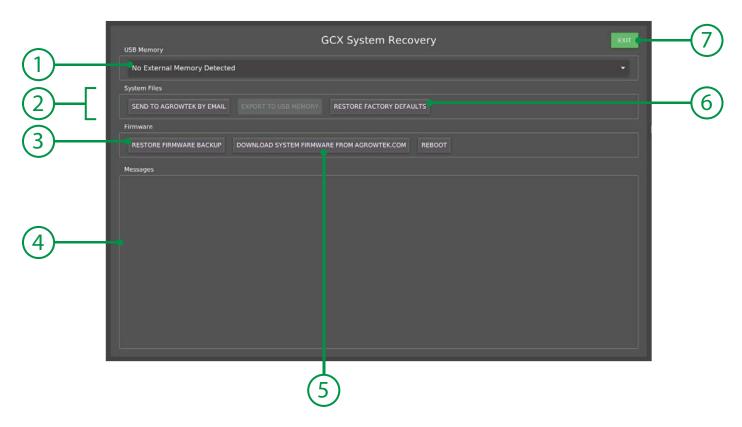   *Button can not be pressed if firmware is found and loaded.*
6. Progress Bar   Indicates the progress of the loader screen before starting the system.

System Recovery

The system recovery dialog is for 'emergency' recovery of a system if a firmware update or other problem is preventing the system from starting successfully. Several recovery tools are available including exporting system files, restoring defaults or the previous firmware version, and forcing an update from Agrowtek.

⚠ **NOTE:** Always export your system files (by email or USB) before restoring factory defaults. These files can aid in bug fixes and restoring your settings to your system.

1. USB Memory   Drop-down menu to select which USB memory stick to use for file recovery.
2. System Files   Functions for exporting the system files for diagnostics via Email or USB.
3. Restore Backup   Restores the backup file of the previous system firmware.
                                 Use this if a firmware update has caused a problem with your system.
4. Messages   Buffer window for messages to display.
5. Download   Forces a download of the most current firmware from the Agrowtek server.
6. Restore Defaults   Deletes all user files (devices, controls, recipes, etc.) and restores to factory.
7. Exit   Exits the recovery screen and attempts to boot the GCX system.

Login Screen

User accounts with operator or administrator access can be configured on the system to restrict access to the system's interface. If "Require Login on Power-up" is checked, the system will boot with the login screen. Swipe the slider at the bottom of the screen to the right to continue.

1. Logo Area   A custom logo can be displayed; see the "Files" page for more information.
2. Swipe Slider   Slide the green dot from the left to the right then release.

If users are configured on the system, the login screen will appear:

1. User Name   Enter your user name by pressing on the text field to bring up the keyboard.
2. Password   Enter your password by pressing on the text field to bring up the keyboard.
3. Login Button   Once you have entered the correct user name and password, press LOGIN.
4. Keyboard   The on-screen keyboard pops-up when ever a text field is selected.

Home

The home page displays a general information overview of the system. The left pane shows recent notifications from the system. The right pane shows a customizable report by control group. Page between the different groups to quickly monitor the conditions and I/O status of devices in each group. Devices with active outputs are highlighted green and sensors in alarm condition are highlighted red for enhanced visibility.

1. Notifications   List of recent notifications from the system.
                        [CLEAR] will delete messages in the list but they remain in the event log.
2. Main Menu Bar   Select between the four main page displays on the system (see below.)
3. Report Area   Customizable reports by control group display the status of devices and control
                        functions that are selected to be shown in the report.
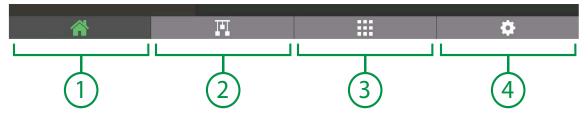4. Report Selection   Select a group from the drop-down or use the arrow buttons to page through reports.
5. Logout Button   Press to log-out of the system and show the login screen.
6. Run/Stop   Press to place entire system into Run or Stop mode. In Stop mode, no outputs activate.

Main Menu Bar

The main menu bar is located at the bottom of the display and is used to switch between the primary screen pages. The bar indicates which page is active by highlighting the icon green and darkening the background. Press the tabs to switch between the screen pages.

1. Home Page   Home screen with customizable report view and system notification history.
2. Devices Page   Device graphs, manual controls, alarms, calibration and management.
3. Controls Page   Workspace and function editor for control logic configuration and monitoring.
4. System Page   Network, email accounts, users, files, updates and system configuration.

Devices Page

The devices page displays all of the relevant data pertaining to GrowNET™ devices that are connected to the system, and manages all of their properties including reference names, alarm settings, calibration and manual operation / overrides.

1. Devices Menu Bar   Change between the different pages in the devices screen.
2. Page Title Bar   Displays the title of the current page. A help [?] button is located on most title bars.
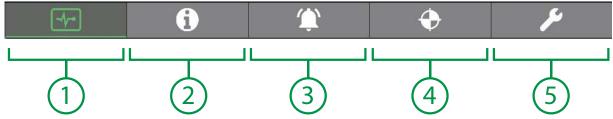3. Page Area   Area to display the selected menu bar page; the device monitor page is shown.
4. Device List   The device list shows the name and status of each device.
                       Select the device to monitor the device or edit the device properties.

Devices Menu Bar

The devices menu bar selects between the monitoring page and, alarms, calibration and other device properties pages. The bar indicates which page is active by highlighting the icon green and darkening the background. Press the tabs to switch between the screen pages.

1. Monitor Page   Display historical data and manually operate control equipment.
2. Info Page   Configure device and output names, report settings and search "where used."
3. Alarms Page   For devices with alarm settings, configure high/low alarm values.
4. Calibration Page   Standard calibration of sensors and dosing pump flow rates.
5. Manage Device   Device manufacturing info, address, sort order, out-of-service mode and more.
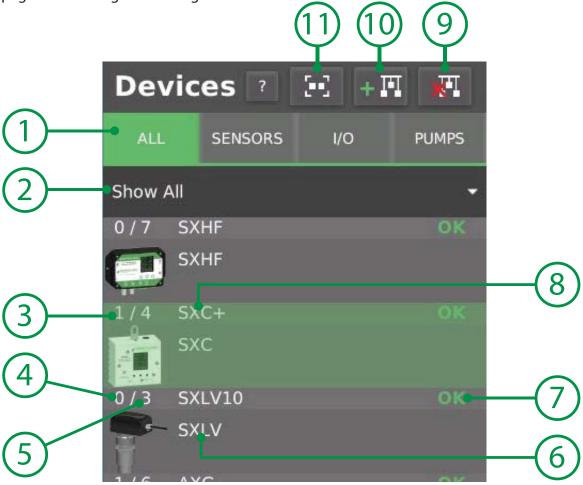
Device List

The device list comprises a list of all of the GrowNET™ devices that are connected to the GCX system. The device list can be organized by device type (sensor, I/O or pumps) or can show all devices (all.) This is also where devices are added to and removed from the system.

Each device in the list includes basic details about the device including the type with an icon, the reference name, communication status and address details. Scrolling through the list of a devices at a glance can identify any offline devices.

Selecting an device in the list will highlight it and populate the properties and data relative to the device on the device pages for viewing and editing.

1. Device Type	Select the type of devices to show in the list.
2. Sort by Location	Show only devices in the list that belong to the selected group/workspace.
3. Selected Device	The selected device is highlighted in a transparent green.
4. Bus Number	The GrowNET™ bus number the device is on (100 devices per bus.)
5. Device Address	The GrowNET™ device address.
6. Device Name	Reference name assigned by the operator and used by the control functions.
7. Device Status	Communication status of the device; see chart below.
8. Product Model	Product type/model number.
9. Delete a Device	Press to delete the currently selected device from the system.
10. Add a Device	Press to open the "Add Device" dialog window and scan for new devices.
11. Group Device	Creates a new "grouped" or averaged device with the selected device as a base.

Input & Sensor Monitoring

Device monitor page provides the current readings of the sensor values and a graphical history for each sensor channel. The time since the last reading update is shown in the page title bar.

Additional data can be displayed by touching on a sensor reading group or a graph pane to open the enlarged graph window.

1. Reading Group   Area grouping the sensor reading, units and icon.
2. Sensor Reading   Actual sensor reading value.
3. Sensor Icon   Icon to identify the sensor type.
4. Sensor Units   Units the sensor reading is being displayed in.
5. Last Update   Amount of time since sensor readings were last updated.
6. Location   Control group that the device is associated with (see device info tab.)
7. Graph Options   X-Axis zoom in/out and graph display options.
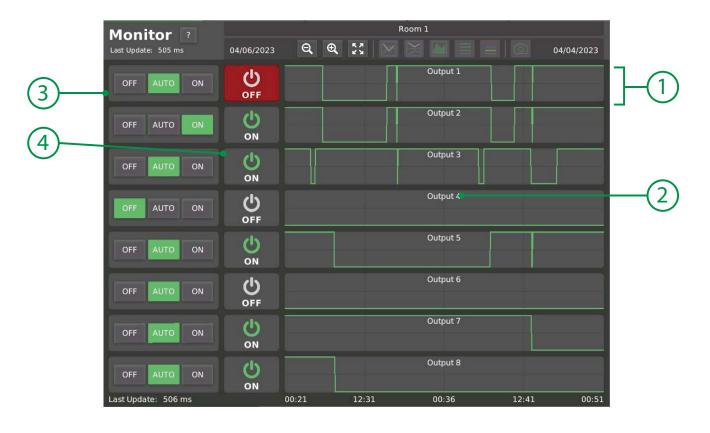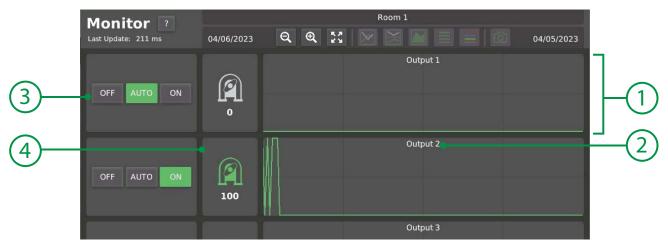8. Graph Pane   Graph history pane showing 1440 points; touch a pane to enlarge the graph.
9. X-Axis   Time axis of graph panes (all share the same time axis.) *Enlarge graph for dates.*

Output & Pump Monitoring

The device monitor page provides the output status' and a graphical history for each output. The time since the last reading update is shown in the page title bar.

Additional data can be displayed by touching on a graph pane to open the enlarged graph window.

1. Graph Pane   Graph history pane showing 1440 points; touch a pane to enlarge the graph.
2. Output Name   Reference name for the output or pump.
3. Manual/Auto   Manually set outputs/pumps Off/On, or set to AUTO for function control.
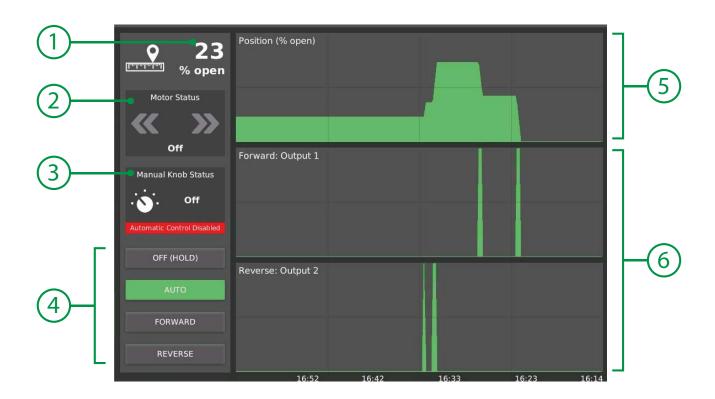4. Output Status   Graphic and info displaying the output status.

MX Motor Monitoring

The MX monitor page displays data relevant to the MX motor controller:
• Current MX controller position
• Forward/reverse output status
• Manual knob position
• Manual overrides
• History charts

The time since the last reading update is shown in the page title bar.
Additional data can be displayed by touching on a graph pane to open the enlarged graph window.

1. Position   Current position reported by the MX controller.
2. Output Status   Graphic and info displaying the output status; forward, reverse or off.
3. Knob Status   Displays current position of the MX controller's manual override knob.
4. Manual/Auto   Manually operate the MX controller, disable or enable automatic control.
                    Automatic or manual controls are not available if the knob position is not in "auto."
5. Position Graph   Graph history pane of the motor position.
6. Output Graph   Graph history pane of the motor outputs (forward, reverse.)

ⓘ **NOTE**
The MX position is calibrated on the calibration page; see the calibration section.
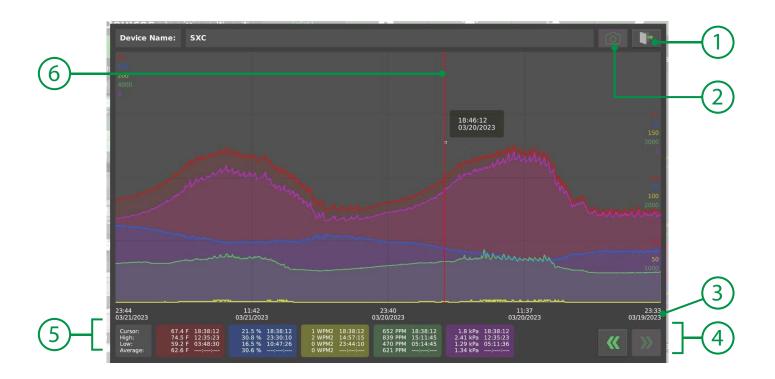
Enlarged Graph Window

Historical graph data can be analyzed on-screen to review:

• Minimum and Maximum (High/Low) sensor readings
• Point data with 'cursor' selection
• Graph history

To open the graph window, touch on a graph pane in the monitor page of a device.

A maximum of 1440 points are shown on the graph pane.

Graph data is stored on the system in .csv format for export by USB or FTP; see the "Files" section of this manual.

1. Exit Button	Press to close the graph window.
2. Screen Capture	Sends a screen capture of the graph window to the email/sms recipients.
3. Date	Beginning and end dates of the data on the chart.
4. Fwd/Back	Page Forward/Backward buttons to move through histortical data.
5. Cursor Data	Data at the point shown by the cursor line when the chart area is touched.
6. Cursor	Touch on the graph display to show cursor data.

Graph Options

Graph options are shown at the top of the graph display in the Monitor view. Adjust the amount of data shown on the graph and how it is displayed to get the most optimal view of the information.

1. Zoom Out   Show a larger time frame on the graph pane.
2. Zoom In   Show a shorter time frame on the graph pane.
3. Zoom Default   Set the default time frame (24 hours) on the graph pane.
4. Y-Axis Scale   Open the y-axis scale configuration dialog (see below.)
5. Single Pane   Show all graph data on a single, overlaid pane (sensors only.)
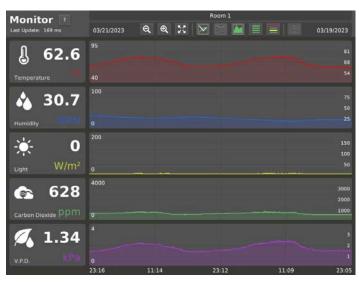6. Multi Pane   Show each grapg on a separate pane.
7. Chart Fill   Enable or disable color fill under the chart line.
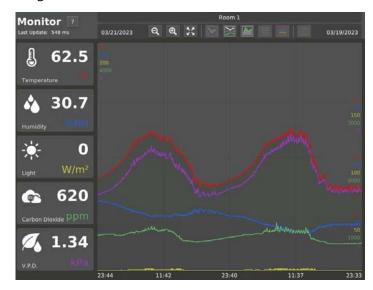8. All Green   Set all charts to default green color.
9. Multi Color   Set sensor charts to multi-color.
10. Screen Capture   Take a screen capture and send it to email/sms recipients.

Multi-Pane, Multi-Color
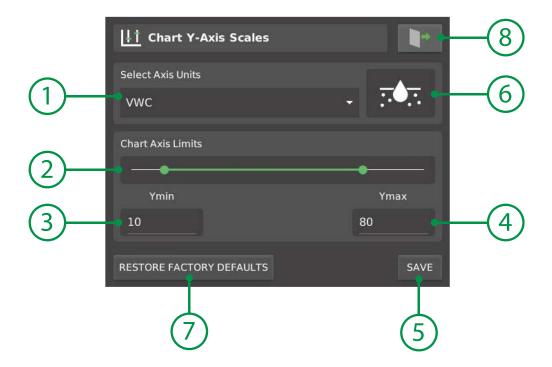

Single-Pane, Color Fill

Y-Axis Scales

Users may configure the Y axis high and low limits for charts based on the various data types.

Open the Chart Scale dialog by pressing the [icon] button at the top of the chart view.

1. Select a chart unit in the drop-down menu of the dialog.
2. Adjust the Ymin and Ymax values using the sliders or by typing in a value.
3. Press SAVE to confirm your changes to the axis range.

1. Axis Units	Select which chart units to edit.	
2. Axis Limits	Slider with Ymin and Ymax positions; slide the dots to adjust the value, or	
3. Ymin	Manually enter the minimum value for the Y axis.	
4. Ymax	Manually enter the maximum value for the Y axis.	
5. Save Button	Press to save the changes to the Y axis limits for the selected units.	
	Save changes before making a new units selection.	
6. Units Icon	Graphical representation of the units which matches the graphic shown on charts.	
7. Factory Defaults	Press to restore all Y-axis scales to factory default settings.	
8. Exit Button	Press to exit the Y-Axis Scale dialog window.	

ⓘ **NOTE:** The current chart plot must be regenerated to show the new scales.

To regenerate a current plot, use one of the ZOOM buttons at the top of the chart. [icons]

Device Information

The device information page is where device names are managed and where devices can be configured for display in the report views on the home page.
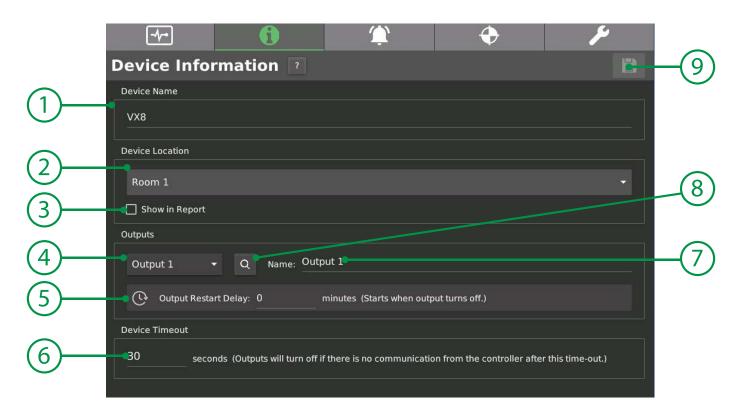
Names
Device names and I/O names are used for more than just reference. Names are used when configuring control functions to assign sensors, outputs, inputs, pumps, etc. to the functions. If equipped with outputs or analog inputs, each channel can be named for reference.

Where Used
To determine which control functions are assigned to use a specific output, select the output from the drop-down menu and press the where-used search button. This can aid in troubleshooting if a device is operating in an unexpected fashion.

Device Location
To show the device in the home report view select a control group to associate it with, then check the box to show it in the report.

1. Device Name   Reference name for the GrowNET™ device.
2. Device Location   Reference the device to a control group to display the device in the home report.
3. Show in Report   Select to show the device in the home report display.
4. Output Select   Select an output (or input) to search "where used" or edit the name.
5. Re-start Delay   Delay time to keep output off after it has turned off to prevent short cycling.
6. Device Timeout   Amount of time to keep state before shutting off outputs GCX is not connected.
7. Name   Output (or input) channel name; typically named for what is connected to it.
8. Where Used   Search where this output is used in the control functions.
9. Save Button   When highlighted Green, there are changes that are not saved.
                     Press the Save button to save the changes to system memory.
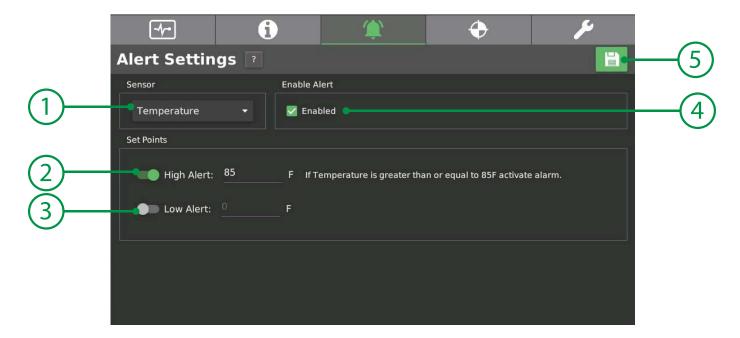
Device Alerts

Devices which are capable of reporting alerts (sensor devices) can configure basic high and low level threshold alerts on the device alerts page. These alerts are recorded in the event log and can be emailed or sent by text message using the system email sender.

To configure an alarm:
1. Select the sensor type.
2. Turn on the high alert and/or low alert switch.
3. Enter the high and/or low alert values.
4. Check the **Enabled** box to enable the alert.

Alerts will only be sent once each time they are activated.

|	
1. Sensor Channel	Select the sensor channel to configure the alert limits.
2. High Alert	If sensor value meets or exceeds this value trigger a high-alert.
3. Low Alert	If sensor value meets or falls below this value trigger a low-alert.
4. Enable Checkbox	Check to enable the alerts for this sensor channel.
5. Save Button	When highlighted Green, there are changes that are not saved. Press the Save button to save the changes to system memory.
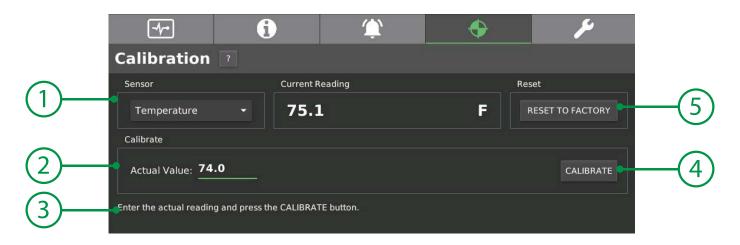
Device Calibration

Sensor devices, motor controllers and dosing pumps require occasional calibration to ensure their readings, positions and dosing volumes are accurate. If a device has features that can be calibrated, a calibration screen will be shown on the calibration page.

Sensor Calibration

A menu of available sensor types is displayed for the sensor unit that is selected. Select the sensor channel to calibrate and follow the prompts on the display.

Most calibration requires the user to simply enter the actual calibrated vale.

1. Channel   Select the sensor channel to calibrate.
2. Calibration Value   Follow the prompts and enter the calibration value.
3. Prompts   Instructions to follow for calibration.
4. Calibrate Button   Press once the calibration value has been entered to save the value.
5. Reset Button   Restores factory sensor calibration values.

pH calibration uses pre-defined calibration solutions which are industry standard.
pH 4 & pH 7 solution are typically used for pH calibration.
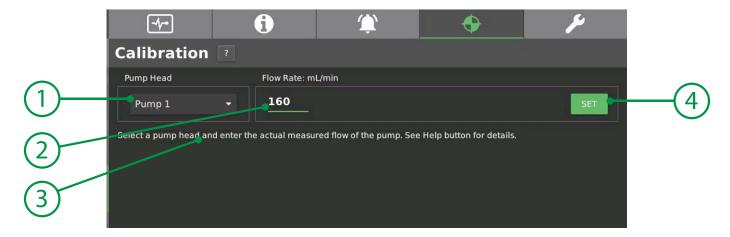
Always begin with pH7 calibration and follow the prompts on the display.

Dosing Pump Calibration

Dosing pumps may vary from the factory calibrated flow rate if fluids are viscous or supply lines are long.

Operate the pump for 60 seconds and measure the output with a graduated cylinder. Enter the measured quantity as the calibration value (mL/min) to set the true flow of the dosing pump.

1. Channel   Select the sensor channel or pump head to calibrate.
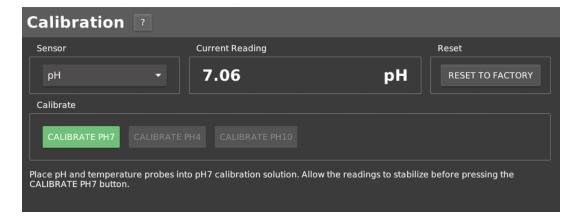2. Calibration Value Follow the prompts and enter the calibration value.
3. Prompts   Instructions to follow for calibration.
4. Calibrate Button   Press once the calibration value has been entered to save the value.
5. Reset Button   Restores factory sensor calibration values.
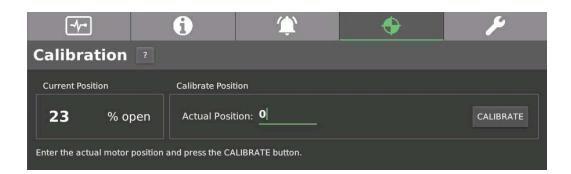
MX Motor Position Calibration

In some cases it may be necessary to adjust the calibration of the MX controller's position to ensure it is accurate in the MX controller. There are two methods for calibrationg the MX controller position:
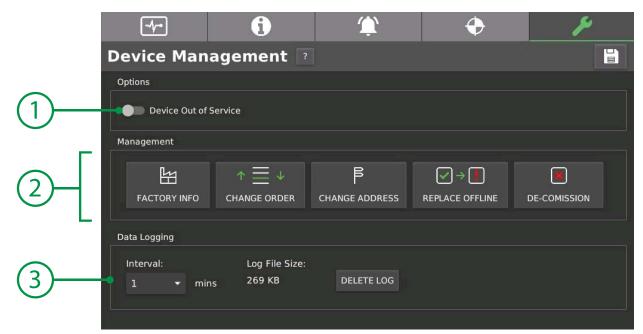
• Manually operate the MX controller until it reaches 0% (closed) and the motor stops at the working limit.
• Set the position to a known value using the device calibration page.

Device Management

General management for GrowNET™ devices is handled on the device management page including:

• Temporarily taking a device offline for service or maintenance
• Replacing a device
• Changing device display order
• Changing the device address
• Removing a device from the system
• Configuring data logging interval

1. Service Switch   Set a device "out-of-service" so the system does not poll it or show errors.
2. Mgmt Buttons   Buttons to activate various management dialogs; see "setting up devices" section.
3. Logging Options   Configure the logging interval and delete logs.
                         See the "Files" page for more advanced log management.
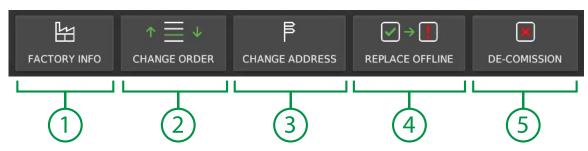
Management Buttons

1. Factory Info   View the production info for a device including serial number, revision, etc.
2. Change Order   Change the order in the device list (also changes polling order.)
3. Change Address   Change the device address; sets a new address to the device.
4. Replace Offline   After adding a new device, it can "replace" an offline device to assume its role.
5. De-Comission   When removing a device to be used on another system it should be decomissioned.
                         Decomissioning removes the device address from the device.

Controls

Control "functions" are used to create control logic in order to operate equipment in a facility. Functions are arranged in work spaces known as "control groups." Control groups are often modeled after an environment zone, but they may also represent sub-zones or other logical groupings of controls.

Create and name control groups according to how you would like to group functions and show report displays. Note the system executes controls in the order of groups and functions within the groups. Groups and functions can be re-arranged to create the logical order required for proper operation.
See the "Programming" section for more information.

ⓘ **TIP:** Press and hold the control icon's **text** (4) to drag the function to a different order in the workspace.

1. Workspace	Controls work space; shows control functions in the selected group.
2. Function Toolbar	Toobar of available functions; press a button to add a new function to the workspace.
3. Workspace Toolbar	Contains items specific to the work space including the day counter.
4. Function Icon	Icon depicting the function type, status and name.
	Press the function icon to open the function editor and configure the function.
5. Run/Pause	Set the control group to run mode or pause (suspend).
6. Control Group	Select the control group to view and edit in the workspace.
7. Rename Group	Opens a dialog to rename the currently selected control group.
8. Add Group	Opens a dialog to add a new control group to the system.
9. Move Group	Opens a dialog to move the current group to a new position in the group list.
10. Remove Group	Opens a dialog to delete the current group and all of it's controls from the system.
11. Day Count	Displays the workspace count and opens a dialog to adjust the day counter.
12. Day/Night Mode	Configure day & night mode for the workspace.
13. Enable Report	Show or hide this workspace from the home page report view.

Network Settings

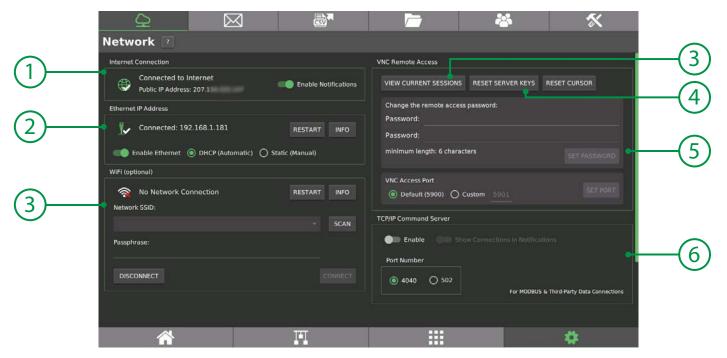The network page shows the status of Ethernet and WiFi connections as well as provides configuration for:

• WiFi scanning & connection
• MODBUS TCP/IP Command server
• VNC Remote access password

A network connection is required for:
• Email/SMS alerts
• Remote access/control
• Internet updates (also available by USB)

The system uses DHCP to obtain an IP address automatically from a newtwork DHCP server/router.
If a static IP addres is preferred, set a static IP address in the network router, or set the system to use STATIC IP and manually enter the IP address, subnet and gateway information.

If a network connection is detected, the controller's IP address will be displayed. Use the [INFO] button to get details about the network activity.

1. Internet Status   If internet connection is available, the public IP of the WAN will be shown.
                       The WAN IP address is used for remote VNC access connections.
2. Ethernet   If a network connection is available, the local IP address of the controller will be shown.
                       The connection can be configured for DHCP (automatic) or STATIC (manual settings.)
3. WiFi   If a network connection is available, the local IP address of the controller will be shown.
                       Use the SCAN button to find networks. A USB WiFi adapter is required.
4. VNC Password   Change the default VNC remote access password (default = gcxvnc).
5. Server Keys   Resets the VNC server keys and challenge phrases.
                       If excessive unathorized access attemptes are detected, the keys may be invalidated
                       and require resetting.
6. TCP/IP Server   Enable or disable the TCP/IP command server for MODBUS integration.
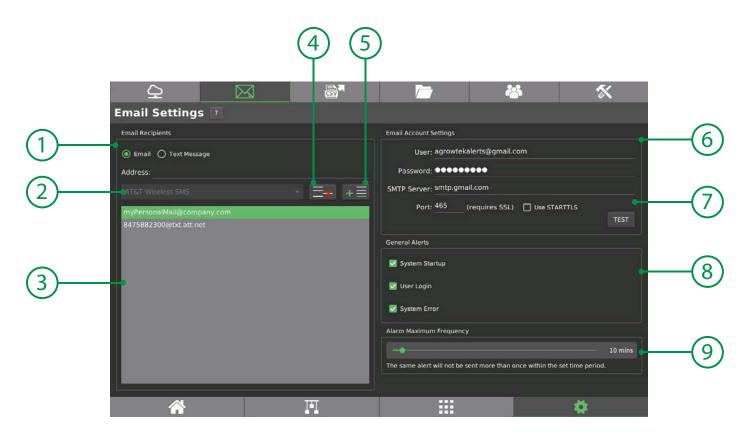
Email Settings

An email account is required to send email or text message alerts from the system. Alerts can be sent to multiple email accounts or phone numbers.

Email alerts can be sent automatically for:
• System power-up
• User Login
• System Error / Alert

To configure email alerts, enter the email account settings to use for sending messages. Add at least one recipient and send a test message. Once a message is sent successfully and the settings are verified correct, general alerts can be enabled.

See "Email Configuration" section for more details and instructions on using Gmail.

1. Recipients   Manage recipients of emails from the system.
2. Text Carrier   If recipient is a mobile phone number, select the carrier of the phone service.
3. Recipeint List   List of message recipients; select a recipient to highlight it.
4. Delete Recipient   Delete the highlighted recipient from the list.
5. Add Recipient   Add the recipient listed in the Address field above.
6. Account Settings   Configuration for the email account used by the system to send messages.
7. Test Button   Send a test message to recipients using the email account configured.
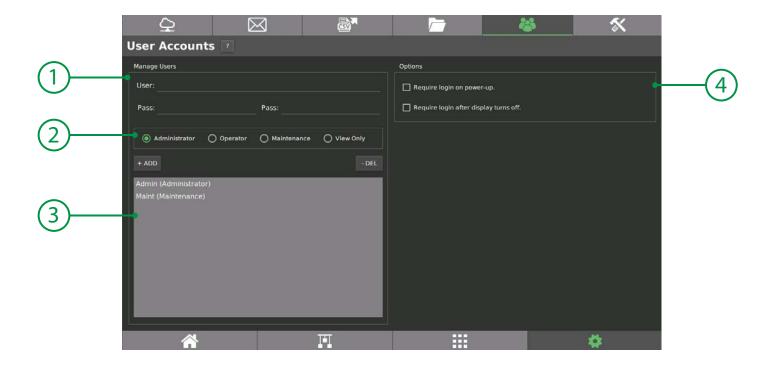8. General Alerts   Select the alerts to be sent by the system to the recipients.
9. Alert Frequency   Time delay between repeating the same alert message.

User Accounts

User accounts allow logged access to the system. When a user logs into the system, that information is recorded in the system log. Additionally, an alert can be sent out any time a user logs into the system.

There are two level of acces: administrator and operator. Administrator has full access to the system while operator does not have access to any of the settings on the system page.

NOTE: If the 'Require login on power-up' option is not checked, the system will automatically login with Administrator access on power-up even if users are configured on the system.

1. Manage Users   Add and remove users from the system.
2. User Level   Select an Administrator or Operator level for the new user.
3. User List   List of users on the system.
4. Options   Check the box to require login when the system boots up.

	View Only	Maintenance	Operator	Administrator
Home Page Status/Reports	X	X	X	X
Controls Editing			X	X
Device Monitoring	X	X	X	X
Device Overrides		X	X	X
Device Calibration		X	X	X
Device Settings			X	X
System & Groups Run/Stop		X	X	X
System Settings				X

System Files

The system files page is where settings files, data logs and other files are managed on the system.
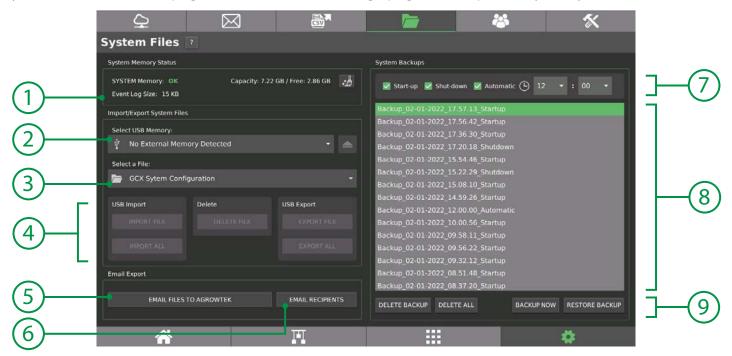
System Settings
All of the device settings, control functions, dosing recipes and other user settings are stored in various files on the system. These files can be backed up to external memory or email, and can be imported to other controllers or if there is a problem where a backup must be restored.

Data Logs
The system stores device log files to the internal memory in a standard .csv format. These files can be exported to USB for historical records or other data manipulations purposes.

Logo Image
A custom logo image can be imported to be displayed on the login screen when users are logged out of the system. The file must be .png format and be named "logo.png" to be imported by the system.

1. System Memory   Status of system memory and capacity.
2. External Memory   Drop down box to select the external USB memory source.
    "No External Memory Detected" is shown if no USB memory is connected.
3. File to Transfer   Select a system file to import or export.
4. File Commands   Commands to import/export or delete the selected file.
5. Service Email   Sends all system files to Agrowtek using the service email account.
    Email configuration is not required to use this function.
6. Email Files   Send system files to system email recipients.
7. Backup Options   Options for how system backups are taken.
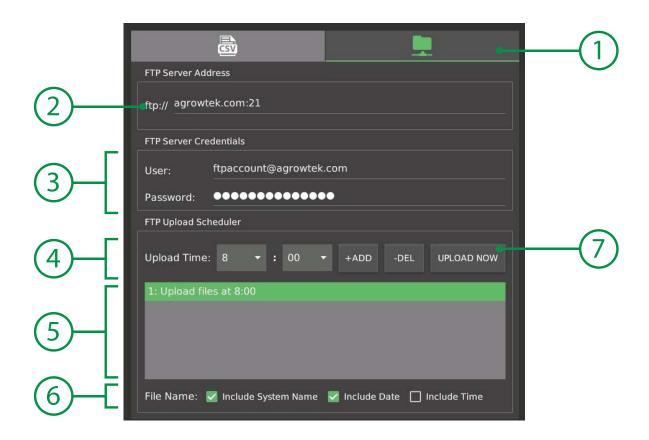8. Backup List   List of all system backups; select a backup to restore or remove.
9. Backup Buttons   Perform operations related to backups including restore, delete and 'backup now.'

Data Log Files

System data log files can be scheduled to automatically upload to an FTP server for remote storage and consumption by third party data analysis solutions. To use the FTP scheduler, configure the connection credentials for your server and test the connection with either individual file uploads or the "Upload Now" button.

To access the FTP server configuration and scheduler, select the FTP Folder icon (1) on the System Files tab:

1. FTP Tab   Select the FTP tab to access the FTP configuration and scheduler (System Files page.)
2. FTP Server   FTP server address. Include the port number in the address as shown.
                                     Example: yourdomain.com:21
3. FTP Credentials   Enter the user name and password for accessing the FTP server.
4. Upload Time   Select an upload time and press "+ADD" to create a new upload event.
5. Event List   Displays when the system will attempt to upload files to the FTP server.
                                     Select an event and press "-DEL" to delete the event from the list.
6. File Name Options   Select how to format the file name when uploading to the server.

System Name
File names can include the controller's system name when multiple controllers are uploading data logs to the same directory.

Date
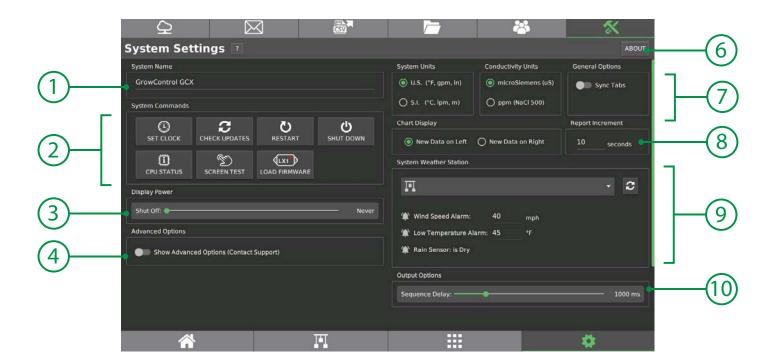Include the date in the file name to create separate files for each day on the server.

Time
Include the time in the file name to allow multiple files per day to be uploaded to the server.

System Settings

The system settings page is where system commands are accessed and settings are conﬁgured including:

• Controller name
• System units
• Time zone
• System weather station & alerts
• Chart display mode
• Check for system updates
• Perform device ﬁrmware updates
• Enable diagnostic options
• Reboot or shutdown the system

1. System Name   Reference name of the controller included in email alerts.
2. Commands   System commands including status, updates, shutdown and reboot.
3. Display Timer   Time-out for display power; turns oﬀ display automatically. Set to 0 to disable.
4. Advanced Options   Settings for diagnostics and repair; contact service.
5. Reset Devices   Functions for resetting device addresses when a PC with LX1 is not available.
6. About Button   Opens the about dialog with system version number and revision history.
7. System Units   Global units selection for sensors to report in.
   System Options   Sync Tabs: Workspace selection synchronized across all tabs.
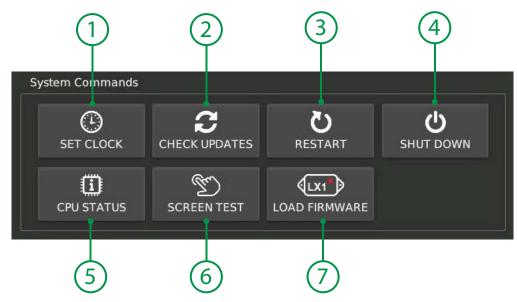8. Report Increment   Interval to automaticall change through reports on home screen.
9. Weather Alarms   Settings for global weather alarm conditions used by control functions.
10. Sequnce Delay   Sets a minimum delay between simultaneously activated outputs.

System Commands

The system commands group includes buttons for accessing the clock configuration dialog, update dialog, cpu status dialog, system console and system reboot/shutdown options.

1. Set Clock   Opens the system clock/time zone dialog window.
2. Check Updates   Opens the updater dialog to check the internet for system updates.
3. Restart   Opens a dialog to restart the GrowControl system app or reboot the operating system.
4. Shut Down   Shuts down and powers off the GCX controller. (Requires power cycle to restart.)
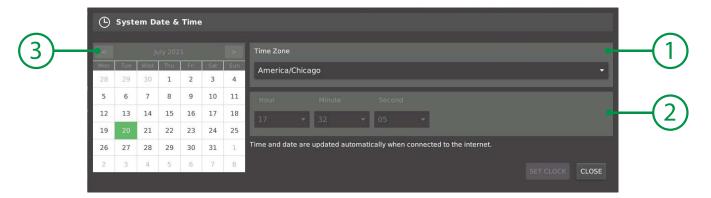5. CPU Status   Displays information and statistics about the main system processor.
6. Screen Test   Test dialog to check touch screen controller operation.
7. Load Firmware   Opens the AgrowLINK updater utility for loading firmware on GrowNET™ devices.

System Date & Time

The system time zone can be set so that the system reports the correct time for your geographic location. Time is automatically updated from the internet when there is a connection, otherwise the time and date can be manually configured from this dialog. To access the dialog, press the "SET CLOCK" button in the System commands group on the System Settings page.

1. Time Zone   Set the local time zone for the GCX system.
2. Time   Manual system time configuration (only when internet connection is unavailable.)
3. Date Picker   Manual system date configuration (only when internet connection is unavailable.)

Device Management

This section of the manual covers details of adding devices to the system and managing the devices.

Topics
• Adding a device
• Removing a device
• Replacing an offline device
• Sorting the Device List
• Changing device addresses
• Editing names
• Searching "where used"

GCX controllers can handle up to 100 device addresses per 8-port bus located on the bottom panel of the controller. *GCX+ model controllers feature two 100 device busses.*

Each GrowNET™ device must have a unique device address number between 1-100. Addresses are automatically selected based on the next available address when they are added to the system, or an address may be specified from available addresses.

Add a Device
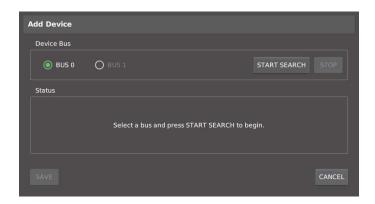
New devices must be added **one at a time** to the system (unless devices are pre-addressed prior to adding them to the system.) If multiple new devices are connected to the system without adding them one at a time, the device search may be unable to detect the devices.

How to add new devices to the system:

1. Connect a single new device to an available GrowNET™ port on the GCX controller or a HX8 hub.
2. Ensure the device is powered by the hub (dosing pumps and RX relays require their own power source.)
3. Navigate to the Devices page and press the [+ ADD] button.

4. The "Add Device" dialog will pop up. Select the device bus to scan.
5. Press the [START SEARCH] button and the system will search the bus for new devices.

6. If a device is found, the next available address will be assigned or select an alternate address from the list.
7. If desired, modify the device name and select a device location, then press [SAVE].

The device will now be shown in the system device list.
Select the device in the list to monitor the device or modify the device properies.

Remove a Device

If a device is no longer in use on a system it can be deleted from the device list.
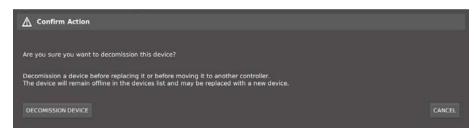
⚠ **NOTE:** Removing a device that is in use by control functions will disable the control function.

If the device is still connected and communicating with the system it should be de-comissioned first to re-move the address that is assigned to the device.

1. If the device is still connected, press the [DE-COMISSION] button.

2. Confirm decomissioning of the device; press the [DECOMISSION DEVICE] button in the dialog.

3. Press the [- DEL] button to remove the device selected in the device list.

4. Press the [DELETE DEVICE] button to confirm removal of the device or press [CANCEL] to leave the device on the system.

The device will be deleted from the device list and the data logs will be erased from the system memory.
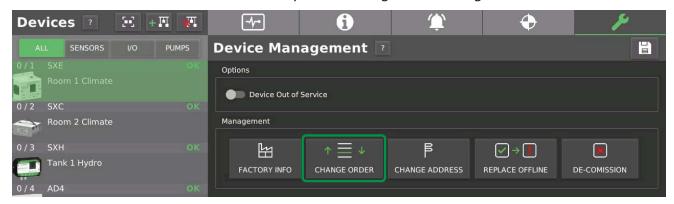
Sort Device List

The system will poll devices in the order they are listed in the device list, however, the list can be organized in any order that is generally convenient.
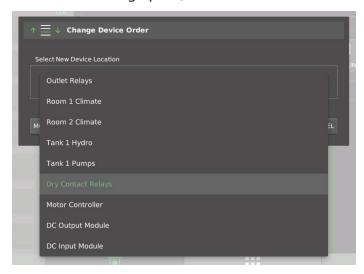
When a new device is added it is automatically populated at the top of the list. It may be desirable to sort the new device to a different order in the list.

To organize the device list:
1. Select the [ALL] button to show all devices in the device list.
2. Press the [CHANGE ORDER] button to open the change order dialog.
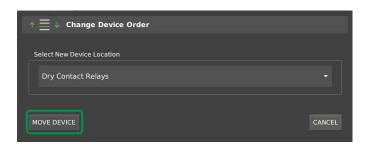
3. When the dialog opens, select the location in the list to move the device to.

4. Press [MOVE DEVICE] to perform the move operation.

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5. The device will now be moved to the new location in the device list.

Change Address

A device address can be manually changed if desired. This will change the address assignment on the device and in the system device list.

⚠ **NOTE:** Changing the address will create a new data log file and erase the previous log data.

To change a device address:

1. Press the [CHANGE ADDRESS] button to open the change address dialog.

2. Select a new address from the list of available addresses (not in use on the bus.)
3. Press [SET ADDRESS] to confirm the new address.

Replace a Device

If a device fails or is otherwise offline, it can be "replaced" with another similar device. This allows the new device to assume the names and assignments in the control functions of the original device without the need to review the controls and update the assignments to the replacement device.

1. Leave the offline device on the system (do not remove it.)
2. Add a new device (the replacement) following the "Add a Device" procedure on previous pages.
3. Select the new device and press the [REPLACE DEVICE] button to open the replace device dialog.

4. Select the offline device you want to replace with the new device.

5. The new device will replace the old device.
Use the [CHANGE ADDRESS] button to modify the device address.

Device Name
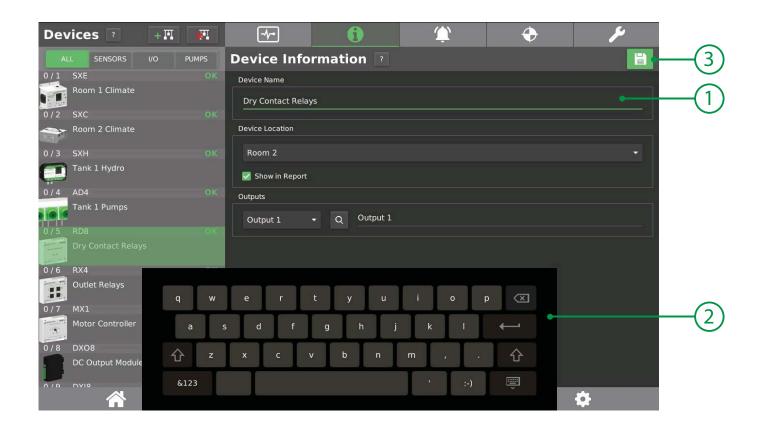
Each device must have a unique name which is used to identify the device.

The device name is used in:
• Control function programming
• Data log files
• Alert messages

Device names can be assigned in the "Add Device" dialog, or can be edited on the device information page.

1. Select the device and then select the device name text field.
2. A keyboard will appear; enter the new name.
3. Press the save button to save the new name to the system memory.

Input & Output Names
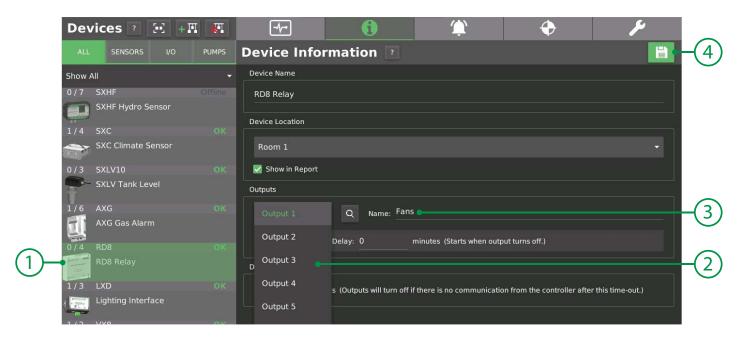
Each input or output on devices with I/O require a unique name to identify the channel. Each output should be named to describe what is connected to the input, output or pump head. The descriptions are used to configure the control functions.

Devices that have I/O names:
• Relays (RX & RD series)
• DIN Rail I/O (DX)
• Motor Controllers (MX)
• Valve Controllers (VX)
• Dosing Pumps (AD)
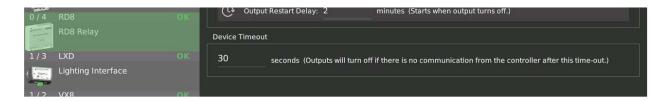
To set an output name:
1. Select the device in the device list.
2. Select the output (or input) channel to edit.
3. Enter the new name.
4. Press the save button to store the new name in system memory.

Device Timeout

All output devices have a timeout setting which will automatically turn off the outputs if no communications have been recieved from the GCX controller after a specified amount of time. Defaults are either 30 or 120 seconds (depending on production date.) The maximum time out is 255 seconds.

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Output Restart Delay
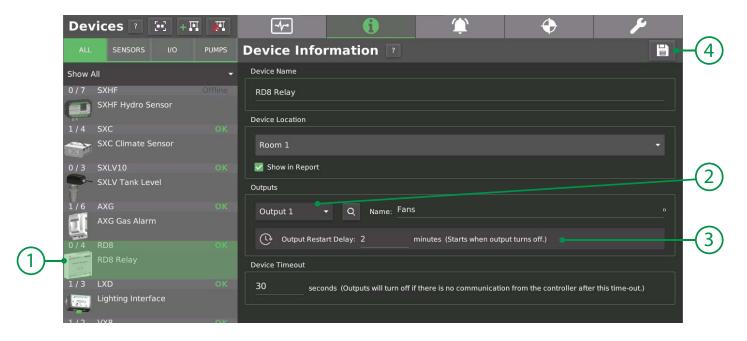
Any device output on the GCX system can be configured with a restart delay timer (anti short-cycle timer.)

If a time value is set for the re-start delay on an output, the output will be disabled for the delay time after it has turned off. The delay time prevents the re-start of the output until it has elapsed in order to prevent a short cycle of the equipment operated by the output.
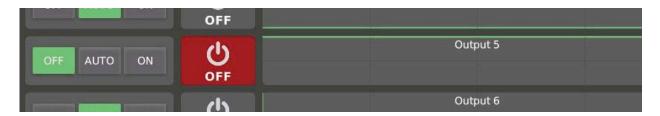
• Pumps
• Compressors
• Fan motors
• Lights

To set an output re-start delay:

1. Select the device in the list.
2. Select the output channel in the drop-down to edit.
3. Enter the desired delay time.
4. Press the save button to store the delay setting in system memory.

When the output turns off and the restart delay timer is active, the output status will be shown in RED.

Input Setup & Scaling

Devices with inputs (DXI8, DXIO, VX8) require configuration to set the input to a custom scale or standard sensor offering (such as SXM moisture sensors.)
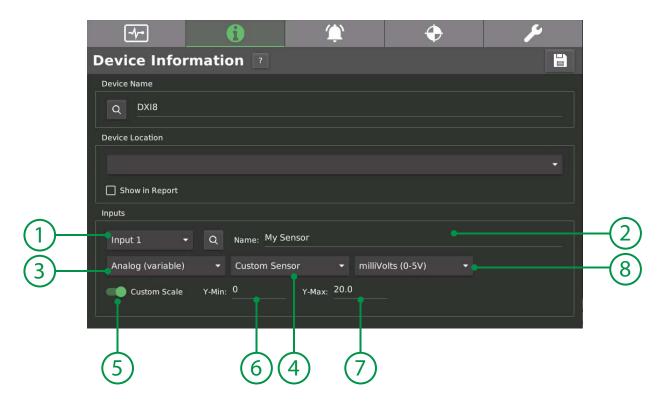
Each input should be named to describe what is connected to the input, then the input should be configured to match the type of sensor connected to the input.

To configure an Input:
1. Select the output (or input) channel to edit.
2. Enter the new name.
3. Press the save button to store the new name in system memory.
4. Select discrete or analog sensor type. On/Off sensors are discrete, sensors which report a value are analog.
5. Select a standard or custom sensor type.

Custom sensor Type:
6. Select millivolts or milliamps scale (must match jumpers in the DX input device.)
7. To configure a custom scale, enable the switch and set the Ymin and Ymax scale values.

1. Input Selection	Select an input number to edit the name and settings.	
2. Input Name	Enter a name to describe the input channel.	
3. Input Type	Select between a discrete or analog type of sensor on the input.	
4. Sensor Type	Select a standard sensor or a custom sensor type.	
5. Custom Scale	Enable a custom scale on the input instead of voltage (or current) readings.	
6. Ymin	Custom scale minimum value.	
7. Ymax	Custom scale maximum value.	
8. Input Units	Configure to match module jumper settings for voltage or current modes.	
	Voltage (millivolts) is default unless jumpers have been set for current mode.	
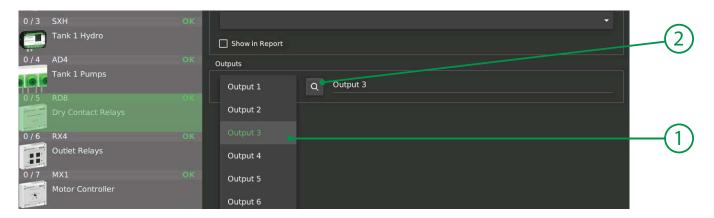
Where Used Search

Controls can become complex and when multiple team members work on a system mistakes can be made that can become difficult to track down. If a device is not functioning properly the first thing that must be considered is how it is being controlled.

The where-used search is designed to help a user identify the control functions that are assigned to a specific input or output. This can then be used to identify potential sources of problems or ensure the output is properly assigned to the correct functions.

To search where an input or output is used:

1. Select the output to search.
2. Press the search icon.

3. The search results dialog is shown indicating the control group and control function name of any functions using the output or input.

If the output is being used by multiple functions, each function will be displayed in the results.

Controls

This section of the manual covers general information about the controls workspace, how to add and manage controls, and descriptions of each control function. *See the "Programming" section for usage examples.*

Topics
• Control Groups
• Control Workspace
• Control Functions

Control functions are how logic is created to control equipment in a growing environment. A variety of control functions are available to create simple or complex nested logic by linking functions together.
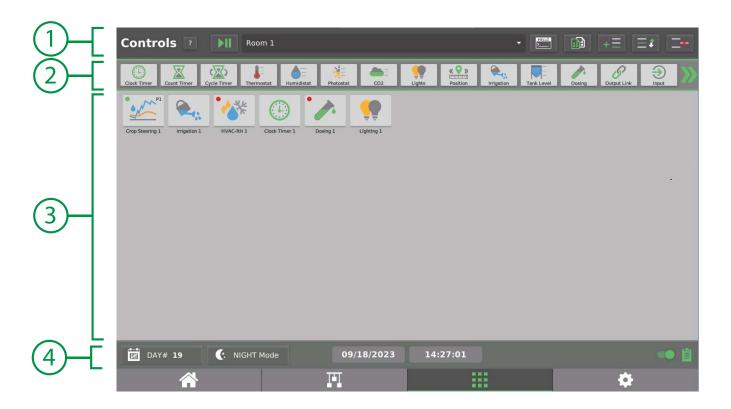
The controls page has these main areas:

1. Workspace Header   Select and edit the properties of the workspace.
2. ControlsToolbar   Add functions to the workspace by pressing them on the toolbar.
3. Workspace   Area where controls in the group are monitored, edited and added.
4. Workspace Settings   Global settings for the workspace functions.

ⓘ **NOTE:** The controls tool bar (2) can SWIPE left or right to show more functions.

Control Groups

Controls functions are sorted by "control groups." Each control group that is created gets it's own "work space" in which to add, edit and monitor control functions.

Control groups are often modeled after the physical spaces they are controlling (room 1, room 2, etc.) but can also be created based on any type of organization that makes sense for the application.
At least one control group is required.

ⓘ **NOTE:** Controls are executed in the order that they are listed in the group list.

Control groups are managed by the workspace bar at the top of the controls page:

1. Run/Pause   Open a dialog to place the group into run or pause mode.
2. Current Group   Select which control group workspace to show.
3. Rename Group   Open a dialog to rename the current control group.
4. Copy Group   Open a dialog to copy the entire workspace.
                      The new workspace will be copied in "pause" mode to allow modifications.
5. Add Group   Open a dialog to add a new control group to the system.
6. Move Group   Open a dialog to move the current control group in the list order.
7. Delete Group   Open a dialog to delete the current group and all of it's control functions.
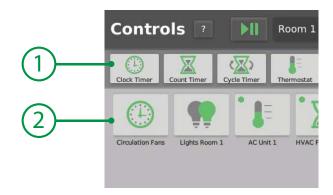
Controls Workspace

Control functions in each control group are edited and monitored in the workspace.

1. Toolbar Functions   The toolbar is used to add new control functions to a workspace.
2. Workspace Functions   Workspace functions show the logic in the workspace.
                            Click the workspace function to edit the settings.

ⓘ **NOTE:** The controls tool bar can SWIPE left or right to show more functions.

Workspace Settings

The bottom tool bar in the workspace area contains several features specific to the selected workspace.

1. Day Counter   Counter that increments at midnight; see function schedules for more information.
2. Day/Night Mode   Coordinate rules for day & night between functions; see function schedules.
3. Date & Time   Displays current system time and date for convenience.
4. Show Report   Show this workspace on the home page report view.

Copy a Workspace

To speed up programming, an entire workspace can be copied and then edited once it has been created. When a workspace is copied, it will be placed into Paused mode so the controls do not interfere with the workspace that was copied. Edit the controls in the new workspace by modifying the equipment settings in each function before placing the workspace into Run mode.
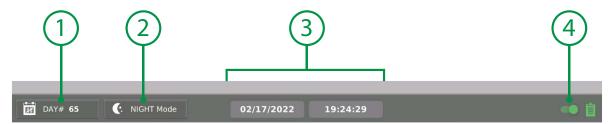

Run/Pause/Maintenance Modes

It is occassionally necessary to pause or suspend all control functions in an environment or to activate only the "maintenance" rules within functions for spraying or other operations.

When the control group is in Pause Mode:
• Functions are suspended in their current status state.
• Any outputs controlled by the functions will no longer be operated by the functions.
• Any dosing pumps will complete their current dose and then suspend dosing.
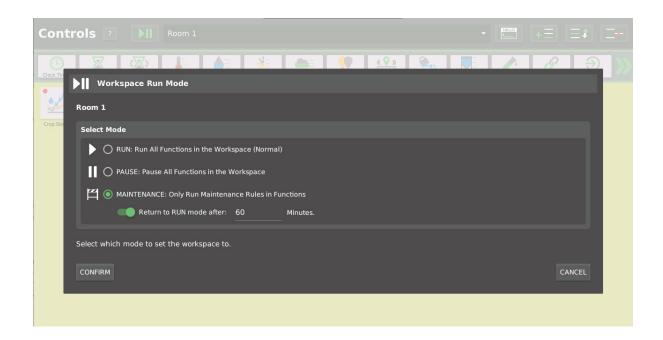
When the control group is in Maintenance Mode:
• Only Maintenance Rules within functions of the workspace will be allowed to operate.
• Functions without Maintenance Rules will be paused.
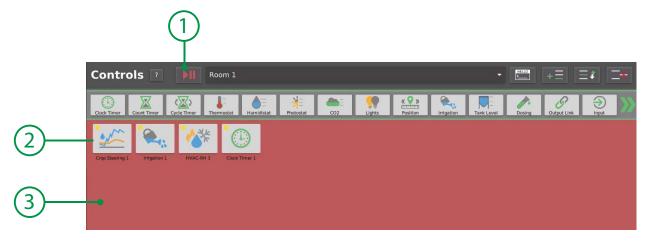
The Run Mode button is located at the top of the Control tab. Press the Run Mode button to open the Run Mode dialog window.

When the control group is paused, the run/pause button (1) and workspace background (3) change to a red shade to indicate they are stopped. The function icons status dot (2) will turn yellow to indicate it is paused.

When the control group is in Maintenance mode, the run/pause button (1) remains green. The function icons status dot (2) will turn Red if no maintenance rules exist in the function. The background will turn yellow to indicate the workspace is in maintenance mode.

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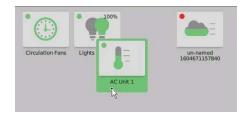
Function Order

Function order dictates priority of commands. Controls are executed in the order that they are shown in the workspace beginning at the top left, going across to the right and beginning at the left again on the next line. If two functions have conflicting aims then the function that is executed last will take the priority.

Re-arranging Functions
To move a function within a workspace, press and hold on the function icon's title text. The function will be highlighted green; drag the function to the new location in the workspace then release.
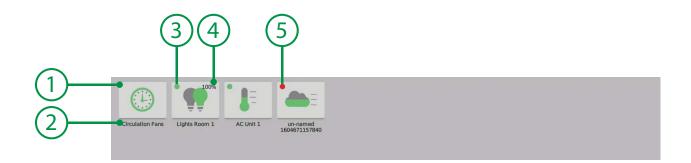
Workspace Icons

Each function that is added to the workspace has it's own button icon in the workspace. The button icons include information about the function and it's status.

1. Function Button   Icon depicts the type of control function; see the tool bar for reference.
2. Function Name   The function name (set by the user) is shown under the function button.
3. Function Status   The status of each function is shown in the upper left with a colored dot:

Empty	Function is valid but not active (idle.)
Green	Function is active.
Yellow	Function is paused (group or system paused.)
Red	Function has invalid parameters or is disabled.

4. Analog Output   If a function has an analog output, the priority output value is shown here.
5. Invalid Status   An invalid or disabled function will show a red dot; this function is not active.

Controls Toolbar

Control functions are added to workspaces using the controls tool bar. The tool bar scrolls to expose more controls.

Press on any function tool bar item and a new function will be added to the end of the current workspace. The function will be added in the disabled state with no settings. Press the function in the workspace to open the editor.
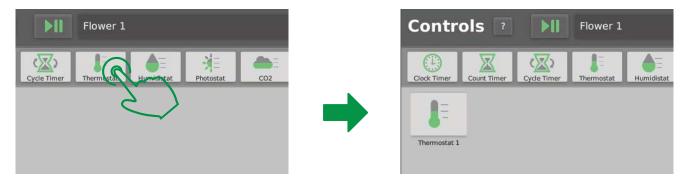
1. Clock Timer Activate a discrete (on/off) output or analog (variable) output during a specified time range.

2. Count Timer Delay-on, delay-off and single-shot timers in seconds, minutes, or hours.

3. Cycle Timer Repeating timer with on and off times in seconds, minutes, or hours.

4. Thermostat Standard heat or cool temperature control function with set point and dead-band to control outputs such as fans, HVAC and A/C systems.

5. Humididstat Standard humidify or dehumidify humidity control function with set point and dead-band to control outputs such as a humidifier or dehumidifier.
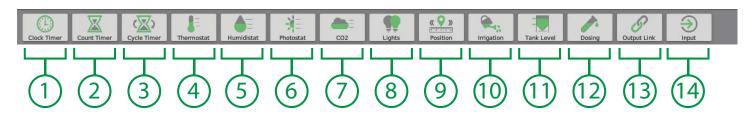
6. Photostat Photo sensitive control to operating an output device based on solar/light levels.
For light dimming in conjuction with the sun, use the LIGHTS function.

7. CO2 Standard ppm-based CO_2 injection or exhaust control function with set point and dead-band. Control a discrete relay for a CO_2 valve or burner for injection, or an exhaust fan or alarm horn for high CO_2.

8. Lights Control for discrete or dimmable lighting systems. Integrate dimming profiles for sunrise/sunset and/or dim lights when sun intensity increases or temperature exceeds limits.

9. Position Advanced position control for greenhouse vent motors, side-walls and shade/blackout curtains.
Requires MX1i digital reversible motor controllers for position control.

10. Irrigation Control up to 99 stages, repeat settings, feed pump/valve control and drain valve control.

11. Tank Level Automatically re-fill a tank when it has reached a low level until it returns to the high level.

12. Dosing Nutrient and pH dosing for stock tanks, reserviors and recirculating hydroponics systems. Automate ppm and pH control for up to 24 nutrient parts with a recipe library.

13. Output Link Connect and daisy-chain multiple outputs together.

14. Input Integrate analog or discrete sensor inputs in control functions with the Input function.
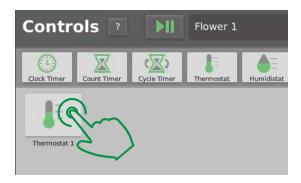
15. Logic Logical operations between functions and physical I/O can be used to create more advanced rules within control functions.

16. Alert Alert functions can be scheduled to provide alarm notifications and actions based on sensor set points.

17. CO2 Alarm Control function for coordinating CO2 gas sensors, horn strobe alarms, purge fans, etc. for a purging and alarming in high ppm concentration conditions.

18. HVAC-RH Integrated Control Manage a standard HVAC unit with two stage heating and cooling, as well as two stage humidification and dehumidifcation from a single function.

19. Analog Out Scale an analog output (0-10V, PWM) according to an analog sensor or input signal.

20. Message Create notes, reminders and alert messages to be stored in workspaces or sent to email or SMS when the rule is triggered.

Adding & Editing Controls

Controls functions are added to a workspace by pressing the desired toolbar button. An un-named function will be added to the workspace.
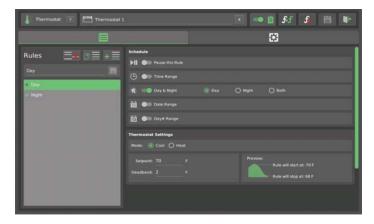
Press on the new function icon in the workspace to open the **function editor** and configure the function.
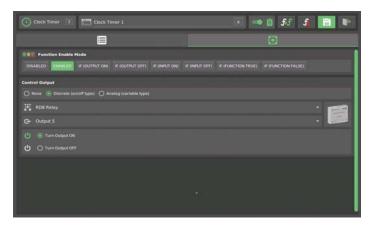
Function Editor

The function editor will open when a function icon within the workspace area is pressed. A header at the top of the editor contains a name field and several buttons to copy, delete and save the function as well as exit the editor window.

Two tabs at the below the top header separate the settings for the RULES ☰ and for the EQUIPMENT ⚙ settings. **Equipment settings apply to all rules in the function.**

The RULES tab where parameters are configured for the function in rules.

The EQUIPMENT tab where inputs and outputs are specified for the function to control.

Function Editor Header

The function editor has a header at the top of the window with a name for the function and several buttons to copy, delete and save the rule. The close the cuntion editor, use the exit door button in the upper right

1. Show in Report   If checked the control function status will be shown on the home page report.
2. Function Name   Press the [X] button to delete the name or press the text field to edit the name.
3. Report Switch   Enable this switch to show the status of the function in the home screen reports.
4. Copy Function   Opens a dialog to make a copy of the current function; select a workspace to copy to.
5. Delete Function   Opens a dialog to delete the current control function from the workspace.
6. Save Settings   Press the save button to save the changes to the system memory.
     The save button will be highlighted green when settings on the page have changed.
7. Exit Editor   Closes the editor dialog and returns to the workspace.
     If changes have been made and are not saved before exiting they will be lost.

Copy a Function

To copy a function with all of the existing rules to a new or the same workspace, use the copy function button at the top of the function editor window. A dialog will prompt for the destination workspace.

Delete a Function

If a function is no longer required or has been created accidentally, open the function editor for the function to be removed by pressing on the function icon in the workspace. In the editor window press on the delete function button. A dialog will appear asking to confirm you wish to delete the function and rules.
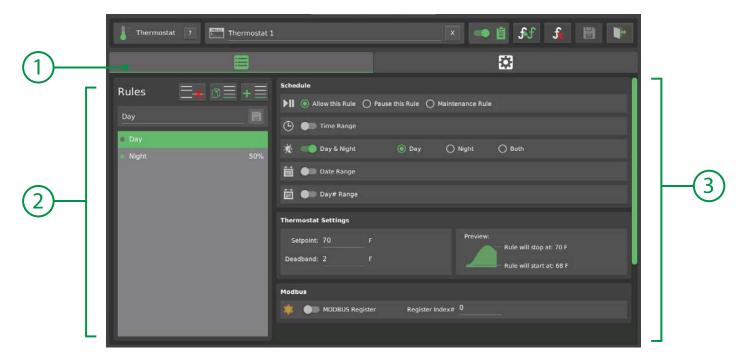
Rules Editor ▤

On the rules tab individual rules can be configured with settings that vary based on time, day/night, date, and workspace day number. A list on the left (2) identifies rules by the names entered. Selecting a rule will populate the data fields and settings in the editor area (3).

The first rule is automatically added when a function is created, however it must be configured before it can function. The rule may be renamed for reference with the text field at the top of the rule list.

1. Rules Tab   Select this tab to create and edit rules for the function.
2. Rule List   Displays the rules in the function and their current status (active, idle or error.)
3. Editor Area   Rule editor area for configuring the rule schedule and settings.
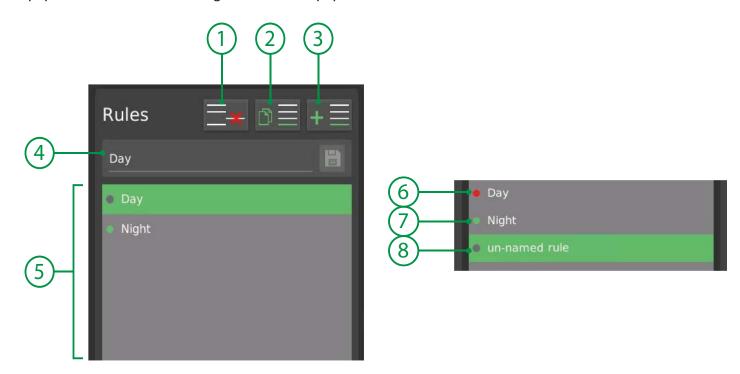
ⓘ **NOTE:** For more information on configuring the rule settings, see the function descriptions.

Function Rule List

The function rule list is used to select the rule to edit, and can also add, copy and delete rules from the function. If there are conflicting rules, the last rule will be the one executed by the system.

• As many rules can be added to a function as required.
• Rules can be scheduled to achieve multiple settings through out a day, or a complete grow cycle.
• At least one valid rule is required to make a function work.
• Equipment must also be configured on the equipment tab to make rules in a function work.

1. Delete   Delete the selected rule from the function.
2. Copy   Copy the selected rule's settings to a new rule.
3. Add   Add a new blank rule to the function.
4. Rule Name   Edit & save the name of the rule for reference.
5. Rule List   List of all rules in the function.
6. Rule, with Error   A red dot indicates there is an error condition in the rule and it will not function.
7. Rule, Active   A green dot indicates the rule is currently active.
8. Rule, Inactive   A grey dot indicates the rule is currently idle.
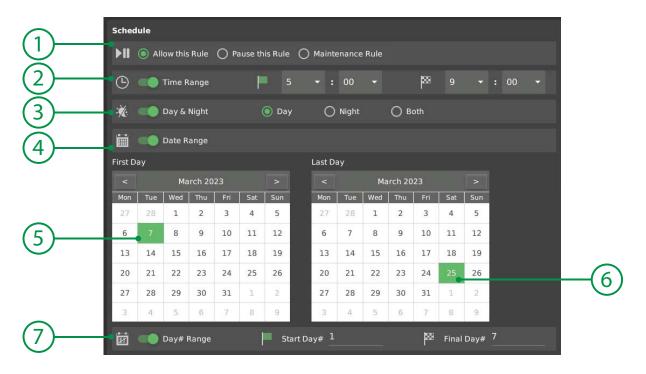
Rule Shedule
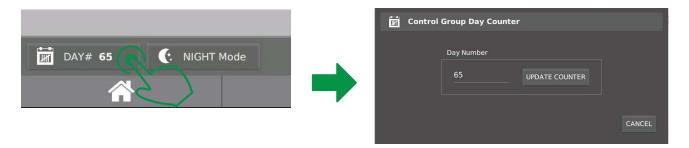
Every rule can be scheduled by time of day, day/night, start/end date, or start/end day number.

ⓘ **NOTE:** If no switches are enabled in the "Rule Schedule" group, the rule will be ALWAYS scheduled.

1. Pause Mode	Allow this Rule: Normal operation, rule is allowed when workspace is in Run mode.
	Pause this Rule: The rule will not operate.
	Maintenance Rule: The rule will operate when the workspace is in Maintenance mode.
2. Time Range	Enable the rule for a specific time range.
3. Day & Night	Enable the rule based on the workspace's day/night status.
	The day/night status is located at the bottom of the control group work space.
4. Date Range	Enable the rule for a specific date range.
5. First Day	First date that the rule will be enabled.
6. Last Day	Last date that the rule will be enabled.
7. Day Range	Enable the rule based on the workspace's current day-number count.*

ⓘ ***NOTE:** The day number counter is located at the bottom of the control group work space.

Time Range

To configure a rule to be active only during a specific time range, enable the Time Range switch.
Set a start time and end time for the rule to be enabled.

Date Range

To configure a rule to be active only during a specific date range, enable the Date Range switch.
Set a start and end date for the rule to be enabled.

Day Range

Each control group workspace has a dedicated "day counter" that increments each day when the date changes. The day counter allows rules to be configured to operate during specific phases of a growth cycle based on the day number in the cycle.

To configure a rule to be active only during a specific day number range, enable the Day# Range switch.
Set a start day# and end day# for the rule to be enabled.
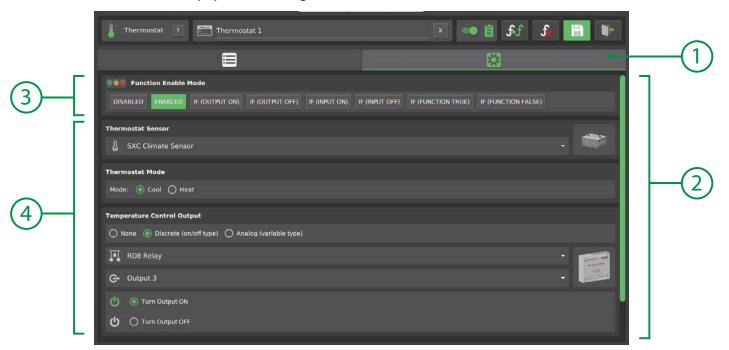
The Day Coutner is located in the bottom tool bar of the control group work space.
Press the counter button to display the count editor dialog to adjust the current day number.

Equipment Editor ⚙

On the equipment tab, inputs, output, sensors and other devices and equipment that will be controlled by the function are generally configured on the equipment tab. (Some rules contain equipment specifications.) Each function may require different equipment configurations and options.

The equipment tab is "global" to the function; this means that the equipment settings apply to all of the rules on the rule editor tab. Equipment settings are **not** individual to each rule.

1. Equipment Tab   Select this tab to create and edit the equipment and sensors for the function.
2. Editor Area   Equipment editor area for selecting the devices to be controlled & general options.
3. Enable Mode   Enable or disable the function based on the condition of an input, output or function.
4. Equipment   Select sensors, outputs, etc. as required by the function.
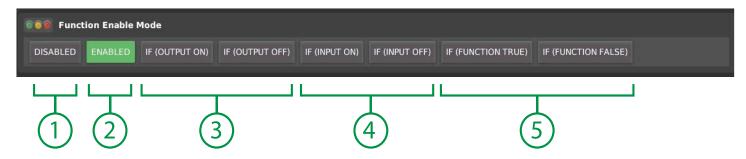
Function Enable Mode

Functions can be enabled in different ways in order to create either simple or complex logic.
The "Enable Mode" settings are found on every function's equipment tab.

1. Disabled   The function is disabled and will not activate.
2. Enabled   The function is enabled and will activate by schedule and other function settings.
3. If Output...   The function is enabled if a selected output is on or off.
4. If Input...   The function is enabled if a selected input is on or off.
5. If Function   The function is enabled if a selected function status is true (active) or false (idle.)
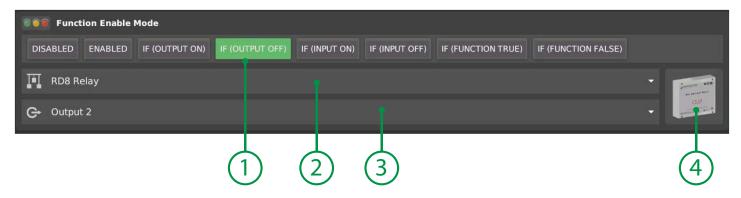
If Input/Output On/Off

To coordinate a function with the status of another device, the function can be configured to be enabled only if an output or input is currently on or off.

1. Press the [IF (OUTPUT ...)] or [IF (INPUT ...)] button in the desired on or off mode.
   The Enable Mode area will expand and the drop-down menus to select an assignment will be displayed.
2. Select an output (or input) device.
3. Select a specific output (or input) on the device.
4. An icon of the device selected in step 2 will be displayed.

The function will now only be enabled according to the status of the selected output or input.
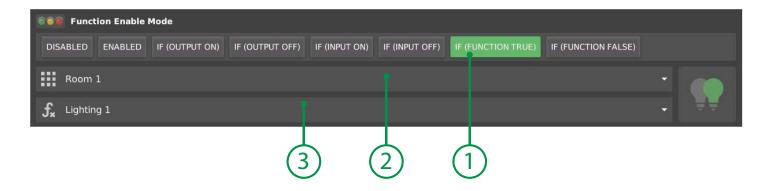
This type of feature is useful for enabling or disable equipment in coordination.
For example, it may be desirable to disable a CO2 control when the exhaust output is activated.

If Function True/False

To enable a function on another function's status (instead of a physical output) select the "If Function" mode.

1. Press the [IF FUNCTION ...] button in the desired on or off mode.
   The Enable Mode area will expand and the drop-down menus to select a function will be displayed.
2. Select a control group.
3. Select a function.
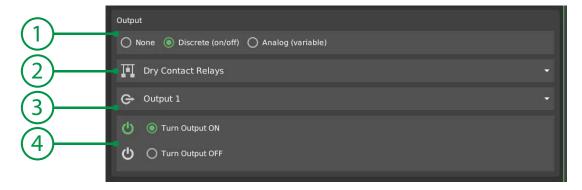
Function Output

Many functions feature the ability to set an output according to the status of the rules.
The equipment output settings are found on the equipment tab of the function editor. ⚙

The output can in most cases be either a discrete type (on/off only) or an analog type (variable output.)
Discrete types are typically relays such as RX or RD series relays. Other devices such as VX and DX series include both discrete and analog outputs in either 0-10V or PWM.

Discrete (on/off) Output

A discrete output is one that can only turn **on or off** such as a relay contact.

| 1. Output Type | Sets the type of output that the function will operate. |

None	The rule will be status-only.
Discrete	The rule will operate a discrete on/off output.
Analog	The rule will operate an analog output.

2. Device   Select the GrowNET™ device that the output is located on.
3. Output   Select the equipment output to be controlled.
4. Output Mode   Select if the rule should turn the output on or off when activated.

Analog (variable) Output

A analog output is one that can **vary**; typically PWM or analog voltage to control light dimming signals or motor speed controllers.

1. Device   Select the GrowNET™ device that the output is located on.
2. Output   Select the analog output to be set by the rule.
3. Value   Enter a value (0-100%) to be sent to the output when the rule is active.
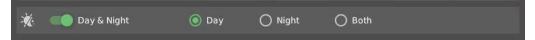
Day & Night Mode

Each control group workspace has a dedicated "day & night" function that can be configured to operate based on time of day, or light intensity levels from a light sensor. The day & night mode function is a powerful and simple way to coordinate functions in your workspaces according to the status of day or night.
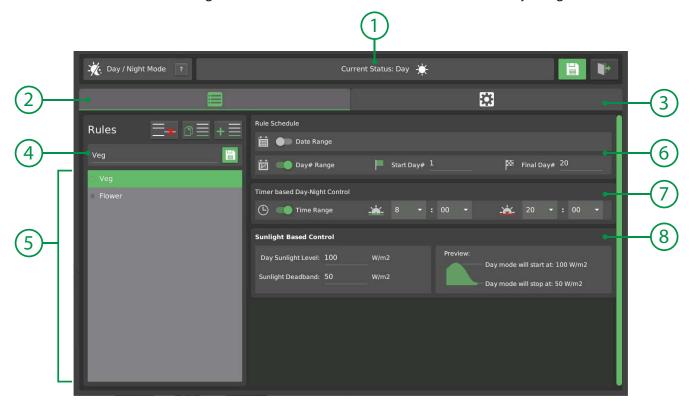
To configure a function to be active only during the day or night, enable the "Day & Night" switch:

The Day/Night mode control is located in the bottom tool bar of each controls work space.
Press the button to display the editor dialog and adjust the rules for day & night.

Day and night time can be simply scheduled with a morning and evening time of day, or multiple rules can be created to schedule the day/night to adjust based on the date range or day number count. Day and night can also be coordinated with a light sensor to set the state based on the intensity of light.

1. Current Status   Shows the current status of the day/night control function.
2. Rules Tab   Edit the day/night schedule rules on this tab.
3. Equipment Tab   Edit the sunlight sensor selection (optional) on this tab.
4. Rule Name   Each rule can be named for reference.
5. Rule List   Select a rule in the list to edit.
6. Rule Schedule   If desired, the rule can be restricted to a date range or day number range.
7. Time Range   Set the day time and night time values if using a time range.
8. Sunlight Settings   Set points for light sensor based day/night control (optional.)

Clock Timer 🕐

The clock timer is the most basic control function in the system featuring only the basic rule properties:

• Rule Scheduling • Time Range   • Equipment Output

Configure the schedule options that are desired (if any) and set a time range. If no time range is configured, the timer rule will be active continuously. Rules are created and edited on the rules tab. ☰
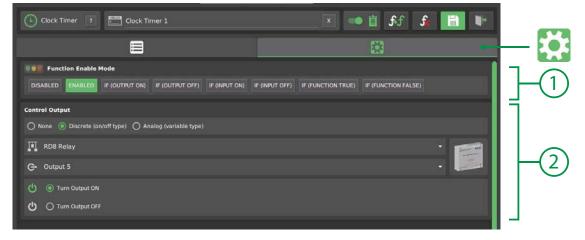
1. Rules List   Select a rule to edit the settings in the rule.
2. Schedule   Options for scheduling the rule based on date, day number, etc.
                  If no schedule options are selected then the rule will always be scheduled.
3. Time Range   Start and End time for the clock timer function to be active.
                  No time range (switch off) will activate the timer continuously.

To operate a device with the clock timer function, assign one on the equipment tab. ⚙
Most functions, including the clock timer, can be a 'soft-function' if no output is assigned.

1. Enable Mode   Select ENABLED or set a conditional rule to apply to the function.
2. Control Output   Select a mode, output device and output channel to operate with the function.
                  Equipment assignments apply to all rules in the function.

An enable mode may also be configured to set additional conditions to the function's operation.
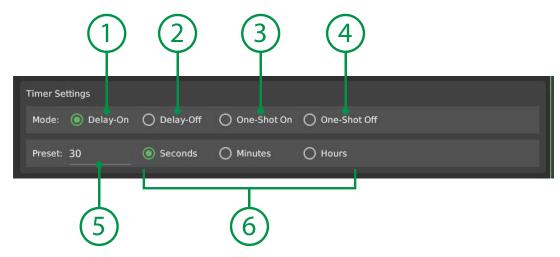
In the example above, the timer rule is "enabled" without any pre-conditions. The output named "Output 5" on the device named "RD8i Relay" will be turned on according to the schedule setting from 8am (8:00) to 3pm (15:00).

Count Timer ⧗

The count timer has several modes that operate based on when the rule's scheduling and/or enable conditions becomes true or false. Count timers are typically used to delay an action or operate a device for a set period based on the action of another device or function.

Example uses:
• Sequencing light banks or other outputs with an on-delay.
• Set an off-delay on a HAVC fan with the AC as the enable input.

1. Delay-On   Activate the rule after the preset delay has elapsed.
2. Delay-Off   Immediate activate then keep the rule activated for the preset delay.
3. One-Shot On   Activate the rule for a preset time when the rule is enabled.
4. One-Shot Off   Activate the rule for a preset time when the rule is disabled.

The diagram below depicts how the different timer modes will activate depeding on the status of the enable input or change in schedule status:

To setup a count timer:
• Set the rule schedule on the rules tab. ▤
• Configure the timer settings on the rules tab. ▤
• Configure an output to control on the equipment tab. ⚙
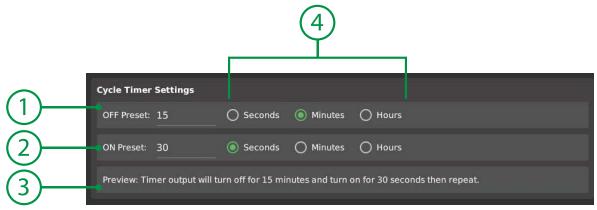
Cycle Timer ⧗

A cycle timer is a classic function where a device is operated in repeating off-on cycles. The cycle timer, like all functions, can be scheduled to operate during a set time of day or can operate continuously.

• Cycling circulation fans • Agitating tanks with a mixing pump • Basic irrigation timer

Rules for timer settings are created and edited on the rules tab. ▤

1. Off Preset   Time duration for the "off" period of the cycle.
2. On Preset   Time duration for the "off" period of the cycle.
3. Preview   A preview of the timer actions is shown in this field.
4. Units   Select the units for the off and on presets; seconds, minutes or hours.

Maximum time values:

Seconds	65500
Minutes	1092
Hours	18

To operate a device with the cycle timer function, assign one on the equipment tab. ⚙
Cycle timer requires an equipment output assignment to operate.

1. Control Output   Select a mode, output device and output channel to operate from the function.
                             Equipment assignments apply to all rules in the function.

ⓘ **NOTE**
To ensure accurate timing, cycle timers operate locally at the GrowNET™ device. The cycle timer function will show active when the timer is operating but will not change status based on the cycle timer. Observe the physical output for the status of the cycle.

Thermostat 🌡

Thermostat controls are used to operate heating or cooling equipment based on a temperature set point and temperature sensor reading. A setpoint determines the target temperature. A "deadband" determines the allowed drift from the target before activating the thermostat to return the reading to the target.

• Heating / Cooling HVAC equipment • Exhaust fans • Chillers • Floor heating

Assign a sensor to read from (1), a mode (2), and a device to control (3) on the equipment tab. ⚙
Equipment assignments apply to all rules in the function.

1. Sensor Device	Select a sensor device (or average) for the thermostat function to read.
2. Mode	Cool: Function activates when temperature exceeds setpoint.
	Heat: Function activates when temperature is below setpoint.
3. Control Output	Select a mode, output device and output channel to operate with the function.

Rules for temperature set points are created and edited on the rules tab. ☰

1. Setpoint	Temperature to start cooling or stop heating.
2. Deadband	Temperature drop before starting heating or before stopping cooling.
3. Preview	A preview of the rule's function.

ⓘ **NOTE**
When configuring HVAC systems with a thermostat function it is recommended to control the "heat" or "cool" output from the thermostat function, then control the "fan" output with an "output link" function to operate the fan any time the heat or cool output are activated.

Humidistat

Humidistat controls are used to operate humidification or dehumidification equipment based on a humidity set point and humidity sensor reading. A setpoint determines the target humidity and a "deadband" determines the allowed drift from the target before activating the humidistat to return the reading to the target.

• Dehumifiers • Exhaust fans • Humidifiers • Misters

Assign a sensor to read from (1), a mode (2), and a device to control (3) on the equipment tab. ⚙
Equipment assignments apply to all rules in the function.

1. Sensor Device Select a sensor device (or average) for the humidistat function to read.
2. Mode   Dehumidify: Function activates when humidity exceeds setpoint.
        Humidify: Function activates when humidity is below setpoint.
3. Control Output Select a mode, output device and output channel to operate with the function.

Rules for humidity set points are created and edited on the rules tab. ▤

1. Setpoint   Humidity reading to start dehumidifying or stop humidifying.
2. Deadband   Humidity drop before starting humidification or before stopping dehumidification.
3. Preview   A preview of the rule's function.

Photostat
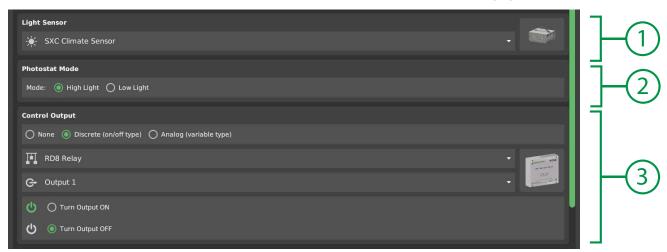
Photostat controls are used to operate equipment based on a light intensity set point and light sensor reading. A setpoint determines the target light intensity and a "deadband" determines the allowed drift from the target before activating the photostat. When the light intensity returns to the target the photostat is deactivated.

Example uses:
• Activate fans with high sunlight for pre-emtpive cooling.
• Open louver vents with high sunlight.
• Turn on a light at night.
• Alarms

Assign a sensor to read from (1), a mode (2), and a device to control (3) on the equipment tab. ⚙

1. Sensor Device	Select a sensor device (or average) for the light function to read.
2. Mode	High Light: Function activates when light exceeds setpoint.
	Low Light: Function activates when light is below setpoint.
3. Control Output	Select a mode, output device and output channel to operate with the function.

Rules for light intensity set points are created and edited on the rules tab. ▤

1. Setpoint	Intensity to start shading or stop lighting.
2. Deadband	Intensity drop before starting lighting or before stopping shading.
3. Preview	A preview of the rule's function.
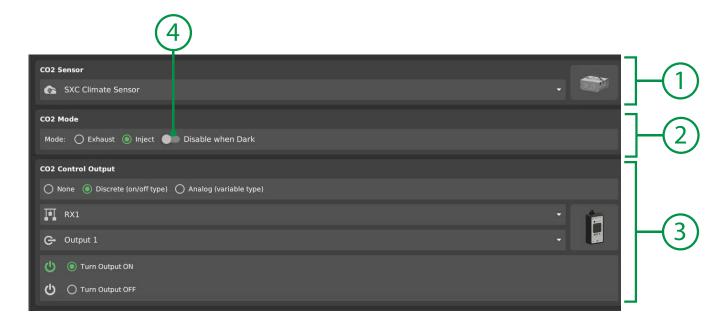
Carbon Dioxide (CO2) ☁

CO2 controls are used to operate CO2 valves, burners and exhaust equipment based on a carbon dioxide intensity set point and sensor reading. A setpoint determines the target CO2 concentration and a "deadband" determines the allowed drift from the target before activating the CO2 control.

• CO2 valves / burners • Exhaust fans • Vents

Assign a sensor to read from (1), a mode (2), and a device to control (3) on the equipment tab. ⚙
Equipment assignments apply to all rules in the function.
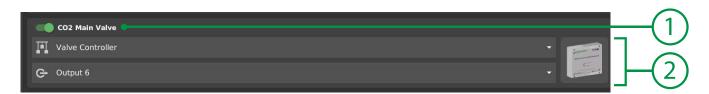
1. Sensor Device	Select a sensor device (or average) for the thermostat function to read.
2. Mode	Exhaust: Function activates when CO2 concentration exceeds setpoint.
	Inject: Function activates when CO2 concentration is below setpoint.
3. Control Output	Select a mode, output device and output channel to operate with the function.
4. Dark Switch	Disables injection when the CO2 sensor unit detects the ambient light level is 0.

Main Gas Valve
If a facility main gas valve is required to be opened when CO2 is turned on, enable the main valve option and assign an output to control the valve. If no CO2 is required, the main valve will turn off.

1. Enable Switch	Operate a main gas valve when the room/zone valve is activated.
2. Output Device	Assign the output device and channel connected to the main gas valve.

Rules for CO2 set points are created and edited on the rules tab. ▤

1. Setpoint   The target sensor value to achieve.
2. Deadband   The allowed drift from the target before activating the function.
3. Preview   A preview of the rule settings.

ℹ **NOTE**
When configuring a CO2 control for injection, ensure the rule is set to inject during the day period only.
CO2 augmentation should only occur during the day photoperiod.

• Turn on the "Disable when Dark" switch to disable when the sensor detects that the ambient light level is 0.
• OR, set the rule time schedule to "DAY" mode or other scheduled time.

Disable with CO2 Alarm Function

CO2 Alarm functions can be used to activate exhaust fans, turn on horn-strobe alarms and disable gas valves. To disable CO2 injection functions when a room CO2 alarm is activated, set the "Enable Mode" as shown below.

1. Select "IF (FUNCTION FALSE)" option in the Function Enable Mode on the equipment tab. ⚙
2. Select the workspace and function name of the CO2 Alarm function.

The CO2 function will now only be able to operate if the CO2 alarm function is "false" and not activated.
If the CO2 alarm function is activated, the CO2 function will be disabled and not activate the CO2 valves.

See the CO2 Alarm section for details on configuring CO2 alarms.

Lights 💡

The lights function can operate basic discrete control (on/off only) or dimmable control with 0-10V dimming or digital control dimming. It is also possible to configure both types in the same function for controlling mains/circuit power and a dimmable output for intensity.

Dimming controls can be ramped up and down with a ramp-rate setting to provide a sun-rise and sun-set feature. Multiple dimming rules can be layered to create a complex lighting profile. Lighting control includes features to dim lights based on a light intensity or if a high temperature condition exists.

Dimming Control Interfaces

Depending on the manufacturer of the light fixture, some are dimmed with a standard analog 0-10V signal while others have a proprietary digital serial communication protocol. Agrowtek manufactures modules to interface with both types of fixtures.

Analog 0-10V Control (DXV4)
Most dimmable fixtures use a 0-10V analog interface with fixtures cabled to-gether with either RJ-12 or RJ-45 type connectors. These fixtures are typically controlled with a DXV4 0-10V module. The DXV4 has four (4) independent output channels which can dim up to 50 fixtures per channel.

Connections to the module are made by cutting the RJ connector off of the cable and terminating the necessary leads into the screw terminals on the DXV4 module. *See the DXV4 guide for wiring diagrams.*

Digital Control (LXD)
Some manufacturers use a more advanced "digital" control signal. This signal can carry dimming information for one or more spectrum channels to the fixture using the same or similar types of cabling between fixtures.

Fixtures which require digital commands to operate the dimming need the LXD digital lighting interface. The interface connects a single zone of any number of fixtures to the GCX control system and provides the full capabili-ties of the fixture's spectrum control capabilities.

Manufacturers that use digital protocols:
• Thinkgrow • Dutch Light Innovations (DLI) • Hydrofarm/Phantom • Scynce • FOHSE

Lighting Equipment
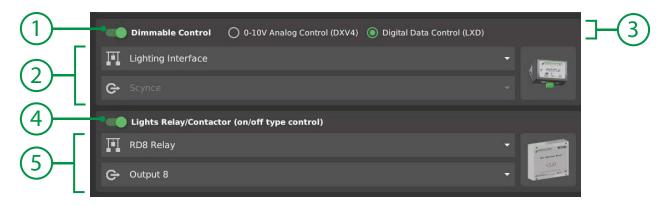
Assign devices to control the lights and sensors to monitor temperature or light on the equipment tab. ⚙ *Equipment assignments apply to all rules in the function.*

Dimming
If lights are controlled by dimming, select the type of interface (5) and then assign a module. If using 0-10V dimming, select which channel on the 0-10V module is connected to the lights. If the lights are digital type and the incorrect manufacturer is shown, change it on the device 'info' tab (exit the function editor window.)

On-Off Only Control
If lights are on-off control only, or, also require a discrete control to power on, then use the relay/contactor option to turn on a discrete output when the lights function is active.

1. Dimmable Option   Enable dimmable control of lights.
2. Dimmable Output   Select a dimming device to control the fixture.
3. Dimmer Type   Select analog 0-10V or digital control according to your fixture requirements.
4. Contactor Option   Enable on/off control of lights for contactor control.
5. Contactor Output   Select a relay device and output to operate a contactor.

Sensors
Lights can be automatically dimmed according to light level or high temperature. To enable these capabilities, turn on the option switch and select a sensor device. The options will appear on the rults tab when the equipment settings have been saved.

1. Temperature Dimming   Enable high temperature dimming (select a sensor.)
2. Sunlight Dimming   Enable sunlight dimming (select a sensor.)

Lighting Control Rules

Rules for light intensity, spectrum, and high temperature are created and edited on the rules tab. ☰

1. Setup the maximum (target) intensity and minimum intensity that the lights are capable of operating at.
2. Decide on a change rate for the light intensity; see the preview (5) to determine the transition times.
3. If spectrum controls are available, configure the spectrum levels as desired.

1. Max Intensity	Target intensity for the lights to reach.
2. Min Intensity	Minimum intensity lights are capable of.*
3. ChangeRate	Rate of change for dimming intensity.
4. Spectrum	Spectrum controls for digital lighting fixtures (LXD module.)
5. Preview	Displays the ramp up/ramp down timing for dimmer intensity.

*Minimum intensity is where the dimming function will start when ramping up, and end when ramping down. When ramping up, the output starts at 0 and jumps immediately to the minimum before ramping. When ramping down, once at the minimum, the output will drop to 0 without ramping.

Temperature Dimming

Lighting can be dimmed in the event that temperatures exceed a limit in order to help reduce stress on plants and limit the heating of the space. If dimming is enabled, the system will begin to dim at the ramp rate until the temperature is reduced below the preset. If dimming is not enabled, the discrete output will be shut down.

1. Max Temperature	Temperature to start dimming (or shutdown.)
2. Deadband	Cooling required before re-starting lights; see preview window.

Sunlight Dimming

Lighting can be dimmed in the event that light levels exceed the target or can be increased up to the maximum intensity if below the target. In this way an ideal light intensity can be maintained. An option allows the lights to turn off when they reach minimum intensity or remain on at the minimum.

1. Light Target   Target light intensity for the function to maintain.
2. Minimum Action   Select if lights should turn off or hold when reaching minimum intensity.

Hotfire Delay

A hot-fire delay can be set to prevent re-activation of the lighting output for a set period to prevent hot-firing arc lamps. This is configured on the INFO tab under the re-start delay setting.

Position 《📍》
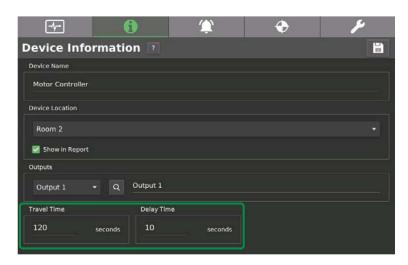
The position function is used to ontrol reversible motors used in shade and black-out curtains, ridge vents, side-wall vents and similar applications. MX motor controllers are required to use position functions.

Position is controlled in MX motor controllers by tracking how long the motor is moving in the forward or reverse direction. The "travel time" programmed into the MX controller is the total amount of time it takes for the motor to move between the fully opened and fully closed positios. If the system needs to open from 0% to 50% it will operate the motor in the forward (open) direction for half of the travel time.

Position Tracking
The travel time parameter and current position are stored in the MX motor controller.
See the device information page.
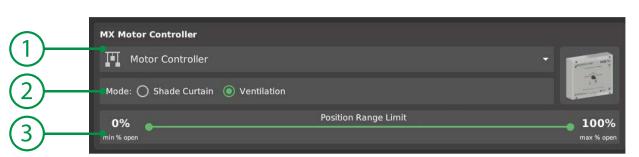
If an operator manipulates the manual override knob, the position will continue to be updated by the MX controller and the position relayed back to the GCX control system. Upon returing the knob to the Auto position, the system will regain control of the MX controller.

Equipment

Assign sensors and a motor controller which will operate the reversible motor on the equipment tab. ⚙

1. Motor Controller   Select an MX motor controller to operate with the position function.
2. Function Mode   Shade Curtain: 0% Open = Full Shade, 100% Open = No Shade
                            Ventilation: 0% Open = Vent Closed, 100% Open = Vent Open
3. Position Limits   Final minimum and maximum position limits for the function.

Position functions can be be configured for shade/blackout curtain or ventilation type control.

Shade/Blackout Curtain
In this mode the position can be by a static setting, a temperature position and a light intensity position.

Ventilation
In this mode the position can be modulated to variable positions based on rising temperature.

Sensors
Position can automatically be adjusted based on temperature and/or light intensity. To use these options, turn on the switch and assign a sensor. Save the function and then configure the rules settings.

1. Temperature Dimming	Enable high temperature dimming (select a sensor.)
2. Sunlight Dimming	Enable sunlight dimming (select a sensor.)

Position Rules

Rules for how to operate the motor controller are created and edited on the rules tab.

Position can be controlled with a simple static position setting, or, sensors can be assigned to allow the rules to set position based on temperature or light intensity. These options can be combined and which ever results in the highest %open position is what the rule will follow.

Static Position

In either operation mode, the rule can be set to a static (manual) position. If the static position is enabled, the rule will move to this position unless another setting in the rule increases the position further.
A weather position override will overrule the static position.

Common uses for a static position include:
• Setting a light deprivation curtain to open between specific times.
• Cracking a vent to remove humidity or provide fresh air.

1. Enable Static	If enabled, rule will set the position according to the setting.
2. Position Setting	Use the slider to set the % open position.

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Shade / Blackout Curtain Mode

This mode is designed to control shade curtains and black-out curtains using the static position option.

Shade mode will reduce the %open position in the solar shading and temperature shading modes in an effort to reduce solar radiation resulting in excess heat. Shading from high intensity light can reduce solar heating or when the interior temperature is too high can help alleviate excess heat.

Additional positions for high light intensity, high temperature and weather alarms can also be configured to actively adjust the position depending on conditions.

ⓘ **NOTE:** To enable a sensor based position option, turn on the appropriate switch on the equipment tab ⚙ and assign a sensor. Once the assignments are saved, the settings will be shown.

1. Temperature Position   Maximum %open position when limit is exceeded.
2. Temperature Limit   Temperature high limit; if reached, the position limit is activated.
                             If temperature is high, the shade will reduce %open to the selected position.

3. Solar Position   Maximum %open position when limit is exceeded.
4. Solar Limit   Light intensity high limit; if reached, the position limit is activated.
                             If intensity is high, the shade will reduce %open to the selected position.
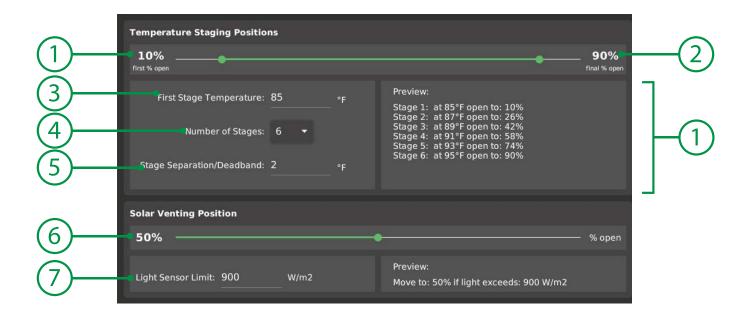
Ventilation Mode

This mode is designed to control ridge vents and side-wall curtains for cooling.

Ventilation mode will increase the %open position in an effort to cool the environment. Cooling can be staged into as many as eight (8) positions; as temperture climbs, the position is increasingly opened.

Additional positions for high light intensity and weather alarms can also be configured to actively adjust depending on conditions if desired.

ⓘ **NOTE:** To enable a sensor based position option, turn on the appropriate switch on the equipment tab ⚙ and assign a sensor. Once the assignments are saved, the settings will be shown.

1. First Position	Move the left slider to the first position that the rule should open to.
2. Final Position	Move the right slider to the final position that the ruls should open to.
3. First Stage Temperature	First temperature stage activation; move to first position.
4. Number of Stages	Select how many stages to break the position movements into.
5. Stage Separation	Degrees between ventilation stages.
	Separation is used both when rising and falling to segregate stage reversal.
6. Solar Position	Maximum %open position when limit is exceeded.
7. Solar Limit	Light intensity high limit; if reached, the position limit is activated.
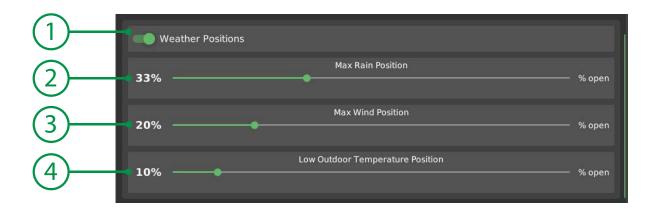
Weather Positions

Ventilation and Shade control settings both feature weather override positions which can be set when the system weather alarms are activated for rain, wind speed or low temperature.

To set weather position limits, turn on the Weather Positions switch and move the sliders to the desired positions.

ⓘ **TIP**
To disable a specific weather override position, set the position to 100%.
This will prevent the override from reducing the position even if the alarm is active.

1. Weather Positions   Set this option to limit the position based on system weather alarms.
2. Rain Position   Sets the maximum position allowed during a rain alarm.
3. Wind Position   Sets the maximum position allowed during a high wind alarm.
4. Temperature Position   Sets the maximum position allowed during a low temperature alarm.

Irrigation 🚿
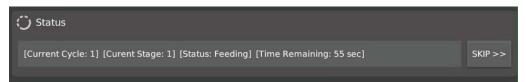
Multi-stage irrigation controls operate watering stages in a sequential fashion. Each stage may have a unique irrigation duration and output assignment (output channels do not need to be sequential.) Once all of the stages have completed, they can be repeated at specific intervals for a specific count, or, multiple irrigation rules can be configured to activate through out the day.

Irrigation stages can coordinate with an irrigation pump or main supply valve, and can operate a drain valve output for flood tables between stages. Irrigation may be triggered based on time of day when the rule is enabled, or by moisture level if a moisture sensor is connected.

Rules for how to operate the irrigation stages are created and edited on the rules tab. 📋

Irrigation Status
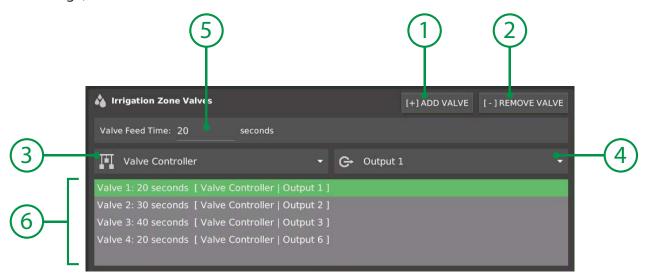
The current irrigation cycles and status can be observed in the function rule editor. Irrigation cycles can also be manually skipped with the SKIP button.

Irrigation Zone Valves

To configure irrigation zones:
1. Press the [+ ADD VALVE] button (1) and a new valve will be added to the valve list.
3. Enter a time duration for the valve to irrigate in the VALVE FEED TIME field (5).
3. Select the device (3) and output (4) that the irrigation valve is connected to.
4. To edit a stage, select a valve in the valve list.

1. Add Stage	Adds a new irrigation stage to the rule.
2. Remove Stage	Deletes the currently selected stage from the rule.
3. Output Device	Relay or Irrigation valve controller device.
4. Valve Output	Output selection on the valve controller device.
5. Feed Time	Amount of time to operate the valve.`
6. Valves List	Valve assignment and feed time list. Select a line to edit or delete it.

Valve Options

Irrigation valves can be operated in a standard sequential pattern (one after the other) or can be allowed to operate simultaneously (at the same time.)

1. Feed Mode   Sequential: Default, one valve operates at a time in sequence.
                                          Simultaneous: All valves start operating at the same time.
2. Valve Delay   Amount of time to delay between closing a valve and opening the next valve.
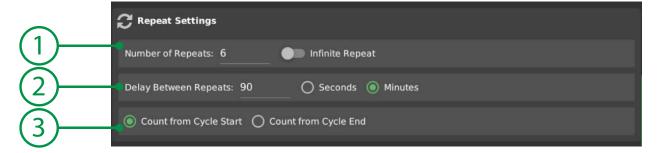
ⓘ **NOTE**: VX8 valve controllers with hardware revision C or earlier are limited to four (4) valves simultaneous operation. VX8 Revision D and later, and RD8i relays, may operate all eight valves simultaneously.

Repeat Irrigation

Once the irrigation cycle is completed, it can be repeated a number of times at a specified interval.
If no repeats are desired (single irrigation cycle only) set the number of repeats to zero and the cycle will occur only the first time.

1. Number of Repeats   Number of times to repeat the irrigation cycles after the first cycle completes.
                                          Enable "infinite repeat" to allow the cycle to repeat as long as the rule is active.
2. Repeat Delay   Amount of time to wait between cycles before repeating.
3. Repeat Mode   Count from Start counts the repeat delay from the start of the first irrigation.
                                          Count from End counts the repeat delay from the last irrigation end.

The main feed pump/valve, master drain valve, and pause options are configured on the equipment tab. ⚙

Feed Pump/Valve

Irrigation can be coordinated with a main supply valve or feed pump if the pump requires external control (does not have a pressure switch to maintain pressure.) When the irrigation zones are activated, the feed pump/valve output will also be activated. The output type can be a standard discrete on/off type of control (or analog voltage/pwm output for variable speed motor controls.) The main valve/pump can also be delayed behind the opening of the stage valve to allow time for the valve to open if it is a slow acting valve.

1. Enable Pump/Valve   Enable the switch to show and configure the output settings.
2. Output Settings   Set the output device and output channel that the pump/valve is connected to.
3. On-Delay   Seconds delay to wait after the zone valve is opened before operating the
                                    feed pump/main valve.
4. Keep On Switch   Prevent the master pump from shutting down during irrigation cycles.

Drain Valve

A drain valve can be incorporated to allow return of water back to a specific area in between irrigation stages.

1. Enable Drain Valve   Enable the switch to show and configure the rule.
2. Output Settings   Set the output device and output channel that the valve is connected to.
3. Drain Duration   Enter a time duration (seconds) that the valve should drain before the system
                                    proceeeds to the next irrigation stage.

Pause Irrigation

Irrigation can be paused while dosing or another function is activated. This prevents irrigating water that is still in the process of being mixed or corrected and resumes irrigation once the function is no longer active.

1. Enable Pause   Enable the switch to pause irrigation when the assigned function is active.
2. Pause Function   Assign a function which will pause irrigation when active.

Moisture Sensor Triggering

Irrigation can be triggered based on the output of a moisture sensor.
Currently, 0-5V type moisture sensors and Teros12 sensors from Meter/Aroya are supported.

The moisture level trigger point is set in %VWC. If moisture sensor triggering is enabled, the irrigation stages will not be activated until the sensor output is below the trigger level minus the dead band. Irrigation cycles stop once the %VWC is greater than or equal to the target.

1. Enable Tirggering   Enable the switch to show and configure the trigger settings.
2. Input Settings   Set the input device and input channel that the sensor is connected to.
3. Trigger Preset   Set the VWC reading from the sensor to trigger the irrigation.

ⓘ **NOTE**
Ensure that the "Repeat Settings" are configured to allow irrigation until the moisture sensor is satisfied, or set the rule for a specific time range so that it will be reset when the rule is disabled.

Notes on Irrigation Timing

If the irrigation rule is scheduled for a TIME RANGE then be sure the time range includes enough time for the stages and the number of repeat cycles that are configured. Stages or cycles outside of the time range may be cut off. The cycle count will be reset when the time range ends or the rule is not activated.

ⓘ **TIP:** To set alternate time intervals or irrigation schedules for lighter or heavier waterings at different times, copy and create multiple rules within the irrigation function.

Tank Level

Water level in a tank can be automated with a high and low sensor or an analog level sensor, and a fill or drain valve. Tank level can be controlled for filling, draining or flushing modes. A flush cycle starts with a drain and finishes with a fill.

Discrete High/Low Sensors
Tank level can be controlled with two sensors, one for high and another for low. The level is automatically controlled by filling to the high sensor when the low sensor is dry, or draining to the low sensor when the high sensor is wet.

Agrowtek's SXL optical liquid level sensors are an excellent choice for sensing water at a specific level. Float switches are also suitable as an alternative.
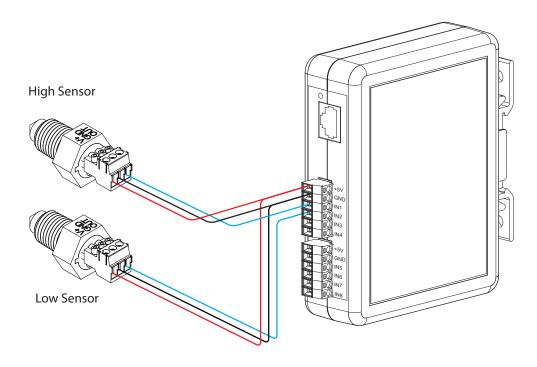
Analog Level Sensors
Tank level can be controlled with one SXLV analog level sensor. The level is automatically controlled by filling to the high set point once the low set point is reached, or draining to the low set point when the high set point is reached.
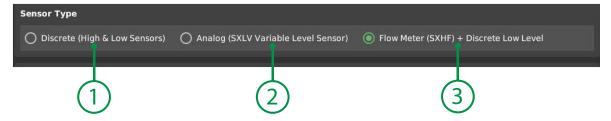
High/Low Sensor Electrical Connections

An input module (DXIO or DXO8) is required to connect high and low sensors to the system to use the tank level control function. SXL optical liquid sensors may be used, or standard float switch sensors may also be used .When using float switches, omit the black wires in the diagram below.

High Sensor

Low Sensor

Valve & Sensor Configuration

Assign sensors and valves which will manage the tank level on the equipment tab. ⚙
First, select which type of sensor will be used to control the level, discrete sensors or an analog sensor.
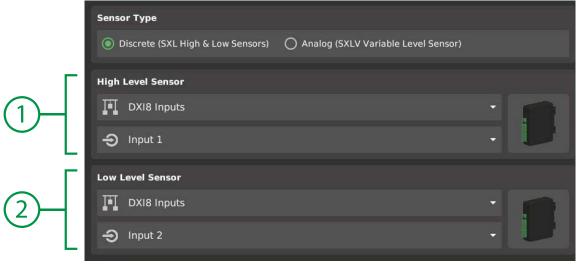

1. Discrete   Use two sensors (high and low) connected to a discrete input module.
2. Analog   Use an analog (SXLV) liquid level sensor with depth set points.
3. Flow Meter   Use a Flow Meter (SXHF, SXF) with a discrete low level sensor to start the fill.

Discrete Sensors

When using discrete sensors, select input channels where the high and low level sensors are connected.

1. High Sensor   Select the input device and channel of the high level sensor.
2. Low Sensor   Select the input device and channel of the low level sensor.

Analog Sensor

When using an analog sensor, simply select the sensor to use for measuring tank depth.

1. Analog Sensor   Select the SXLV analog level sensor to use for depth level control.
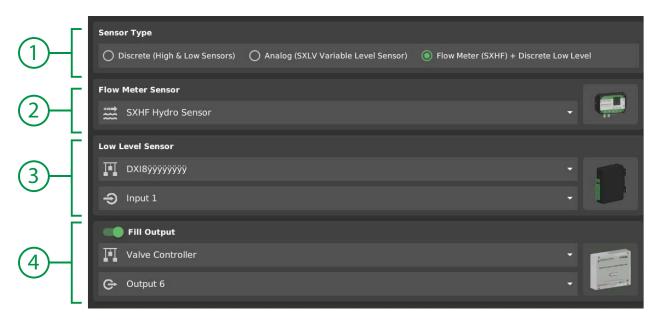
Flow Meter + Low Level

Flow meter filling requires a flow meter sensor, low level sensor and a fill output. When the low level sensor detects a dry state, the fill output will be activated while the flow meter measure out the volume of water specified in the active rule. Once the volume is reached, the fill output is turned off.

ⓘ **NOTE**
If the tank fill completes and the low level sensor is still reading dry, the function will enter an error state. The error state can be reset when the low level sensor registers a wet signal.

1. Sensor Type   Select the Flow Meter type for metered, volume-based tank filling.
2. Flow Meter Sensor   Assign a sensor with a flow meter to read the flow rate.
3. Low Level Sensor   Assign a sensor input for the low level sensor in the tank.
4. Fill Output   Assign an output to operate the fill valve.

Level Control Settings

Rules for how to control the tank level are created and edited on the rules tab. ▦

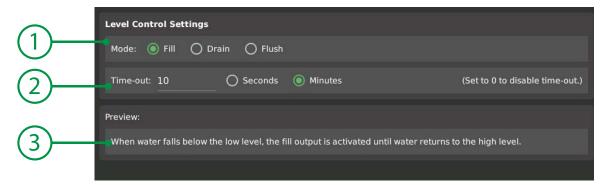First, select how the rule should control the level; filling, draining or flushing.
Second, a time-out should be configured to prevent over-filling.

The rule will use the sensors and valves confugred on the equipment tab to control the water level.

Discrete Sensors

1. Mode	FILL: Fill valve opens when low level is dry until high level is wet.
	DRAIN: Drain valve opens when high level is wet until low level is dry.
	PURGE: Drain valve opens until low level is dry, fill valve opens until high level is wet.
2. Timeout	Limit the fill time to prevent over-fill from a hardware failure.
	Set to 0 to disable the timeout feature.
3. Preview	Shows a preview of how the rule will operate.

Analog Sensor

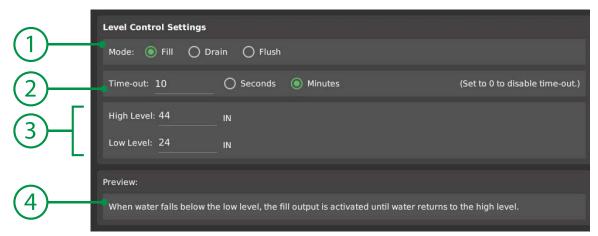| 1. Mode | FILL: Fill valve opens at low level and shuts off at high level. |
	DRAIN: Drain valve opens at high level and shuts off at low level.
	PURGE: Drain valve opens until low level, then fill valve opens until high level.
2. Timeout	Limit the fill time to prevent over-fill from a hardware failure.
	Set to 0 to disable the timeout feature.
3. High/Low	Set the high and low levels of water for the rule to use.
4. Preview	Shows a preview of how the rule will operate.

Dosing

Nutrient dosing functions on the GCX control system are designed for injecting nutrients and controlling pH in stock tanks. Nutrient dosing can be managed in several different ways from a GCX controller:

• Recirculating mode which adds doses as pH or EC change.
• One-shot mode which performs a fixed dose from a recipe.
• Inline mode which doses according to flow rates measured by a flow meter *(in development.)*

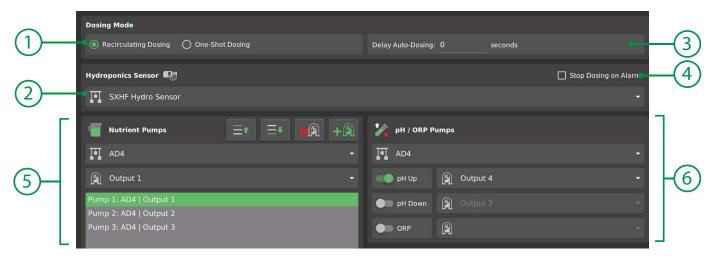Three components are necessary to operate the dosing function:

• SXH or PHX series hydroponic sensor transmitter is used to monitor the water conditions.
 SXHF model with flow meter required for inline dosing mode.
• ADi series peristaltic dosing pumps are used to inject nutrients, ph buffers and ORP solutions.
• Recipes designate the dosing targets and component properties for the rule to use.
 Recipes can contain up to 6 nutrient parts, 2 pH parts and one ORP part.

How to setup the dosing function:
1. Assign a sensor and dosing pumps for the function to use on the equipment tab. ⚙
2. Create rules and select recipes to use. ▤

Sensor & Pump Configuration

The equipment tab contains settings for the dosing modes and assignments for the hydroponics sensors and chemical dosing pumps. These settings are used for all of the rules in the dosing function.
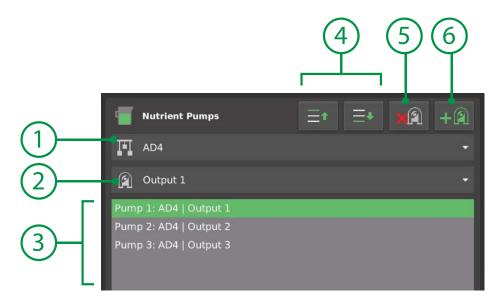
1. Dosing Mode	Recirculating:	Doses injected when pH/EC outside of setpoint/deadband.
	One-Shot:	Fixed amounts injected when the rule is activated.
	Inline Flow:	Chemicals injected according to flow rate reading.
2. Hydroponics Sensor	Select the hydro sensor for the function to read pH, EC and ORP (if available.)
3. Auto Dose Delay	When in recirculating mode, delay dosing after rule is activated.
4. Stop on Alarm	If an alarm is active on the hydroponics sensor, stop the dosing function.
5. Nutrient Pumps	Area to assign dosing pumps for the function.
6. pH/ORP Pumps	Area to assign pH and ORP dosing pumps for the function.

Nutrient Pumps

The nutrient pumps are assigned by creating a list of dosing pumps. Up to six (6) nutrient pumps can be added to the function.

To create a list of pumps, use the **Add Pump** button (6), then modify the pump device (1) and pump head (2) selection. Add and edit additional pumps until all of the pumps have been added. Adjust the order of pumps to match the recipe order if necessary by using the sort buttongs (4) to move the selected pump up or down in the list.

1. Dosing Pump Device	Select the device that has the desired chemical pump head on it.
2. Pump Head	Select the pump head on the pump device.
3. Pump List	List of dosing pumps by pump name (description.) *Corresponding recipe part name is shown in parenthesis.*
4. Sort Buttons	Use the sort buttons to move the selected pump up or down in the list. *Sort buttons help match the pump order to the recipe order.*
5. Delete Pump	Deletes the selected pump from the pump list.
6. Add Pump	Adds a new pump to the pump list.

ⓘ **TIP:** To edit a pump, select the list item then modify the device or pump head assignment drop-down.

pH & ORP Pumps

pH and ORP pumps must all be on the same dosing pump device (but may be assigned to individual pump heads.) pH and ORP dosing is performed at a specific flow rate (ml/min) until the target value is achieved. pH and ORP dosing can be disabled while nutrient dosing is being performed so that it occurs after the nutrient dosing instead of simultaneously.

To configure pH/ORP dosing, first select a dosing pump device (1.) Next, enable the pH Up, pH Down and ORP switch options (2) that will be used. When enabled, select the pump head to use.

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1. Dosing Pump Device   Select the device that has the desired chemical pump heads on it.
2. pH Dosing   Turn on the switch to enable and assign a pH up or down pump head.
3. ORP Dosing   Turn on the switch to enable and assign a ORP dosing pump head.

Discrete Output

A discrete output can be activated when ever the dosing function is operating in order to control a mixing pump, operate a valve, or run some other device while the dosing is running.

1. Enable Output   Enable the discrete output to show the output device settings.
2. Run Mode   Continuous: Run the output any time a rule is enabled.
                                    Only when Dosing: Turn off the output when chemical dosing is not active.
3. Output Device   Assign a device and output to operate when the dosing rule is active.

Dose when Function Activated

Dosing can be activated when another function is activated (such as a tank fill function.) When dosing is activated this way, it the dosing cycle will complete even if the enabling function becomes false (for example: if tank fill function is done) as long as the rule is still enabled and scheduled.

1. Enable Activation Mode   Enable the option to start dosing only when the selected function is active.
3. Function Assignment   Assign a function to monitor for activation.

Recipe

The recipe contains the target set points for pH, conductivity and ORP, as well as the nutrient dosing formula.

If the desired recipe exists in the system library you can select it in the drop-down (1), otherwise the recipe can be created using the recipe editor button (2).

1. Recipe Editor   Open the recipe editor to create or modify dosing recipes.
2. Dosing Recipe   Use the drop-down to select a recipe from the library.
3. Pump Assignments   Preview of how the recipe matches up with the pump order.
            Edit the order of pumps on the equipment tab. ⚙

pH/ORP Injection

pH injection is specified as a rate (ml/min) for recirculating dosing methods; otherwise by volume (ml/gal.)

1. Disable Switch   Disables the pH/ORP dosing when the nutrient dosing is active.
2. pH Flow Rates   Flow rate for the pH up or down pump heads to dose at.
3. ORP Flow Rate   Flow rate for ORP dosing (not enabled if no pump head assigned.)

ⓘ **TIP**
Recirculating Mode: pH will dose the ml specified in the flow rate every minute until target is reached.
Single Shot Mode: pH will dose the ml specified in the flow rate every minute until target is reached.
Inline Flow Mode: pH will dose the ml/gal volume according to the flow rate measured.

Recipe Editor
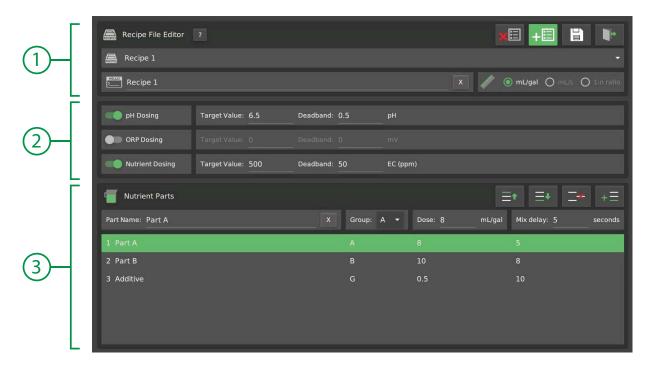
The dosing recipe editor screen is opened by pressing the recipe editor button in the DOSING RECIPE group.

The editor is where new recipes can be created, or existing recipes can be modified.

The recipe editor screen is divided into three main sections:

1. Editor Controls   Select the recipe to edit or use the buttons to create or delete recipes.
2. Targets   Enable dosing modes, then set the target sensor values and deadbands.
3. Nutrient Parts   Editor area for the nutrient recipe (do not include pH/ORP parts.)

Editor Controls

The editor controls is where the recipe is selected and the recipe name can be edited. Recipes can also be added or removed and the current settings saved to memory.

1. Recipe Selection   Select the recipe to edit or use the buttons to create or delete recipes.
2. Recipe Name   Edit the recipe name to a useful description.
3. Clear Name   Erases the existing name for entry of a new name.
4. Delete Recipe   Deletes the currently selected recipe.
5. Add Recipe   Adds a new blank recipe to the system.
6. Save   Saves the current recipe settings to memory.
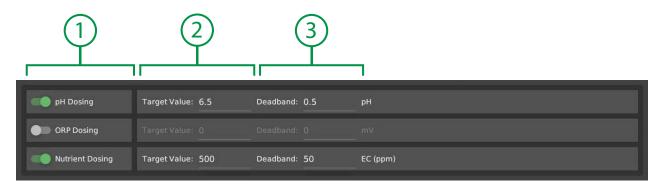
Targets

Dosing targets are compared to the sensor readings for pH, conductivity (nutrients,) and ORP. If the targets are outside of the allowed drift range, the recipe will activate the dosing function to take corrective action.

1. Target Enable   Enable the switches to turn on dosing modes.
2. Target Value   Target value for the dosing mode.
3. Deadband   Deadband (drift) for the dosing mode.

Nutrient Parts

Nutrient parts are entered in a fashion similar to most manufacturer's recipe recommendations in ml/gal. Alternative units are also available.

Each nutrient part may be named for reference and assigned to a dosing "group." Parts that are assigned to the same group will dose at the same time. Otherwise, parts will dose sequentially in order of their group assignment. Nutrient parts will be mated with the dosing pumps in the dosing function according to the order in the part list (1).

1. Nutrient Part List   List of all the nutrient parts in the recipe. Select a part to edit the values.
2. Part Name   Reference name of the recipe part.
3. Dosing Group   Select a group for the nutrient part; groups are dosed sequentially.
4. Dose Size   Dose size per manufacturer recipe (ml/gal.)
5. Mix Delay   Delay after dosing before moving to the next group.
6. Sort Buttons   Move the selected part up or down in the list.
7. Delete Part   Delete the selected part from the list.
8. Add Part   Add a new part to the list.

ⓘ TIP
The smallest dose that the ADi pumps can produce with a standard tubing kit is 3ml. Recipes with parts smaller than 3ml will have the entire recipe multiplied automatically to produce a minimum dose of 3ml when dosing.

Output Link 🔗

Output Link controls are used to "connect" outputs together (daisy chain.)

An output is monitored (trigger source) in each function rule and when one is active, the function output can be assigned to activate or de-activate.

Example uses:
• Linking HVAC outputs (Turn on FAN output when HEAT or COOL outputs are on.)
• Tying multiple irrigation valves together.
• Linking multiple dehumidifier outputs together.

Trigger Rules

Rules for how to operate the output are created and edited on the rules tab. ☰
Multiple rules can be created; each rule may have a different trigger source assignment.
All of the rules will link to the output device assigned on the equipment tab. ⚙
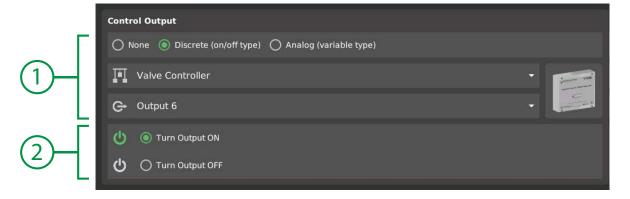
| 1. Trigger Source | Select the device and output to monitor as the "trigger" for the linked output. |
| 2. Preview | Gives a short preview of how the rule will function. |

Linked Output

The output device that will be operated if any trigger is activated is assigned on the equipment tab. ⚙

| 1. Linked Output | Select the device and output to activate (or disable) when the trigger is active (on.) |
| 2. Output Mode | Select whether the function should activate or disable the linked output when any trigger rules are active. |

Input ⊙
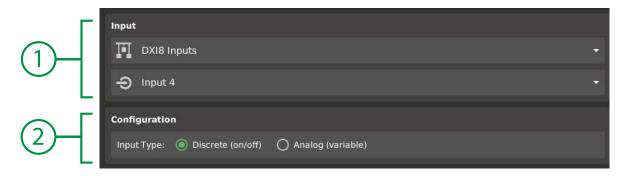
Input controls use physical sensor inputs from input modules to operate outputs or integrate with control functions in ways other than those built into specific functions. Input functions can be used to enable or disable outputs, or other functions, based on the status or value of the input.

Example uses:
• Custom sensors; 0-5V or 4-20mA sensor based equipment control.

Input Rules

Rules for how to operate the function are created and edited on the rules tab. ☰
Multiple rules can be created; each rule may have a different type and input assignment.

①
②

Input

⊞ DXI8 Inputs	▼
⊙ Input 4	▼

Configuration

Input Type: ⦿ Discrete (on/off)   ○ Analog (variable)

1. Input Source   Select the device and input to monitor/read.
2. Configuration   Select whether the input is discrete (on-off sensors) or analog (variable) type.
                    If analog is selected, a setpoint and deadband setting are enabled.

Analog type rules can have an action type which controls if it is for raising or lowering a parameter. A setpoint and dead band control when the rule will activate and de-activate according to the analog value.

③
④

Configuration

Input Type: ○ Discrete (on/off)   ⦿ Analog (variable)

Action: ⦿ Lower   ○ Raise

Preview:
Function will activate at: 100
Function will de-activate at: 80

Setpoint: 100   Deadband: 20

3. Action   Sets whether to activate when the sensor is too high (lower) or too low (raise.)
4. Setpoints   Enter the set point and dead band values. Check the preview box.
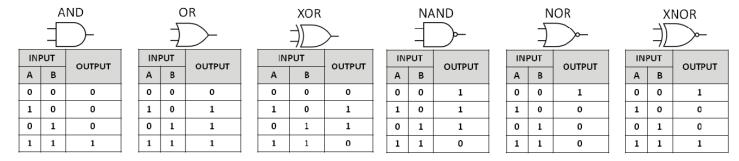
Control Output

The output device that will be operated if any input rule is activated is assigned on the equipment tab. ⚙

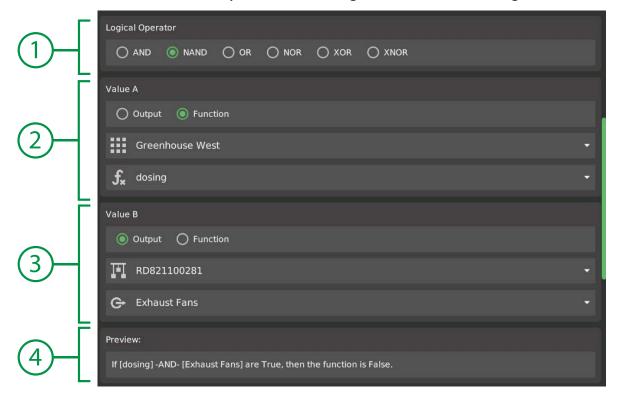*See the "Function Output" section in the Equipment Editor description for details.*

Logic

Logic functions evaluate a boolean expression between two values, A & B. The values may be the status of a function in a work space, or the status of a physical I/O point such as an output. The logic function's status will be the result of the boolean operation. An output can also be controlled with the result of the operation if one is selected.

AND INPUT A	B	OUTPUT
0	0	0
1	0	0
0	1	0
1	1	1

OR INPUT A	B	OUTPUT
0	0	0
1	0	1
0	1	1
1	1	1

XOR INPUT A	B	OUTPUT
0	0	0
1	0	1
0	1	1
1	1	0

NAND INPUT A	B	OUTPUT
0	0	1
1	0	1
0	1	1
1	1	0

NOR INPUT A	B	OUTPUT
0	0	1
1	0	0
0	1	0
1	1	0

XNOR INPUT A	B	OUTPUT
0	0	1
1	0	0
0	1	0
1	1	1

Logic Rules

Rules for how to operate the function are created and edited on the rules tab.
Multiple rules can be created; each rule may have different logical conditions and assignments.

1. Logical Operator — Select the operation for the function to evaluate between values A & B
2, 3. Value A, B — Select an output or function to use as the value in the expression.
4. Preview — Displays a preview of how the expression will be evaluated.
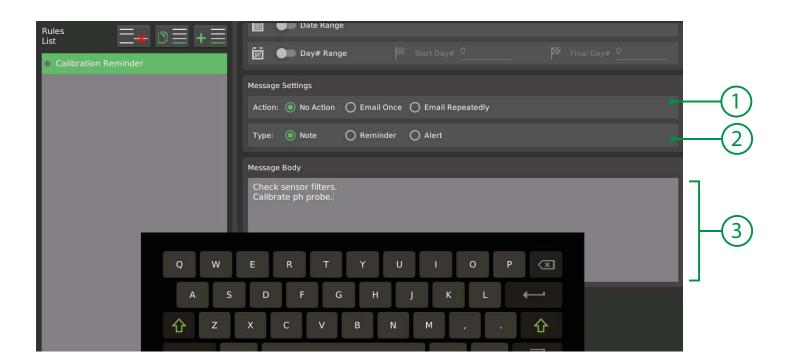
Control Output

The output device that will be operated if any input rule is activated is assigned on the equipment tab.

See the "Function Output" section in the Equipment Editor description for details.

Message 📋

Message functions can be used to leave notes in workspaces, create and send reminders, or send custom alert messages when certain conditions arise. A full text message body can be stored in the work space, and can be sent by email or SMS text message. Messages can be sent once when the rule is activated, or can be sent continuosly depending on the system's message frequency settings.

1. Action   Select if an email should be sent once, repeated or not at all.
2. Type   Action type will be included with messages so the can be differentiated.
3. Message   Type multi-line notes, reminders or alert messages in the body area.
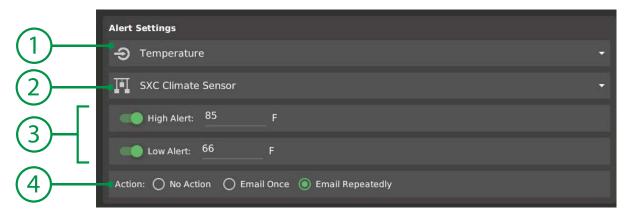
Alert 🔔

Alert functions allow more advanced alerts from sensor values than those provided in the device alerts. The Alert function may be scheduled to operate only during specific times and may have multiple rules in the same way as other functions. This allows different alarm values for day versus night, for example.

To configure an alert, place the function into a workspace and create a rule. Select a sensor type and then select the device to use as a sensor. A high and/or low alert may be set to trigger an email message or operate an output device (such as a buzzer or alarm indicator light.)

Alert Rules

Rules for how to trigger alerts are created and edited on the rules tab. ▤
Multiple rules can be created; each rule may have different sensor types and set points.

1. Sensor Type	Select which type of sensor paramter the alert is for.
2. Sensor Device	Select which sensor device the reading should be taken from.
3. High/Low	Set points for high and low alarm values.
4. Action	Action to take when the alarm is active.

Control Output

The output device that will be operated if any rule is activated is assigned on the equipment tab. ⚙

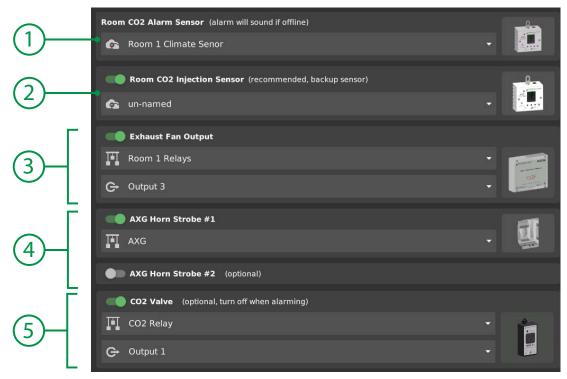*See the"Function Output" section in the Equipment Editor description for details.*

CO2 Alarm

CO2 alarm functions monitor a specified sensor and activate exhaust fans, disable valves and sound horn-stobes when concentrations reach hazardous levels. If AXG horn strobes are available, a "purge" button can activate the function to purge down a room before entering. When depressed, the horn-stobe and exhaust will activate until the CO2 concentration has reached the "safe" level. The room CO2 injection sensor can also be monitored as a backup to the main alarm sensor in the event of a fault.

Configure the CO2 sensor, exhaust fan, alarm modules and other devices on the equipment tab. ⚙

1. CO2 Alarm Sensor   Assign a primary sensor to read CO2; a SXG gas sensor mounted near the ground.
2. CO2 Inject Sensor   Select the sensor that is used to inject CO2; a SXC sensor hanging in the room.
2. Exhaust Fan   Assign an output to operate a purge exhaust fan while the alarm is active.
3. AXG Alarms   Assign AXG alarm modules to provide visual & audible alarm, purge inputs.
4. CO2 Shut-Off   Assign a valve to shut off when the alarm function is activated.

Rules for alarm and safe limits are created and edited on the rules tab. 📊

1. Alarm Level   Set the limit to activate the alarm rule at.
2. Safe Level   Set the level at which the alarm will stop sounding once activated.
3. Preview   Shows how the alarm will operate.

ⓘ **IMPORTANT:** Only "administrator" users have access to configuring the CO2 alarm functions. To prevent unauthorized access, configure user levels on the system.

HVAC/RH 🔥💧❄

The HVAC function is design to be a comprehensive control for temperature and humidity in an environment. Operate standard HVAC units and humidity equipment with two stages of control each for heating, cooling, humidification and dehumidification. Options are included for reheat dehumidification for systems that require reheat control.
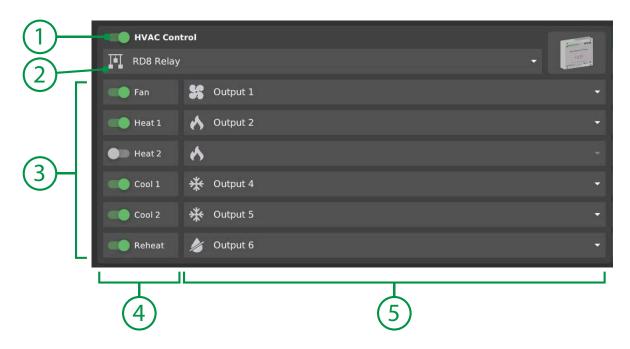
HVAC function simplifies setup of environmental control with equipment assignments and rule set points all configured in one function as opposed to multiple functions.

The first step to configure the HVAC function is to assign devices on the equipment tab. ⚙

HVAC Control

HVAC (heating, ventilation, air conditioning) units control tempeature in a space. Some units also work to control humidity with reheat dehumidification. The relay and outputs must be specified for the HVAC unit.

To configure HVAC control, turn on the HVAC CONTROL switch (1) and select the relay device (2) that will be controlling the signals (3) for the HVAC unit. Next, turn on switches for HVAC signals (4) that will be controlled, then select the output (5) for that signal.

1. HVAC Switch   Turn on to enable control of HVAC signals.
2. HVAC Relay Device   Assign a relay device that will be switching the HVAC signals.
3. HVAC Signals   Various signal options that can be controlled on the HVAC unit.
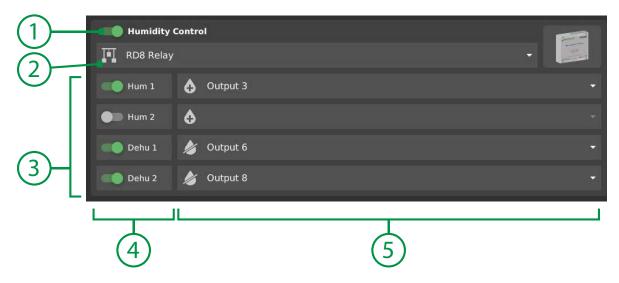4. Signal Switches   Select switches for signals that will be controlled by the function.
5. Signal Outputs   Assign outputs on the relay that will control the HVAC signals.

HumidityControl

Humidification equipment such as foggers and humidifiers add humidity to the air when it is too low in the enviromentby adding water droplets to the air. Dehumidification equipment reduces humidity in the air by using refrigeration condensation cycles to condense water out of the air and remove it from the space.

To configure humidity control, turn on the HUMIDITY CONTROL switch (1) and select the relay device (2) that will be controlling the signals (3) for the humidity units. Next, turn on switches for humidity signals (4) that will be controlled, then select the output (5) for that signal.

1. HUMIDITY Switch   Turn on to enable control of humidity signals.
2. Humidity Relay Device   Assign a relay device that will be switching the humidity signals.
3. Humidity Signals   Various humidity stages that can be controlled by the function.
4. Signal Switches   Select switches for signals that will be controlled by the function.
5. Signal Outputs   Assign outputs on the relay that will control the humidity signals.

Re-Heat De-Humidification

HVAC units with reheat can be used for dehumidification. If using reheat for dehumidification, enable the re-heat interlock option switch. This will activate the reheat output (or heating output if no reheat output is available) with the cooling output when dehumidification is demanded. If cooling or heating are demanded, the reheat or cooling outputs are disabled respectively.

To enable the reheat dehumidification mode, turn on the the re-heat lockout option switch.

NOTE: If the reheat interlock mode is not enabled, the "Reheat" HVAC output will operate as a standard dehumidification output within the reheat temperature limits (configured in the settings rule.)

Temperature & Humidity Settings

Settings for temperature and humidity can be scheduled and configured on the rules tab. ▤
Multiple rules can be created; each rule may have different set points.

Temperature and humidity controls each have two stages. Activation of the second stage is managed by a "stage separation" value. "Unified" stages will start at separate set points, but will turn off together when the settings are satisfied.

Preview charts depict the sensor readings at which equipment will start and stop. Modify the set point values until the previews show the setpoints the way you would like them to operate.

Temperature Control

Temperature is managed by heating and cooling set points. Heating and cooling both have two stage control; stages are separated by a "stage separation" value. Set points and deadbands have slightly different meanings depending on whether they are for heating or cooling.

1. Heating Settings   Set point, dead band and stage separation values for heating.
2. Cooling Settings   Set point, dead band and stage separation values for cooling.
3. Preview   Shows a preview of how the heating or cooling function will operate.
4. Unify Option   Check to enable unified stage end target.
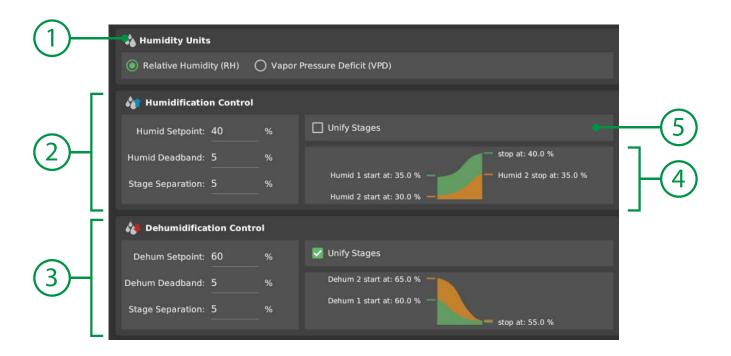
	Heating	Cooling
Set Point (SP)	Temperature to heat to.	Temperature to start cooling at.
Deadband (DB)	Temperature drop before heating.	Temperature drop to stop cooling.
Stage Separation	Temperature below SP to start stage 2.	Temperature above SP to start stage 2.

Humidity Control

Humidity is managed by humidify and dehumidify set points. Humidification and dehumidification both have two stage control; stages are separated by a "stage separation" value. Set points and deadbands have slightly different meanings depending on whether they are for humidification or dehumidification.

1. Humidity Control   Settings group for the humidity control parameters.
2. Control Units   Select RH (standard) or VPD sensor based control.
3. Humidify Settings   Set point, dead band and stage separation values for humidification.
4. Dehumidify Settings   Set point, dead band and stage separation values for dehumidification.
5. Preview   Shows a preview of how the function will operate.

	Humidification	Dehumidification
Set Point (SP)	RH to humidify to.	RH to start dehumidifying at.
Deadband (DB)	RH drop before humidifying.	RH drop to stop dehumidifying.
Stage Separation	RH below SP to start stage 2.	RH above SP to start stage 2.

Humidity can also be managed based on VPD set points instead of RH. Select the VPD mode and enter the VPD set points for humidification and dehumidifcation.

Reheat Limits

Additional limits can be placed on the reheat logic to disable reheat operation in the event the high or low temperature limit are reached. In normal conditions if the heating or cooling stages become active, reheat will automatically be disabled.
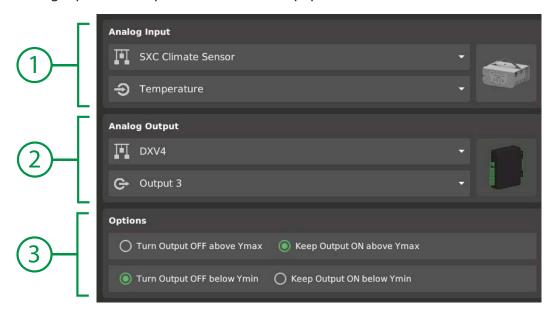
Analog Out

Analog Out functions scale an analog output (0-10V or PWM) according to an analog sensor or analog input signal. Analog Out functions are used to control fan speeds, pump motor speeds, modulate water valves and other variable output control applications.

Analog Out functions require an analog input signal such as a sensor or analog input and an analog output. Assign the analog input and output devices on the equipment tab. ⚙

1. Analog Input   Select an analog input device and input channel/sensor value.
2. Analog Output   Select an analog output device and output channel to control.
3. Options   Select which options for the function to use when reaching the high/low limits of the function output.

Rules for how to operate the function are created and edited on the rules tab. ☰
Multiple rules can be created; each rule may have a different scaling configuration.

1. Input Range   Enter the minimum and maximum values of the input scale (X1, X2.)
2. Output Range   Enter the minimum and maximum values of the output scale (Y1, Y2.)
3. Preview   The scaling will be shown in the preview window to confirm.

Crop Steering Irrigation 〰️

The Crop Steering irrigation methods is a popular technique that drives plant activity in part by carefully controlling the moisture levels (volumetric water content, or VWC) of the growing media through out various phases of the day using irrigation drippers and feedback from media moisture sensors.

Note: Moisture sensors are required for crop steering irrigation.

The crop steering function allows the use of "recipes" which can be scheduled out in various rules within the function. The function also defines which moisture sensors to use and which valves to control according to the recipe.

Irrigation Phases

Irrigation recipes define parameters for four distinct **"phases"** through a 24-hour period:

P0 - Activation
The P0 phase begins at lights-on. No irrigation events take place in the P0 phase which typically lasts 1-3 hours. The goal is to observe an "additional dry back" in the media as the plant activity increases. The plants should begin transpiring before initiating irrigation events.

P1 - Ramp Up
The P1 phase is a transition phase between minimum VWC and the target saturation level for the media. Ramp up is achieved by applying specified shot volumes to the media and allowing for a specified 'dry-back' amount between irrigation shots. The cycle is repeated until the target is reached (or time limit is exceeded.) The goal is to reach saturation and achieve run-off within 1-3 hours of P1 start.

P2 - Maintenance
Once the target VWC is reached (or P1 times out) the maintenance phase is entered. In the maintenance phase the media is "maintained" in a more level irrigation pattern. In generative recipes the shot size typically equals the dry-back setting, while vegetative recipes often feature a shot size larger than the dry-back setting to promote higher levels of run-off. The goal of the maintenance phase is to maintain the moisture level at or near field capacity until 1-2 hours before lights-off. Timing the end of the P2 phase correctly plays a significant role in achieving the desired dry down in P3.

P3 - Dry Down
The P3 phase typically begins 1-2 hours before lights-off and continues until the start of the P0 phase. The goal of the P3 phase is to achieve a 10-15% dry-down* during vegetative steering and 15-30% dry-down* during generative steering. Ideally, no irrigation is necessary during the P3 phase.
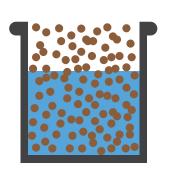
ⓘ **TIP:** If irrigation is required during the P3 phase, try extending the P2 duration to end later. If dry-down is not adequate, try shortening the P2 phase to end earlier and allow more dry-down time under the lights.
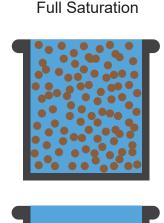
Volumetric Water Content

Volumetric water content (VWC) is the ratio of the volume of water to the volume of growing media.

VWC % = (Water Volume / Media Volume) x 100

The volume of the growing media is based on the dimensions of the media (cube size) or pot volume. The diagram to the right depicts a container in partial and full saturation visualized to show the ratio concept.

Partial Saturation   Full Saturation
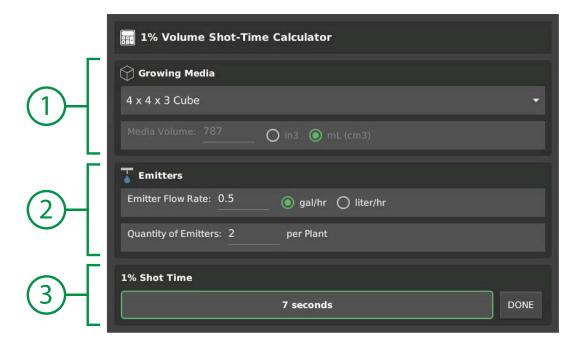

ⓘ **Why doesn't VWC read 100% when wet?**
Consider a 1 gallon pot full of soil as depicted in the diagrams above. Water can be added to the soil until all of the air space in the soil is replaced with water, but the soil is still there. Because there is soil in the pot, there can never be 100% water in the pot.

1% Shot Time Calculator

Irrigation recipes are based off of VWC percentages. In order for the function to be able to feed a specific percentage of water volume, the "1% shot time" must be be calculated and provided to the function. This time is dependent on the volume of the media and the feed rate of water to the media. To assist with this calculation, a calculator is provided in the function editor.

1. Media Selector   Use the drop-down to select a standard media type or enter a custom value.
2. Drippers/Emitters   Enter the flow rate and number of drippers per plant.
3. Result   The shot time is automatically calculated based on your inputs.
                           Press the DONE button to exit and set the value in your function.

Rule Configuration

Rules are created and edited on the Rules tab in the function editor dialog. ▤

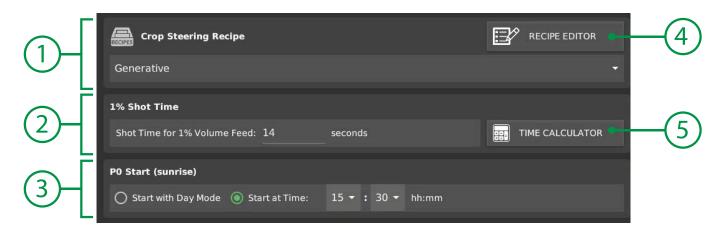In the crop steering irrigation function, rules specify:

• Which recipe to use.
• What the 1% shot time is.
• When to start P0.

1% Shot Time
This is the amount of time it takes your drippers to provide a shot in the amount of 1% of the media volume. *If your cube is 4x4x4in (64 cu. in.) then it is the time it takes to deliver 0.64 cu. in. of water.*

ⓘ **TIP:** Different recipes may require different 1% shot times depending on changes in media volume (repotting or adding slabs) during the growth cycle.

ⓘ **NOTE:** If you are not sure what the 1% shot time is for your media and dripper combination, or you are not sure how to calculate it, use the Time Calculator to figure the shot time.

1. Recipe Selector	Use the drop-down box to select the recipe for the rule to use.
	If you do not have a recipe available or to create and edit recipes, press the Recipe Editor button (4) to open the editor dialog.
2. 1% Shot Time	Time required to dispense water equivalent to 1% of the media volume.
	If you do not know the 1% time, use the Time Calculator (5) dialog.
3. P0 Start Mode	Select if the P0 phase should begin with the workspace Day mode time, or with a custom set time of day (hh:mm).
4. Recipe Editor	Press to open the recipe editor dialog.
5. Time Calculator	Press to open the 1% shot time calculator dialog.

Sensor & Valve Configuration

The equipment tab is where the sensors are specified and the valves are assigned for the irrigation shots. The assignments on the equipment tab apply to all of the rules created within the function.
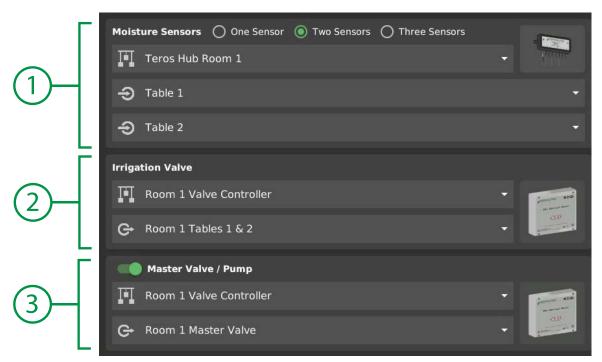

Moisture Sensors
Up to three sensors from a single sensor hub can be averaged. Select the number of sensors to average, then select the hub device and sensor channels to monitor.

Valves
A zone valve and a master valve/pump output can be specified. Both output selections will operate simultaneously when an irrigation shot is required.

1. Moisture Sensors   Select one, two or three sensor inputs for the function to monitor, then
                           select a sensor input device and the desired sensor input channels.
                           At least one moisture sensor is required to use this function.
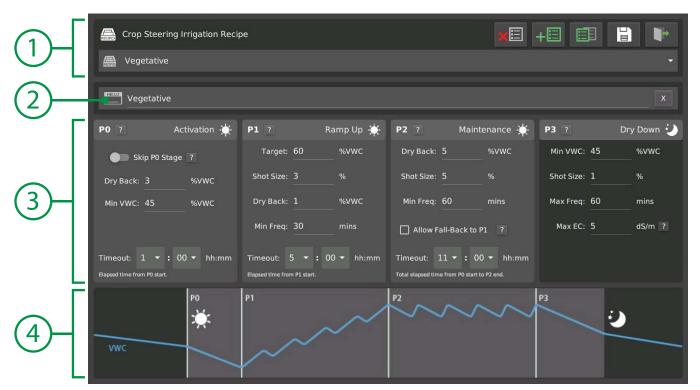2. Irrigation Valve   Assign the primary irrigation controller and output channel that will operate
                           irrigation zone valve for this function.
3. Master Valve/Pump   If a master valve or irrigation pump output must be operated in tandem with
                           the irrigation zone valve, enable the option and select the valve controller and
                           output channel to operate.

Irrigation Recipe Editor

Open the irrigation recipe editor dialog by pressing the "Recipe Editor" button in the Crop Steering function. Recipes that are created and edited in this dialog can be used in any crop steering function on the controller.

1. Editor Heading   Contains a drop-down menu to select a recipe and various button commands.
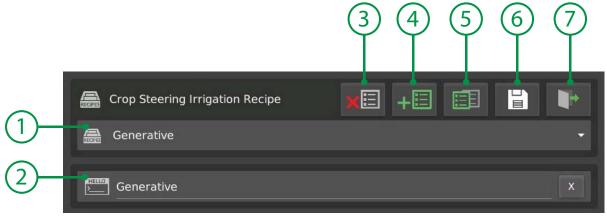   *Delete, New, Copy, Save, Exit*
2. Recipe Name   Edit the recipe name by touching on the text field.
                           Use the X button to erase the text field.
3. Phase Settings   Settings for the various P phases in the recipe.
4. Example Graphic   Depicts a generic graphic of the media moisture through the various phases.

1. Recipe Selection   Drop-down menu to select a recipe.
2. Recipe Name   Edit the recipe name by touching on the text field.
3. Delete Recipe   Deletes the current recipe.
4. New Recipe   Creates a new recipe from scratch.
5. Copy Recipe   Copies the current recipe to a new one.
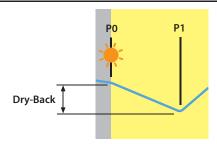6. Save Recipe   Save the changes to the current recipe.
7. Exit   Close the editor dialog.

The recipe editor provides four grouped areas to configure the settings for each of the irrigation phases. Each area has a heading describing the phase. Phases P0, P1 and P2 each have a "timeout" area at the bottom of the phase settings. Timeout settings ensure that irrigation phases do not get stuck if a set point can not be achieved or if there is some sort of sensor reading problem. P0 and P1 time outs can be set to zero to ignore the time out, however, the P2 timeout is required to time the "irrigation window" and end irrigation events at the appropriate time.
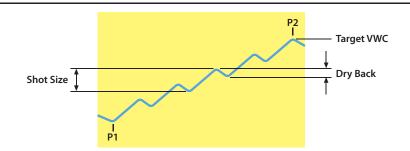
P0 - Activation

During the P0 phase no irrigation occurs. The function looks for an "additional dry-back" to indicate that the plants have begun the transpiration process before switching to the P1 phase to begin irrigation. A time-out is provided to switch to P1 in the event dry-back is not achieved in the allotted time.

A minimum VWC can be configured to end the P0 phase if the VWC is at or below the minimum setting. This prevents the possibility of dry-back below a minimum desired value in the P0 phase.

P1 - Saturation

During the P1 phase the function irrigates in shots to raise the VWC of the media to a target value. Between each shot the media is allowed to "dry back" by a specified VWC before peforming another shot.
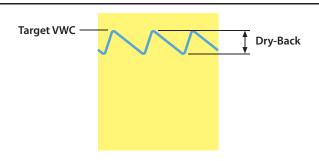
A minimum shot frequency can be configured to ensure irrigation in the event of a sensor malfunction.

ⓘ **TIP:** To prevent shots at minimum intervals, set the minimum frequency time to zero.

A phase time out allows the function to automatically switch to P2 after a specified time out. The P1 phase timeout counts from the start of the P1 phase.

P2 - Maintenance

Target VWC

Dry-Back

During the P2 phase the function irrigates in shots to maintain the target VWC after a dry-back period. In the maintenance phase the shot size is typically set equal to the dry-back amount, but may be set differently.

A minimum shot time can be configured to ensure adequate irrigation in the event of a sensor malfunction.

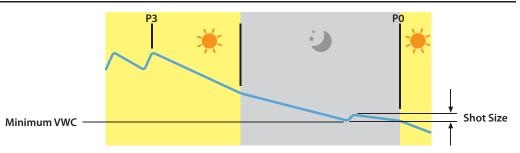ⓘ **TIP:** To prevent shots at minimum intervals, set the minimum frequency time to zero.

A time out is required to switch the function into the P3 phase.
P2 timeout begins counting at the start of P0 (or P1 if P0 is skipped.) This allows the function to enter the P3 phase at a set time from when P0 begins. P3 should typically begin 1 to 2 hours before lights turn off.
For example: a 12 hour light cycle would have a P2 timeout of 10 to 11 hours.

For additional details on the P2 phase please see the section "P2 Phase Troubleshooting" on the following page.

P3 - Dry Down

P3

P0

Minimum VWC

Shot Size

The goal of the P3 phase is to achieve a 10-15% dry-down during vegetative steering and 15-30% dry-down during generative steering from the P2 VWC. Ideally no irrigation is required during P3, however, a minimum VWC can be set to trigger small shots to prevent excess dry back.

Irrigation can also be triggered in P3 by a high EC condition using the "Max EC" setting.

A maximum shot time can be configured to prevent excessive irrigation in the P3 phase.

ⓘ **NOTE:** Percent dry-back, often referred to as "overnight dry back," is typically specified as a percentage of change in the VWC from field capacity to the end of the P3 phase.
For example: a 10% dry-back from a 50% VWC would be a change of -5% VWC.

ⓘ **TIP:** Setting the shot size or maximum frequency to zero will prevent any shots during P3.
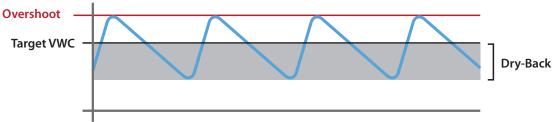
P2 Phase Troubleshooting

The P2 "maintenance" phase is designed to maintain the VWC between the P1 target value and the dry-back amount. Correct maintenance cycles depend on the settings being applied correctly. The 1% shot time is set correctly when an irrigation shot results in 1% VWC change. During maintenance, it is suggested to size shots equal to the dry-back amount and should result in cycles that return the VWC to the target value after dry-back.
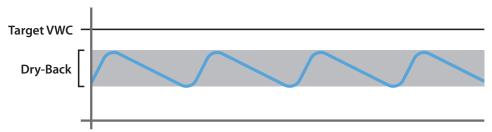

Excess Overshoot
If P2 maintenance cycles are overshooting the target value significantly, then the 1% shot time may be too long. Errors in the shot time can be due to incorrect dripper flow rates or media volume measurement. Correc thte shot time or reduce the shot size in the P2 phase.
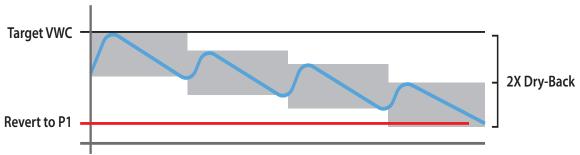

Saturated Media
If P2 maintenance cycles are not able to achieve the desired target value, the media may already be fully saturated and unable to take on additional water content. The result is excess run-off which may be desirable in some circumstances but in most cases wastes water. Excess run-off or failure to reach field capacity may also be due to media (rockwool) being allowed to dry out excessivly causing it to become hydrophobic.

Insufficient Feeding
If the 1% shot time is too short then the irrigation cycles will not be able to rehydrate the media after a dry back. If P2 maintenance cycles are not able to restore the VWC after a dry-back period and the VWC continues to fall due to lack of water, the function can revert to P1 phase in an attempt to restore the VWC level.

Allow Fallback to P1: Function reverts from P2 to P1 when VWC has fallen below the target by double the dry-back setting if "allow fallback to P1" is enabled in the recipe.

VNC Remote App

The GCX system has full remote control capabilities using a standard VNC application (virtual network computing) on a phone, tablet or computer. VNC applications allow control of the system as if you were at the screen. VNC connections are secured using 128bit AES encryption and a user-set passcode.

There are a variety of free VNC client applications that can run on any device:
• RealVNC   • TigerVNC   • TightVNC   • UltraVNC   • Mocha VNC Lite   • noVNC   • UltraVNC

Agrowtek currently recommends the free "Real VNC" viewer application:
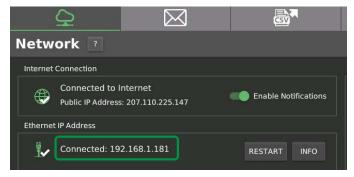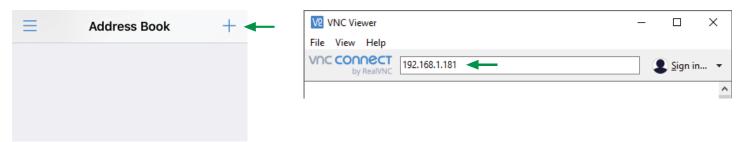
Local Network Access

A VNC application can connect directly to the controller's local IP address when the vnc viewer application has access to the local network. If a pc or phone is connected to the wifi or Ethernet network that the controller is on, use the controller IP address to test the VNC application.

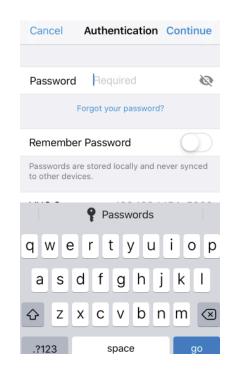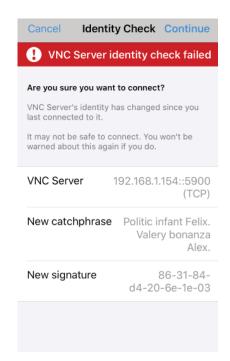1. Locate the Ethernet or Wi-Fi I.P. address of the controller on the Network page:

2. Open the app and press the + button, or, using the PC app, enter the IP address into the address bar.

3. Enter the I.P. address of the controller and a reference name for the connection, then press Connect.

4. Enter the password then accept the new identity check message to allow the connection to establish.
This message will be shown on the first connection. After the certificate is accepted the identity is confirmed.

ⓘ **Picture Quality**
If you experience picture quality problems (low resolution) change the picture quality from automatic to medium or high.

ⓘ **Mouse Pointer Alignment**
If the mouse pointer on your device is not aligned with the mouse pointer on the VNC display, move the mouse to the **upper-left** corner of the screen to align the pointers on the devices.

Remote Network Access

There are currently two recommended methods for accessing the VNC screen control remotely;
port forwarding rules setup on the router/modem, or a VPN (virtual private network) connection.
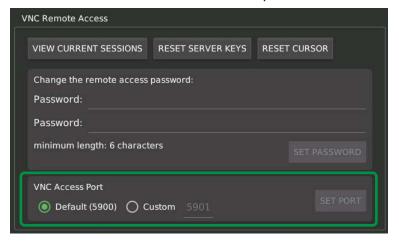
VPN
VPN (virtual private network) connections provide a secure tunnel between a remote computer and the facility network that the controller is operating on. The advantage is that VPN connections are very secure when configured correctly, and the controller can be connected to with the same IP address as on-site without any port forwarding rules. A VPN connection may require the assitance of your IT professional.

Port Forwarding
Port forwarding is done at the network router/modem that the system is connected to. Each manufacturer has slightly different configurations for port forwarding screens, however the concept is the same. A connection is made to the controller from outside the router by going through the port forwarding rule setup in the router. This is common with gaming systems and other equipment.
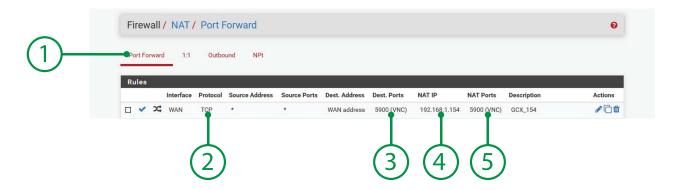
VNC Port Forwarding
GCX controllers use the standard VNC port number of 5900, or a custom VNC port can be configured.

Router Configuration
For "port forwarding" instructions, please reference the manual for your network router.
Each router has unique menus, however, the process is generally the same; an example is shown below.

1. Port Forwarding   Navigate to the Port Forwarding rules section of your router.
2. Protocol   Set the protocol type to TCP if prompted.
3. Desintation Port   The port number that is used to access the controller on the router.
       This is sometimes referred to an "external" port number.
4. IP Address   The local IP address of the controller as shown on the controller screen.
5. Device (NAT) Port   The port number that is used by the controller (default 5900 or customer port.)
       This is sometimes referred to an "internal" port number.

Some routers/modems (Comcast) do not have separate port numbers and instead use the same port number for both. In this case, use the port number that is configured for use on the controller.
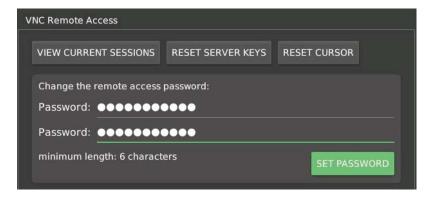
ⓘ **Notes**
• A static IP address should be assigned to the controller in the network router's DHCP table.
• An external port of your choice should be opened and directed to the VNC port on the GCX controller.
• If the internet service is not static IP, consider dyndns or similar service for a static access url.

VNC Password & Security

The VNC server has a default password (gcxvnc) which should be changed when the system is installed.

To change the password, navigate to the network tab and enter the desired password twice:

VNC Remote Access

| VIEW CURRENT SESSIONS | RESET SERVER KEYS | RESET CURSOR |

Change the remote access password:

Password: ●●●●●●●●●●

Password: ●●●●●●●●●●

minimum length: 6 characters   SET PASSWORD

Security
GCX controllers operate on a Linux OS using direct frame buffering without any windowing system. VNC connections are password protected and encrypted, with access only to the framebuffer. Internally managed security certificates and phrases will invalidate and require resetting if excessive unathorized access is attempted. If using port forwarding, use an uncommon external port number to reduce likelyhood of unathorized access attempts. Additionally, the GCX system may be secured with user access control to prevent physical or remote access to the screen.

With secure passwords there are no known security vulnerabilities on GCX systems using VNC.
It is recommended to change the default VNC password when seting up your system.

Email Conﬁguration

The GCX system can send alerts and system ﬁles by email using a built-in SMTP mail client.
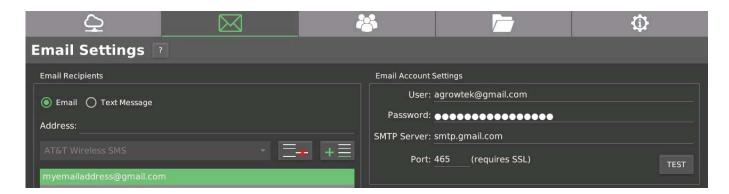*An email account is required to send email or text messages from the system.*

Email Account Requirements:
Access Type: IMAP (SMTP)
Port: 465 (SSL)

To conﬁgure email alerts:
1. Add recipients to the recipient list; type an address and press +ADD.
2. Conﬁgure the account settings; SSL and SMTP are required.
3. Press the TEST button to send a test message and check if the email settings are properly conﬁgured.
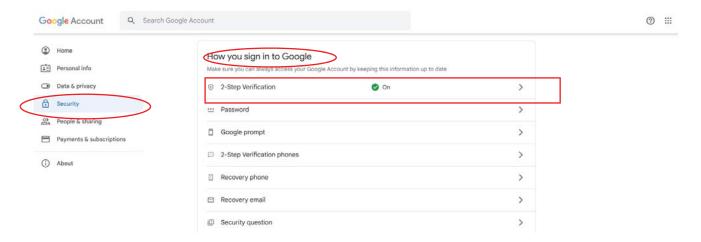

Using Gmail

Gmail requires an "app password" to be generated to allow applications to use the e-mail account.

To generate app passwords, the account must have two-factor authentication enabled.
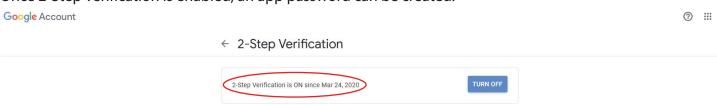
1. Log into your google account (manage your account) and select "Security."
2. Locate the "How you sign in to Google" panel and click "2-Step Veriﬁcation >".
3. Follow the prompts to turn on 2-step veriﬁcation.

App Password
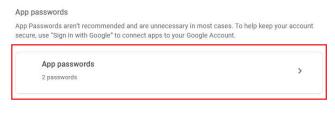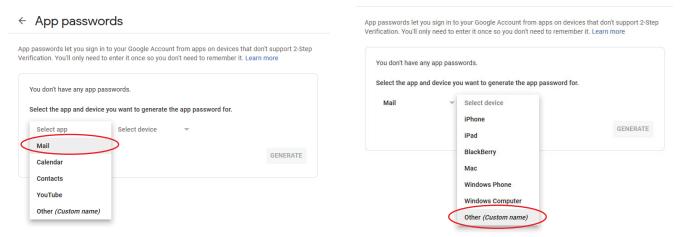
Once 2-Step verification is enabled, an app password can be created.
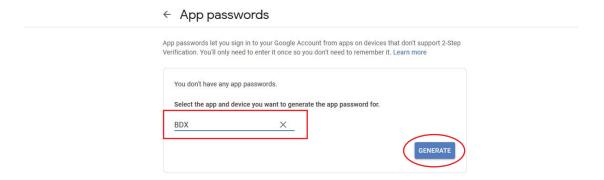
1. Scroll to the bottom of the "2-Step Verification" page and click on the "App passwords" option.

2. From the "Select app" drop-down, choose "Mail."
3. From the "Select device" drop-down, choose "Other (custom name)."

4. Enter a name for reference, then click the "GENERATE" button to create the app password.

5. Use the password in the yellow box in place of your account password in the email account settings.
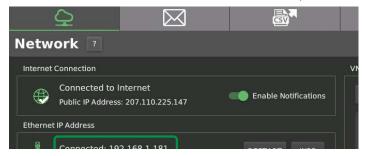
Firmware Update
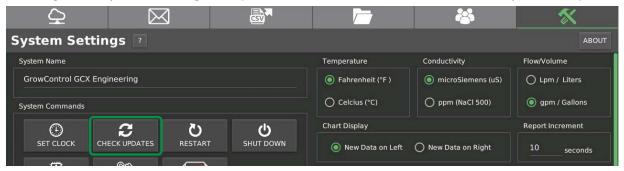
Agrowtek occasionally releases updates to system firmware that add new features or resolve bugs. Firmware may be updated via the internet if an internet connection is available, or by USB memory. A system reboot is required to complete a firmware update. It is recommended to place all relays into "Off" status.

Internet Update

An internet connection is required to update the firmware from the internet.
Check that the network is connected and the system has an IP address on the network tab.

1. Navigate to System Settings and press [CHECK UPDATES] to check if the system is up to date.

2. If a new update is available, press [DOWNLOAD UPDATE] to download it to the system.

3. When the download completes, press REBOOT to restart the system.
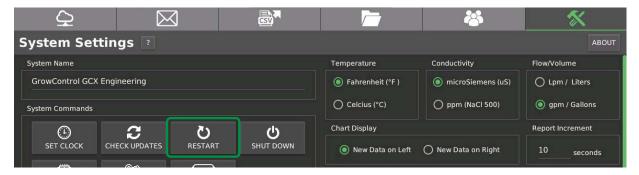
Skip to the "System Firmware Loader" section.
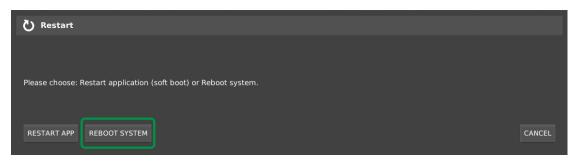
USB Update

A USB flash drive is required for the USB update procedure. Contact the factory for firmware.

1. Copy the firmware file on to a USB flash drive.
2. Plug the USB flash drive into an available USB port.
3. Press the [RESTART] button on the system settings page.

4. In the Restart dialog, press [REBOOT SYSTEM] and the system will reboot.

⚠ CAUTION
It is recommended to place equipment into Off mode prior to rebooting.
Once the system is rebooted, place equipment back into Auto mode.

ⓘ USB File
USB memory will retain the update file so that it may be used on multiple machines without loss of the file.
Remove the USB memory after the update or the loader will update the firmware on each boot.

ⓘ USB Troubleshooting
Some memory cards are not read properly by the GCX system. If the firmware file is not detected by the System Loader, then please try another USB flash drive or another format when formatting the flash drive.
Recommended Format: Fat16

System Firmware Loader

When the GCX system boots up, the system loader checks:
• If new firmware has been downloaded from the internet,
• If new firmware is found on a USB memory source.

If firmware is found from either source, it will update the system with the firmware found.
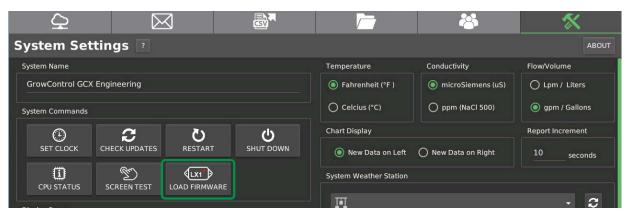
To confirm the firmware has loaded go to the System Settings page and press the [ABOUT] button.
Check the firmware version matches the expected new version.
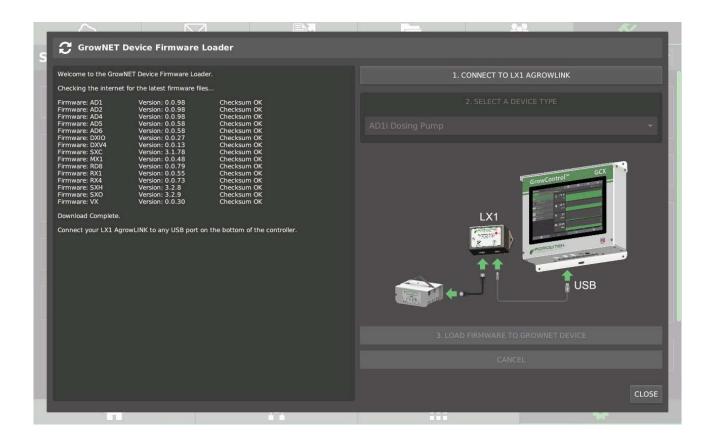
GrowNET™ Device Update

Agrowtek occasionally releases updates to GrowNET™ device hardware (environment sensors, hydroponics sensors, relay boxes, dosing pumps, etc.) The devices which physically connect to the GCX system can be updated with a LX1 AgrowLINK™ plugged into the GCX system's USB ports.

To update a GrowNET device, navigate to the System Settings page and press the LOAD FIRMWARE button:
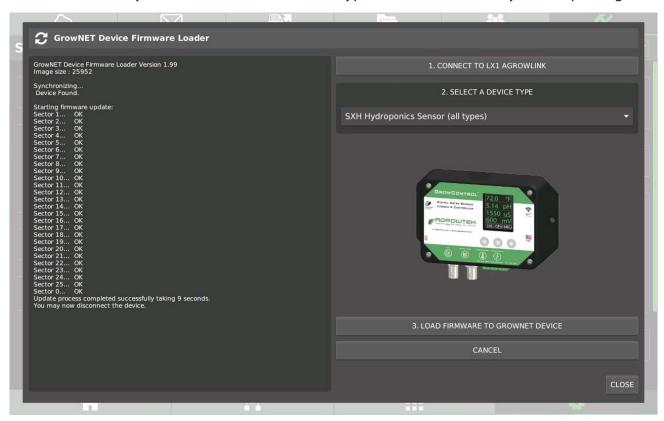
When the loader dialog is opened, the system will automatically attempt to download the latest device firmware files to the GCX controller. These firmware files can then be loaded to individual devices as required with an LX1 USB AgrowLINK.

A LX1 USB AgrowLINK is required to load firmware from the GCX system onto a GrowNET™ device. Follow the on-screen diagram and connect the LX1 to the GCX system's USB ports, then connect the device to update.

1. Press the CONNECT TO LX1 AGROWLINK button to detect the LX1.

2. If the LX1 is detected, you can then select the device type to match the device you are updating:

3. Press the LOAD FIRMWARE TO GROWNET DEVICE button to begin the firmware update.

IMPORTANT: GrowNET™ devices allow a 30 SECOND WINDOW from power-up to begin the update. If the loader window displays "Synchronizing..." for more than a few seconds, disconnect and re-connect the device to power-cycle it. The update should begin immediately if it has not timed out and failed.

MODBUS TCP/IP

MODBUS registers are available to read and write data to peripheral devices on the GCX system.
The TCP Command server must be enabled and may be operated on port 502 or 4040.

Each device on the GCX system can be accessed individually by the device address assigned to each device on the GrowNET™ bus.

Device Address
GrowNET™ devices on the GCX system are assigned a device address from 1 to 100 on each GrowNET™ bus. GCX+ systems suport two GrowNET™ busses for a total of 200 devices.

MODBUS addresses on bus 0: Device address on GCX system.
MODBUS addresses on bus 1: Device address on GCX system +100.

Example:
Device Address 20 on bus 0 is MODBUS device address 20.
Device Address 20 on bus 1 is MODBUS device address 120.

Supported Commands
0x01 Read Output Coils
0x02 Read Input Coils
0x03 Read Holding Registers
0x05 Force Single Output Coil
0x06 Write Single Holding Register

Standard Error Responses
-Unsupported MODBUS commands will return an 'illegal function' error (0x01.)
-Unsupported registers or request lengths will return an 'illegal data address' error (0x02.)
-Writing invalid data to a register will return an 'illegal data value' error (0x03.)
-Writing data to regsiters that require diagnostic mode will return a 'slave device busy' error (0x06.)

Register Types
All registers are 16 bits wide with addresses using the standard MODICON protocol. Floating point values use the standard IEEE 32-bit format occupying two contiguous 16 bit registers. ASCII values (text strings) are stored with two characters (bytes) per register in hexadecimal format with trailing 0x00 for empty bytes.

Coil Registers
Devices with discrete coil registers (relays) may be accessed beginning with the first output (1) up to the number of outputs on the device (8 max. typical.) Forcing a coil register will set the output to Off or On mode, disabling the Auto mode.

Input Registers
Devices with discrete input registers (input modules) may be accessed beginning with input 1 (register 10001) up to the number of inputs on the device (8 maximum typical.) Input modules feature both analog and discrete registers for each input. Discrete inputs register "true" when the analog voltage is above 20% of the input range.

Device Holding Registers

Holding registers contain data and from sensors and devices in 16 bit or 32 bit "word" data structures.

Parameter	Description	Values	Type	Access	Address
Name (max 100 char)	Device Name	ASCII Characters	2 chars/register	R	40001
Integer Register	Integer Value 1	Sensor Reading Analog Input Value PWM Output (% Duty) Pump Speed (%)	16 bit, signed	R	40101
	Integer Value 2				40102
	Integer Value 3				40103
	Integer Value 4				40104
	Integer Value 5				40105
	Integer Value 6				40106
	Integer Value 7				40107
	Integer Value 8				40108
Float Register	Floating Point Value 1		32 bit, floating pt	R	40201
	Floating Point Value 2				40203
	Floating Point Value 3				40205
	Floating Point Value 4				40207
	Floating Point Value 5				40208
	Floating Point Value 6				40211
	Floating Point Value 7				40213
	Floating Point Value 8				40215

Integer Scaling

Sensor values are available in integer or floating point formats depending on the register requested (see map.) Some integer formatted values are scaled by factors of 10's to maintain decimal precision and require division to calculate the final value.

Environment Sensors (SXC, SXE)

Sensor #	Type	Integer Scale	Range
1	Temperature	x100	-2000 - 6000 (-20 - 60°C) / -400 - 14000 (-4 - 140°F)
2	Humidity	x10	0 - 1000 (0 - 100%)
3	Light	x1	0 - 1000 W/m2
4	CO2	x1	0 - 10,000 ppm
5	VPD	x100	0 - 10 kPa

Weather Sensors (SXW)

Sensor #	Type	Integer Scale	Range
1	Temperature	x100	-2000 - 6000 (-20 - 60°C) / -400 - 14000 (-4 - 140°F)
2	Humidity	x10	0 - 1000 (0 - 100%)
3	Light	x1	0 - 1000 W/m2
4	CO2	x1	0 - 10,000 ppm
5	Speed	x1	0 - 125mph
6	Direction	x1	0 - 359°
7	Barometric Pressure		*NOT CURRENTLY AVAILABLE*
8	Rain		0 - 1

Hydroponics Sensors (SXH, GXH, PHX)

Sensor #	Type	Integer Scale	Range
1	Temperature	x100	-2000 - 6000 (-20 - 60°C)
2	pH	x100	0 - 1400 (0 - 14.00pH)
3	Conductivity	x1	0 - 2500 ppm
4	O.R.P.	x1	-1000 - +1000 mV
5	D.O.	x100	0 - 2000 (0 - 20.00 mg/L)
6	Flow	x10	0 - 125 gpm

Input Modules (DXI8)

Type	Integer Scale	Range
Voltage	x1	0 - 5000 mV
Current	x100	0 - 2000 (0 - 20 mA)

Calibration Registers

Offset Calibration
Offset (zero) calibration is an arithmatic positive or negative correction to the sensor reading and is the only type of sensor calibration available on climate/environmental sensors. To perform a sensor offset calibration, write the correct sensor value to the offset calibration regsiter (consider the integer scaling noted.)

Span Calibration
Span, or slope calibration, corrects the slop of the sensor reading at a second point, away from the zero calibration. Operations performed using the span register are:

-pH 4.01 or 10.0 calibration
-Conductivity, ORP or DO calibration to solution standard

Environment Sensors (SXC, SXE)

Parameter	Description	Range	Type	Access	Address
Calibration Input, Offset (Zero)	Temperature	See integer ranges.	16 bit, signed	W	41101
	Humidity				41102
	Light				41103
	CO2				41104

Hydroponics Sensors (SXH, PHX)

Parameter	Description	Range	Type	Access	Address
Calibration Input, Zero	Temperature	See integer ranges.	16 bit, signed	W	41101
	pH				41102
	Conductivity				41103
	O.R.P. / D.O.				41104
Calibration Input, Span	pH	See integer ranges.	16 bit, signed	W	41202
	Conductivity				41203
	O.R.P. / D.O.				41204

Discrete Registers

Discrete registers provide details on the I/O status of on/off type of outputs, and allow manual overrides of outputs. Output status registers are read-only; manual control is accomplished via the override registers.

Override Registers
A "force-on" and "force-off" register is available for each output. To force an output on or off, set the respective register to "true." To return an output to "auto" mode, set both overrides to "false".
Note: Setting one override to true will automatically set the opposite override to false.

| Parameter	Description	Type	Access	Address
Output Status Register	Output 1	bit	R	1
	Output 2			2
	Output 3			3
	Output 4			4
	Output 5			5
	Output 6			6
	Output 7			7
	Output 8			8
Output Override OFF	Force-Off 1	bit	R/W	101
	Force-Off 2			102
	Force-Off 3			103
	Force-Off 4			104
	Force-Off 5			105
	Force-Off 6			106
	Force-Off 7			107
	Force-Off 8			108
Output Override ON	Force-On 1	bit	R/W	201
	Force-On 2			202
	Force-On 3			203
	Force-On 4			204
	Force-On 5			205
	Force-On 6			206
	Force-On 7			207
	Force-On 8			208

Control Function Registers
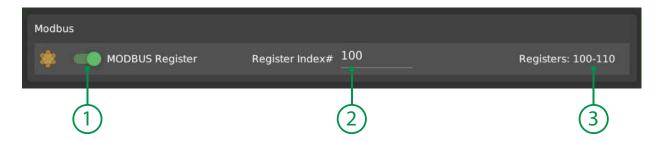
Control function values can be accessed if a MODBUS register is set for the specific control function setting. This allows read and write of control parameters using MODBUS registers.

Device Address
Access to control functions is performed through device address **201**.

Register Index
Function registers are accessed by setting a primary register which subsequent registers are indexed from. The user or integrator must set an index register for each function setting to access the settings.

1. Enable Modbus   Enable access to the function registers with MODBUS (administrator only.)
2. Register Index   Number to use as the first (index) register for accessing the settings.
3. Register Preview   Displays the range of registers used for this setting according to the index.

Accessing Registers
The settings are accessed by sending read-register requsts to device address 201, at the index or specific register number requested according to the offset tables on the following pages. Multiple registers can be requested up to the Modbus limit.

For example; requesting the registers from the graphic above for the "Function Status" and "Function Value" :

Device Address = 201
Start Register = 1000
Number of Registers = 2

For a complete listing of function registers, please reference the MODBUS manual available at:

https://agrowtek.com/doc/im/IM_MODBUS.pdf

Technical Information

Specifications

Input Power	24 Vdc, 2.5A Max
Included Power Supply	UL Listed Class II Limited Energy Power Supply 90-265VAC Input, 24Vdc 2.5A Max Output
Control Interface	GCX: 10.1" (1024 x 800) Capacitive Touch Screen GCX+: 15.6" (1920 x 1080) Capacitive Touch Screen
GrowNET™ Ports / Devices	GCX: 8 / 100 GCX+: 16 / 200 (100 devices per 8-port bus)
Network Communication	10/100 Ethernet (RJ-45) WiFi (optional, USB)
USB Ports	4x USB A 2.0 Host, 1x USB B Slave (boot loader)
Processor	Quad-Core 1.2GHz ARM
OS	Linux
Operating System Memory	8GB, Industrial Flash
RAM	1GB (512MB shared GPU memory)
Enclosure	Powder Coated Aluminum
Working Environment	Maximum 70% RH non-condensing. Avoid direct sunlight.

These specifications are subject to change without notice as hardware updates and improvements occur.

Storage and Disposal

Storage
Store equipment in a clean, dry environment with ambient temperature between10-50°C.

Disposal
This indsutrial control equipment may contain traces of lead or other metals and environmental contami-nants and must not be discarded as unsorted municipal waste, but must be collected separately for the purpose of treatment, recovery and environmentally sound disposal. Wash hands after handling internal components, tubing or PCB's.

Warranty

Agrowtek Inc. warrants that all manufactured products are, to the best of its knowledge, free of defective material and workmanship and warrants this product for three (3) years from the date of purchase. This warranty is extended to the original purchaser from the date of receipt. This warranty does not cover damages from abuse, accidental breakage, or units that have been modified, altered, or installed in a manner other than that which is specified in the installation instructions. Agrowtek Inc. must be contacted prior to return shipment for a return authorization. No returns will be accepted without a return authorization. This warranty is applicable only to products that have been properly stored, installed, and maintained per the installation and operation manual and used for their intended purpose. This limited warranty does not cover products installed in or operated under unusual conditions or environments including, but not limited to, high humidity or high temperature conditions. The products which have been claimed and comply with the aforementioned restrictions shall be replaced or repaired at the sole discretion of the Agrowtek Inc. at no charge. This warranty is provided in lieu of all other warranty provisions, express or implied. It is including but not limited to any implied warranty of fitness or merchantability for a particular purpose and is limited to the Warranty Period. In no event or circumstance shall Agrowtek Inc. be liable to any third party or the claimant for damages in excess of the price paid for the product, or for any loss of use, inconvenience, commercial loss, loss of time, lost profits or savings or any other incidental, consequential or special damages arising out of the use of, or inability to use, the product. This disclaimer is made to the fullest extent allowed by law or regulation and is specifically made to specify that the liability of Agrowtek Inc. under this limited warranty, or any claimed extension thereof, shall be to replace or repair the Product or refund the price paid for the Product.