OpenSprinkler User Manual

Firmware 2.2.1(3) (Sep 1, 2025)

Contents

Introduction

OpenSprinkler is an open-source, web-based sprinkler/irrigation controller designed as a drop-in replacement for conventional sprinkler controllers that lack web connectivity. Its key benefits include an intuitive user interface, remote access, and smart weather-based watering control. It is ideal for homeowners and businesses in applications such as lawn and garden watering, plant irrigation, drip irrigation, hydroponics etc.

The OpenSprinkler hardware comes in two flavors:

- **OpenSprinkler v3** – Features built-in WiFi, two independent sensor ports, and an optional wired Ethernet module. It is fully assembled and pre-loaded with firmware.
- **OpenSprinkler Pi (OSPi)** – Powered by a Raspberry Pi (RPi), requiring some assembly (such as connecting the RPi) and firmware installation.

Each controller has 8 zones by default, with expansion possible through zone expanders (each adding 16 zones). **OpenSprinkler v3 supports up to 72 zones**, while **OSPi** can manage up to **200 zones.**

In addition, OpenSprinkler v3 is available in three power variants:

- **AC-powered** – Comes with an **orange** terminal block (v3.0-v3.3) or **red** power barrel (v3.4), and works with a 24VAC transformer only. The transformer is NOT included by default but can be purchased as an add-on (or use your own 24VAC transformer).
- **DC-powered** – Comes with a **black** power barrel and includes a 7.5VDC adapter for North American users. It can operate with any DC adapter (7.5V–12VDC) or a 12VDC solar panel. Despite using DC power, it is designed to operate 24VAC sprinkler valves.
- **LATCH** – Similar to the DC-powered model, it comes with a **black** power barrel and a 7.5VDC adapter for North American users. It's specifically designed for use with **latching** solenoid valves only.

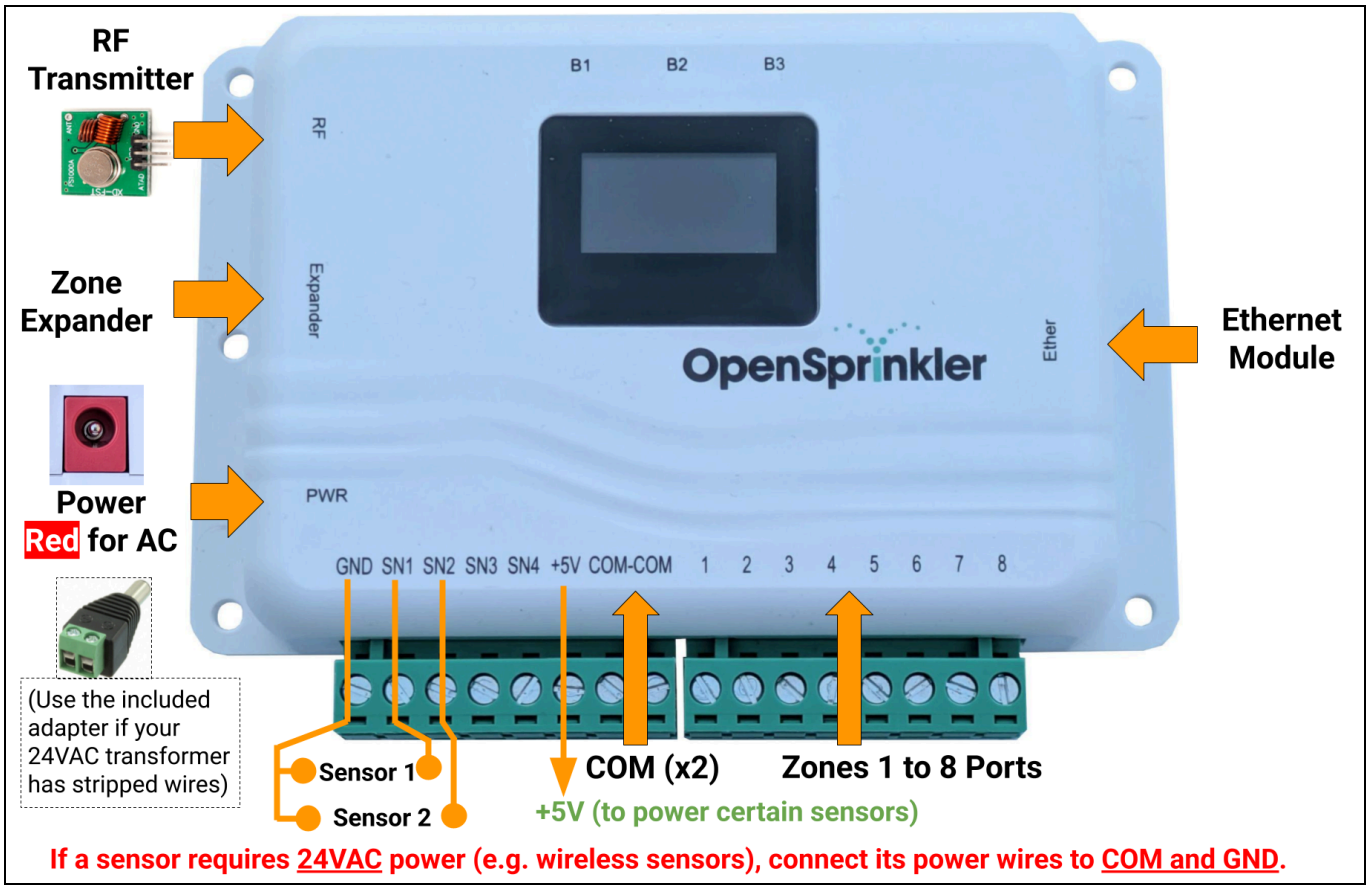
What's New in this Firmware?

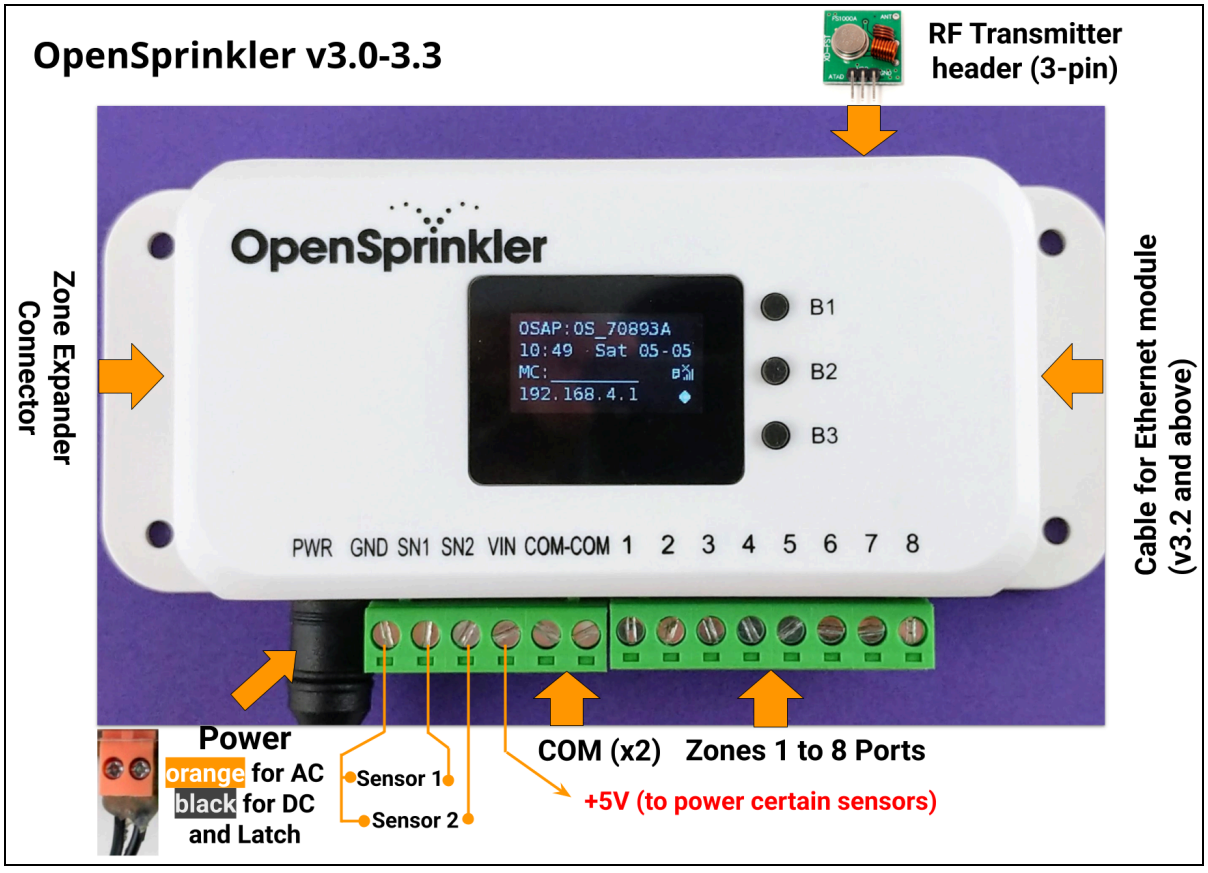
Firmware 2.2.1(3) is a minor revision. Here are the key changes introduced since the previous version, 2.2.1(2):

- **Support for Multi-Day Watering Levels**: When using the Zimmerman or ETo weather adjustment methods, programs that run on fixed intervals can now base watering levels on multi-day averages, instead of solely on the previous day's. This allows more accurate adjustments for programs that don't run daily, accounting for all weather changes since the last run. Refer to ***Section 5 – Weather and Sensors*** for details.
- **Support for Weather Restrictions**: Programs can be skipped based on conditions such as low temperature, forecasted rain, or the legacy California rule. These restrictions are supported with all weather adjustment methods, subject to the limits of your weather provider's forecast data. See ***Section 5 – Weather and Sensors*** for details.
- **Overcurrent and Undercurrent Fault Detection and Notifications:** The firmware now detects overcurrent (e.g. due to shorted solenoids, faulty wiring, running too many zones concurrently) and undercurrent (broken wire, faulty solenoid), with adjustable threshold for each. Zones shut off automatically on overcurrent, and fault alerts appear in the UI, LCD, and notification channels. See ***Section 5 – Advanced Settings*** for details.
- **Bug Fixes and Minor Improvements**
  - Concurrent zone activations are staggered by 1 second to reduce the impact of inrush current.
  - Added notifications for skipped programs (e.g. due to 0% watering level or active weather restrictions).
  - Manually starting a program now honors the program name annotation for custom station run-order.
  - Weather queries now use HTTPs (secure HTTP) on OS v3.x and OSPi.
  - Fixed URL decoding bug for parsing HTTP station data on OS v2.3.

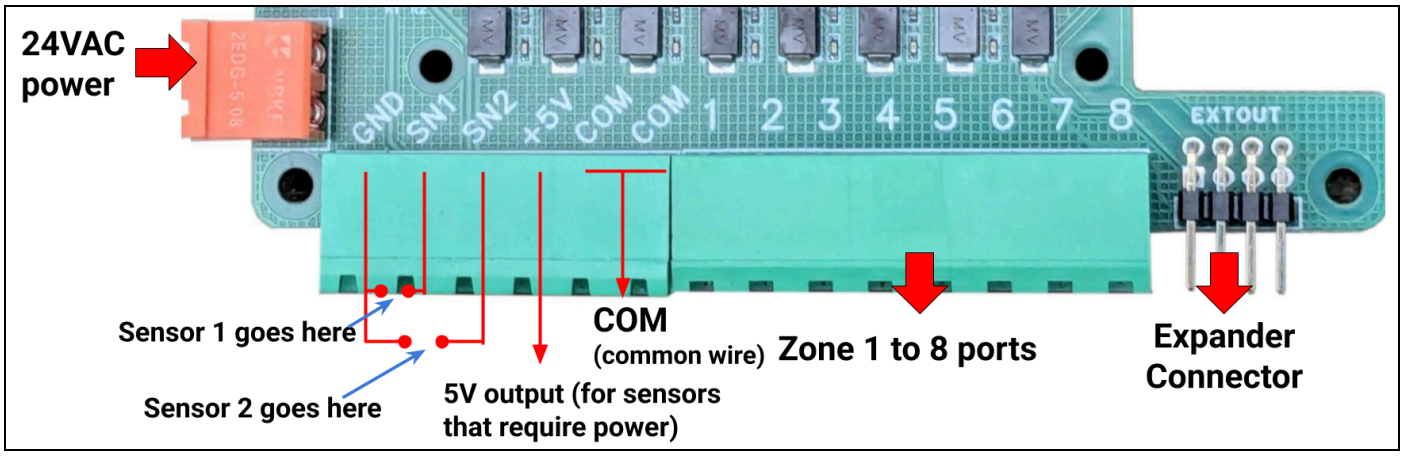
Hardware Interface

OpenSprinkler v3.4 AC (new enclosure)

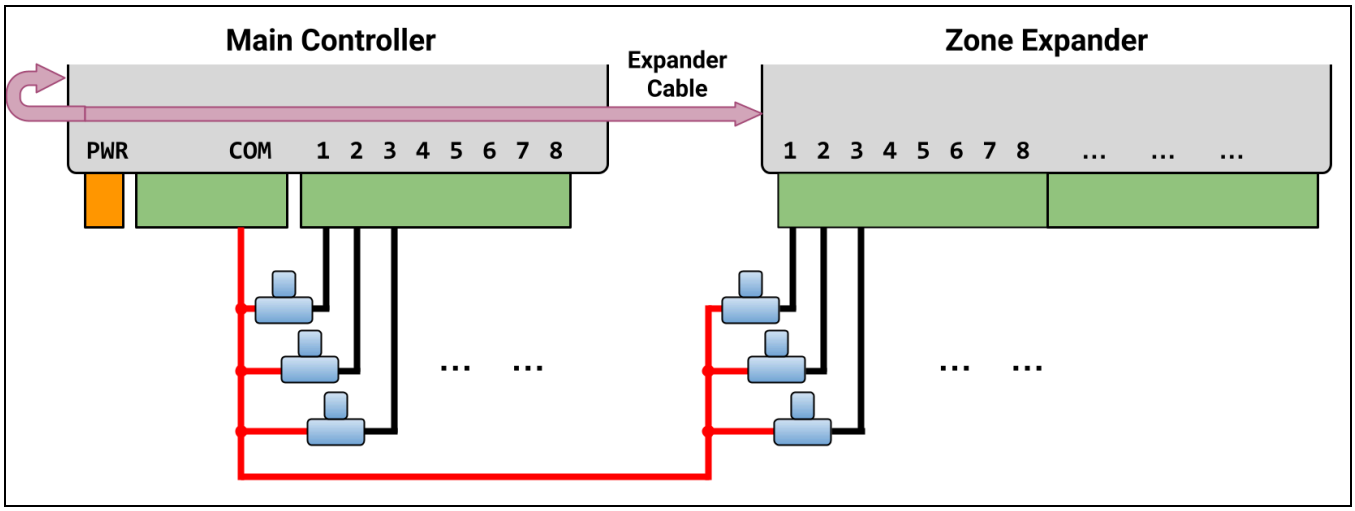




OpenSprinkler Pi (OSPi):



Zone Wire Connection Diagrams



- Each valve solenoid has two wires. Typically, one wire from each valve – whether connected to the main controller or an expander – is bundled together into a COM (common) wire. This COM wire must go to the COM (**NOT GND!!!**) terminal port on OpenSprinkler.
- OpenSprinkler features two COM ports, and you can use either one as they are internally connected.
- The other wire from each valve should go to an individual zone port.
  - *If the solenoid is **polarized** (as with DC and Latching valves), connect the positive wire (usually **red**) to the COM terminal, and the negative wire (usually **black**) to the corresponding zone port.*
- If you have a master valve or pump start relay wire, you can insert it into any zone port -- OpenSprinkler uses software defined master / pump zone, so you can designate any zone as a master in software settings.

Installation

Important Notes

- OpenSprinkler is **NOT waterproof**. **For outdoor installation**, please be sure to use a **waterproof enclosure**.
- **International Customers**: If using the AC-powered OpenSprinkler, please ensure you have a 24VAC transformer that matches your country's powerline voltage standard. Using an incompatible transformer can damage the controller. If a suitable 24VAC transformer is unavailable, consider the DC-powered OpenSprinkler, which operates on a low-voltage adapter (7.5V–12VDC).

Wiring and Installation Tutorial Video:

- **Installation and tutorial videos** are available at https://support.opensprinkler.com

Instructions:

Step 1: Label wires and remove your existing sprinkler controller.

Carefully label and remove the wires from your existing sprinkler controller, then remove it from the wall. You will typically find **power supply wires**, a **COM (common) wire**, one or more **Zone wires**. Depending on your setup, you may also have a **Master Zone** (or Pump Start Relay) wire, and wires for **Rain / Soil / Flow Sensors** (if any are in use).

Step 2: Attach OpenSprinkler to the wall, and re-insert the wires:

Refer to the Hardware Interface and Zone Wire Connection diagrams from the previous pages. All terminal blocks on OpenSprinkler are **removable** for easy wiring. To detach a terminal block, firmly grab either end, wiggle, and pull it out. Next, insert the COM and Zone wires into their corresponding terminal ports on OpenSprinkler.

- To power **powered OpenSprinkler AC**:
  - For OpenSprinkler v3.4 AC: Insert the 24VAC transformer to the **Red** power barrel. (If your transformer has stripped wire, use the included screw-terminal-to-plug adapter).
  - For OpenSprinkler v3.3 AC and earlier: Insert and tighten the 24VAC wires into the **Orange** terminal block. **AC has no polarity** so the two wires have no distinction.
- **For OpenSprinkler DC and LATCH**: Note the COM terminal is **positive** (+). If your solenoid wires have polarity, ensure the positive wire (typically **red**) connects to COM. Insert the DC adapter into the **Black** power barrel.

If using a **sensor**: its signal wires should go **into SN1 and GND** (or **SN2 and GND** if using a second sensor). **DO NOT** plug any signal wire of a sensor to COM -- OpenSprinkler uses GND (not COM) as the common terminal for sensors. If the sensor requires **24VAC power** (e.g. wireless sensors): insert its power wires to **COM and GND**, which supply 24VAC.

For additional details on sensor connections (e.g. rain / soil / flow sensors), refer to Section 5 of this manual.

Step 3: Connect OpenSprinkler Zone Expanders (Optional):

Power off the main controller before connecting any expanders. Once the power is off, plug one end of the zone expander cable into OpenSprinkler's **Zone Expander Connector**. This connector is polarized so you can only plug it in one way.

- For **OpenSprinkler Pi (OSPi)**: Connect the other end of the cable to the Zone Expander's **IN connector**. If using multiple expanders, daisy-chain them by following the **OUT → IN** links.
- For **OpenSprinkler v3**: Connect the other end of the cable to the Expander's connectors on either side, as the two connectors are identical. For multiple expanders, use additional cables to link them together.

  Since all Expanders share the same I2C bus, **each must have a unique index** (1, 2, 3, or 4). This is set using the **DIP switch at the back of the expander** (see picture on the right). The first expander (directly

connected to the main controller) should have an index of **1** (DIP switch: **DOWN DOWN**), the second expander should be **2** (**UP DOWN**), third is 3 (**DOWN UP**), and fourth is 4 (**UP UP**).

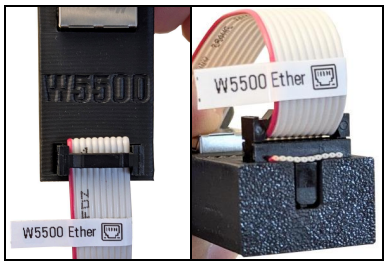
Understanding Zone Mapping: Zones on the main controller correspond to indices 1–8; zones on the first expander (DIP position DOWN DOWN) correspond to indices 9–24; additional expanders follow the same pattern.

The firmware can automatically detect the expander with the highest index, but **you must still manually set the number of zones in software settings**. You can also configure more zones than physically available, to leverage the **Virtual Zones** features (e.g. Remote, HTTP, RF zones. See Section 3.2).

Step 4: Setting Up WiFi or Wired Ethernet on OpenSprinkler v3:

- **WiFi mode**. When you power on OpenSprinkler for the first time (or after a factory reset), it **starts in WiFi Access Point (AP)** mode, creating an open WiFi network. The SSID (e.g. `OS_xxxxxx`) will be displayed on the LCD screen. Use your phone or laptop to connect to this WiFi network.
  - ***Android users**: you may see a warning: "WiFi has no Internet connection". Select **Yes** to stay connected.*
- Once connected, open a web browser and go to **192.168.4.1** to access the WiFi setup page, follow the instructions therein to connect OpenSprinkler to your home WiFi. Specifically, select (or manually enter) **your WiFi's SSID and password** (NOT OpenSprinkler's password!). The WiFi network's **BSSID and Channel** will be automatically detected and populated (but you can leave them empty if preferred). Then click **Connect** to complete the setup.
- Once OpenSprinkler connects to your WiFi successfully, it will automatically reboot into **WiFi Station mode**. To find its new IP (i.e. the **device IP**) assigned by your router, **click push-button B1**, and the device IP will be displayed on the LCD screen. On your phone or computer, either use the **OpenSprinkler mobile app**, or launch a **web browser,** and enter the device IP, you will see the OpenSprinkler web interface and log-in screen.
- **The default device password is opendoor**.
  For security, please change this password after setup.

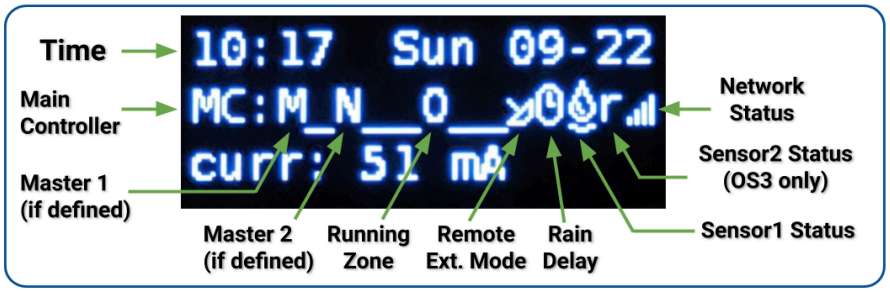
Wired Ethernet. Starting with version 3.2, OpenSprinkler supports both WiFi and wired Ethernet. You can purchase an add-on Ethernet module to enable wired connectivity. The module comes with a gray ribbon cable. Firmly plug the ribbon cable connector into the Ethernet module (shown on the right). Note that the connector is polarized, so it will only fit one way. Then, connect an RJ45 Ethernet cable to the other end of the module. If the Ethernet module is plugged in before the controller is powered on, it will automatically detect the module and boot into wired Ethernet mode.



Reset WiFi / Reset Device Password / Factory Reset

- **Reset WiFi**. To reset or switch the WiFi network on OpenSprinkler v3 without erasing settings: press B3 followed by B2 (i.e. B3+B2 like pressing Ctrl+C) until the screen displays "**Reset to AP mode?**". Click B3 to confirm.
  - Alternatively, you can trigger a WiFi reset using the OpenSprinkler mobile app or web UI. To do so, go to **Edit Options -> Reset -> Reset WiFi**.
- **Reset Device Password**. If you have forgotten your device password, you can bypass it using buttons. To do so:
  - Remove power from OpenSprinkler, then plug the power back in. **As soon as you see the OpenSprinkler Logo, press and hold button B3**, and continue holding B3 until the LCD displays "**Setup Options**".
  - Click B3 multiple times until it shows "**Ignore Password**". Click B1 to select **Yes**.
  - Finally, **press and hold B3 until the controller reboots**. After this, you can access the controller without a password. For security, immediately change the password and set the **Ignore Password** option back to No.
- **Factory Reset**. To perform a factory reset: remove power from OpenSprinkler, then plug the power back in. **As soon as you see the OpenSprinkler Logo, press and hold button B1**, and continue holding B1 until the LCD displays "**Reset?**" Ensure the answer is **Yes**, then **press and hold button B3** until the controller reboots and completes the reset. After this, all settings, including the device password and WiFi, will return to factory defaults.

LCD Display and Button Functions



- **Master Zone 1** (if configured) is marked with an **M**; and **Master Zone 2** (if configured) is marked with an **N**.
- By default the LCD shows the status of the **8 zones** on the main controller (MC). If you have expanded zones, click **B3** to switch to the next group of 8 zones. Each **running** zone is displayed with a three-letter animation: **. o O**
- If there are no running zones currently, a **(System Idle)** message will be displayed at the top.
- If the controller is configured in **Remote Extension** mode, a **radar** icon will appear.
- If **Pause Station Runs** or **Rain Delay** is active, a **clock** icon will appear.
- If **Sensor 1** is configured, a corresponding letter will appear as follows: **r** (rain sensor), **s** (soil sensor), **p** (program switch), and **f** (flow sensor). In addition, a **rain** icon will appear if the rain sensor is activated, and a **soil** icon for the soil sensor. Similarly, if **Sensor 2** is configured, the display will follow the same format as Sensor 1.

<u>After the controller is powered on</u>, the buttons are assigned the following functions:

	Click (i.e. Short Press)	***Press and Hold (i.e. Long Press)***
B1:	Display device IP address, port and OTC status	Stop all zones immediately
B2:	Display device MAC address	Reboot the controller
B3:	Toggle between the main controller (MC) and each group of 8 expanded zones (E1, E2, E3 etc).	Manually start an existing program or a test program.
B1 + B2	Display gateway (router) IP (i.e. press and hold B1, then press B2, similar to pressing Ctrl+C on a keyboard.)	
B2 + B1	Display external (WAN) IP.	
B2 + B3	Display timestamp of the last weather server response	
B3 + B2	For OpenSprinkler v3: reset controller to AP mode (for re-configuring WiFi).	
B1 + B3	(*for internal testing only*) Start a very quick (2 seconds each zone) test program.	
B3 + B1	Display the last system reboot timestamp and reboot reason.	

During power-up, <u>while the OpenSprinkler Logo is displayed</u>, the following button actions are supported:

- If **B1** is pressed and held while the logo is displayed: enter **Factory Reset**.
- If **B2** is pressed and held while the logo is displayed: enter internal test mode
- If **B3** is pressed and held while the logo is displayed: enter **Setup Options**.

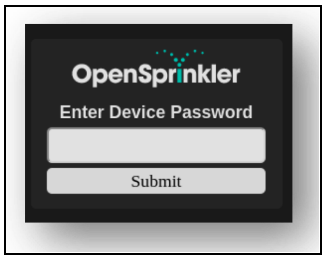
Firmware 2.2.1(3) User Manual

1. Overview

OpenSprinkler's built-in user interface is compatible with both mobile devices and laptop/desktop computers, enabling you to adjust settings and modify programs anytime. You can access the interface through a **web browser,** or use the free **OpenSprinkler mobile app**. To install the app, simply search for **OpenSprinkler** in your app store.

- **Firmware tutorial videos** are available at https://support.opensprinkler.com

2. Accessing the Controller



Local Access. Once the controller is connected, you can find its IP address and HTTP port on the LCD by clicking button B1. We will refer to this as ***os-ip*** (e.g. *192.168.1.122*). To access it locally, open a browser and enter the URL *http://os-ip* (e.g. *http://192.168.1.122*). If you have configured a custom HTTP port (other than the default 80), include the port number in the URL. For example, if the port number is 8765, enter *http://os-ip:8765*.

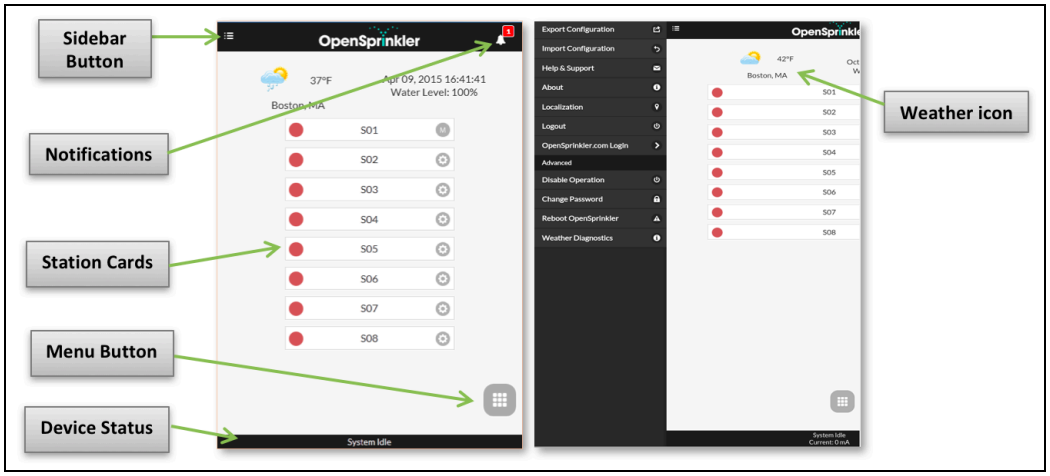
The default device password is opendoor. For security, change the password upon first use.

When using the OpenSprinkler mobile app, select **Manually Add Device**. Enter the IP as described above (without the *http://* prefix). Using the IP to access the controller works as long as you are on the same network as the controller.

Remote Access. To access the controller remotely when you are on a different network, you need to first set up an **OpenThings Cloud (OTC) token** (see Section 5). Then, in the OpenSprinkler mobile app, select **Manually Add Device**, choose **OpenThings Cloud** as the Connection Type, and paste the OTC token there.

You can also access the controller remotely in a web browser, by visiting `cloud.openthings.io/forward/v1/token` where `token` is the OTC token you set up (refer to Section 5 for details).

3. Homepage



On the homepage, you'll see a weather icon along with a list of all stations and their current status. The bell icon in the upper-right corner (when visible) indicates that notifications are available and opens a sidebar displaying all notifications. The button on the upper-left corner opens the sidebar menu, where you'll find options such as:

- **Manage Sites:** Manage multiple controllers (this option is available in the mobile app).
- **Export/Import Configuration:** Save or restore controller settings and programs. This is useful during firmware upgrade or in preparation for a factory reset.
- **About:** View the app version, firmware version, and hardware version.
- **Localization**: Change the display language.
- **OpenSprinkler.com Login**: Log in with your opensprinkler.com account credentials. This allows cloud-synced features, such as station photos, notes, site configurations. (See Section 3.2)
- **Disable Operation:** Disable zone operations, which is useful if OpenSprinkler will not be used for an extended period.

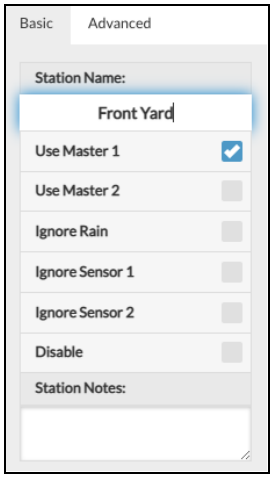
- **Change Password:** Change the device password (default is **opendoor**).
- **Reboot OpenSprinkler**: Perform a software reboot of the controller.
- **System Diagnostics**: View diagnostic information, including the timestamp and cause of the last reboot, the timestamp of the last weather call, response code, weather data, and the OpenThings Cloud (OTC) connection status.

TIP: You can **open the sidebar menu** on the left at any time by swiping your mouse pointer from left to right (on laptop/desktop computers) or swiping your finger from left to right (on mobile devices).

3.1 Device Status

The footer shows the device's current status, prioritizing the following information: **system enable** status, currently **running stations**, **pause status**, or **active rain delay** status. If no active events are detected, the system will display information about the **last run station**, or "**System Idle**" if no such data is available. If a flow sensor is configured, the status bar shows the **real-time flow rate** (updated every 30 seconds). Additionally, if any zone is active, the status bar also displays the **total current draw** of all solenoid valves, which is useful for diagnosing solenoid issues. If the controller detects an overcurrent situation, an **overcurrent alert** is displayed.

3.2 Zone Attributes

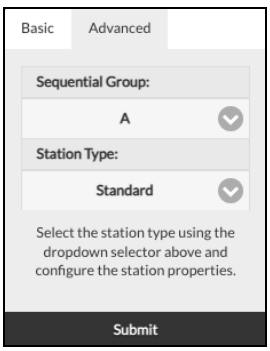


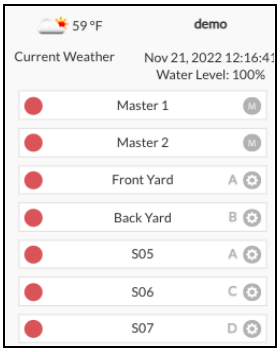
Click the **gear icon** next to each zone name, to open the zone attribute box. In the **Basic** tab:

- **Station Name**: Assign a **custom name** to the zone (up to 32 letters). ***Annotated Name****: if a flow sensor is configured (see Section 5), and the* ***last 5 letters*** *of the station name represent a numerical value, a Flow Alert notification will trigger when the flow rate exceeds this threshold after the zone completes its run. Example: if the station name is* ***Front Yard 1.357****, a flow alert will trigger if the flow rate surpasses 1.357 after this zone finishes.*
- **Use Masters**: When enabled, the associated Master zone(s) will activate whenever this zone runs. These attributes are only visible if the corresponding Master zones are configured.
- **Ignore Rain / Sensor1 / Sensor2**: When enabled, the zone will bypass manual rain delay, Sensor 1 or Sensor 2. By default, these options are unchecked.
- **Disable**: When checked, this zone will be disabled and hidden from the user interface.

In the **Advanced** tab: you will find the **Sequential Group** attribute. Each zone can be assigned to one of the **4 Sequential groups (A, B, C, or D)**, or to the **Parallel (P) group**. Zones in the same sequential group are automatically serialized – no two zones will run simultaneously. Conversely, zones in different sequential groups can run simultaneously. Zones in the parallel (P) group can run alongside any other zones. At factory reset, all zones are assigned to **Sequential Group A**. The sequential group attribute replaces the previous per-zone "Sequential" flag, offering greater flexibility for simultaneous zone operations. The group label of each zone is displayed on the homepage next to the zone name.

Another option in the **Advanced** tab is **Station Type**. The default setting is **Standard**, but you can select from several **Virtual Zone** types:



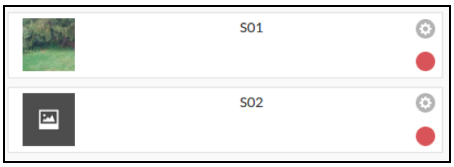


- **RF**: With an RF (radio frequency) transmitter (see **Advanced Topics** section), OpenSprinkler can control common RF remote power sockets. To set this up, you need to purchase an **RFtoy** to decode the RF signals from your remote power sockets. Once configured, OpenSprinkler will send the corresponding on/off signals via the RF transmitter, allowing you to switch powerline devices such as Christmas lights, heaters, pumps.
- **Remote Station (IP)**: This allows one OpenSprinkler to command a different OpenSprinkler. The remote station is identified by its *IP address*, *port number*, and *station index*. For example, Zone 1 on the master controller can be mapped to Zone 5 on the remote controller. Both controllers **must use the same device password** (thus eliminating the need to specify the remote controller's password separately).

- **Remote Station (OTC)**: Similar to Remote Station (IP), but instead of an IP address, the remote controller is identified by an OTC token. This facilitates the management of multiple controllers across different networks. Again, both controllers must share the same password.
- **GPIO**: Allows the zone to directly control a spare GPIO pin on the controller. Only available GPIO pins are shown for selection (some controllers may not have any), and you can define whether the pin is Active High or Active Low.
- **HTTP**: Enables the zone to send a general HTTP GET request. To configure an HTTP zone, provide a *server name* (either domain name or IP address), *port number*, and the *on/off command* (excluding the leading slash /). When this zone turns on, it automatically sends a request in the following format: **`server:port/on_command`**. When turned off, it sends: **`server:port/off_command`**.
- **HTTPS**: Functions like the HTTP Zone but supports secure (HTTPS) servers.

These special station types are **virtual**, meaning they do NOT require physical zones to operate. Even if you don't have a zone expander, you can use virtual zones up to the maximum number of zones supported by OpenSprinkler.

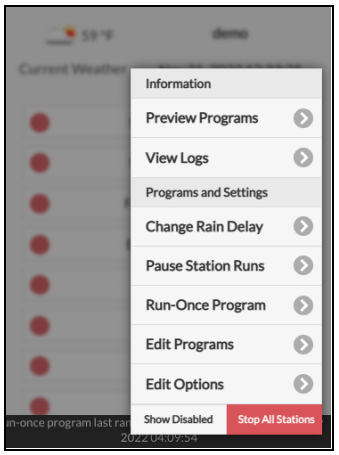
3.3 Cloud-Synced Features



After logging into **opensprinkler.com** in the UI / app (via the sidebar menu), cloud-synced attributes become available, including **station photos** and **notes**. You can capture and assign a custom photo to each station using the OpenSprinkler mobile app.

Cloud-synced data also includes site configurations, making it easier to manage multiple controllers. When switching to a different computer or phone, this feature quickly loads existing sites from your account, eliminating the need to manually add them again.

4. Menu Button



The **menu button** (aka footer menu) is located in the bottom right corner of all pages, providing quick access to key controller functions. The menu includes the following options:

- **Preview Programs** (or use the keyboard shortcut *ALT+V*)
- **View Logs** (*ALT+L*)
- **Change Rain Delay** (*ALT+D*)
- **Pause Station Runs** (*ALT+U*)
- **Run-Once Program** (*ALT+R*)
- **Edit Programs** (*ALT+P*)
- **Edit Options** (*ALT+O*)
- **Stop All Stations**

On the home page, an additional **Show/Hide Disabled** option appears in the menu, allowing you to display any zones that have been disabled (thus hidden).

TIP: on laptop or desktop computers, you can also open the menu by pressing the **M** key on your keyboard.

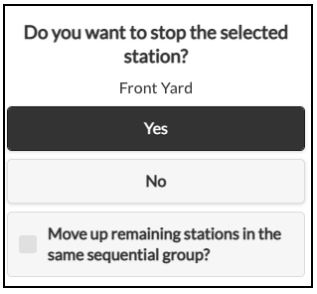
4.1 Change Rain Delay

Click the menu button and select **Change Rain Delay** to enter a custom delay time (in hours). Any zone affected by rain delay will immediately stop and remain inactive until the delay period ends. To cancel an active rain delay, click the status bar at the footer, or set a rain delay time of 0.

4.2 Pause Station Runs

Select **Pause Station Runs** in the menu and enter a duration to temporarily stop all running zones. Active zones will halt immediately and resume once the pause timer reaches 0. The start times of all zones, including those in the queue, will adjust accordingly. If a program's start time falls within the pause period, it will be queued and delayed until the pause ends. During the pause, the footer will display the pause status. To update or cancel an active pause, click the status bar at the footer, or go to Menu -> **Change Pause**.

4.3 Manually Stop a Zone from Running



If a zone is currently running, or in the queue waiting to run, clicking on its zone card opens a confirmation dialog. Here you can choose to stop the zone from running.

If there are other zones in the same sequential group waiting to run, a checkbox labelled "**Move up remaining zones in the same sequential group**" will appear. Selecting this option allows you to shift up all remaining zones in the group, so that the next zone starts immediately rather than waiting for its originally scheduled time.

4.4 Stop All Zones

Click **Stop All Stations** to immediately terminate all zones, including those in the queue waiting to start.

5. Edit Options

Click Menu -> **Edit Options** (or use keyboard shortcut *ALT+O*) to configure settings in the following categories.

System Settings

- **Location:** Click Location to open a map, where you can search for, find, and select your address. Alternatively, you can manually enter a GPS location by clicking the **pencil icon** to the right of the Location setting.
    - ***PWS** location: when using WUnderground (WU) as the weather data provider, you must choose a PWS location. To do so, first enter and submit a valid WU API key in the **Weather and Sensors tab** (see below). Then return to the Location settings, the PWS locations will appear as blue dots on the map. Select one of them as the PWS location.*
- **Time Zone:** OpenSprinkler automatically detects your time zone, Daylight Savings Time (DST), and gathers weather data based on the Location you set. To manually override the timezone, click the **cross icon** to the right of the Location setting to clear the field – once empty, the time zone will become editable.
- **Enable Logging:** Log data will be stored on the internal flash memory. This feature is turned on by default.

App Settings

These settings are stored locally in the app / UI and do not affect the controller.

- **Use Metric / 24 Hr Time:** Choose your preferred unit system (imperial or metric) and time format (12-hr or 24-hr). The UI automatically detects your unit system, but you can manually override it using these settings.
- **Orders Stations by Groups / Names:** These settings allow zones on the homepage to be sorted by their sequential groups and/or by their names (instead of by zone indices).
- **Show Disabled:** Show or hide disabled stations and programs.
- **Show Station Number:** Include the station number (index) anywhere the station name is displayed.

Configure Master

This firmware supports **up to 2 independent** Master Stations, each with customizable settings:

- **Master Station:** Choose a master station, also known as a pump zone. A master station activates alongside other zones. Any zone can be designated as a master. By default, no master station is assigned.
- **Master On Adjustment:** Fine-tunes the exact time at which the master **turns on**, with a range of **-600 to 600 seconds** (in **5-second increments)**. Example: A setting of 15 turns the master on 15 seconds **after** an associated zone starts; a setting of -60 turns it on 60 seconds **before** a zone starts.
- **Master Off Adjustment:** Functions like Master On Adjustment, but fine-tunes the exact time the master **turns off**.

Station Handling

- **Number of Stations:** OpenSprinkler automatically detects the available expanded zones, but users **must still configure this number manually**. This allows the number of zones to exceed what's physically available, which is useful for virtual stations (explained in Section 3.2). The default is 8 zones.
- **Station Delay:** Sets the delay time between two consecutive stations, with a range of **-600 to 600 seconds** (in **5-second increments**). Example: A setting of 60 delays the next zone by **1 minute after** the previous one closes; while a setting of -15 starts the next zone **15 seconds before** the previous one shuts off (which is helpful in managing water throttling issues). The default value is 0, meaning the next zone starts immediately after the previous one.

Weather and Sensors

- **Adjustment Method:** Choose a weather-based adjustment method. If **Manual** (the default) is chosen, the **% Watering** must be set manually (see below). Otherwise, it is automatically calculated based on the chosen method. Detailed explanations of supported methods are available on the OpenSprinkler.com support page.
- **Adjustment Method Options:** Tap to configure settings for each selected adjustment method.

- **Adjust Interval Programs Using Multiple Days of Weather Data:** When the Zimmerman or ETo adjustment method is selected, this option becomes available. Enabling it allows all **interval programs** to apply the **average watering level** calculated using weather data across the program's interval, rather than just the previous day's. For instance, a program set to run every 4 days will use the 4-day average. For programs that don't run daily, this provides more accurate adjustments that reflect all weather changes since the last run.

  Note that this feature applies only to **interval programs** with the "*Use Weather*" flag enabled, and is limited by the historical data range available from the selected weather provider (e.g., Apple supports up to 10 days; others may offer fewer). If the interval length exceeds the provider's available data, the maximum available range is used. The array of current multi-day average watering levels are shown in System Diagnostics.
- **Weather Restrictions:** For all adjustment methods (including Manual), you can enable these restrictions:
  - **Rain** – skip watering if the total forecast rain exceeds a set amount over a user-defined number of days (e.g. 0.5 inch in the next 3 days). Setting either value to 0 disables this rule. Note that the forecast capability is limited by your selected weather provider (e.g. Apple supports up to 10 days; others may support only 5 days or less). If the number of forecast days exceeds the provider's data, the maximum available range is used.
  - **Temperature** – skip watering if the current temperature falls below a set value (e.g. 50°F or 10°C). A value of -40 (either °F or °C) disables this rule.
  - **California Rule** – Legacy option that prevents watering if rainfall in the past 48 hours exceeds 0.1".

  Active weather restrictions are displayed on both the homepage and in System Diagnostics.
- **Weather Data Provider:** Choose your preferred weather data provider. The default option is **Apple**. If the provider requires an API key, an additional input box will appear. Note that some providers have restrictions. For example, **DWD** is limited to locations in Germany, and **WUnderground** requires the Location to be a valid PWS location.
- **% Watering:** A global scaling factor applied to station water times. For example, setting it to **75%** will multiply all station water times by **0.75** (except for programs that do NOT use weather adjustment). The default is 100%. This option is only editable when the Weather Adjustment method is set to Manual; otherwise it is grayed out.

Sensor Setup. OpenSprinkler supports **two independent sensors** (**SN1** and **SN2**) and several types: **Rain**, **Soil** (binary output only), **Flow**, and **Program Switch**. Note that the Flow Sensor is currently only supported on SN1.

- A sensor's signal wires should be connected between SN1 and GND (or SN2 and GND). **Do NOT** connect any sensor's signal wire to COM as it may damage the controller.
- Sensors that need +5V power (e.g. certain flow sensors) can use the +5V (VIN) terminal to supply +5V.
- Sensors that need 24VAC power (e.g. wireless sensors) can use COM and GND to supply 24VAC.

* *For OpenSprinkler v3.4: SN3 and SN4 are reserved for future use and currently not enabled in this firmware.*

- **Rain / Soil Sensor:** A rain or soil sensor allows the controller to automatically stop zones from running when rain or excessive soil moisture is detected. You can choose the sensor type: **normally open** or **normally closed**. These sensors function as rain or soil-activated switches, with **normally closed** being the most common type. Note that while many soil sensors output analog signals, OpenSprinkler only supports those that output binary signals (either ON or OFF). If your sensor is analog, you can purchase an Analog-to-Digital Adapter to convert it to digital.
- **Delayed On / Off Times:** Set the Delayed On / Off times for rain / soil sensors. For example: **a delayed-on time of 10 minutes** means the controller considers the sensor activated only after it has **been on for at least 10 minutes**, while **a delayed-off time** of 30 minutes means the sensor is considered deactivated after it has remained off for 30 minutes. The delayed-on time helps prevent false triggering of sensors, and the delayed-off time allows you to extend the sensor activation, such as prolonging rain sensor activation after the rain has stopped.
- **Program Switch:** When selected, you can use a dry-contact switch / button to activate programs. If a switch installed on SN1 is pressed for at least 1 second, the controller will start Program 1 (or Program 2 for switch installed on SN2).
- **Flow Sensor:** A flow sensor allows the controller to detect flow pulses, display real-time flow rate in the status bar, and log the total flow volume at the end of each station and program run. By default, **dry-contact, 2-wire flow sensors are supported**. These sensors function as flow-activated reed switches that open and close repeatedly as water flows through the meter. They require no power and typically use only 2 wires.

Connect the sensor's two wires to SN1 and GND ports (no polarity required). Next, set the **flow pulse rate**, which you can find in your sensor's datasheet. This rate is used to convert the pulse count to water volume. We recommend you to keep **L/pulse** as the unit, even if your sensor's datasheet specifies Gallon/pulse – the unit is for display purposes only; the import factor is the pulse count and number. The firmware supports only **2 decimal places** for the flow pulse rate. Any additional decimals will be discarded. If higher precision is needed, consider scaling the rate by a factor of 10.

Flow sensors with 3 wires that require 5V may also be used. Connect the **ground wire** (typically black) to **GND**, the **5V** wire (typically red) to **+5V (or VIN)**, and the **data wire** (yellow) to SN1. Due to software limitations, the signal frequency from the flow sensor should not exceed 50Hz, as higher frequencies may lead to inaccurate readings.

Integrations

- **OTC:** Configure remote access using an OpenThings Cloud (OTC) token. For details, refer to the OTC support article.
- **MQTT:** Configure MQTT settings. For details, refer to the How to use MQTT support article.
- **Email Notifications:** Configure email settings. For details, refer to the Setting up Email notifications support article.
- **IFTTT Notifications:** Configure IFTTT Webhooks key. For details, refer to the Setting up IFTTT support article.
- **Notification Events:** Configure the events that trigger notifications. This applies to all of MQTT, Email, and IFTTT notifications. Keep in mind that **enabling too many events or notification methods may cause significant delays, missed responses, or even skipped short water events**.
- **Device Name:** The name to be displayed at the homepage and included in Email/IFTTT notification messages, to help identify the controller that sent them.

LCD Screen

- **Idle Brightness:** Set the LCD brightness when the controller is inactive. Lowering it helps extend the LCD's lifespan. Setting it to 0 will turn off the LCD completely when inactive. Pressing any buttons will reactivate the LCD.

Advanced Settings

- **HTTP Port:** Customize the device's HTTP port. The default is 80, and there is usually no need to change this setting.
- **Undercurrent Threshold:** Sends an Undercurrent notification if a zone's current draw falls below this value (mA) at the end of its run (e.g., due to broken wire or faulty solenoid). The recommended value is **100 mA**, or approximately **half the holding current** of your solenoids. Set to 0 to disable this detection.
- **Overcurrent Limit:** Sends an Overcurrent notification and alert if the current draw exceeds this value (mA), such as from shorted solenoids, faulty wiring, or too many zones running concurrently.
  - If detected immediately upon turning on a zone, the affected zone is shut off immediately.
  - If detected during operation, all active zones are turned off.
  - Overcurrent alerts appear in the UI/App, LCD, and all enabled notification channels.
  - When the alert is raised, the controller can continue running programs and zones (as long as they don't trigger overcurrent again), but the alert will remain active until the controller is rebooted.
  - Set to 0 to use the system default. Set to 2550 (max) to disable this feature (**NOT recommended** as disabling it exposes the controller to potential overcurrent damage).
  - The most effective way to diagnose an overcurrent situation is to perform a **solenoid resistance test**: with the **controller powered off**, measure resistance between the COM wire and each zone wire. The typical solenoid resistance is 20~60 ohm. A value significantly below 20 ohm indicates a short.

Note that undercurrent and overcurrent detection are **supported only on AC- and DC-powered OpenSprinkler v2.3 and v3.x**, and are disabled on OpenSprinkler Latch and OSPi (due to the lack of current-sensing capability).

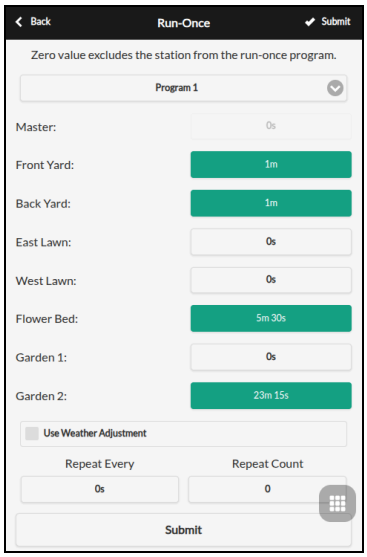
- **Boost Time: Applies only to DC-powered OpenSprinkler and OpenSprinkler Latch**. It defines the voltage boost time (ranging from 0 to 1000ms), with the default set to 320ms. When using a low-current (weak) DC adapter, you may need to increase this value for the voltage booster to generate enough power to energize the valves.
- **Latch On / Off Voltage:** Applies only to **OpenSprinkler Latch**. It customizes the voltages generated by the booster to activate and deactivate latching solenoid valves. The maximum value for each is 24V.
- **NTP IP Address:** Set a custom server for NTP time sync. Setting it to 0.0.0.0 will revert to the system's default.
- **Ignore Password:** When enabled, the device password will be ignored, allowing any password to be accepted.
- **Special Station Auto-Refresh:** When enabled, the system periodically sends refresh commands to special stations (e.g. RF, remote, HTTP stations) to keep them synchronized with the master controller.
- **NTP Sync:** Automatically syncs the device time based on your location. To manually adjust the device time, you must disable this option, which will make the Device Time editable.
- **Use DHCP:** When enabled, OpenSprinkler will automatically receive its IP from the router. If disabled, a **Static IP** must be manually entered, along with the **Gateway IP**, **Subnet Mask**, and **DNS IP**.

  Note: *if you prefer **static IP assignment**, we highly recommend you to use the router's **DHCP reservation** or IP-to-Mac binding feature, instead of disabling DHCP. Disable DHCP only if your router doesn't support these features.*

Reset

- **Clear Log Data:** Erase all log data.
- **Reset All Options:** Restore all options back to their default factory values.
- **Delete All Programs:** Erase all programs.
- **Reset Station Attributes:** Return all station settings to their factory defaults.
- **Reset Wireless:** Applicable to OpenSprinkler v3 only – reset the controller to WiFi AP mode for re-configuring WiFi.

6. Run-Once Program



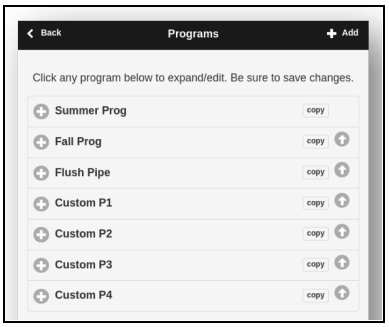
To manually start a one-time program, select Menu -> **Run-Once Program** (*ALT+R*). Here you can load preset water times from an existing program, or start a quick test program. You can also manually adjust the water time for each station.

- If the controller is currently running a program, you will be prompted to stop it before proceeding.
- All zone attributes such as *Use Master, Sequential Group*, are applied, along with controller settings such as *Station Delay Time*, *Master On / Off Adjustments*.
- You can choose whether to apply the current % Watering adjustment to the program.
- If you set the program to repeat, it will automatically create a Single-Run program upon confirmation (see Section 7).

TIP 1: you can start a run-once program directly from the controller using buttons – useful for landscapers or gardeners who need controller access without WiFi. To do so, **press and hold button B3** until the LCD displays "**Run a Program**", then click B3 to browse available programs. Once you've found the program, **press and hold B3** to start it.

TIP 2: If you'd like to create a test program that doesn't run automatically, but is available for manual activation: create a new program and set it as "**Disabled**" (refer to the next section). This prevents it from running normally, while keeping it accessible in the run-once program list or via button activation.

7. Programs



Select Menu -> **Edit Programs** (*ALT+P*) to view the list of programs. From here you can: **Add** a new program; **Copy, Modify, Delete, Manually Run** an existing program; **Reorder** programs using the arrow buttons. You can create **up to 40 programs**.

7.1 Program Data

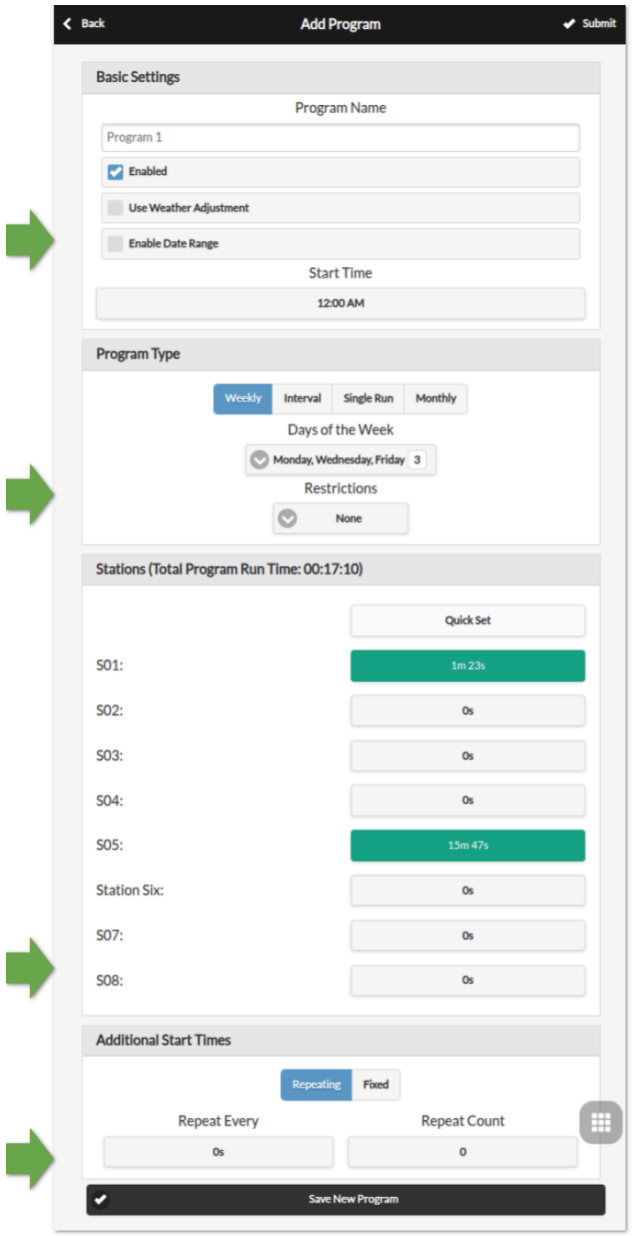
Click the **+ Add** button in the upper-right corner to create a new program. Each program includes the following details:

Basic Settings

- **Program Name**: Up to 32 characters. See **Section 7.2** for supported **program name annotations**.
- **Enabled**: Indicates whether the program is enabled.
- **Use Weather Adjustment**: When enabled, the program applies the current **watering level** to all station run times, enforces **weather restrictions** (see Section 5), and uses **multi-day average** watering level for Interval programs (see Program Type below).
- **Enable Date Range**: Set a date range for when the program is active. Example: 05/15 to 09/15 (May 15 to Sep 15 each year), or 11/10 to 02/20 (Nov 10 to Feb 20 the following year).
- **Start Time**: the **first start time** of the program (e.g. 8:00 AM). It also supports using sunrise / sunset times with an offset.

Program Type

- **Weekly**: Program will run weekly on the selected weekdays.
- **Interval**: Program will run **every N days** (N can be any value in 1~128). The **Starting in** parameter specifies when the program should first run relative to today: 0 means it starts from today; 1 means tomorrow; 2 means the day after tomorrow, and so on. The Starting in parameter must be between 0 and N-1. Multi-day average watering level applies to this type of program.
- **Single-Run**: A one-time program that automatically deletes itself after completing its last scheduled start time.
- **Monthly**: A program that runs on a specific day of each month. Example: 1 means it runs on the 1st of every month. Use 0 to indicate the last day of every month.
- **Restrictions**: Odd/even day restrictions. An **Odd** day means it only runs on odd-numbered days (except for every 31st, or Feb 29th). An **Even** day means it only runs on even-numbered days.



Station Water Times

Set the water time for each station, with a precision of 1 second, ranging from 0 to 64800 seconds (18 hours max), It also supports durations based on sunrise-to-sunset or sunset-to-sunrise times.

Additional Start Times

Two types of additional start times are supported:

- **Fixed**: Allows up to 3 additional start times. Any time of the day.
- **Repeating**: Set start times at regular intervals, e.g. every 45 minutes for 8 cycles. This is useful for splitting long watering durations into shorter cycles. It also supports repeating start times that extend overnight to the next day.

7.2 Program Name Annotations

Program names may be annotated in the following ways:

Station Order Annotation: By default a program runs stations in ascending order of their indices (from lowest to highest). To change this behavior, **append** the program name with a `>` followed by one of the following letters.

- `I`: descending order of station indices (from highest to lowest)
- `n`: ascending order of station names
- `N`: descending order of station names
- `r`: random order
- `a`: alternating by index: odd-numbered runs ascending, even-numbered runs descending
- `A`: alternating by index: odd-numbered runs descending, even-numbered runs ascending
- `t`: alternating by name: odd-numbered runs ascending, even-numbered runs descending
- `T`: alternating by name: odd-numbered runs descending, even-numbered runs ascending

For example: if the program name is `Summer Garden >t`, the stations will run in ascending order of station names during the first start time, in descending order during the second start time, and will continue alternating in this pattern.

The Program Preview (Section 7.3) accounts for program name annotations, allowing you to easily verify whether the stations will run as intended. Manually starting a program also honors the program name annotations.

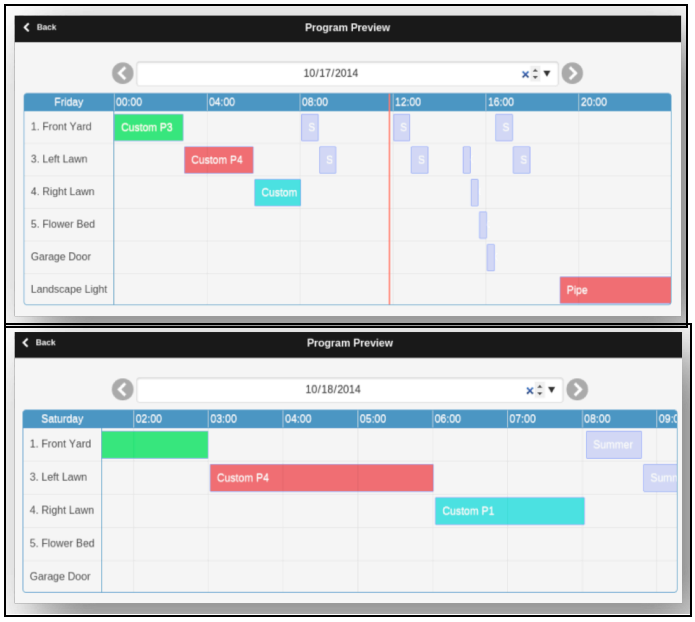
Reboot Annotation: Use the following special program names to schedule a reboot at regular intervals:

- `:>reboot` trigger a reboot as soon as the controller is idle (i.e. no stations are running).
- `:>reboot_now` trigger an immediate reboot, regardless of station activity.

Both reboot actions are **delayed by 1 minute from the scheduled start time**, to prevent an immediate retrigger after rebooting. For example: creating a program named `:>reboot` that starts daily at 2:00 AM will trigger a reboot at that time each day. When setting up the program, at least one zone and its duration must be provided; however, the exact zone to choose doesn't matter as the firmware recognizes the special program name and does not activate any zones.

7.3 Program Preview

To verify that all programs are set up correctly, select Menu -> **Preview Programs** to visualize the daily schedule.



- **Today's schedule** is displayed by default. Click the left and right arrows at the top to view schedules of a different day.
- **Current time** is marked by a pink vertical line. You can zoom in/out or drag the plot left/right to see details.
- **Colored bars** display each station's runtime and program name. Clicking on a bar will open the corresponding program's editing page.

Simulation Accuracy. The program preview feature uses a software simulation of the controller's scheduling algorithm, providing an accurate representation of how programs will run. All controller settings, including *Master zones*, *Station Delay Time*, *Master On / Off Adjustments*, are accounted for. Additionally, station attributes such as *Use Masters*, *Sequential Groups* are observed.

Weather & Dynamic Events. **Rain Delay and Sensor Settings are ignored**, as they rely on real-time conditions that cannot be predicted in advance.

Programs set to **Use Weather Adjustment** will scale according to the current **% *Watering*** parameter.

- When using **Manual Adjustment**, the same **% *Watering*** is applied uniformly across all preview days.
- When using **Zimmerman** or **ETo Adjustment** method, the current **% *Watering*** applies only to today's schedule, while all other days assume 100% (as these methods rely on real-time weather data that cannot be predicted for other days).
- **Weather restrictions** and **Multi-day average watering levels** apply to today's program schedules only (again, because these values rely on real-time weather data that cannot be predicted for other days).
- If **% *Watering*** is below 20%, any station with a calculated runtime of less than 10 seconds will be skipped to avoid excessively short watering periods. This is the same as the firmware's behavior.

7.4 Zone's Sequential Group Attribute

This firmware supports running **multiple zones** either **sequentially** (one after another), or **in parallel** (concurrently). This behavior is controlled by each zone's **Sequential Group** attribute.

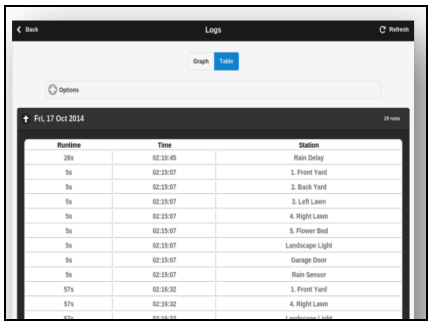
Zones Assigned to the Same Sequential Group are automatically serialized (one at a time). For example, if Zones 1, 2, and 3 belong to Group A, the controller ensures that only one of them runs at any given time. If Zone 2 is scheduled to start while Zone 1 is still running, it will automatically be queued to run after Zone 1. This is a common method used in most sprinkler controllers, to maintain water pressure by preventing multiple zones from running simultaneously.

Zones Assigned to Different Sequential Groups can run simultaneously (in parallel). For example, if Zones 4, 5, and 6 belong to Group B, they will be serialized within their group but can run concurrently with zones in Group A. This means a program running Zones 1, 2, and 3 can operate alongside another program running Zones 4, 5, and 6.

In previous firmwares, zones had a simple "sequential" flag, which effectively meant all zones belong to a single sequential group. This firmware expands this functionality by allowing multiple independent sequential groups, offering greater flexibility in scheduling zones.

Zones Assigned to the Parallel Group can run at any time, regardless of other zones' status. This is equivalent to disabling the "sequential" flag in previous firmwares. The parallel group is especially useful for controlling non-sprinkler devices, such as lights, pumps, or heaters, which usually should not be serialized with sprinkler zones.

8. Logging



OpenSprinkler supports logging, which records zone activity, rain delays, sensor status changes, flow volumes, and watering percentage adjustments.

To access logs:

- Select Menu -> **View Logs** (*ALT+L*) to see a graphical plot of the log data.
- In the **Options** tab, select the start and end dates of the query (default is the past 7 days). If the dataset is large, consider **narrowing the range to 1 day** for faster and more reliable loading.
- Click **Table** at the top to switch to a tabular view of the data.

For additional details on the format of the log data, and scripts to download the log data as spreadsheet files, check the [OpenSprinkler API document].

9. Firmware Update, FAQ, Support, and Github

- Visit [OpenSprinkler.com] for [Firmware Update Guide] and detailed [FAQs].
- For additional questions, visit [support.opensprinkler.com] where you will find articles covering a variety of topics such as weather adjustment methods, OTC, Email notifications, API documents, and firmware compilation instructions.
- OpenSprinkler is a **fully open-source** product, with all source code and hardware design files publicly available on the [OpenSprinkler Github repository].

Specifications

	OpenSprinkler v3	OpenSprinkler Pi (OSPi)
Input Voltage:	22V~28V AC (AC-powered model and OSPi); 7.5V-12V DC (DC and LATCH models).	
Power Consumption:	0.5 ~ 0.8 Watt	
Number of Zones:	8 on the main controller, expandable to 72	8 on main controller, expandable to 200
Max Switch Current:	800mA per zone (AC-powered and OSPi); 2A per zone (DC and Latch).	
Over-voltage Protection:	Bi-directional TVS and RC snubber on each zone and power input	
Product Size:	140mm x 56mm x 33mm (v3.0-v3.3) 125mm x 79mm x 25mm (v3.4)	135mm x 105mm x 38mm
Product Weight:	140g (5oz)	200g
Expander Size:	130mm x 75mm x 25mm	
Expander Weight:	100g	

Advanced Topics

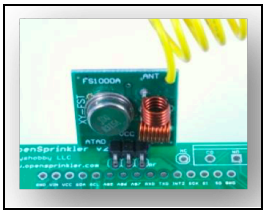
Installing a Radio Frequency (RF) Transmitter

OpenSprinkler supports standard 434MHz or 315MHz Radio Frequency (RF) transmitters, enabling control of remote power sockets for switching powerline devices such as lights, heaters, fans, and pumps. To use this feature, you need to purchase an **RFtoy** to decode the RF signal from your remote power sockets. Each signal code is a 16-digit string (e.g. `51001A0100BA00AA`) that encodes the on-signal, off-signal, and timing information.

The RFToy package includes both 433MHz and 315MHz transmitter-receiver pairs – choose the one matching your wireless device's frequency. For maximum transmission range, **solder a 17cm-long wire** antenna to the **ANT pin** on the transmitter, either straight or curled (see image on the right).

Connecting the RF Transmitter:

- **OpenSprinkler v3** and **OSPi v2** both have a built-in 3-pin RF transmitter header on the top side. Simply plug in the transmitter, ensuring it **faces up** (refer to the **Hardware Interface** diagram).
- **OSPi v1** does not have a dedicated RF header but provides PCB pins **(DATA, VIN, GND)** for soldering the transmitter. To install, locate the RF pins on the circuit board at the top-right corner, and solder the transmitter to the corresponding pins.



For more details about the RF Station Feature, refer to the related **blog post**.