



 **RainMachine Mini**
The Forecast Sprinkler

USER MANUAL v. 1.0

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1. INSTALLATION

1.1. Fastening unit

- Place the RainMachine controller close to an electrical outlet. We recommend placing it indoors (i.e. garage).
- The quick install guide is also a fastening template. Place the provided template on the wall. Mark and drill through the holes labeled "DRILL HERE".
- Using provided screws fasten the unit to the wall.
- Indoor operating temperature range*: 32F to 122F / 0° to 50° C

1.2. Electrical

- Remove the white plastic terminals lid by pressing on the 2 edge dimples white pulling up the tabs below them.
- Connect your valve wires to the green terminals labeled 1 through 8.
- You can control up to 8 valves with one RainMachine unit.
- C is Common terminal – all valves share 2 common terminals labeled "C". The common terminals are electrically connected together. One or both Commons can be used.

Note: OK to use only one Common terminal (either one) for all 8 valves as the two Common terminals are internally and electrically connected together.

1.3. Power up

- Replace terminal white terminal lid.
- Connect the 24VAC power cables to the terminals marked "24VAC".
- Plug transformer (included in the package) into AC wall socket.
- System will boot (1-2 minutes) for the first time and will enter into the initial setup mode and the display will show the letter A

1.4. Setup

- Join the "RainMachine" Wi-Fi network using your smartphone:
 - Go to Settings
 - Choose Wi-Fi
 - In the discovered Wi-Fi networks list you will find the "RainMachine-XXXXXX" (eg: RainMachine-81a175) Wi-Fi network
 - Tap it and will automatically connect to the RainMachine Wi-Fi network.

- Launch [iOS](#) / [Android](#) RainMachine mobile app on your smartphone to continue setup process of the device. Connect it to your home Wi-Fi network (choose your Wi-Fi SSID name and then enter its password, if any, in the smartphone app screen). After successfully Wi-Fi setup, choose a name, location and timezone for your RainMachine Mini device.

Note: *In order to complete the setup, you need a working Internet connection and Wi-Fi*

After you completed the setup wizard you need to add watering **Programs** and edit **Zones** using the RainMachine smartphone application ([see chapter 4](#)) .

Congratulations! Your unit is up and running.

2. HOW IT WORKS

An irrigation controller is a device to operate automatic irrigation systems such as lawn sprinkler. Controllers have means of setting the frequency of irrigation, the start time, and the duration of watering.

While most sprinklers have a fixed duration of watering (e.g. 1 minutes per zone, as defined by the user), the RainMachine automatically adjusts your *base watering duration* by lowering it on rainy or colder days and increasing it on hot summer days.

Because the system dynamically adjust the watering duration the RainMachine not only saves water but it also protects your plants.

2.1. Base Watering Duration

The Base Watering Duration is the duration of watering required for each zone, **during a normal, summer day**, as defined by the end-user.

Initial calibration efforts using complex formulas that take in consideration soil type, inclination and hypothetical solar irradiation amounts are possible, but they are not practical. Variable city water pressure as well as uneven water distribution among all sprinkler heads, coupled with local shading conditions create an impractical and inaccurate model in gauging what's best for your garden.

Note: *Our device guarantees seasonally and daily water savings based on calculations that take in consideration vegetation type, variability of the weather and time of year, but it cannot prevent water waste, should you set the Base Watering Duration to something much higher than normal.*

Given a Base Watering duration per each zone, as decided by you, the RainMachine will then dynamically adjust the watering duration, up and down, as needed. These adjustments are the result of Evapotranspiration calculations based on your vegetation type (Lawn, Bushes, Flowers, Vegetables, Citrus, etc) and feedback from meteorological data such as:

- Forecasted Temperature from National Weather Service.
 - Quantitative Precipitation Forecast from NOAA's National Weather Service.
 - Solar Radial Levels adjusted to Earth's rotation and inclination during the year.
-

Note: See [Appendix 1](#) for a detailed explanation of the Evapotranspiration (ET), Quantitative Precipitation Forecast (QPF) algorithms.

2.2. Protecting your plants – Hi and Low temperatures

While saving water is one of the RainMachine's main goals, growing a healthy lawn or garden is equally important. RainMachine protects your plants against extreme weather conditions, like freezing temperatures or unusually hot days.

Using the RainMachine mobile application navigate to **Setting -> Restrictions** and you can instruct the RainMachine to avoid watering when the minimum temperature drops below a certain level, or to add more water in extreme hot conditions. In addition, you can select individual months of the year when the controller prevents starting of any watering cycle.

Note: *By setting up freeze protect you instruct RainMachine to not start watering cycles under a specified temperature or on specific months. That does not protect your pipes or other parts of the system against freezing. If you live in a zone where freezing occurs, please winterize your system.*

2.3. Missing Internet weather data

The RainMachine can properly work even when your Internet connection temporarily goes down. The controller downloads forecast data for up to 7 days; therefore, it can continue normal operation several days with intermittent Internet failures.

Note: *You need a working Internet connection when you setup the controller for the first time.*

In addition, RainMachine uses a historical database with your local weather conditions, and, if no Internet weather data is available, it stills saves you some water by using a locally stored historical averages table.

Note: Using Forecast data and/or Historical averages can be disabled for any specific zone.

If both **Forecast data** and **Historical averages** are disabled for a specific zone, the RainMachine will act as a regular sprinkler controller, watering the amount you programmed (the Base Watering Duration) for each zone, without any adjustment.

3. MANUAL USER INTERFACE



On the RainMachine Mini's glass capacitive touch screen there are:

- Wi-Fi & DELAY backlit icons
- Digit display
- 3 backlit illuminated circle touch buttons.

IMPORTANT: Available touch actions to navigate and make changes on the RainMachine device are: **one finger touch and long finger touch on the circle buttons**. When the screen enters into sleep mode (only the Wi-Fi icon is ON), one finger tap the circle touch buttons will restore the active state of the device.

Using the 3 backlit illuminated circle touch buttons the RainMachine Mini can be manually controlled. To select a watering zone tap UP and DOWN buttons - the digit display will show the number of the zone and a short audio beep will sound.

Note: If the Master Valve is set as Zone 1, the digit display will start counting the watering zones from 2 up to 8.

To manually start watering the desirable zone tap the last circle touch button: **WATER**. This button will start flashing meaning that the watering process has started. To stop pe watering process on that zone tap the **WATER** button once again. On both action two short audio

beeps will sound.

The default amount of watering time per zone is 1 minute. If the zone was previously set up, that last amount of time will be used, when the zone is started manually again. Only one zone at a time will be active. To start another zone the active zone has to finish or has to be stopped.

4. MOBILE USER INTERFACE

This section will show you how to connect your RainMachine to your Apple/Android smartphone/tablets and how the application works.

Note: *The following steps are the same on each mobile platform.*

4.1. Installing mobile app

Step 1: On your device open the **App Store/Google Play** app. Search for the “rainmachine” word. You should find the RainMachine mobile application.

Step 2: Download and Install the application.

4.2. Discovered devices

- A list with local network RainMachine devices will be displayed.
- **RainMachine-81a175** is the name and **192.168.13.1:8080** is the Local Network IP Address and port of the RainMachine Mini device.

4.2.1. Add a new device

- Press the “**Add new device +**” button.
- Enter the RainMachine device:

Name (optional): i.e. **MyRainMachine**
and

URL or IP address: i.e. **201.68.0.102**

and then tap **Save** button.

Note: *Default port is TCP/443 or TCP/18443.*

*If you need to specify another port, enter address in this format: **address:port***

example: 201.68.0.12:8080

- When you are away from home you must configure your home Wi-Fi router to give you access to your RainMachine via **Port Forwarding** (see below).

4.2.3. Port Forwarding (optional)

To make your home RainMachine accessible through the Internet you must configure your router using [port forwarding](#).

Quick note for tech savvy users: all you need is to forward public port **443** (default) or **18443** to your Rainmachine's **local_address:443** or **local_address:18443** (eg: 192.168.12.142:443)

You can find more info and port forwarding tutorials on portforward.com.

1) Find your **external public IP address (also called WAN IP address)** by connecting to your WIFI router, and navigate to Internet or **WAN** section, depending on your router model. You can double-check that by opening a browser and your computer and navigate to <http://www.whatismyip.com>

Note: In our example the public IP address (WAN IP address) would be: **201.68.0.102**

2). Find the RainMachine's **local IP address** by going to the RainMachine **Settings -> Advanced -> WIFI**. The **first line** in this screen contains the IP address of your device.

Note: In our example local IP address is: **192.168.12.142**

3) Login into your WIFI router and configure TCP port forwarding:

Protocol = TCP

Source Port = 443 (or 18443)

Destination port = 443 (or 18443)

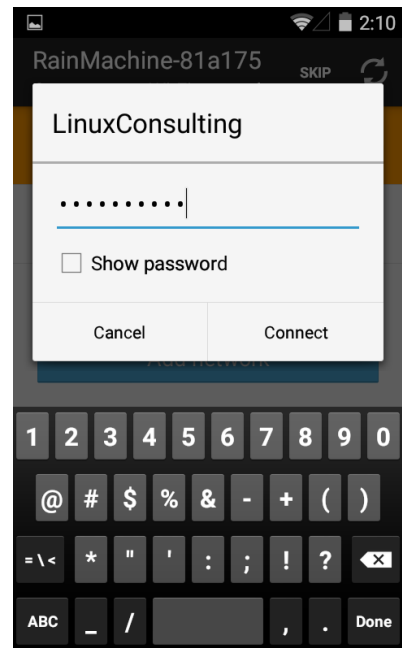
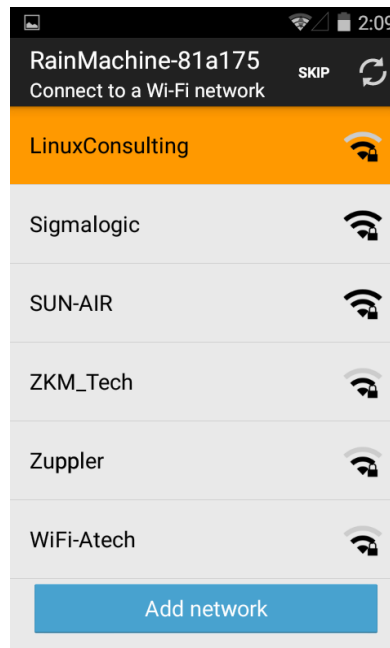
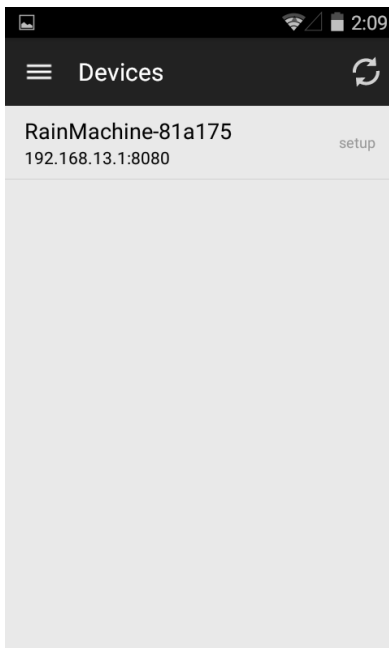
Destination IP = RainMachine's IP address (example: 192.168.12.142)

4) Go to your SmartPhone App and add a new device by clicking on "**Add new device +**" button.

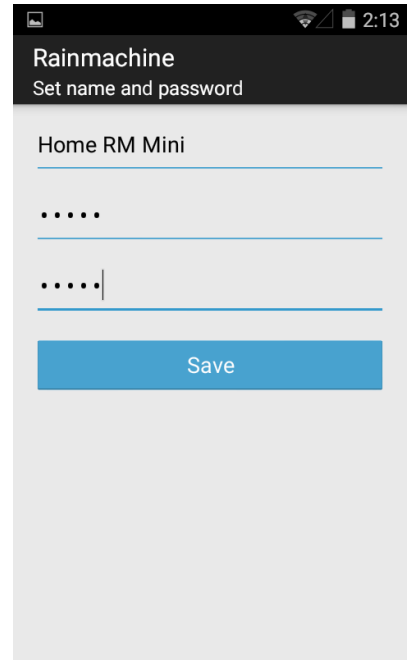
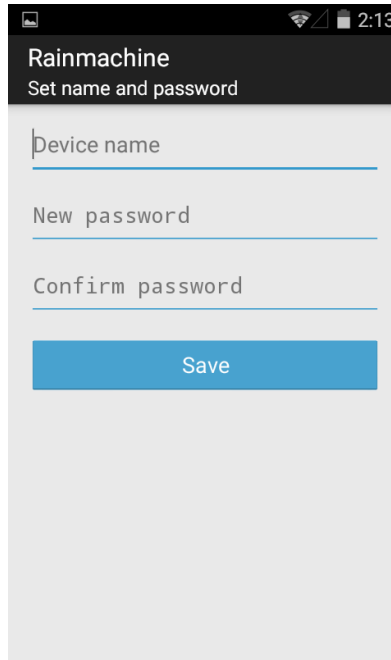
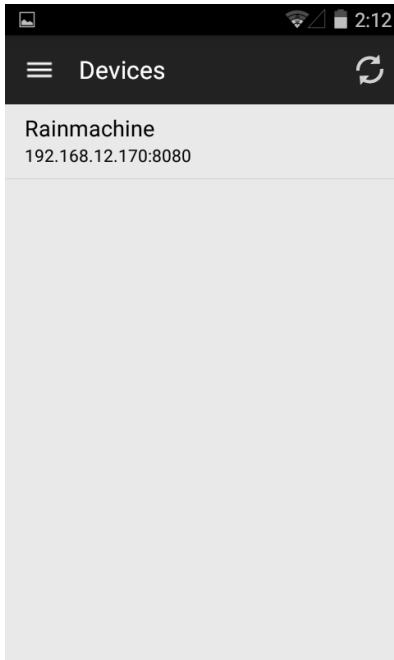
Important Note for Airport Users: Do not set up your Rainmachine in the Airport's Guest Network as you will have a difficult time accessing the device from your local LAN as well as from the Outside world. The Guest network can be opened for guests only and by definition cannot access the internal hosts and vice-versa.

4.3. Connecting to the RainMachine Mini

- First make sure the device is in AP Mode (wireless access point mode) - letter A will show on the digit display. It means that the RainMachine Mini has started to broadcast its own Wi-Fi network.
- Join the "RainMachine" Wi-Fi network using your smartphone:
 - Go to Settings
 - Choose Wi-Fi
 - In the discovered Wi-Fi networks list you will find the "RainMachine-XXXXXX" (eg: RainMachine-81a175) Wi-Fi network
 - Tap it and will automatically connect
- Launch [Android](#) (same for [iOS](#) app) RainMachine mobile app on your smartphone to continue setup process. On the main app screen **Devices** the RainMachine Mini will be listed with "setup" label attached, it means you can now start the setup process.
- Tap on it and you'll be asked to connect it to your home Wi-Fi network. Choose your home Wi-Fi SSID from the discovered Wi-Fi networks list, type the home Wi-Fi network password and tap **Connect**. The RainMachine Mini will be connected to your Wi-Fi network.



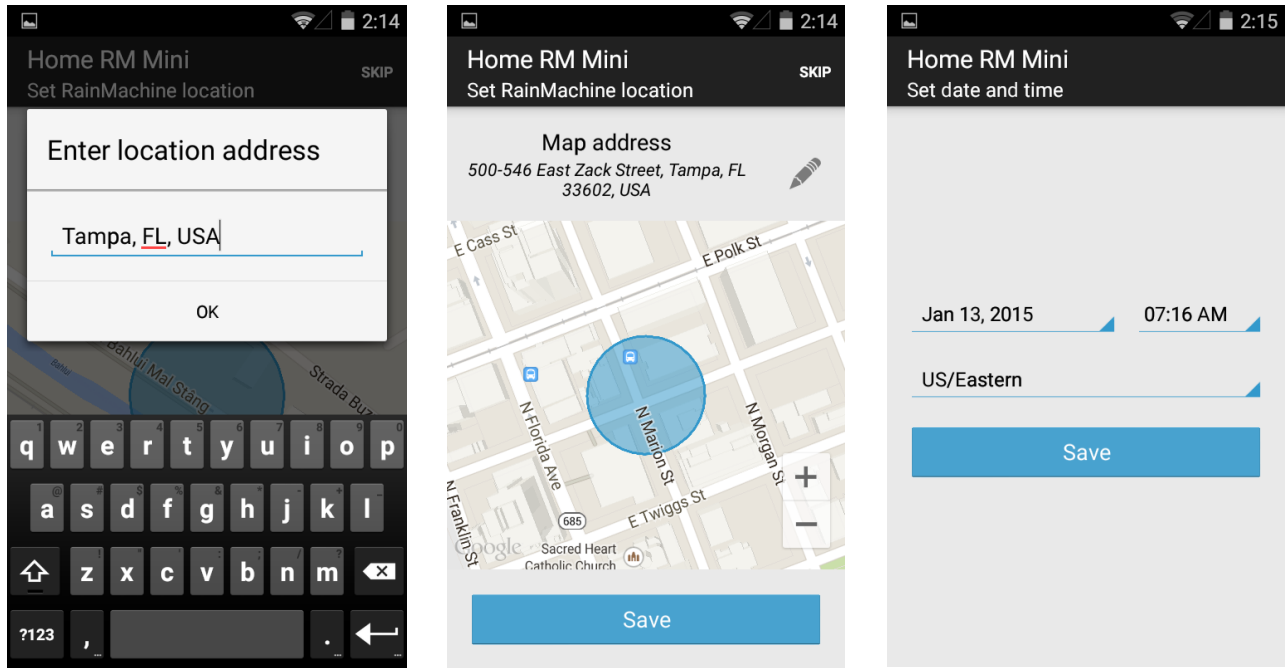
- Back on **Devices** list - now the RainMachine Mini device is successfully connected to your home Wi-Fi network and has a local IP (eg: 192.168.12.170:8080).
- Tap on it and you'll be asked to rename it and to change its default login password.



- Tap **Save** to save this settings and go to the next screen where you can setup the location of the RainMachine Mini device.
- The mobile application discover your location, but you can also change it by typing the Edit button next to the discovered location and start typing your RainMachine Mini location, up to street level.

Note: *It's very important to setup the location of the RainMachine Mini device for future accuracy of the forecast weather data*

- Then choose date & time and the timezone based on location

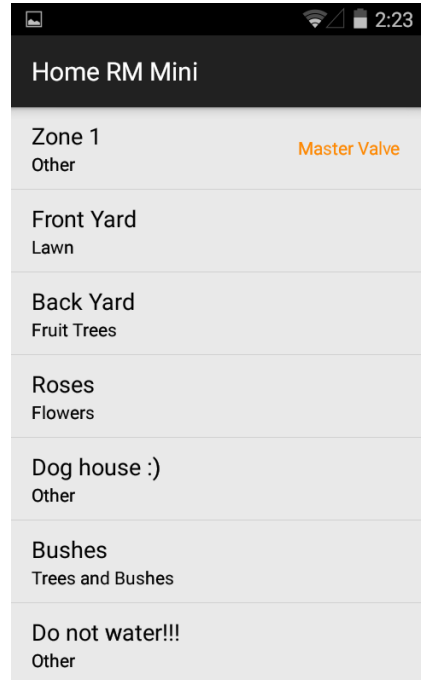
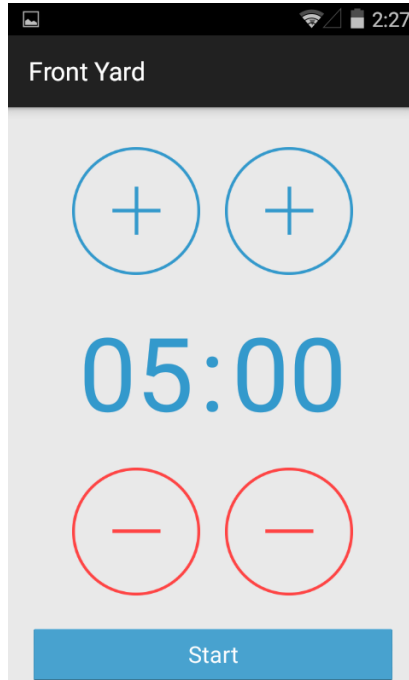
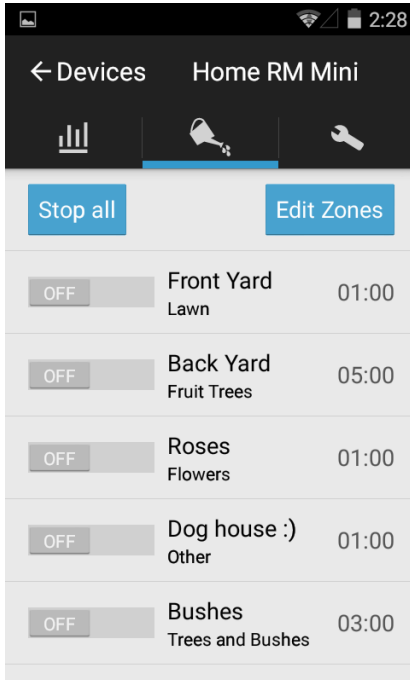


4.4. Login

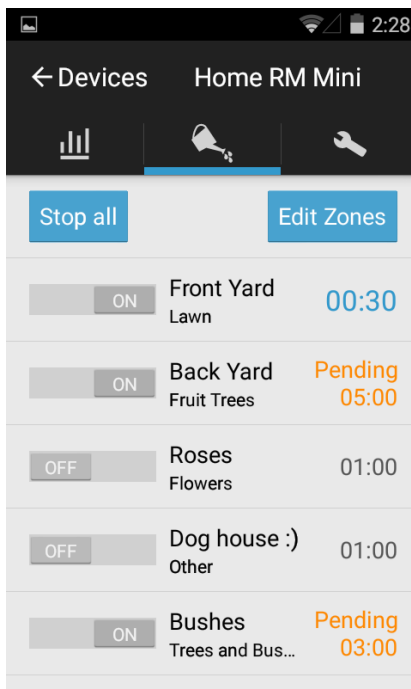
After connecting a RainMachine device to your mobile, the login screen will be displayed. Enter the password and click on **Login**. Check the **Remember me** checkbox if you want your login password to be remembered by the mobile application.

4.5. How the application works

- Upon successfully login the application will open the **Stats** screen. In this section you can see the information about the presumed water consumption percent, icon for weather condition and the textual Low/High temperatures for the next 5 days, including **Today**.
- On the bottom of the screen there are info about the weather parser (NOAA's weather servers) latest data update on the RainMachine device, followed by a green checkbox for "success download". For "no data" or "no connection" the green checkbox will be replaced with an yellow triangle with black exclamation sign.
- The user can manage maximum 8 zones that the device can be programmed to water and all active zones can be seen in **Zones** section. By default, the watering time is set to 1 minutes and 0 seconds. This can be changed by tapping a zone and then change the amount of time using + and - circle buttons for minutes and seconds.



- The **Zone 1** can be set as **Master Valve**
- Only one zone can water at one time. If more zones were scheduled for watering they will receive the status "Pending" until the first one finishes.
- The watering will start in the order the zones were scheduled.



4.6. Zones - Manual watering

In **Zones** section you can manage the zones you want to be watered at one time. In this section, the list with all available zones is displayed.

To begin the watering, choose a zone, set the number of minutes and seconds the sprinkler will water using + and - circle buttons and then click on **Start** or if there is no need to change the amount of watering time, just tap the **ON** (start/pending watering) / **OFF** (stop watering) switch in front of the zone name and the action is instant.

If you want all the remaining zones to be watered, you can put them in pending by tapping the switches. To stop the watering select the zone and click on **Stop**, or tap the **ON/OFF** switch. To stop all watering tap the upper left side **Stop All** text button.

4.7. Programs

The application allows you to organize your zones into programs or to delay watering activities. Go to **Settings** section and click on **Programs** to create, start, edit or discard programs.

To add a new program:

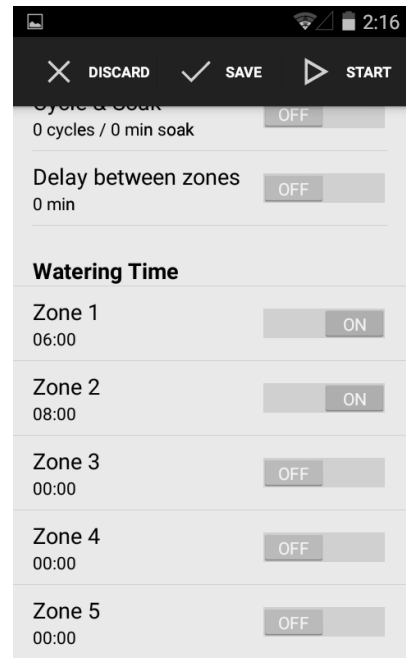
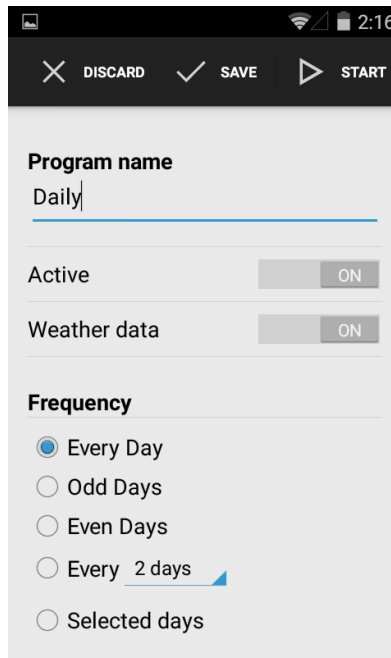
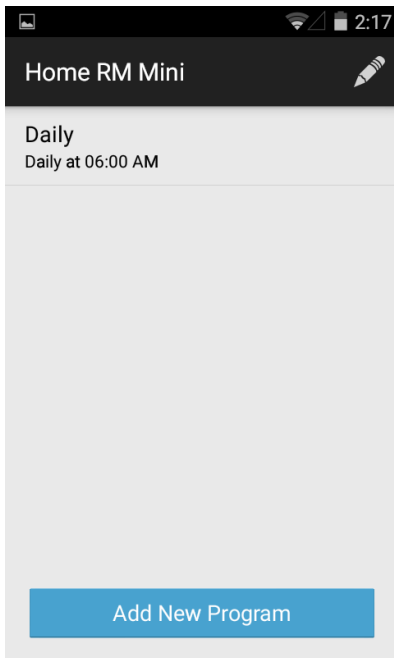
- Go to **Settings -> Programs** and click on **Add New Program +**
 - To set the same number of minutes for all zones to be watered or select a different value for each zone.
 - To delay the watering of the zones inside a program with “n” minutes choose **Delay between zones** option.
 - From **Cycle & Soak** option you can set the number of minutes for water cycles and soak. This option divides each zone into a number of parts equal to water cycles and delays every part with the number of minutes equal to soak.
- Rename the program and tap on **Save** button. The newly created program will now be displayed in **Programs** list. Also, to discard all changes, tap on **Discard** text button.
- Tapping **Start** text button will automatically start the program you created

To delete a program go to **Settings -> Programs**. Tap on **Edit (pencil)** upper right button and choose what program to delete, tap the **Delete** button and the program will be erased

from **Programs** list.

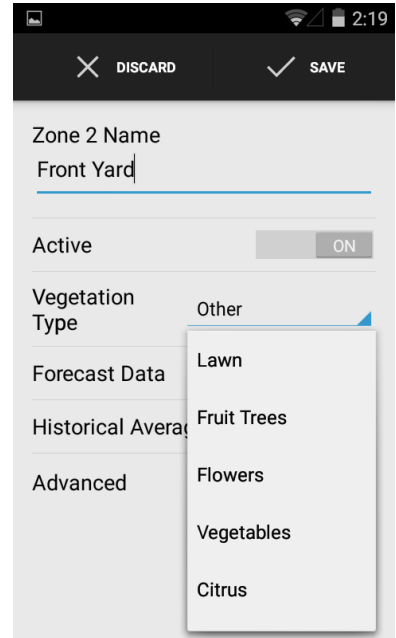
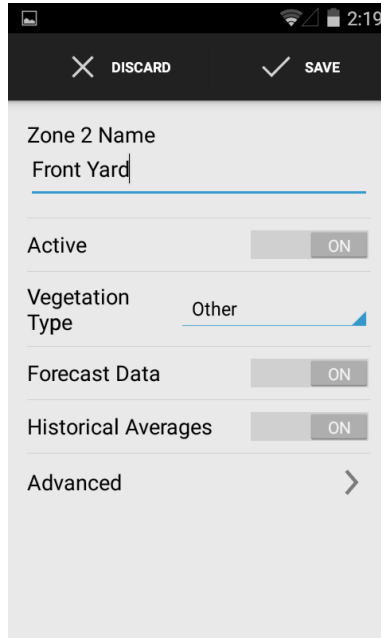
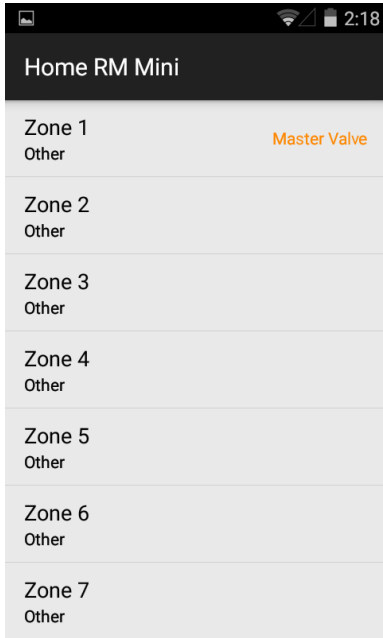
You can edit a program by simply tapping it in **Programs** list. Modify the options and tap on **Save** red text button.

Programs can also be activated or deactivated from **Programs** list. Tap on a program and choose **Active** ON/OFF switch option.



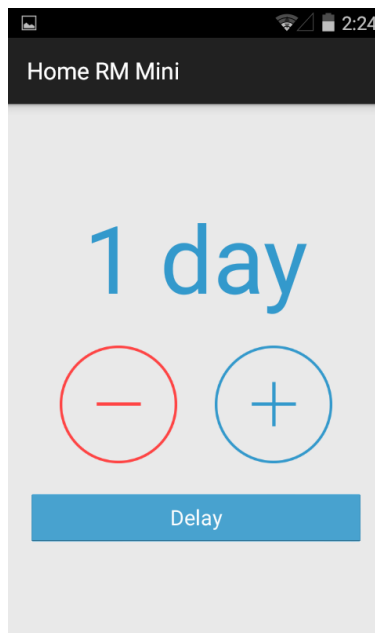
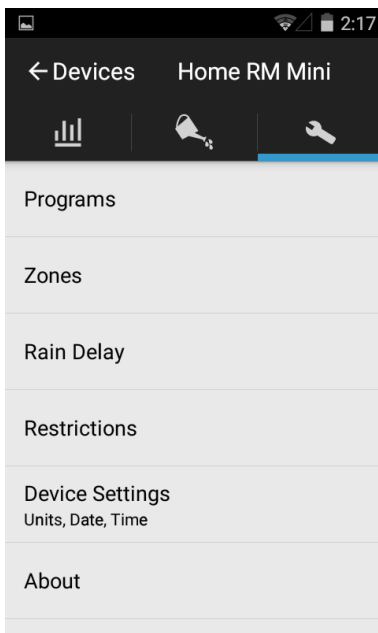
4.8. Zones

- You can edit a zone by selecting **Settings -> Zones** section. For each zone you can change the name, active state, vegetation, turn ON/OFF forecast data and historical averages options. When finished, tap the **Save** text button to save the changes made.



4.9. Rain Delay

- The application allows you to delay all your watering activities. From **Settings** -> **Rain Delay** section, select the number of days and tap on **Delay** button.



4.10. Security

- Change device password: Access **Password** section, enter old and new password and click on **Save** button.

4.11. Date/Time

- Date and time settings can be changed from **Settings** -> **Date/Time** section.

4.12. Units

- You can also select the units for the temperature values displayed in **Stats** screen. You can do this by accessing **Settings** -> **Units** section.

5. Specification

5.1. Controller features

- Weather aware, ET controller *
- Wi-Fi, web based controller
- 8 zones, master valve
- Location based weather data (NOAA)
- Glass capacitive touch screen
- iPhone and Android apps
- Automatic or Manual Rain Delay
- Freeze Control
- Hot Weather Compensation (ET based *) * ET = Evapotranspiration controller
- Indoor use only

5.2. Programming features

- Unlimited Programs
- Programmable Station Delay
- Multiple Cycle and Soak timers
- Active/Inactive Programs
- Daily, Odd, Even, specific week days

5.3. Zones features

- Master valve pre and post delay
- Editable zone names
- Zone vegetation type
- Weather data parameters per zone

5.4. Mechanical specs

- Dimensions: 5.9x5.9x1 in
- Weight: 7 oz
- Package contains: smart sprinkler controller, AC adapter, wall screws, quick setup guide
- Shipping weight: 34 oz

5.5. Electrical specs

- Wire range: AWG 14-22, 0.75 -1.5mm
- AC Input: 24VAC, 60Hz, 750mA (adapter included)
- Valve output: 24VAC, max 8VA
- Master valve: 24VAC, 60HZ, 8VA
- WIFI: 802.11N, 2.4Ghz, US/Japan/EU

5.6. Warranty

- 1 Year std hardware warranty
- Indoor operating temperature range*: 32F to 122F / 0° to 50° C

* For high temperature environments please ensure adequate air flow in vertical position

6. Appendix 1

6.1. Evapotranspiration (ET)

Evapotranspiration accounts for the amount of water lost to the atmosphere as a result of evaporation (both from soil and plant leaves) and transpiration from the plant tissues. Using ET, the RainMachine estimates how much water your lawn, garden and trees need to grow healthy. To learn more about evapotranspiration, please consult:

<http://en.wikipedia.org/wiki/Evapotranspiration>

RainMachine downloads weather forecast data from NOAA* and using a complex algorithm, it calculates ET and estimates the water needs for the next days. NOAA provides forecast data for the entire US with a 5 km (approx. 3 miles) spatial resolution, allowing RainMachine to predict the watering adjustments.

* National Oceanic and Atmospheric Administration <http://www.noaa.gov>

Note: Unlike other smart sprinkler controllers, RainMachine uses free weather data from NOAA's National Weather Service, a governmental agency paid from your tax dollars. You will never pay fees for accessing weather data.

6.2. Quantitative Precipitation Forecast (QPF)

After estimating the water loss, RainMachine takes into account the estimated amount of rain, with spatial resolution of 5 km.

QPF is the expected amount of melted precipitation accumulated over a specified time period over a certain area. To learn more about QPF, please refer to:

<http://www.hpc.ncep.noaa.gov/qpf/qpf2.shtml>

Note: QPF becomes better as we approach the event (e.g.: the rainfall). Better results on saving water can be obtained if your program frequency is less than 3 days.

6.3. Crop Coefficient - Kc

Each zone has its own water requirements. Depending on vegetation type, RainMachine adjust the ET values using a crop coefficient abbreviated “Kc”. Navigate to **Settings/Zones** to set the vegetation type for each zone. That will improve both the health of your plants, and the amount of water saved.

6.4. The RainMachine Algorithm

The user is required to set the Base Watering Duration for each zone as required in a normal summer day, and RainMachine takes it from there, adjusting watering time based on estimated ET, QPF and Kc.

The RainMachine has an internal database with average ET on your area (ETavg), and compares that with current ET, deriving a percent of *water need* (WN).

$$WN = (Kc \times ET - QPF) / (Kc \times ET_{avg})$$

For instance, if you programmed to water for 5 minutes during the summer, and if the above formula returns WN=80%, RainMachine is going to water only 4 minutes (80% from 5 minutes).

If QPF becomes bigger than ET (e.g. lots of rain), the RainMachine will not start watering at all. (WN is zero or less).

If WN becomes negative, that means we have a surplus of water, and the RainMachine stores that surplus in a non-volatile memory, delaying watering cycles for up to 3 days of ETavg. That accounts for even more water savings.

Note: *The adjusting algorithm (Internet Weather check box) can be disabled per individual zone, allowing you to have different watering behavior on different zones . Do not set Internet Weather = Yes for greenhouses, covered patios, flower pots.*

FCC Certification Requirements

Caution: Any changes or modifications in construction of this device which are not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.