OpenSprinkler Pi (OSPi) v2.0 User Manual

(*Updated Sep 25, 2024*)

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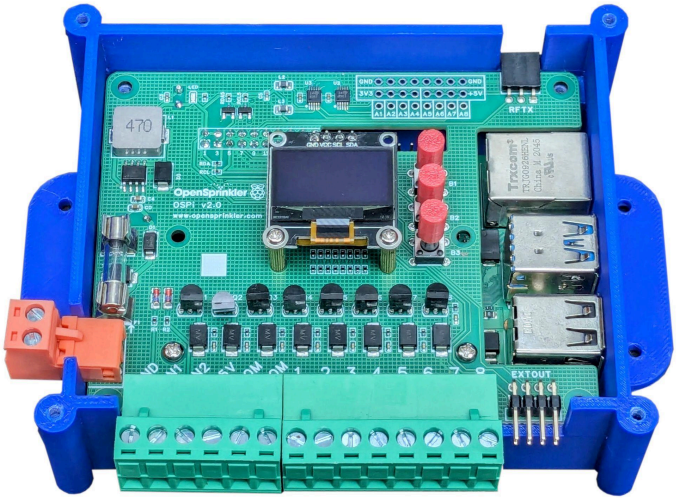


Introduction

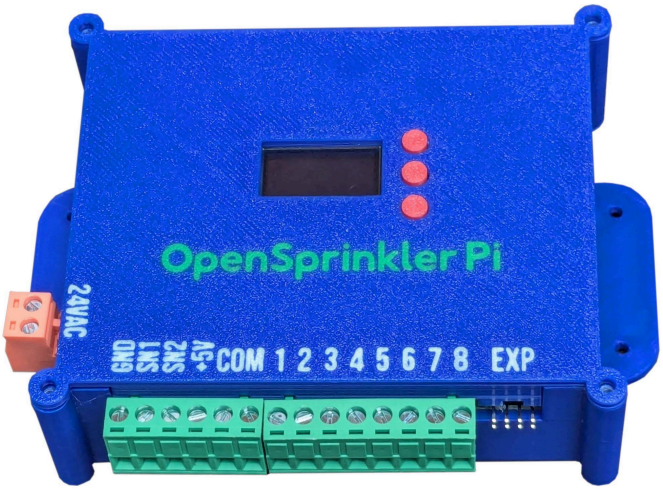
OpenSprinkler Pi (OSPi) is an open-source sprinkler / irrigation extension board for the Raspberry Pi. It's an easy and low-cost solution to transform your Raspberry Pi into a capable sprinkler controller with an unlimited number of stations and advanced software features, for lawn and plant watering, farm irrigation and other similar applications.

The OSPi v2.0 kit includes one assembled and tested **OSPi v2.0 circuit board**, **terminal blocks, OLED display**, screws, and support pillars. The built-in components include 24VAC to 5VDC switching regulator, solenoid drivers, per-station transient voltage protector and 2x 4-channel ADCs. OSPi v2.0 does not come with an enclosure, but a 3D printable design is provided to you, which you can download and print using your own 3D printer, or order online at places like jlcpcb.com.

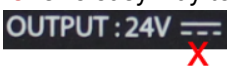
(Enclosure is not included)



(Enclosure is not included)



To get started, you will also need the following, which are NOT included by default and need to be purchased separately.

- a Raspberry Pi (any version)
- a 4GB or above microSD card
- 24V AC sprinkler transformer (output voltage 24V AC -- note that the output must be AC, not DC! One easy way to tell is to look at your transformer label, if it says output is 24V followed by a straight line like: 

that means it outputs DC voltage, which is NOT acceptable to OSPi.)
- 24V AC sprinkler valves (note that it's 24V AC valve, not DC or latching solenoid valve!)

(Sold separately)

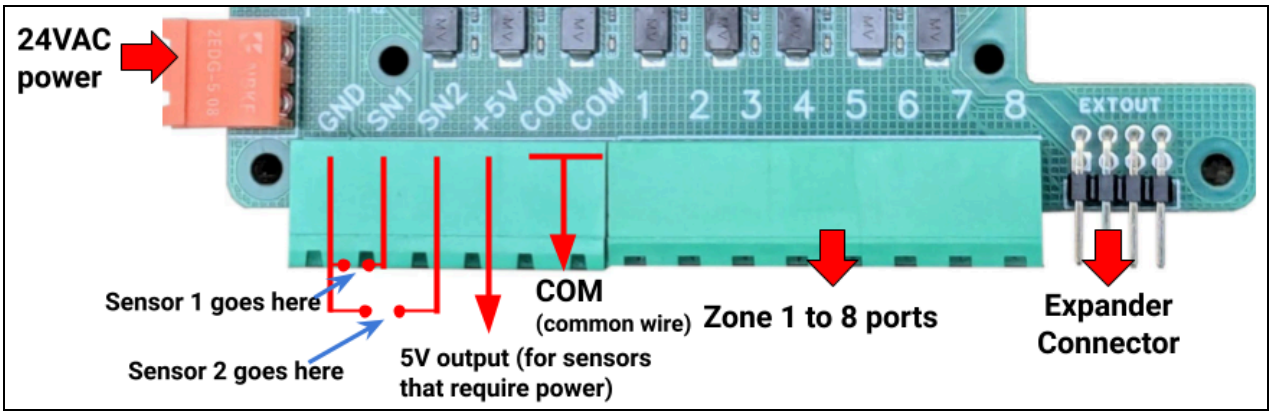




Hardware Interface

The images below show the OSPi connectors. Version 2.0 has two sensor ports. To connect a sensor, such as a rain sensor, the first sensor should be connected between GND and SN1, and the second sensor between GND and SN2. The +5V pin can be used to provide power to certain sensors such as 3-wire flow sensors.

Version 2.0:

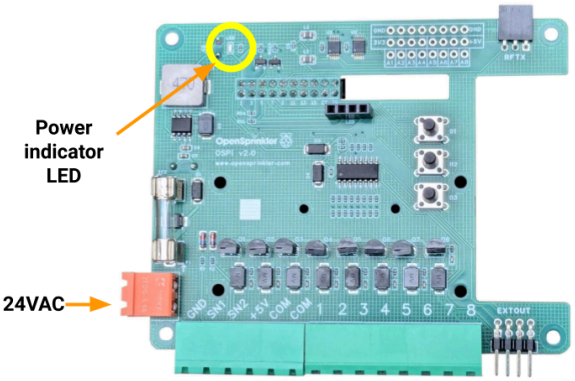


1. Test 24VAC Power Supply First

Make sure the 24VAC transformer is **unplugged to begin with**. Insert the sprinkler transformer wires into the **orange** terminal block, tighten the terminal block screws. Now plug in the transformer to a power socket, and insert the orange terminal into the matching connector on OSPi. The indicator LED should light up, indicating power is on. See pictures below. **After testing, please remove the orange terminal block to power off the circuit board.**

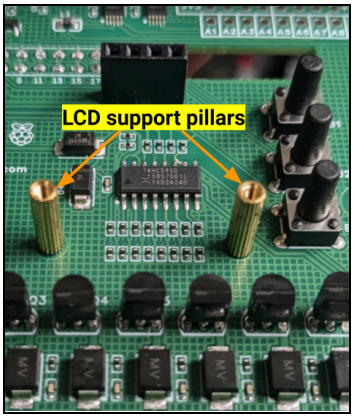
Warning: if the LED doesn't light up, or any component starts to smoke, or you smell anything burnt, please unplug the power immediately. If you can't figure out the problem, contact the support at support.opensprinkler.com

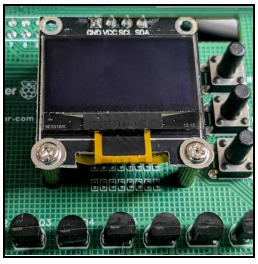




2. Install OLED Display

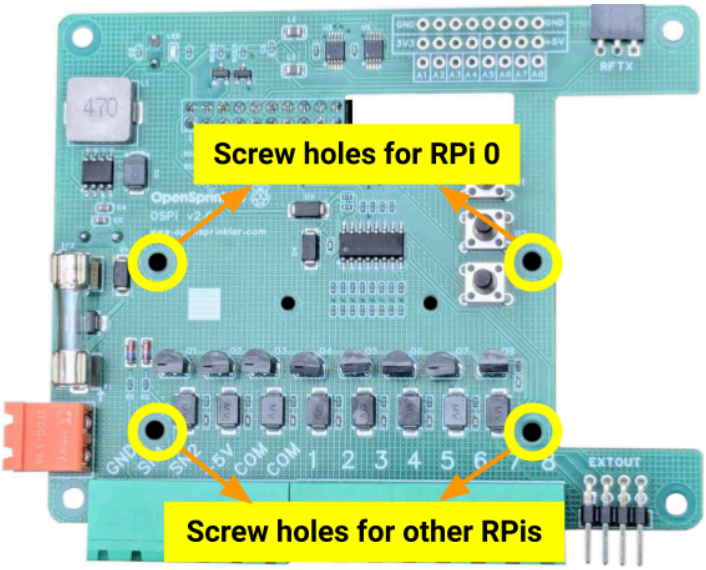
Use 2x M2 (i.e. 2mm) screws to install and tighten the two M2 copper support pillars for the LCD. Then plug in the LCD, and install the remaining 2x M2 screws to secure the LCD to the pillars. See pictures on the right.

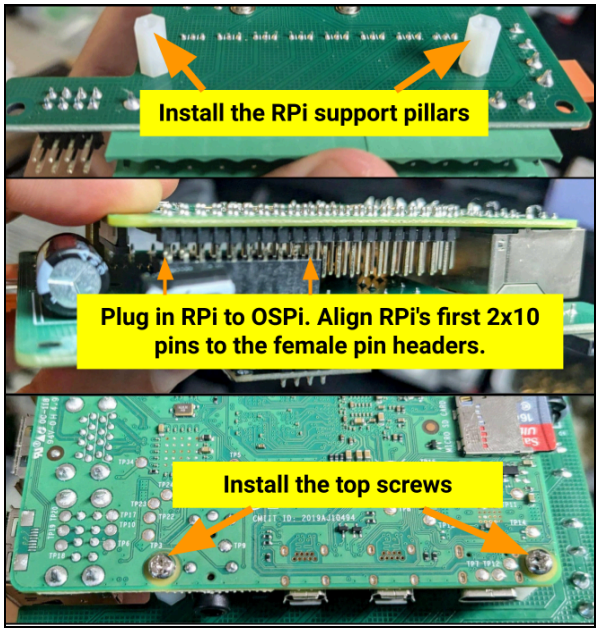




3. Attach RPi to OSPi

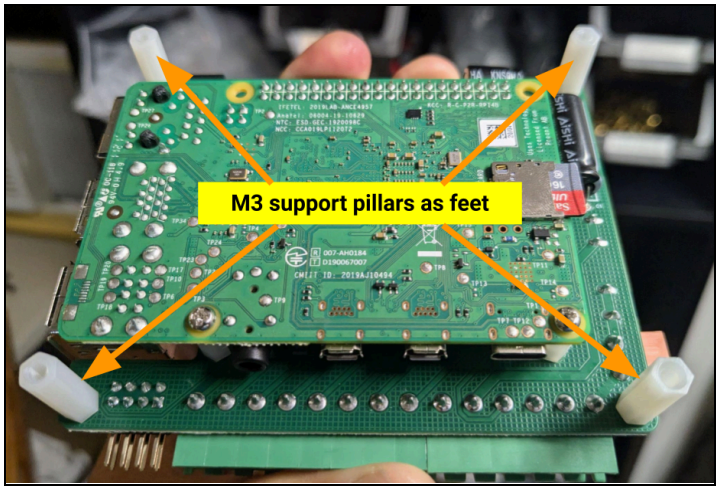
Make sure power has been removed from the OSPi board. Depending on the version of your RPi, there are a pair of screw holes to mount your RPi to OSPi. The image on the left below shows the locations of these screw holes. Identify the correct pair of holes for your specific RPi. Use 2x M2.5 (2.5mm) screws to install and tighten the two M2.5 pillars to the **back side** of the OSPi board. Next, plug in your RPi to the 2x10 female pin headers at the back side of the OSPi board, such that the **first 2x10 pins of your RPi** are plugged all the way into the female headers. **Double check and make sure all pins are aligned**. **Any misalignment may result in damage to your RPi!!!** Finally, the two support pillars should match two of your RPi's screw holes. Use the remaining 2x M2.5 screws to secure RPi to the support pillars.

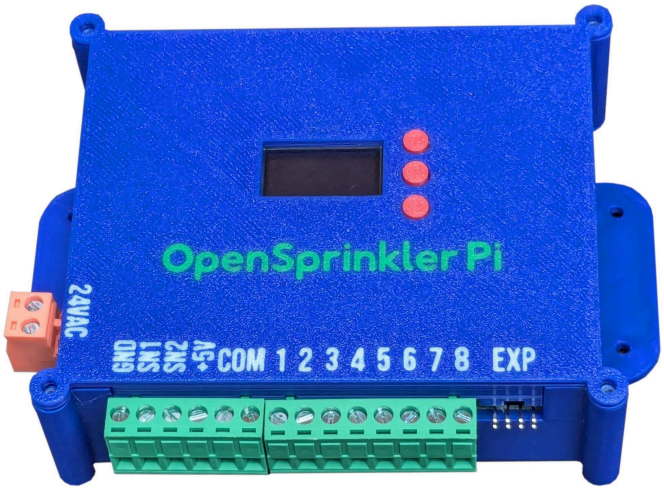




4. Enclosure

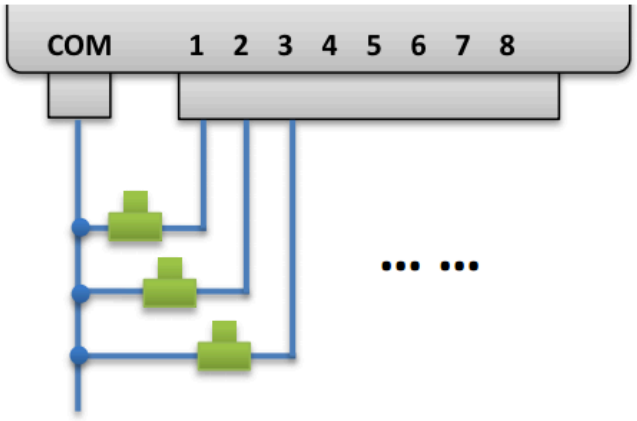
OSPi v2.0 does not come with an enclosure. If you don't plan to use an enclosure, you can install the included M3 (3mm) screws and support pillars as feet, which provides minimum support, as shown in the left image below. If you do want an enclosure, we provide a 3D printable design, which you can download and print using your own 3D printer, or order it online at places like jlcpcb.com. A colored version is also provided (see the image on the right below), specifically for Bambu printers with AMS. You can use the included M3 screws to secure OSPi to the enclosure, and also mount the top cover to the bottom base. You can also customize the enclosure. For example, if you need to use wired Ethernet, the provided enclosure does not have a cutout for the cable, but you can digitally modify the 3D file to make a custom cutout.



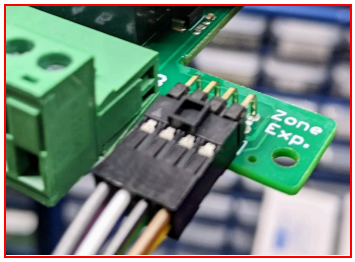


5. Wiring Sprinkler Valves

To connect one sprinkler valve, insert one wire to the **COM** (common) terminal, and the other wire to any of the station terminals (1-8). The COM terminal has two ports – they are internally connected so either port is fine. To connect multiple valves, one wire from each valve should come together and go to the **COM** terminal; and the other wire from each valve goes to an individual station terminal. See the diagram below.

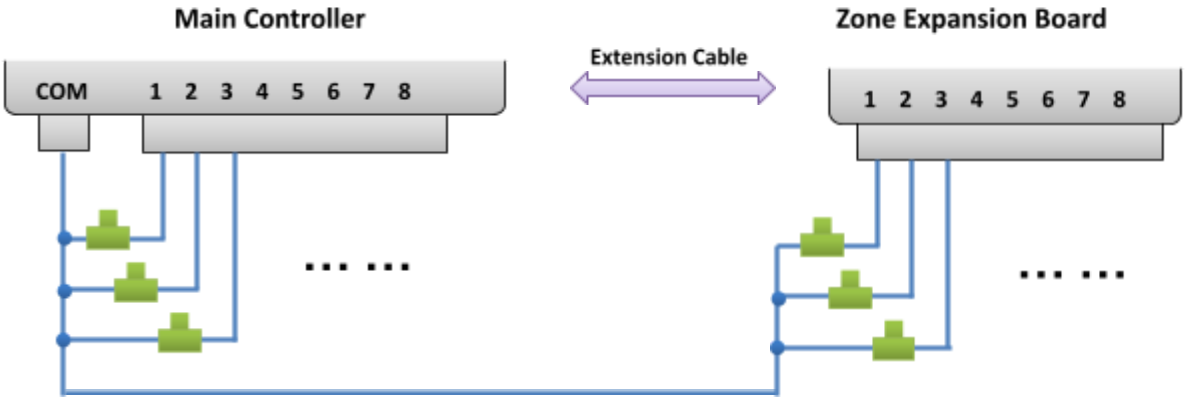


6. Zone Expansion Board



To connect a zone expansion board, use the extension cable you received to link the OSPi's ***EXP*** port (i.e. zone expander port) to the expansion board's ***IN*** port. The connector on the cable is polarized (with a bump on the top), so there is only one way to plug it. If you have multiple expansion boards, you can daisy chain them in the same way, by following the **OUT -> IN** links.

When using zone expansion boards, the sprinkler valves are wired the same way as before: one wire from each valve should come together and go to the **COM** terminal on the OSPi; and the other wire from each valve goes to an individual station terminal. Refer to the diagram below:



7. LCD, Button, Sensor Functions, and RF Transmitter

From firmware 2.2.1(1), LCD and button support is added for OSPi 2.0. Please refer to the **OpenSprinkler User Manual** for details on the LCD and button functions.

OSPi v2.0 has two independent sensor ports that support rain sensors, dry contact sensors, flow sensors, program switches etc. It also has a 3-pin header that fits a 433MHz or 315MHz radio frequency (RF) transmitter. This allows you to use OSPi to communicate with RF wireless power sockets. Again, please refer to the corresponding sections in the **OpenSprinkler User Manual** for details.

8. Analog-to-Digital Converters (ADCs)

OSPi v2.0 has 2x 4-channel ADCs (using 2x ADS1115). In other words, it has a total of 8 analog-to-digital channels, for reading analog sensors. At the moment the firmware hasn't enabled support for analog sensor reading. Work is under way to enable such features, and we will announce it once it's ready in future firmwares.

Software Setup

1. Install OpenSprinkler Unified Firmware

The recommended way to install OpenSprinkler Firmware is to start from a standard Raspbian image, make sure you can boot RPi correctly, then follow the OSPi firmware installation instructions below to install the firmware yourself:

- **OSPi Firmware Installation Instructions**

2. Using OSPi Firmware

The default firmware set to run on start-up is the OpenSprinkler Unified Firmware. It's available at **port 8080**. Open a browser, and type in ***http://ospi_ip:8080/*** to start using the firmware, where ospi_ip is your OSPi's local IP address. Details about the OpenSprinkler Unified Firmware can be found in the OpenSprinkler Firmware User Manual:

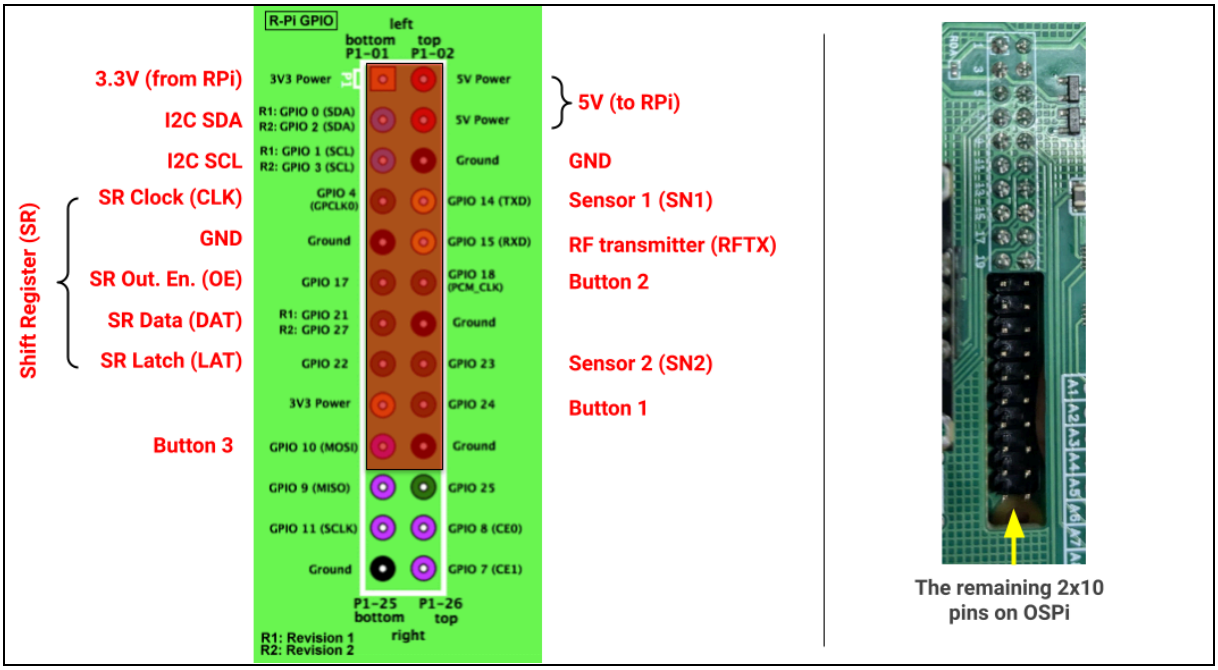
- **OpenSprinkler User Manual**

The two alternative firmwares are the Python Interval Program (written by Dan Kimberling) and the sprinklers_pi program (written by Rich Zimmerman). Please refer to their specific Github repositories for installation and usage instructions. Alternative firmwares may or may not support LCD and button functions.

Technical Details

RPi Pin Uses

OSPi 2.0 uses the first 2x10 pins on the RPi. The other 2x10 pins are free. Specific functions of each pin are illustrated below. The power pins as well as SDA/SCL pins can be shared with other devices. The unused 2x10 pins are all exposed through a cutout on the OSPi circuit board.



Specifications

- **Input Voltage:** 22V AC to 30V AC.
- **DC Output Current:** 1.5 A @ 5V (to power RPi).
- **Number of Zones:** 8 on the OSPi, expandable by linking zone expansion boards.
- **AC Output Current:** 800mA continues @ 24V AC per zone / station, 8A impulse / inrush.
- **Over-voltage Protection:** 48V bi-directional TVS on each zone, AC input, and rain sensor terminal.
- **Size:** 135mm x 100mm x 32mm (5.3” x 4” x 1.26”)
- **Weight:** 150g (5.3oz) w/o RPi

Terms and Conditions

OpenSprinkler Pi (OSPi) is an open-source project. The hardware design and software code are made publicly available under the Creative Commons Attribution-ShareAlike (CC BY--SA) 3.0 license. The product is open-source for educational purpose and to promote innovations. The hardware and software are provided as is. We (OpenSprinkler) are not responsible for any damage or accident that may occur due to hardware or software error, or during the assembly, use, and modification of OSPi.

Open-Source Links

- OSPi Github Repository
- OpenSprinkler Firmware Github Repository
- OSPi homepage