

OpenSprinkler Pi (OSPi) v1.52 User Manual

(Updated Sep 12, 2022)

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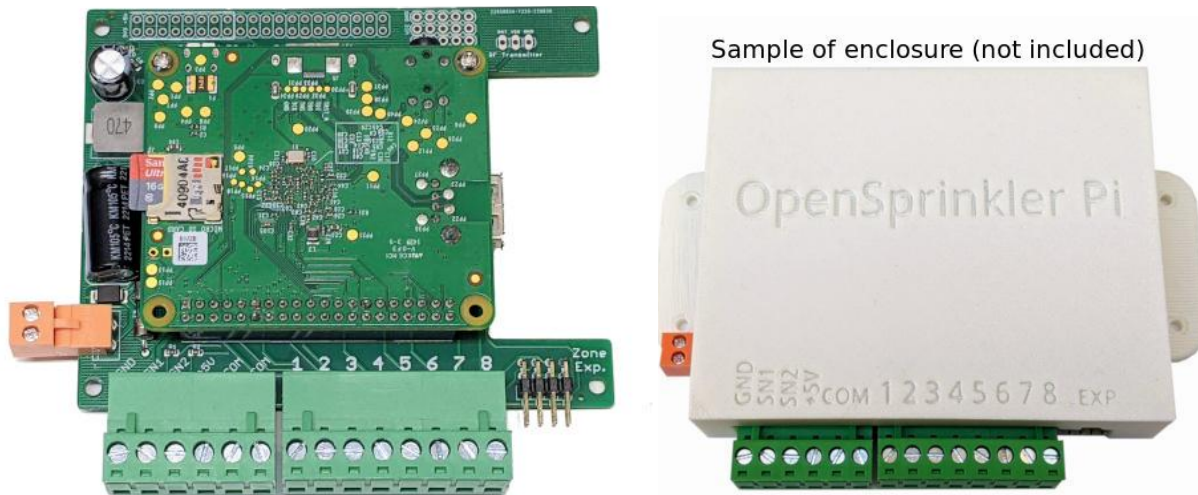
[Open-Source Links](#)




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, for lawn and plant watering, farm irrigation and other similar applications.

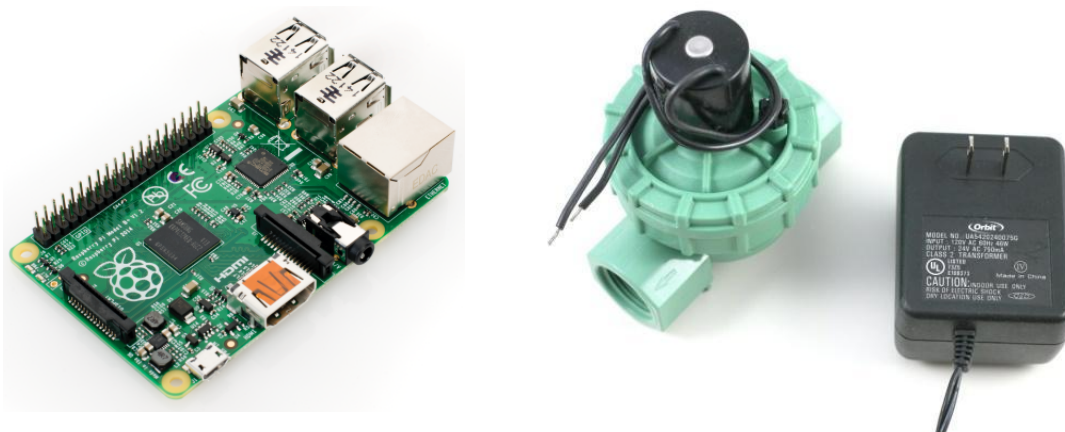
The OSPi v1.52 kit includes one assembled and tested **OSPi circuit board**, **terminal blocks**, support pillars and screws for RPi. The built-in components include 24VAC to 5VDC switching regulator, solenoid drivers, per-station transient voltage protector. While OSPi v1.52 does not include an enclosure, a 3D printable enclosure design is provided to you, which you can print out using your own 3D printer, or order it online at places like [jlcpcb.com](#). The laser cut acrylic enclosure design is also provided to you, you can use a laser cutter to cut acrylic pieces or order them online.



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 [nano-size USB WiFi dongle](#) (optional, if your RPi does not have built-in WiFi)
- 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: **OUTPUT : 24V —** ) 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)

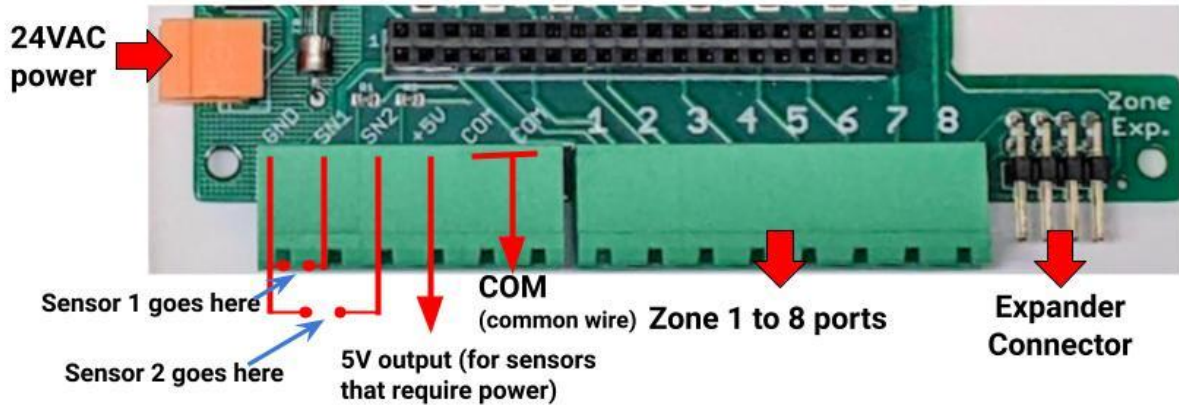


Hardware Interface

The images below show the OSPi hardware interface, including the connectors and terminal pins, and the whole assembly with RPI plugged in. Note that version 1.52 has two sensor ports. To connect a sensor such as rain sensor, generally the first sensor should be connected between GND and SN1, and the second sensor (if applicable) should be connected between GND and SN2.

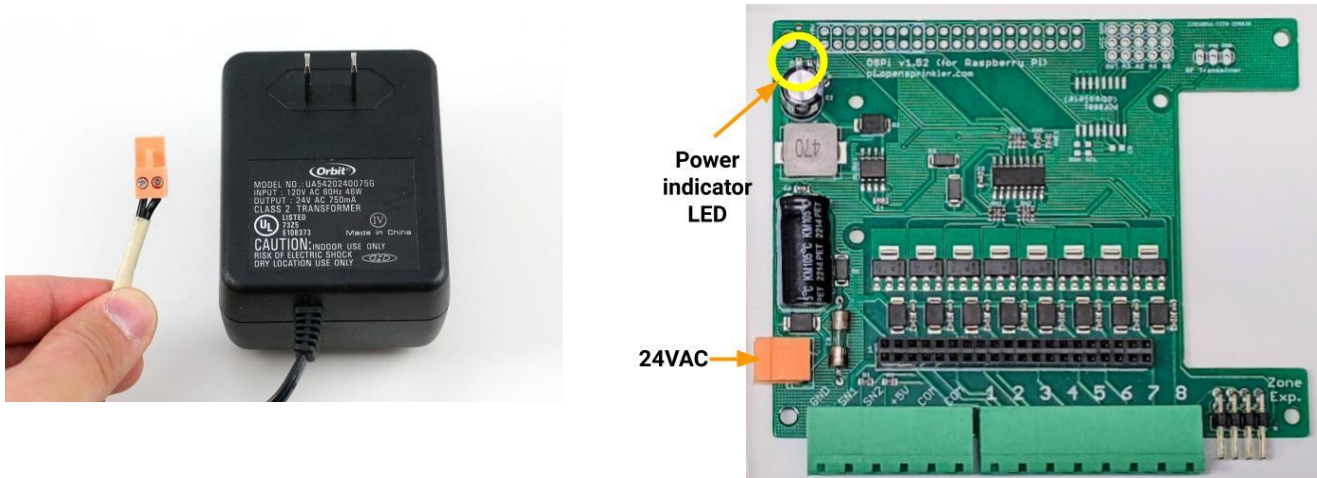
Version

1.5x:



1. Test Power Supply First

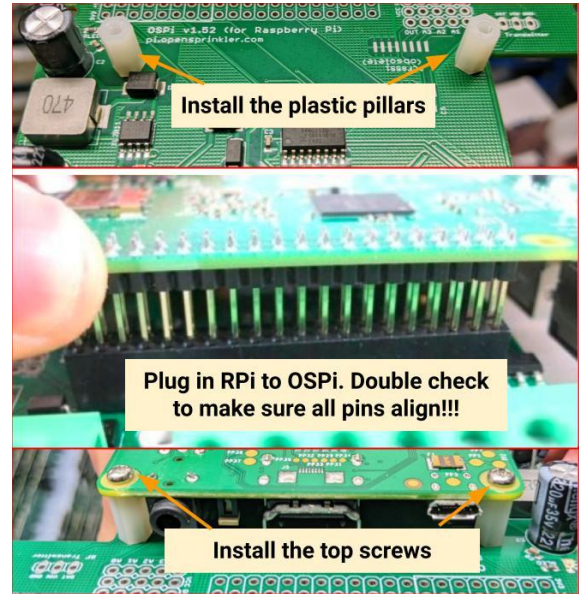
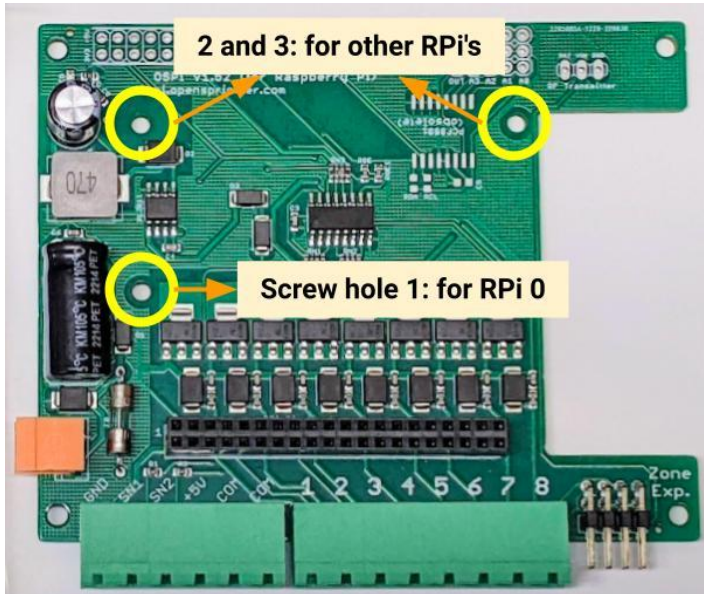
Make sure the sprinkler transformer is unplugged to begin with. Insert the sprinkler transformer wires into the **orange** terminal block, tighten the terminal block screws. Then plug the orange terminal into the matching terminal on OSPi. The green LED should light up, indicating power is on. See pictures 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. Attach RPi to OSPi

Make sure power has been removed from the OSPi circuit board. Next, OSPi has three support pillars (positions marked in the image on the left below) that match the screw holes on RPi (for RPi 0, use screw hole 1; for other RPi's, use screw holes 2 and 3). **First, install the plastic support pillars to the OSPi board**, then, plug RPi into OSPi through the 2x20 pin headers, with SD card slot facing the left, and USB and Ethernet jack facing the right. **Double check the orientation and make sure all pins are aligned.** Any misalignment may result in damage to RPi! The two screw holes should also match the positions of the two support pillars. Insert RPi all the way to the end. The USB and Ethernet connector should go through the cutouts on the PCB.



3. Enclosure (optional)

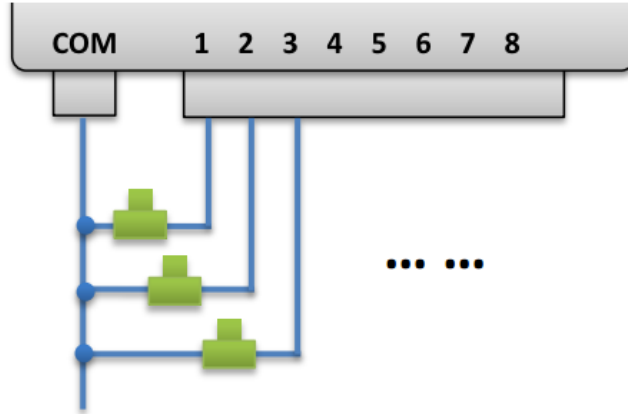
OSPi v1.52 no longer includes an enclosure. Instead, we provide a [3D printable enclosure design](#), which you can print out using your own 3D printer, or order it online at places like jlcpcb.com. You can also customize the enclosure. For example, if you need to use wired Ethernet cable, the provided enclosure does not have a cutout for the cable, but you can digitally modify the 3D design to make a custom cutout. Also, if you prefer a transparent front cover, you can use the 'no front panel' version of the 3D design, and add a laser cut transparent acrylic front cover. Below are two sample enclosures. If you have access to a laser cutter, we also provide the [laser cut acrylic enclosure design](#).

Sample of enclosure (not included)



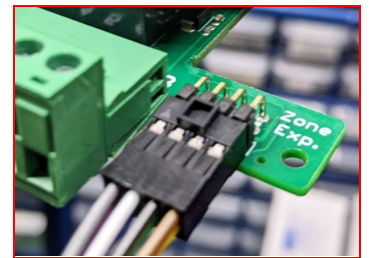
4. Wiring Sprinkler Valves

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.

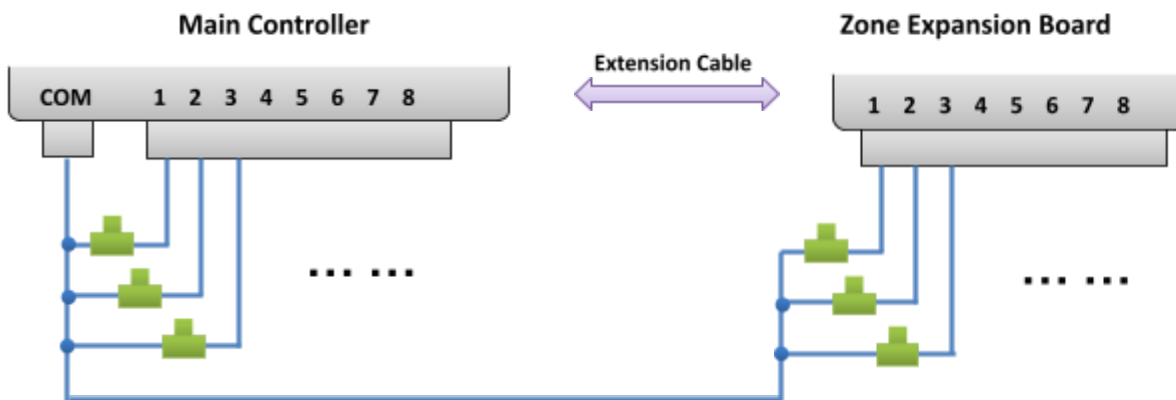


5. Zone Expansion Board

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:



6. Rain Sensor / Flow Sensor / Program Switch

If you have a [rain sensor](#), you can connect it to OSPi via the rain sensor terminal. The rain sensor has two wires and is essentially a rain-activated switch. The OSPi software can decide what to do when rain is detected, such as turn off stations or ignore rain. The latest OpenSprinkler also supports using the sensor terminal to connect a flow sensor, or program switch. Please refer to the [OpenSprinkler User Manual](#) Sensors Section for details.

7. Radio Frequency (RF) Transmitter (Advanced Topic)

The current OSPi 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. Please refer to the [OpenSprinkler User Manual](#) RF Transmitter Section for details.

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](#)

NOTE: some Raspbian systems installed by NOOBs will take over GPIO 4 for 1-wire interface, but that OSPi needs GPIO 4 to send control signals to the solenoid valves. If you found that the firmware runs correctly but OSPi does not turn on valves correctly, one solution is to `sudo open /etc/modules`, and comment out the line containing `w1-gpio`, then reboot. Another solution is to reinstall Raspbian OS from scratch without using NOOBs.

The previous OSPi pre-configured SD card image is retired – we no longer provide pre-configured SD card image because it's relatively easy to install a fresh Raspbian and follow the instructions above to install the OpenSprinkler firmware.

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](#)

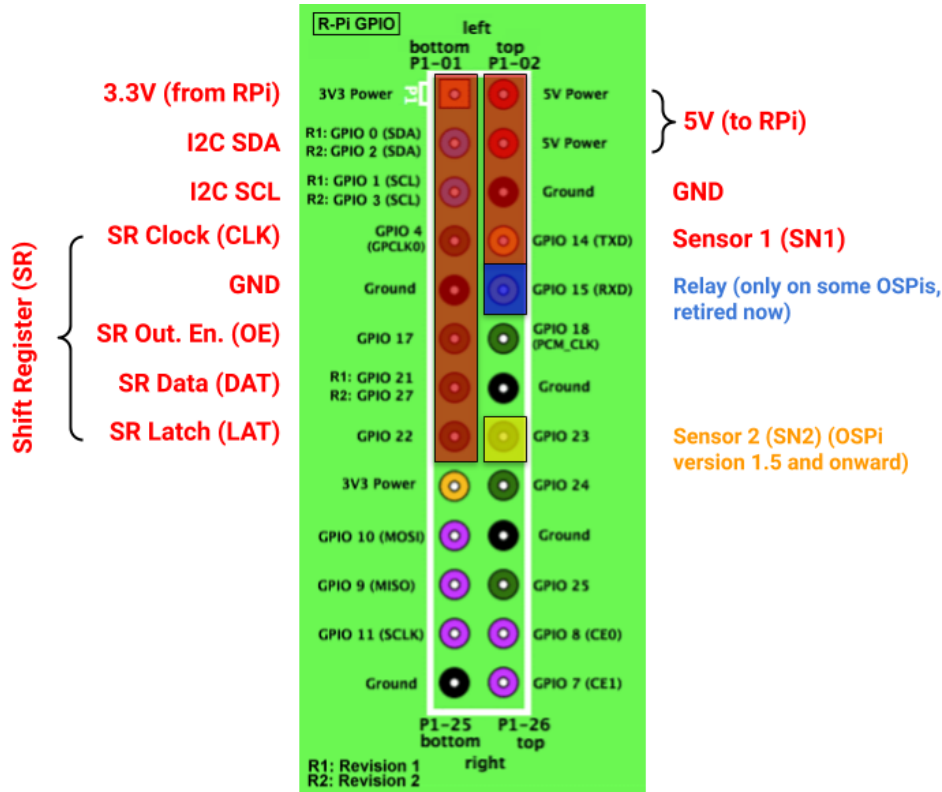
The two alternative firmwares are the [Python Interval Program](#) (written by Dan Kimberling) and the [sprinklers_pi](#) program (written by Rich Zimmerman). Please refer to their specific Github repositories for installation and usage instructions.

If you want to write your own firmware, use the provided firmwares as starting point. In addition, in the OSPi Github folder, there are [a few demo programs](#) that shows basic solenoid control in various programming languages.

Technical Details

RPi Pin Uses

OSPi uses the following GPIO pins on the RPi (shaded in red, blue, and yellow colors below). The other pins are free. The power pins as well as SDA/SCL pins can be shared with other devices. All 40 pins from RPi are mapped out in the pinout area at the upper left corner of the OSPi circuit board. The layout of the mapped out pins match the RPi GPIO pins.



Mapped out pins on the top-left area of OSPi



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](https://creativecommons.org/licenses/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](#)

