

Raspberry Pi OS Bookworm with Wayland

Raspberry Pi 4 B and Raspberry Pi 5

Pi-SPROG 3, Pi-SPROG 3 v2 and Pi-SPROG 3 Plus

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These instructions describe the process of setting up a Raspberry Pi 4 Model B or Raspberry Pi 5 as a WiFi access point (AP) for connection by hand-held devices running WiThrottle, EngineDriver or other similar apps. The use of an up-to-date Windows 10/11 installation is assumed.

If you have downloaded or purchased the image on SD card from SPROG DCC then you do not need these instructions, other than for reference.

Some familiarity with the Raspberry Pi and Linux operating system is assumed, especially the use of the command line in a terminal, and simple editors such as vi or nano.

Where we say “we like...” in the following instructions, we indicate how our SPROG DCC pre-built card images are made. These steps can be tailored by more advanced users to your own preference.

Rather than using a wired Ethernet connection and SSH for the initial setup, it should be possible to do the setup locally on the R-Pi by attaching a USB keyboard, mouse and a HDMI display.

Unless explicitly stated, references to Pi-SPROG 3 can be taken as also applying to the Pi-SPROG 3 Plus and Pi-SPROG 3 v2.

Bold Consolas font text indicates text that is typed at the R-Pi command line in an SSH shell, or a desktop terminal window.

Indented Bold Consolas font text indicates text that is entered in text editor.

Hardware Requirements

Raspberry Pi 3 model B+ or Raspberry Pi 4 Model B and suitable power supply.

MicroSD memory card (16Gb, or larger, recommended)

Pi-SPROG 3 and power supply

Host PC (Windows or Linux)

Wired network connection from the R-Pi to your router during setup and if you require network (e.g. internet) access whilst using the R-Pi as an Access Point.

Software Requirements

SSH client installed on the host PC or use ssh from a Windows command line,

VNC Viewer installed on the host. For compatibility with the Wayland desktop in Bookworm, download and install tigerVNC. Download the latest stable tigervnc64.exe from <https://github.com/TigerVNC/tigervnc/releases>

Raspberry Pi Imager <https://www.raspberrypi.com/software/>

Create the SD Card Image

Use the Raspberry Pi Imager to create the initial SD card image with the Raspberry Pi OS image with desktop. Use the advanced options to set the hostname. This document assumes the hostname 'sprog-pi4'. On a Raspberry Pi 5 you might want to use 'sprog-pi5', for example. Enable SSH and set the user name (we assume the default user 'pi' in these instructions) and password of your choice.

Put the SD card in the R-Pi's SD card slot, connect the R-Pi to your home network via the wired ethernet port and connect power to the R-Pi.

Connecting With SSH

Using your chosen SSH client, or Windows command line, connect and login using the default user name and hostname, e.g., pi@sprog-pi4 or pi@sprog-pi4.local.

If neither of those work, determine the R-Pi's IP address (from your router) and use that in place of the hostname, e.g. pi@192.168.1.19

Update R-Pi Firmware (Optional)

You may want to update the firmware on your R-Pi 4, depending when it was purchased, in order to get the latest power saving features.

```
sudo rpi-eeprom-update
```

If you see something like ***** UPDATE REQUIRED ***** or ***** UPDATE AVAILABLE ***** then run the command with the **-a** switch if you wish to install the update.

```
sudo rpi-eeprom-update -a
```

Reboot your R-Pi.

```
sudo reboot
```

Reconnect with SSH once the R-Pi has rebooted.

Run raspi-config

To allow remote access to the virtual desktop, rather than the SSH command line, we need to enable VNC which is included with the Raspberry Pi OS distribution. Use the raspi-config utility. In the SSH session, type

```
sudo raspi-config
```

Select interface Options -> VNC -> Yes to enable VNC.

Exit raspi-config and log out of the SSH session (type control+D).

Connecting With VNC

Start TigerVNC viewer on the host PC.

Click the "Options" button. Navigate to the "Input" tab. Check the box next to "Show dot when no cursor" to ensure that you can always see a cursor in TigerVNC.

Enter the VNC Server name, e.g., 'sprog-pi4' and click Connect.

Continue in the identity check dialog.

Enter your username and password that you chose earlier.

If you used the default password and the default user 'pi', you will see a warning message each time you connect. This may be hidden by the Welcome dialog on first boot.

Raspberry Pi Configuration

From the Raspberry Pi menu (click the Raspberry icon) select Preferences -> Raspberry Pi Configuration

Click the Interfaces tab and enable the Serial Port

Click OK to apply the changes and reboot.

Reconnect with TigerVNC.

Software Updates

Open the software update tool (download icon on right of R-Pi task bar) and select Install Updates.

This may take a few minutes.

UART Setup for Pi 4

Skip this section if using a Pi 5.

Get UART Overlays

We require the UART interfaces to be swapped for the Pi-SPROG 3 so that serial0 is routed to the GPIO connector instead of being used for BlueTooth. We also require RTS and CTS handshaking to be enabled for the Pi-SPROG 3 Plus.

Download the uart-rtsrts overlay. In a terminal window

```
wget https://raw.githubusercontent.com/Hiassoft/AtariSIO/master/contrib/rpi/uart-ctsrts.dtbo
```

Copy it to the required directory.

```
sudo cp uart-ctsrts.dtbo /boot/overlays/
```

Add the overlays to config.txt.

```
sudo nano /boot/firmware/config.txt
```

Scroll to the end of the file and add the following lines:

```
dtoverlay=miniuart-bt  
enable_uart=1  
dtoverlay=uart-ctsrts
```

Save (Write Out) the file and Exit.

UART setup

Edit the command line to prevent the Kernel using the UART at startup. Open a terminal window.

```
sudo nano /boot/firmware/cmdline.txt
```

Remove 'console=serial0,115200' noting that this file must contain only one line. Be careful not to split the line when editing it.

Save (Write out) the file and quit the editor.

Reboot your R-Pi (Raspberry Pi logo -> Shutdown -> Reboot), or

```
sudo reboot
```

Reconnect with TigerVNC.

Check that the UARTs are mapped correctly, open a terminal and type

```
ls -l /dev/ser*
```

The output should be

```
lrwxrwxrwx 1 root root 5 Dec 13 13:34 /dev/serial0 -> ttyAMA0
```

Check that the RTS/CTS handshaking is enabled on the GPIO. In the terminal window, type

```
pinctrl 16
```

The output should show that GPIO 16 is now CTS0:

```
16: a3 pd | lo // GPIO16 = CTS0
```

Next, type

```
pinctrl 17
```

The output should show that GPIO 17 is now RTS0:

```
17: a3 pd | hi // GPIO17 = RTS0
```

UART Setup for Pi 5

See the previous section if using a Pi 4.

Apply UART Overlay

Edit config.txt in a terminal window

```
sudo nano /boot/firmware/config.txt
```

Scroll to the end of the file and add the line:

```
dtoverlay=uart0,ctsrts
```

Save (Write Out) the file and Exit.

Download and Install Java 17

JMRI since version 5 requires Java 11, but Java 17 is now the recommended version

Go to www.azul.com and select the black Download Now button on the right.

Scroll down and select Java 17 (LTS), Linux, ARM 64 bit, JRE. With the download button. choose the .deb option.

When the download is complete, open a terminal window and navigate to the Downloads directory

```
cd ~/Downloads
```

Install required dependencies

```
sudo apt install default-jre-headless
```

Install the package just downloaded

```
sudo dpkg -i zulu17.54.21-ca-jre17.0.13-linux_arm64.deb
```

Check the installation

```
java --version
```

```
openjdk 17.0.13 2024-10-15 LTS
```

```
OpenJDK Runtime Environment Zulu17.54+21-CA (build 17.0.13+11-LTS)
```

```
OpenJDK 64-Bit Server VM Zulu17.54+21-CA (build 17.0.13+11-LTS, mixed mode, sharing)
```

To preserve disk space you may wish to delete the .deb file.

Download and Install JMRI

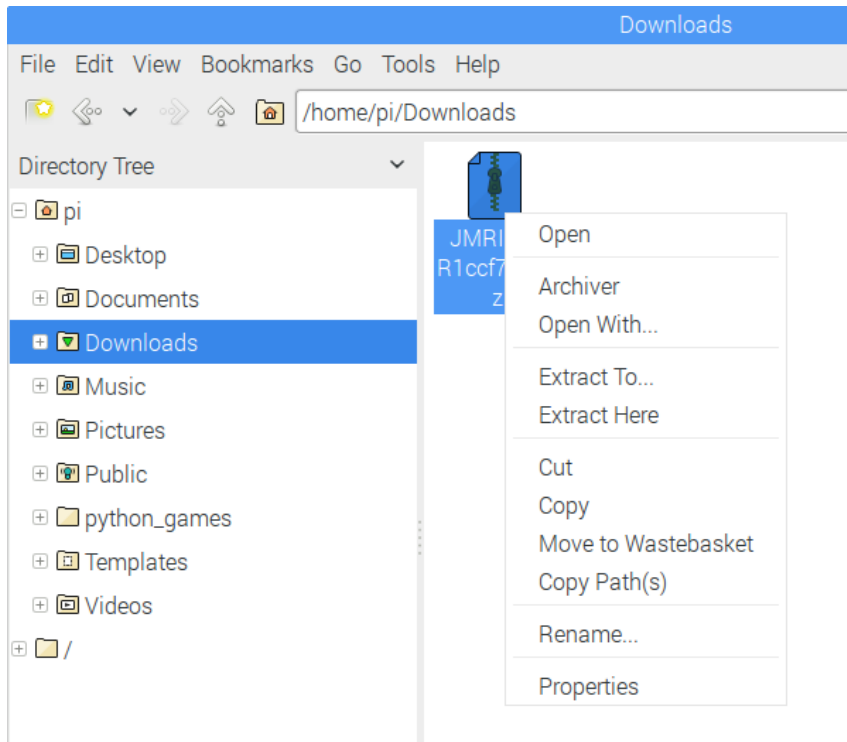
At the time of writing, JMRI 5.10 is the latest production version.

To get the latest features you may need to download a later test version.

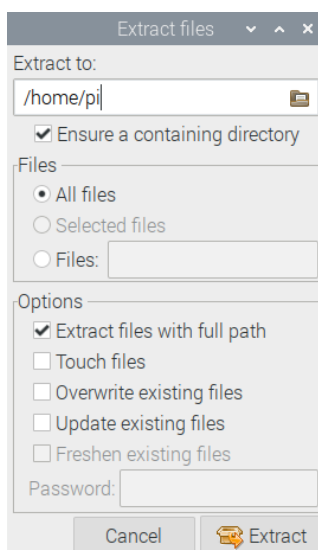
Using the R-Pi web browser, navigate to www.jmri.org/download/index.shtml and download your chosen JMRI version for Linux (.tgz file).

When the download is complete, open the Downloads folder in File Manager, right click the downloaded archive and Extract To... (may take a little while to open the archive).

When the download is complete, open the Downloads folder in File Manager, right click the downloaded archive and Extract To... (may take a little while to open the archive).



Browse to, or type, your chosen location for installing JMRI, e.g., /home/pi, select "Ensure a containing directory". Click Extract.



If extracted to /home/pi then the path to the application will be /home/pi/JMRI which we use in the following steps.

To preserve disk space you may wish to delete the downloaded archive.

PanelPro or DecoderPro?

DecoderPro and PanelPro are different interfaces to the same underlying JMRI software. The split exists mainly for historical reasons. There are some differences in the functions that are available from the menus (or how they are accessed) but most features are available through both interfaces.

The Pi-SPROG 3 Plus has two track outputs, one of which supports 'service mode' programming on a programming track.

The Pi-SPROG 3 v2 and Pi-SPROG 3 have only a single output that may be switched between service mode programming and layout operation. Unlike earlier SPROG products, it is not necessary to restart DecoderPro or PanelPro, or select a different connection profile, to change the operating mode, so there is no need to create shortcuts for both DecoderPro and PanelPro.

You can use either DecoderPro or PanelPro, depending on your preference.

If you have a Pi-SPROG 3 or Pi-SPROG 3 v2 and will be mainly using it for programming on a programming track then we would recommend DecoderPro as the Roster view is available immediately, rather than requiring a menu selection in PanelPro.

To Create a Desktop Icon for PanelPro

In a terminal window create and edit a desktop shortcut.

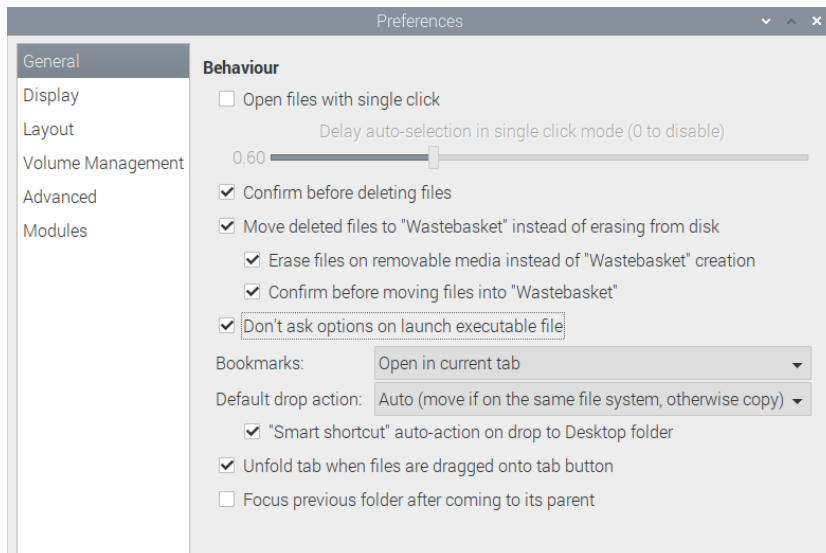
```
sudo nano /home/pi/Desktop/PanelPro
```

```
[Desktop Entry]
Type=Application
Encoding=UTF-8
Name=PanelPro
Comment=JMRI PanelPro
Icon=/home/pi/JMRI/resources/PanelPro.gif
Exec=/home/pi/JMRI/PanelPro
Terminal=false;
```

Adjust the paths as appropriate, depending where you extracted JMRI in the previous step.

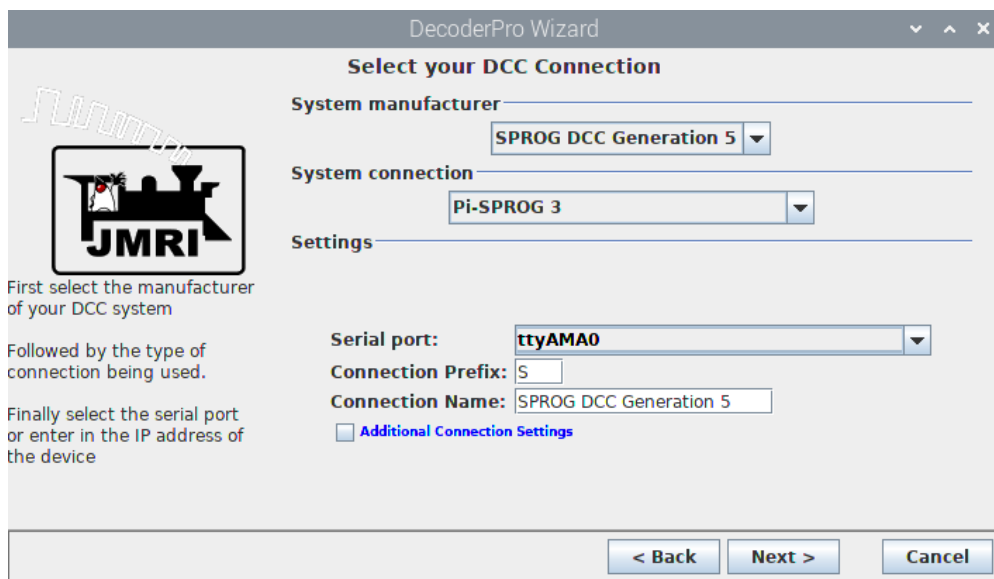
Save the file and quit the editor. A new desktop icon should appear for PanelPro.

In the File Manager, edit the preferences and select "Don't ask options on launch executable file"



Start PanelPro by double clicking the desktop icon.

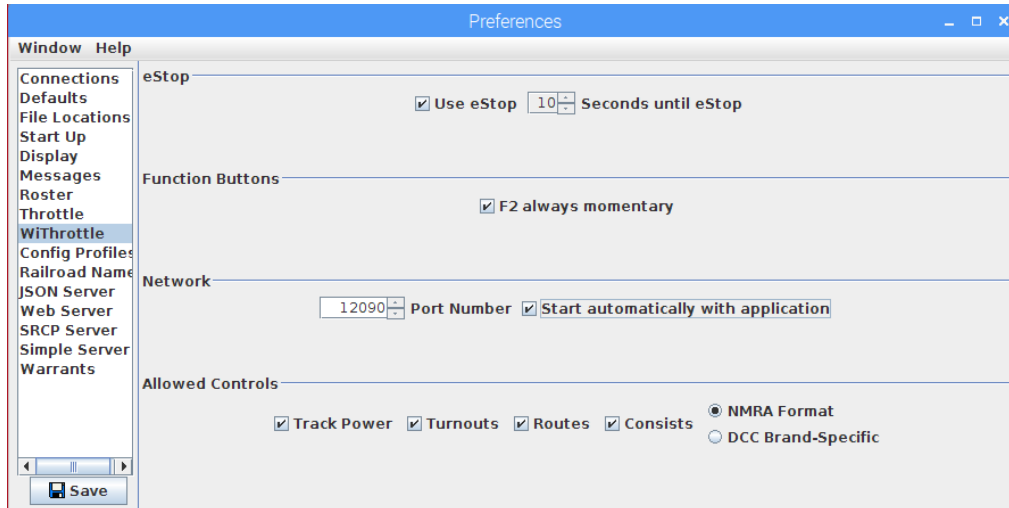
When the Preferences appears (the Chromium web browser may also open, and can be closed), create a new profile by selecting SPROG DCC Generation 5 (**Not** simply SPROG DCC) as the System and Pi-SPROG 3, Pi-SPROG 3 v2 or Pi-SPROG 3 Plus (depending on your SPROG hardware) as the System connection. Select ttyAMA0 as the Serial port.



Keep the Preferences open for the next step.

Start Withrottle Server Automatically (Optional)

If you want to operate your layout using mobile devices as Throttles (cabs) using an Android or iOS app then you can set the WiThrottle server to start automatically. Click WiThrottle in the left hand pane and Select Start automatically with application on port 12090.



Save the preferences and restart PanelPro. The WiThrottle server should start up (may be hidden behind the PanelPro window).

Quit PanelPro.

To Create a Desktop Icon for DecoderPro

In a terminal window create and edit another desktop shortcut.

```
sudo nano /home/pi/Desktop/DecoderPro
```

```
[Desktop Entry]
Type=Application
Encoding=UTF-8
Name=DecoderPro
Comment=JMRI DecoderPro
Icon=/home/pi/JMRI/resources/dp3_48x48.gif
Exec=/home/pi/JMRI/DecoderPro
Terminal=false;
```

Save the file and quit the editor. A new desktop icon should appear for DecoderPro.

Start DecoderPro and click New when the Profile selector appears.

Give the Profile a name, e.g., DecoderPro-Pi-SPROG-3v2 (or Plus) and click OK. The name can be any descriptive name you wish to allow distinction between different connection profiles, e.g., if you also have other hardware connected to the Raspberry-Pi.

Click OK.

Click Next.

Work through the connection wizard and set the same preferences as you did for PanelPro. Be sure to select "SPROG DCC Generation 5" and not "SPROG DCC" as the manufacturer.

Quit DecoderPro.

Create WiFi Access Point (AP) (Optional)

To connect directly to the R-Pi for use with WiThrottle, laptop or tablet, you may setup a wireless access point.

Click the R-Pi taskbar icon for network connections and setup your WiFi country.

Click the R-Pi taskbar icon for network connections -> Advanced options -> Create Wireless Hotspot

Enter a network name, e.g. use the hostname, sprog-pi4 in our example

Set the security to WPA & WPA2 personal and enter a password, which you must be able to remember.

Click Create to create the WiFi AP.

To set the AP to start automatically when the R-Pi boots

```
sudo nmtui
```

Edit a Connection -> WiFi -> sprog-pi4 -> [X] Automatically connect -> OK -> Back -> Quit
(Use space bar to toggle the [X] Automatically connect selection)

To connect to the AP, select the network (example sprog-pi5, above) and login with the WPA passphrase, entered above. Run TigerVNC on your laptop or tablet to see the R-Pi desktop.

Some mobile devices will need to be configured to allow connection to a network that has no internet access. How to do this is device dependent and beyond the scope of this document.

The setup presented here does not allow wireless devices connected to the R-Pi to access the wired connection (e.g., to access the internet). This is intended as a security measure. More advanced users can perform further configuration (not covered here) to allow routing.

Run PanelPro (or DecoderPro) at Startup (optional)

You must only try to run one of PanelPro or DecoderPro at any one time, otherwise there will be a conflict of access to the serial port.

Complete this step if you want the software to start automatically at startup. E.g., to start PanelPro if you do not have a screen and keyboard connected to the Pi.

```
mkdir -p /home/pi/.config/autostart  
sudo nano /home/pi/.config/autostart/panelpro.desktop
```

Add the following three lines:

```
[Desktop Entry]  
Type=Application  
Exec=/home/pi/JMRI/PanelPro
```

Save the file and quit the editor.

At this point you may wish to reboot the R-Pi to verify that PanelPro starts up. Then quit PanelPro.

Make a Backup

Once everything is working, we strongly suggest you make a backup copy of your SD card.

Caring for your SD Card

To avoid the possibility of data corruption on the SD card, you should always perform a clean shutdown of the R-Pi before removing power. If you do not have access to the virtual desktop then this can be done remotely from the device you use as a throttle, e.g., for Android we recommend the SSH button app. Configure it with the host name, user and password and send the command 'sudo shutdown -h now'.

Updating JMRI

Follow the earlier instructions for installing JMRI if you wish to download and install a newer release. You may wish to create a backup image of your SD card before doing so.