Raspberry Pi 5 and JMRI with WiFi Access Point for Pi-SPROG 3, Pi-SPROG 3 v2and Pi-SPROG 3 Plus
2023-12-05--raspbios-bookworm ARM64 build, Java 11 and JMRI 5.6

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These instructions describe the process of setting up a 64-bit 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.

These instructions are very similar to our YouTube video https://www.youtube.com/watch?v=iq3Yy83pcPM including the subsequent update https://www.youtube.com/watch?v=rcpkRZxap0Q&t=1s with the main difference being that, here, we set the hostname in the R-Pi imager tool, before crating the SD card. This saves a step of setting the hostname later. You may find it useful to follow the video (which includes screenshots) along with these instructions.

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 PuTTY 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.

These instructions should be generally applicable to the Raspberry Pi OS distribution on other Raspberry Pi hardware, as well as other Raspberry Pi OS releases.

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 5 and suitable power supply.

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

Pi-SPROG 3, or chosen hardware, and power supply (PI-LCC is powered from the LCC network).

Host PC (Windows or Linux)

Wired network connection from the R-Pi to your router during setup to allow software downloads, whilst using the R-Pi as an Access Point.

Software Requirements

SSH client installed on the host PC. These instructions assume the use of putty.exe https://www.putty.org/ on Windows. A recent version of PuTTY is required for compatibility with Bookworm. You can also use ssh from a Windows command line,

VNC Viewer installed on the host, We use Real VNC but this requires a workaround on the R-Pi to revert to the X11 desktop.

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. Edit the OS customization to set the hostname and enable remote access. This document assumes the hostname 'sprog-pi5'. 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.

Connect With SSH

Using your chosen SSH client, connect and login using the default user name and hostname pi@sprog-pi5.local or pi@sprog-pi5.

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

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.

`sudo raspi-config`

Select Advanced Option -> Wayland -> X11 -> OK

Exit out of raspi-config.

Reboot your R-Pi.

`sudo reboot`

Reconnect with SSH

Start the config tool again.

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

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

Connecting With VNC

Start VNC viewer on the host PC. Enter the VNC Server name 'sprogpi5' 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.

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

You can change the hostname here, if you did not do it in the imager tool when creating the SDc ard image.

Click the Display tab and change the resolution to your desired setting.

Click the Interfaces tab and enable the Serial Port

Click OK to apply the changes and reboot.

Reconnect with VNC. Real VNC will do this automatically when the R-Pi reboots, unless you changed the hostname.

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.

Fix Chromium Browser Performance

Open a terminal window and edit cmdline.tx

```
sudo nano /boot/firmware/cmdline.txt
```
NOTE: The file has moved since the video was created.

Add the command video= with the screen resolution you chose earlier, e.g.

Write out the new file and quit the editor.

Reboot the R-Pi (Raspberry menu -> Shutdown -> Reboot).

Apply UART Overlay

Ignore the original video and review the subsequent update
https://www.youtube.com/watch?v=rcpkRZxap0Q&t=1s

Edit config.txt in a terminal window

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

NOTE: The file has moved since the video was created.

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 11

JMRI since version 5 requires Java 11.

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

Scroll down and select Java 11 (LTS), Linux, ARM 64 bit. 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 the package just downloaded

```
sudo dpkg -i zulu11.68.17-ca-jdk11.0.21-linux_arm64.deb
```

Chack the installation

```
java --version
```

openjdk 11.0.22 2024-01-16 LTS
OpenJDK Runtime Environment Zulu11.70+15-CA (build 11.0.22+7-LTS)
*OpenJDK 64-Bit Server VM Zulu11.70+15-CA (build 11.0.22+7-LTS, mixed mode)*

Download and Install JMRI

At the time of writing, JMRI 5.6 is the latest stable version.

For the PI-LCC you should download version 5.7.1 or later

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).
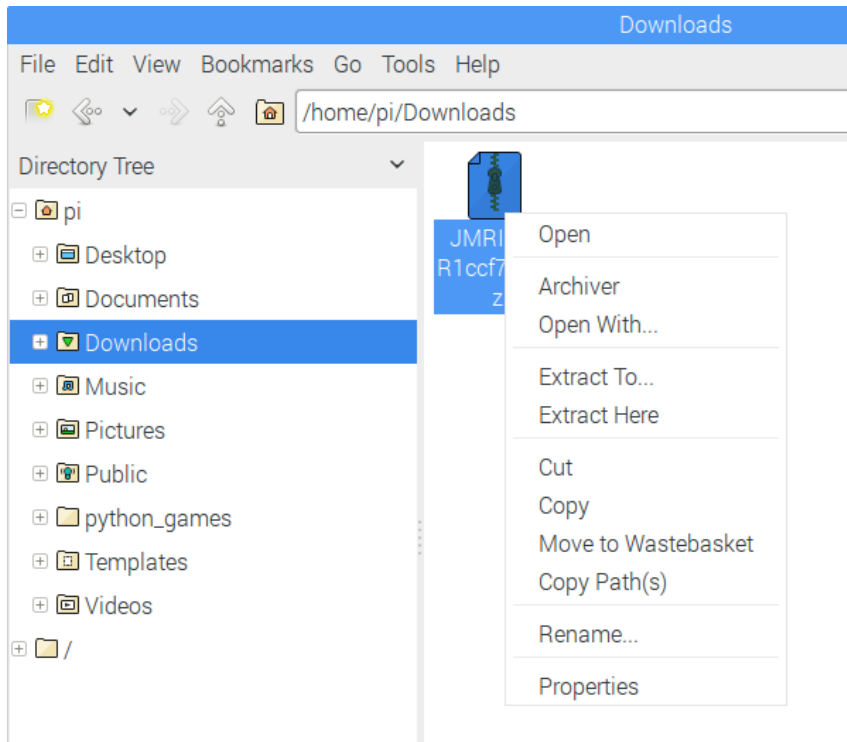
Browse to, or type, your chosen location for installing JMRI, e.g., /home/pi, select "Ensure a containing directory". Click Extract.
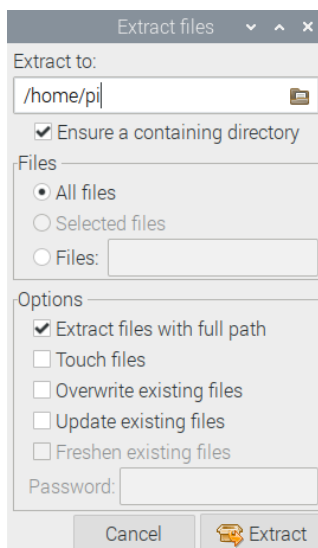
If extracted to /home/pi then the path to the application will be /home/pi/JMRI which we use in the following steps.

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"
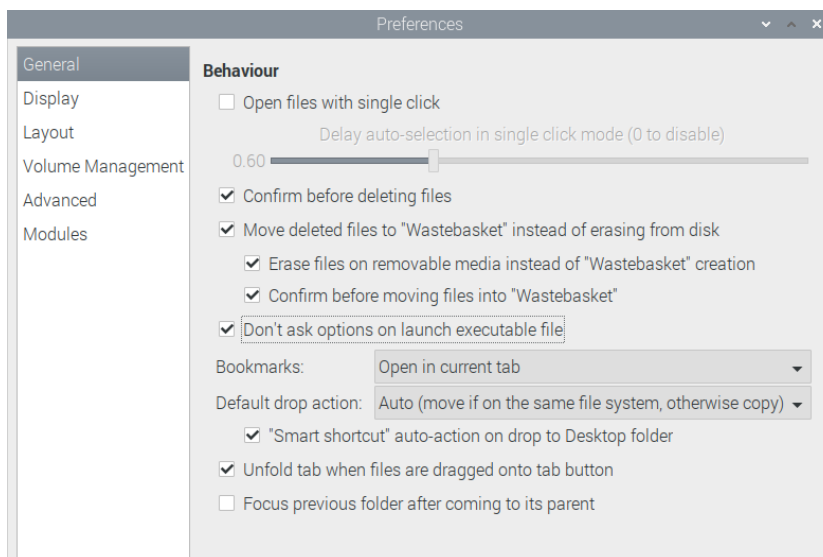
Start PanelPro by double clicking the desktop icon.

When the Preferences appears (the Chromium web browser may also open, and can be closed), create a new profile.

For the Pi-SPROG family, select 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.
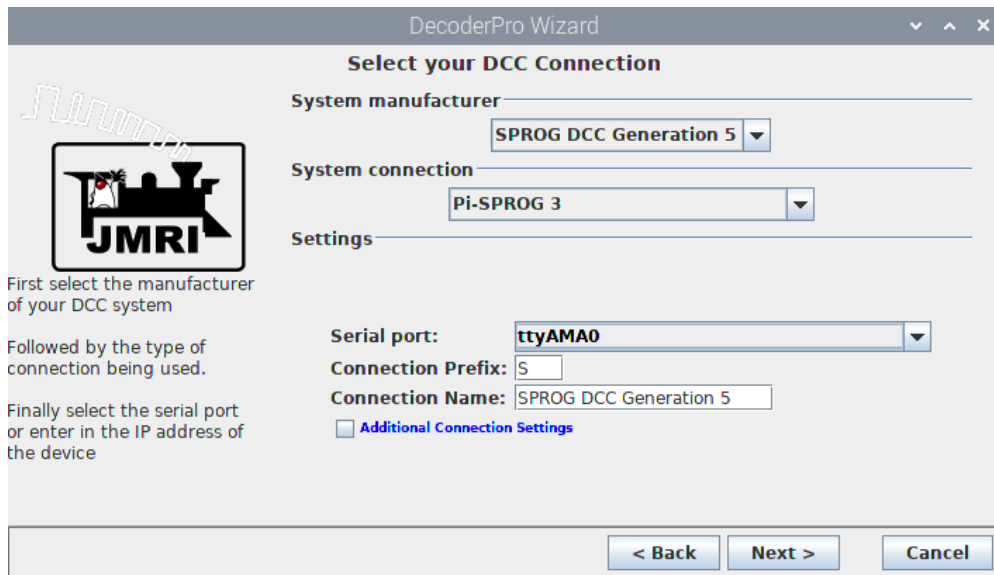
Keep the Preferences open for the next step.

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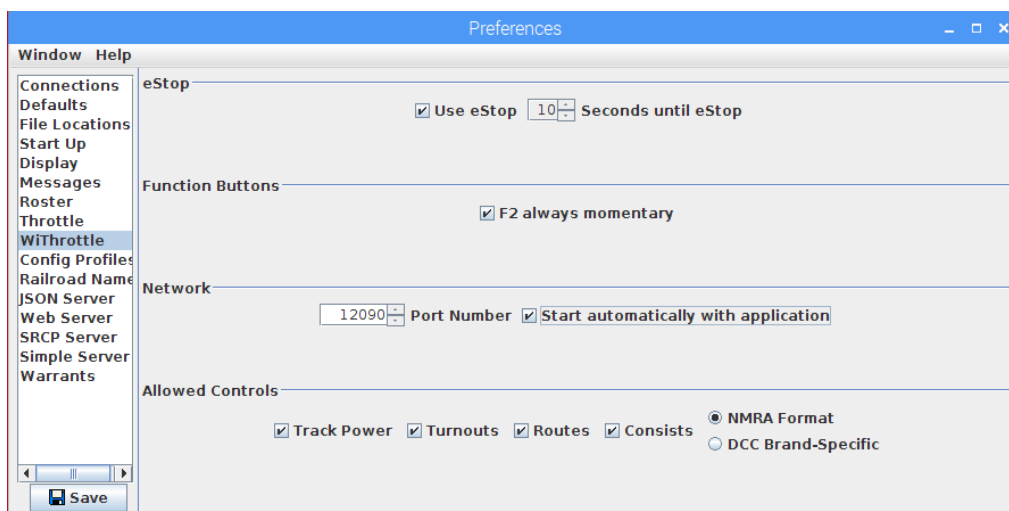
Save the preferences and restart PanelPro. The WiThrottle server should start up (may be hidden behind the PanelPro window).

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)

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-pi5 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-pi5 –> [X] Automatically connect -> OK -> Back -> Quit

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.

In a terminal create a session autostart file

```
sudo mkdir -p .config/lxsession/LXDE-pi
sudo cp /etc/xdg/lxsession/LXDE-pi/autostart .config/lxsession/LXDE-pi/
sudo nano /home/pi/.config/lxsession/LXDE-pi/autostart
```

Add the following line, with the path to the location where you installed PanelPro (or DecoderPro)

```
@/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.

Reboot your R-Pi.

PanelPro should start automatically, along with the WiThrottle server (if enabled).

You should now be able to connect to the sprog-pi4 network and be assigned an IP address. You may receive a notification that there is no internet connection. You may need to edit your wireless device settings to allow it to connect to a server that does not provide internet access.

WiThrottle or EngineDriver apps should now be able to connect to the WiThrottle server in JMRI.

You may also connect to the R-Pi from, e.g., a laptop or tablet by selecting the sprog-pi4 network in the wireless network setup. Login with the WPA passphrase, entered above, as you would when connecting to your own wireless router. Run VNC viewer, or similar, on your laptop or tablet to see the R-Pi desktop.

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.

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.