

Electronics Workshop Setup the Raspberry Pi

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Today's Workshop



- Set up a Raspberry Pi from scratch
- Using Raspberry Pi Model 4 B
 - Pi 5 requires Bookworm
- Using Raspberry Pi OS Buster
 - Bookworm not yet stable
- Using 32 bit version
 - Not all apps work on 64 bit version

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Why a Pi?



- Two is one and one is none
 - Backup to desktop
- Portable / low power solution (Pi and tablet/phone)
 - Winlink, APRS, FT8
- Dedicated to a function
 - APRS station
 - APRS Digipeater
 - Winlink Gateway
 - WSPR
 - Hotspot / Allstar

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Bill of Materials - 1



- Computer: Windows, Mac, Linux
 - Make SD card from image file
 - RealVNC client to Pi RealVNC Server
 - For RealVNC client, also tablet or smartphone
- Raspberry Pi 4 B
 - I am using 4GB version
- Power supply, 5v, 3A, USB-C
 - Mine came with an on-off switch

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Bill of Materials - 2



- MicroHDMI to HDMI cable (Pi 4 or 5)
 - For connecting monitor to Pi
- MicroSD card
 - I recommend selecting one card and sticking with it
 - Sandisk Ultra 32GB – usually the least expensive option
- Optional
 - Case
 - Fan
 - Heatsinks

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Bill of Materials - 3



- <https://rpilocator.com>
 - Links to web site of supplier with in-stock
 - I just found one with a Pi 5 4GB in stock
- Option 1: monitor, keyboard, mouse
- Option 2: computer with RealVNC client
- USB to MicroSD card reader
- More SD cards for backup

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Bill of Materials - 4



- Optional GPS
 - VK-162 USB GPS receiver
 - GlobalSat BU-353S4 USB receiver
- TNC (Terminal Node Controller)
 - May be a “real TNC”
 - May be a sound card/ audio interface
 - More later on this

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Network for today



- CARC-Demo
- Also CARC-demo-5G
- Password: fuzzysox

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Copy IMG file to SD Card

- Insert MicroSD card into USB reader
- Insert Reader into computer
- Install Raspberry Pi Imager
 - <https://www.raspberrypi.org/downloads/>

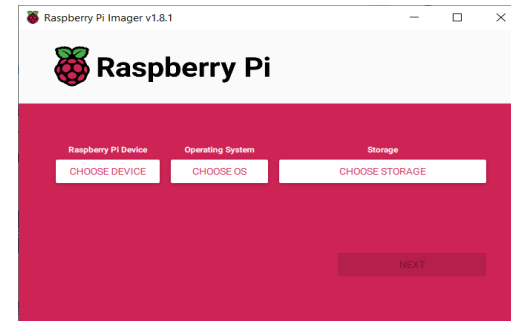


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Raspberry Pi Imager



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Rpi Imager

- Choose Device: Raspberry Pi 4
- Choose OS: RASPBERRY PI OS (LEGACY)
 - Bullseye 32 bit version
 - Not all apps work on 64 bit version
- Choose SD CARD



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OS Customization

- Edit Settings
- General:
 - Hostname: Call sign
 - Username: pi
 - Password: remember it!
 - Configure Wireless LAN
 - SSID: "CARC-Demo"
 - Password: fuzzysox
 - Time Zone: America/New York
 - Keyboard layout: US



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OS Customization



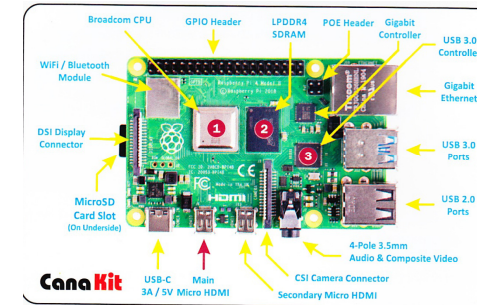
- SERVICES
 - Enable SSH
 - Use Password Authentication
- OPTIONS
 - Eject Media when finished

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Walk around the Pi



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Linux Notes



- All commands are case-sensitive
 - Ssh != ssh
- Command prompt: pi@AA6BD:~ \$
 - Username
 - Hostname
 - Directory
 - ~ means at the user directory (/home/pi/)
- Commands in this document shown with a \$
- Do not type the \$

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1 – Monitor, keyboard, mouse



- Plug microHDMI cable into HDMI 0 port, nearest power port (Pi 4 or 5)
- Plug in keyboard and mouse
- Insert microSD card
- Option: Plug in GPS before powering on
- Insert power cord and turn on power
- Observe IP address


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1 - Pi Configuration



- Start: 
- Start > Preferences > Raspberry Pi Configuration
- Interfaces
- Enable VNC

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2 – Use VNC



- RealVNC is built into Pi
- Create RealVNC account at <https://www.realvnc.com/en/>
- Download viewer to your computer
- Insert microSD card
- Option: Plug in GPS before powering on
- Insert power cord and turn on power

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2 – Connect VNC



- On your computer, open Command window
 - Windows: cmd
 - \$ ssh [pi@<hostname>.local](mailto:pi@AA6BD.local) (or .lan)
 - pi@AA6BD.lan
 - OR
 - \$ ssh pi@<ip address>
 - Enter password – it does not echo

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2 – Configure VNC



- \$ sudo raspi-config
 - “sudo” Execute as root user
- Interface Options
 - VNC <YES>
- Display Options > VNC Resolution
 - 1920x1080
 - Or other resolution
- Tab to <Finish>
- Reboot <Yes>

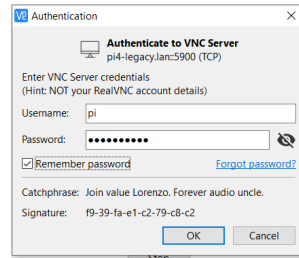
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2 – Connect VNC

- Start VNC Viewer
- In address bar: AA6BD.local
- Enter Username and Password and save password




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Update Software

- PI OS does not update automatically
- Either 
- Or
 - \$ sudo apt-get update && sudo apt-get full-upgrade
 - Two commands on one line
- Build-a-Pi/73Linux runs update whenever you install any new software
- BACKUP BEFORE installing software and/or updating

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Shut down Pi

- If you turn off power without shutting down OS, you can damage SD card
- Start > Shutdown > shutdown
- Wait for green light flashing on and off ~8 times
- Remove power

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Pushbutton Switch

- Configure /boot/config.txt to support switch
- Push once to shutdown OS
- Push again to start OS



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Backup SD card

- Insert second SD card into USB reader
- Insert into USB port
- Start > Accessories > SD Card Copier
- Press Start



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Patch USB bug

- CHECK IF NEEDED:
- Insert USB device like GPS
- `$ ls /dev/serial/by-id`
- If you see something like `usb-Prolific_Technology_Inc_USB_Serial_Controller..`
No patch is needed
- If "ls: cannot access '/dev/serial/by-id': No such file or directory"
see next slide
- CAUTION: OS Updates may change this



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Patch details

- `$ cd /lib/udev/rules.d/`
 - Ending / indicates directory
- `$ sudo cp 60-serial.rules 60-serial.backup`
- `$ sudo mousepad 60-serial.rules`
- Replace contents of file with
<https://github.com/systemd/systemd/blob/main/rules.d/60-serial.rules>
- Ctrl-S and Ctrl-Q
- Reboot



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Check patch

- Insert USB device like GPS
- `$ ls /dev/serial/by-id`




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Ham Radio Applications



- Build-a-Pi >> 73Linux
- Will support Pi and x86_64 Linux systems
- Browse to <https://github.com/km4ack/73Linux>
- Under Install
- Click 
- `$ git clone https://github.com/km4ack/73Linux.git`
`$HOME/73Linux && bash $HOME/73Linux/73.sh`
- Enter Terminal window and paste (right-click paste)
- Follow prompts

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First apps



- CONKY
- GPS
- GPSUPDATE
- HAMCLOCK
- First, PI OS will update itself
- Then, apps will be installed
- Reboot when requested

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Check GPS



- `$ cgps`
- Or
- `$ xgps`
- `$ gpsupdate`
 - If needed
 - Or apply patch

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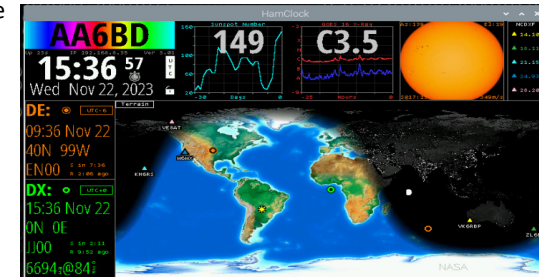
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Hamclock



- Start > Hamradio > Hamclock
- Configure



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Hamclock web interface



- Hamclock includes a web interface so you can see it on other computers on your LAN.
- Browse to `http://<pi address>:8081/live.html`
- For example, <http://192.168.234.89:8081/live.html>

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Conky



- See patch in document for selecting display size

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Winlink



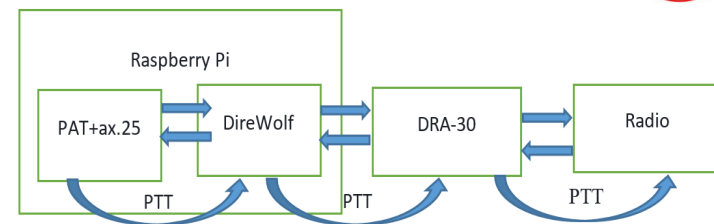
- Hardware: TNC or sound card
 - DRA-30
 - Signalink
 - Mobilinkd
 - Digirig
 - more

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System diagram



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Install Pat (Winlink)



- Start > Hamradio > 73Linux > 73Linux
 - PAT
 - PATMENU
- For VHF:
 - DIREWOLF
 - AX25
- For HF
 - ARDOP
 - ARDOPGUI

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Continue installation



- Six character grid square
- Winlink Password
 - Blank if you don't yet have an account
- Install/Update selected
- Reboot

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Configure Direwolf for your system



- Confirm your soundcard
 - `$ arecord -l` (Lima, not one)
 - Card 3: Device [USB PnP Sound Device]. Device 0: USB Audio [USB Audio]
- Edit direwolf.conf
 - `$ mousepad direwolf.conf`
 - Depends on your soundcard for how it gets PTT
 - Example: DRA-30
 - Uncomment: (remove the leading #)
 - PTT CM108
 - Example: Signalink: no editing needed
 - Ctrl-s Ctrl-q

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Send email using Winlink



- Start > Hamradio > Pat Meu
- Click Start/Stop Modem
- Click Start Packet Modem
- Modem will start and browser will open window
- Allow show notifications
- Action > Compose
 - Create email
 - Optional: Forms (Template)
 - POST

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Send - 2



- Action > Connect
 - Transport AX25
 - Target AK4ZX-12
 - Radio 145.050 (rig control not yet enabled)
 - Connect
- Also: Telnet (using just the Internet)
- If you don't yet have a Winlink account, see notes

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Send - Pi to IC-7100



- Re-install Direwolf with hamlib support
- Edit direwolf.conf:
 - #Uncomment line below for PTT with CAT through FLRIG
 - PTT RIG 2 localhost:4532
- Flrig: config > setup > transceiver
 - Select IC-7100
 - Select /dev/serial/by-id/usb-Silicon_Labs_CP2102_USB_to_UART_Bridge_Controller_IC-7100_02007036_A-if00-port0
- Hamlib: \$ rigctld -m 3070 -r /dev/ttyUSB0
- Then Action > Connect as before

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Change Pat port



- Conflict with Hamclock!
- Start > Hamradio > Pat Menu
- Click Settings/Config
- Click Current Config Settings
- Change Pat Port from 8080 to 5000.
- Click Update.
- Click Main Menu.

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Change - 2



- Open a Terminal window.
- \$ pat configure
- Editor is Nano
- In the line
 - "http addr": "127.0.0.1:8080"
 - Change "8080" to "5000"
- Type Ctrl-o, Hit enter, and Ctrl-x
- Reboot

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Winlink Catalog

- Pat Menu > Pat Catalog
- Weather
- Radar
- Position
- Propagation
- News
- SMS



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My Pi Apps

- Pat Winlink
- WSPR
- YAAC APRS
- PiGate RMS / LinBPQ
- MMDVM hotspot
- (Allstar)
- (Packet – BPQ)



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APRS Control and more

- Use APRS to send a message from one radio to another and use that message to control another radio, such as turn it on and off.

- Check this out:

<https://www.youtube.com/watch?v=F8EmZNcbKT0>

- Radio to TXT
- Digipeater
- Pi Display



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Other apps

- APRS: YAAC, Xastir, PIAPRS
- Hotspot
- Hamlib, flrig
- Fldigi, flarq, flwrap, flmsg: NBEMS
- WSJT-X, FT8
- JS8CALL
- QSSTV
- LinBPQ
- Utilities



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Support



- <https://groups.io/g/KM4ACK-Pi>
 - Forum postings
- <https://github.com/km4ack/73Linux/issues>
 - To post any issues or research known ones
- Documentation at <https://github.com/km4ack/pi-build>
- <https://www.youtube.com/@KM4ACK/videos>
 - Explains many BAP features and a lot more
- Raspberry Pi official documentation
 - <https://www.raspberrypi.com/documentation/>

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What's Next



- Raspberry Pi further projects
- Arduino projects
- Something else?
 - ESP32 CW Keyboard/decoder

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Comments / Questions



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