RASPBERRY PI

SINGLE BOARD COMPUTER

https://www.raspberrypi.org/

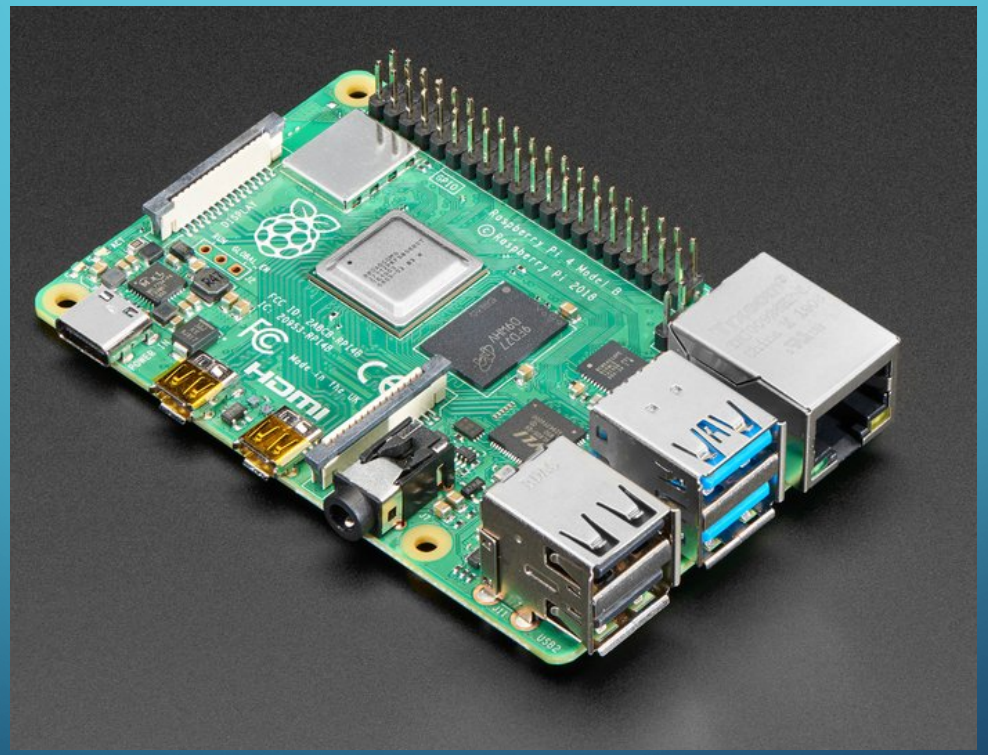
MICROCONTROLLER / SINGLE BOARD COMPUTER

- The Arduino's are Microcontrollers, designed to run a single application.
- Raspberry Pi's (except for the Pico which is a microcontroller) are single board computers. They can be just like your laptop or desktop with additional I/O opportunities.

OTHER SINGLE BOARD COMPUTERS

- Beagle Bone
- NVidia Jetson
- Asus Tinkerboard

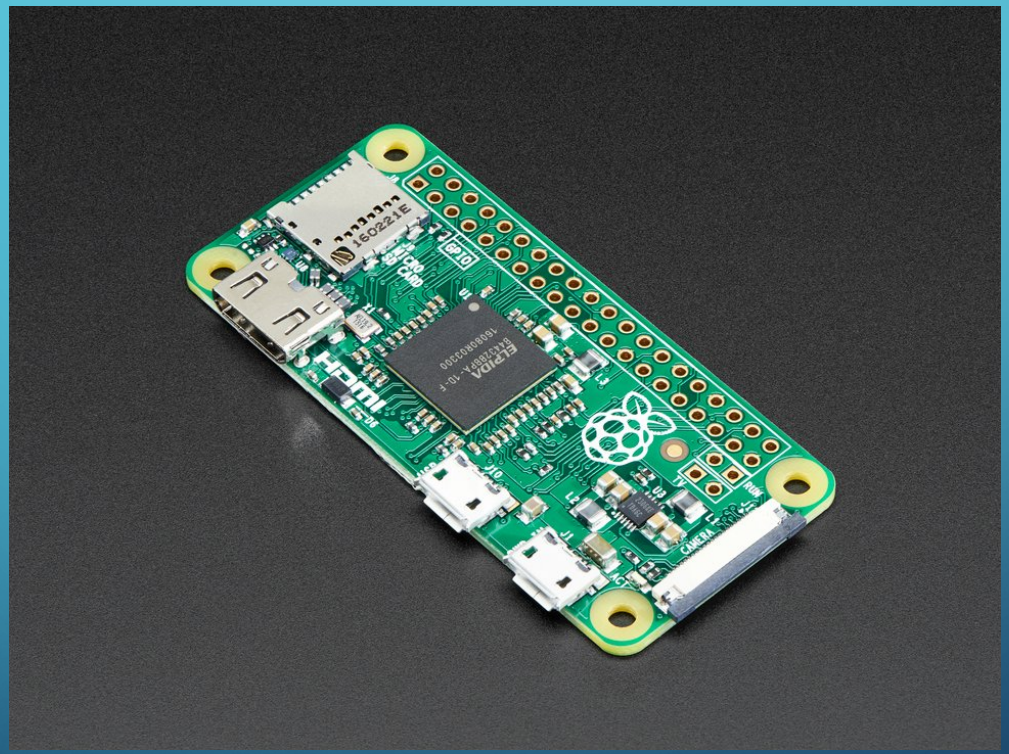
MODEL 4B - $45 (2 GB) - $75 (8 GB)



MODEL 4B

- 64-bit 1.5 GHz quad core processor
- 1 / 2 /4 / 8 GB RAM
- 4 USB ports (2 - 3.0)
- Wired / wireless LAN
- Dual HDMI output (one at 4K)
- MicroSD card storage (32 GB+)
- Camera interface
- GPIO bus

ZERO - $5



ZERO

- Single core 1 GHz
- 512 MB RAM
- Mini HDMI
- Micro SD Card
- 2 USB (one for power)
- GPIO bus

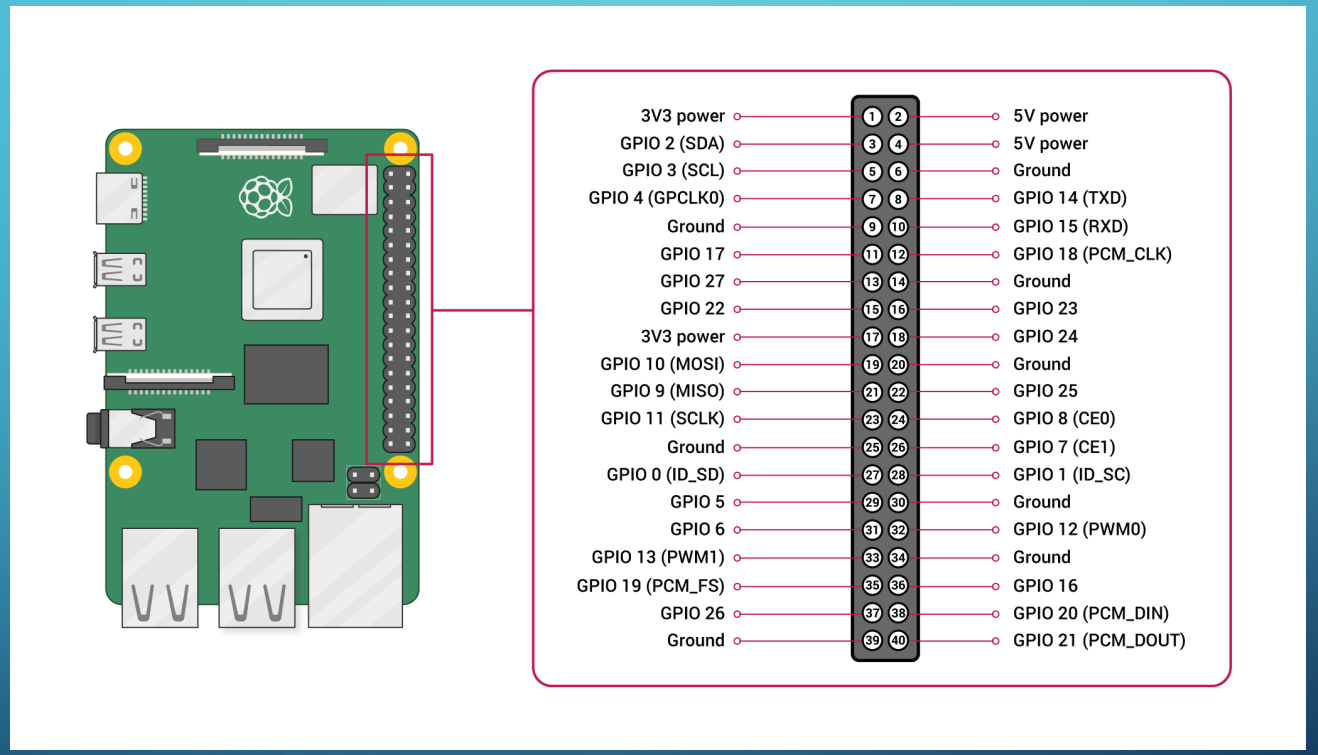
ZERO W - $10

- Zero with WiFi

ZERO 2W - $15

- Quad-core 64-bit ARM Cortex-A53 1 GHz
- 512 MB SDRAM
- Up to 5 times faster than the original Pi Zero
- Shielded WiFi enclosure

RASPBERRY PI GPIO PINOUT



SIMPLE SETUP

- USB Keyboard / Mouse
- HDMI Display
- Alternatively can access remotely via SSH (command line) or RealVNC (graphical). RaspiOS includes the RealVNC server. The client is free for home use. Mac users can use Desktop Sharing instead the RealVNC Client.
- The Pi Zero can create a network over a USB connections.
- The other Pi's connect to your router over Ethernet.

RASPBERRY PI 400 - $70

RASPBERRY PI 400

4 GB Model 4B built into a keyboard

MAIN OPERATING SYSTEM LINUX

- RaspiOS (Original release based on Debian Buster)
- Bullseye version released October 2021

MICRO SD CARD

The Operating System, user programs and data are stored on a micro SD card.

The older models were limited to 16 GB or 32 GB

SOFTWARE INSTALLATION

Download a SD Card image and flash a SD card

- Bare bones Linux install with or without a GUI
- You can add additional Linux software to do what you need. There are lots of tutorials online.
- Alternatively, you can download and install a pre-made image that has all the needed software for a particular purpose installed and configured. A drawback is that the configuration may break the Linux automatic update process

SD CARD IMAGE WRITING SOFTWARE

- Win32 Disk Imager (Windows)
- (Balena) Etcher (Windows / Mac / Linux)
- Raspberry Pi Imager (Windows / Mac / Linux / Pi)

RASPBERRY PI IMAGER

- Windows, Mac, Linux - download from raspberrypi.com
- Raspberry pi - sudo apt install rpi-imager


Raspberry Pi Imager v1.6
Raspberry Pi
Operating System
CHOOSE OS
Storage
CHOOSE STORAGE
WRITE

HEADLESS

- After burning the SD card, add the file “ssh” to the config-root to enable SSH
- On Windows use PuTTY (or another SSH client), on the Mac and Linux, use SSH from the command line.
- ssh pi@raspberrypi.local or use the IP address of the Pi. The tricky part is finding that.
- The default password is “raspberry”
- sudo raspi-config and enable VNC server
- Use RealVNC client to access (Windows)

SCREEN SHARING MAC

Requires changes to VNC Setup (on the Pi)

- Set encryption to Prefer Off
- Set authentication to VNC Password
- I “cheated” and did the setup from Windows using RealVNC client, but there probably is a way to edit the VNC server parameters from a ssh command line

DESKTOP COMPUTER REPLACEMENT?

You can run a desktop GUI on even the $5 Pi Zero, but expect to spend a lot of time waiting.

The 4B (and even the 3B) have acceptable response times to use as a low-end desktop.

SERVER

- VPN
- NAS
- Video Server
- Web Server
- DVSwitch (DStar – Fusion – DMR)
- Build-a-Pi (KM4ACK)

LINUX DESKTOP

Using Desktop Sharing on a Mac or VNC on Windows, I can run software on the Pi that I don't want to (or can't install) on the Mac or PC.

GPIO BUS

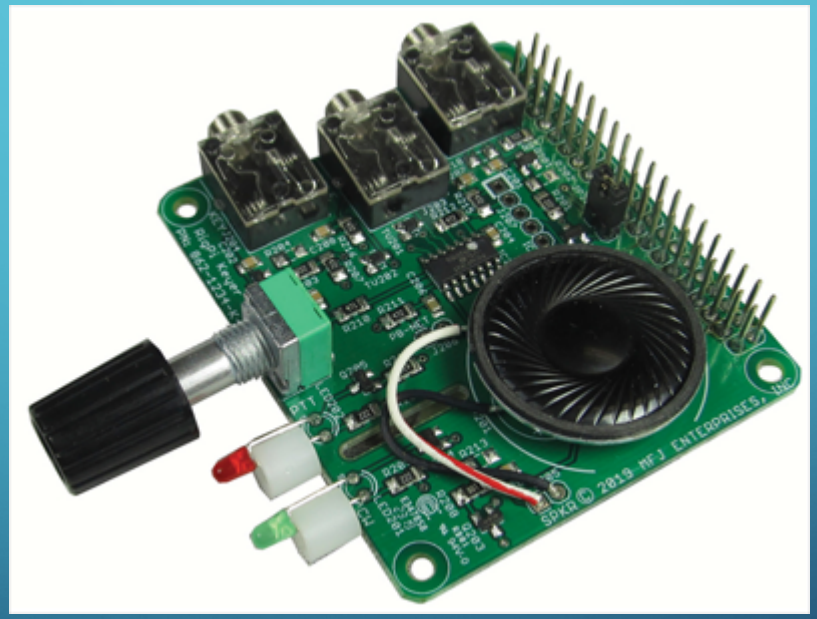
- Pins for external interfacing similar to Arduino
- Digital I/O
- PWM
- SPI
- I2C
- Serial

HATS

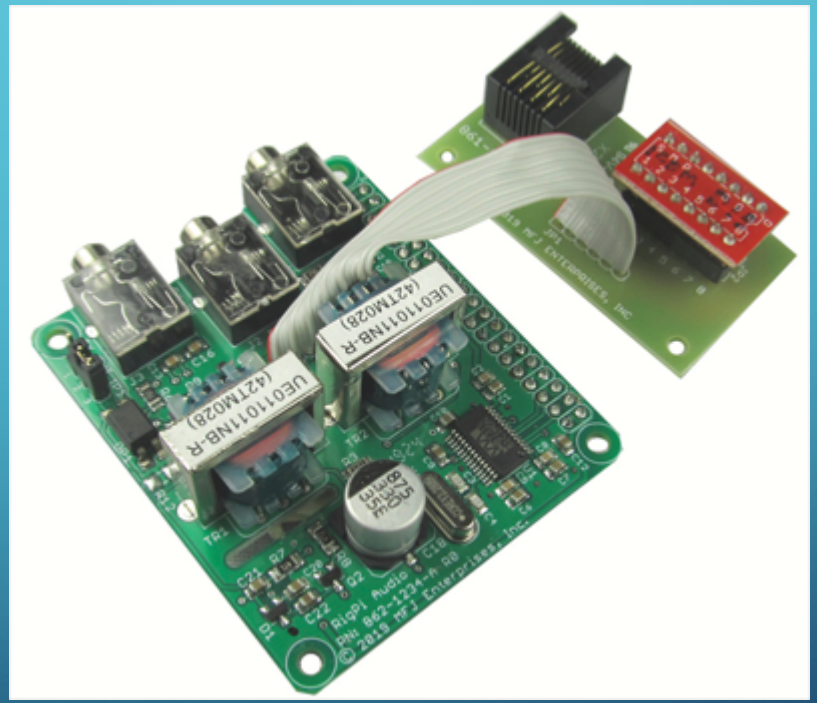
Similar to Arduino Shields. They provide prebuilt interface hardware.

MFJ-1234 RIGPI

RIGPI KEYER BOARD



RIGPI AUDIO BOARD



RIGPI REMOTE SOFTWARE (WEB BASED)

KM4ACK BUILD-A-PI

Pre configured with Ham Radio Software

- WSJT-X
- FLDigi
- PAT Winlink
- ARDOP
- Direwolf
- Chirp
- GPS
- and more

PROGRAMMING

As a Linux computer, Pi's can be programmed using other languages available on Linux:

- Python
- C/C++
- Perl
- and others

PROGRAMMING

Libraries are available to access the lower level hardware interfaces.

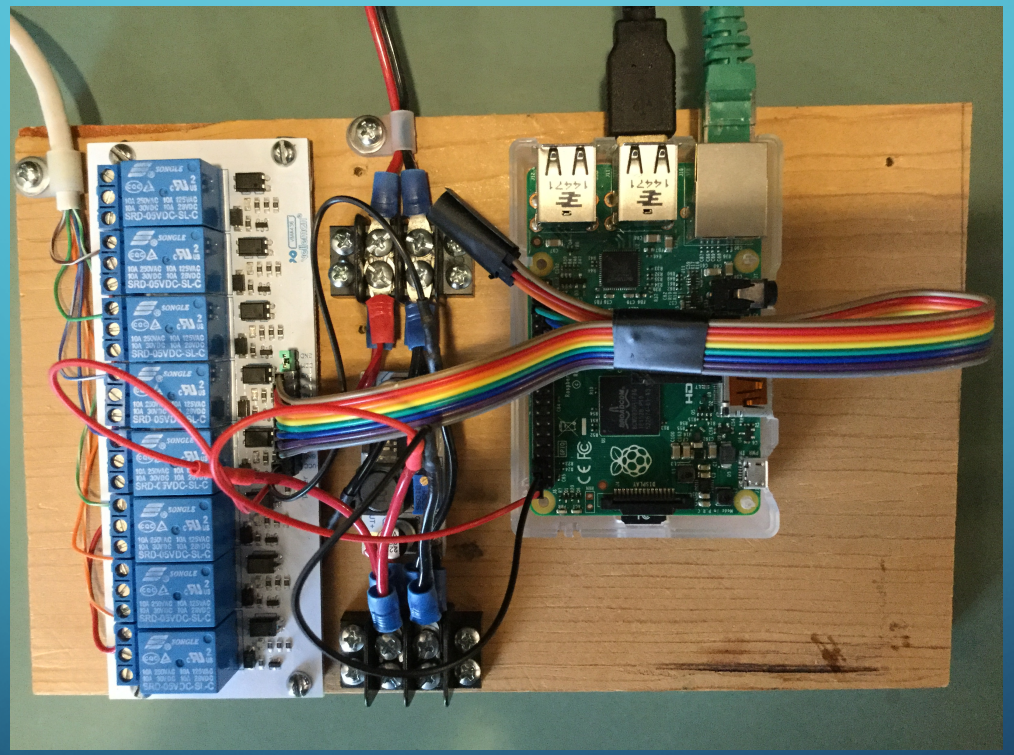
REMOTE USB SERVER

Allows access to USB devices over a network.

See my article in the July 2020 QST. That approach used ser2net.

Since then, I've found another project, ser2tcp that does much the same, but is written in Python, so it can be tweaked as needed. For example, when I removed the USB port to my SPE 2K-FA linear amplifier, I lost the ability to turn the amp on remotely (I could still turn it off). There was a command to turn the amp off, but to turn it on, the Windows program manipulated the DTR and RTS lines, so I modified ser2tcp.py to do that when needed.

REMOTE ANTENNA SWITCH CONTROLLER USB SERVER



LEARNING / EXPERIMENTATION

- Great platform for learning Linux
- When you screw things up, just reflash

GPIO PINS CAN ONLY SOURCE OR SINK A FEW MILLIAMPS

- Need external relays or transistors