Ham 79 - Pi power cooling

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The Raspberry Pi computer is an awesome, powerful controller in a very small package. The first viable machine was the Model 2 in 2014. I have been asked multiple times cooling needs and which Pi is best.

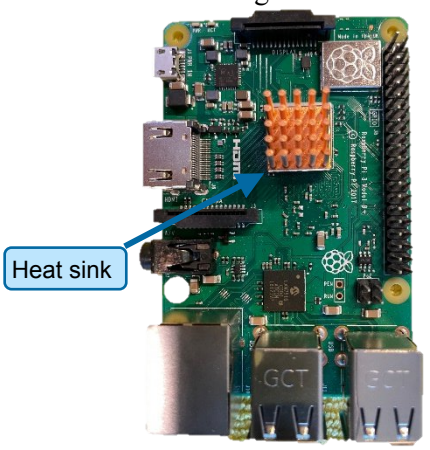
The Pi machine models have progressed forward to being faster with more memory and bigger operating systems. Other models have regressed to being simpler with a bare-bones.

Background. We have used the Pi since 2014, when we built our first oilwell Pump-Off Controller. Our devices are predominantly placed in closed steel electrical enclosures to operate the motors. Other Pi operated oilwell control devices we build include a cable driven pump for testing wells without bringing in a huge pulling-unit rig.

This is far from a benign environment. The Pi controllers are exposed to the hottest heat with direct sun in the summer and the coldest cold with intense wind in winter during intervals of rain, snow, and blowing dust. We still have units running from the first day. We have had power supply problems and sensor problems. We switched to a proper quality power supply. We have had display screens cracked, but still running. To date we have never had a Pi fail.

What is the secret? Knowing your equipment and either a little engineering or common sense.

The earliest functional serious control unit was the Raspberry Pi Model 2. Several variations came along. It was not very fast and had limited internal memory. A USB device was required for Wi-Fi. The operating system demanded the developer create many drivers. Its power need was 5.1 V at 2.0 Amps.



The next functional series was the Model 3. The A variant had less connections for USB. The B and B+ variants were really great control devices. They had built in Wi-Fi, Bluetooth, and four USB connectors. The operating system had improved dramatically, no longer requiring the developer to write all the drivers for interfaces. For dedicated control purposes, like our oilfield applications and the AllStarLink ham project, this is the ideal trade-off machine. Its power need is 2.5 Amps.

Then the next was the Model 4. A great general-purpose machine, it even made an acceptable desktop for many purposes. However, for a control machine, the operating system was becoming bloated. The added computing power came at a price. Its electrical need was 3 Amps.

No conventional Pi 2-3-4 was favorable to battery operation, but the 4 sucked the life out quickly. What does this have to do with cooling? Everything. All three models had the same footprint of 85mm x 56mm. Nevertheless, the power needs grew to 50% greater.

Model 2 requires 5.1 V * 2 A = 10.2 Watts. The Model 3 requires 12.75 Watts, and the Model 4 requires 15.3 Watts.

Obviously, more heat requires more cooling, to reduce the risk of failure. This is our experience.
Model 2, do nothing special.
Model 3, add good quality heat sink with a good conductive glue.
Model 4, add a fan.

Pi Zero 2W is a stripped-down machine. It has a quad-core, 1GHz processor with 512 MB SRAM, wireless LAN and Bluetooth, but no Ethernet. The 65mm x 30mm is about half the width of the Model 2-3-4. At 150 mA to 200mA when loaded, it is a low power, cool- running machine. No heat sink or fan is required. The Zero 2W can run AllStarLink.

Selecting the appropriate Pi, like every decision, is a trade-off. If you do not need the capabilities of the more advanced device, do not get it. Progressively larger devices demand more power, create more heat, so they are more prone to failure. You do not need a new 18-wheeler to go to the grocery.

Fan. If you need a fan, PuTTY to the Pi. Get to the black command line screen. Insert these instructions.

sudo raspi-config
Select: Performance Options > Fan > Yes when prompted for fan.
Enter ‘18’ for GPIO of fan connection. <Enter>. GPIO18 is Pin 12 on the board.
Enter ‘60’ for fan turn on temperature. <OK>.

If a fan turn-on temperature lower than 60C (140F) is desired, go to the black screen command line.
sudo nano /boot/config.txt
At the bottom, new lines were written when the fan was activated.
Change the ‘60000’ value to ‘50000’ for a 50C turn on.
To Exit: Control-x (^x) > Y(es) > Enter.

Life is good. Enjoy!