

Test Report - VxScan Thermals

Pius Wong Jul 17, 2024

Measurements of interest from Jul 2, 2024 to Jul 15, 2024, from thermal imager and thermocouples, searching for hottest points.

Summary of Results

1. Most user-facing surfaces did not exceed the “safe” OSHA threshold temperature of 60°C:
 - o EXCEPT the SanDisk USB3.0 stick when in use for ~2 hours at room temperature ambient temperature, which hit 63°C surface temperature at the base (**rise of 38°C**)
 - o EXCEPT the Samsung USB3.1 stick when in use for ~2 hours at warm ambient temperature up to 35C (95F), which hit 61C surface temperature at the base (**rise of 26°C**)
2. SBC temps are too high at room temperature ambient temperature; mitigations needed.
 - o At 21°C ambient, air temp next to the SBC board (not the heatsink side) was 62°C (**rise of 41°C**); this is greater than the 60°C operating spec
 - o So it's expected that an ambient operating temp of 35°C (specified in VVSG) would lead to air temps next to the SBC of ~72°C without mitigations;

See the data below for details.

Surface temperatures measured w/ thermal imager

1. After being on for several hours, idle, in room temp
 - a. ...in ambient air temp ~23°C (74°F) on a wooden frame... Jul 2, 2024
 - b. External surface temperatures
 - i. USB port with USB3.0 stick: 57°C (135°F)
 - ii. USB port with USB3.1 stick: 51°C (123°F) Jul 3, 2024
 - iii. USB port with no USB stick: 42°C (107°F)
 - iv. Panel above SBC: 41°C (106°F)
 - v. Door above USB reader: 31°C (87°F)
 - vi. Screen: 29-31°C (84-87°F)
 - c. Internal surface temperatures (measured w/ thermal imager, top panel removed):
 - i. **“RAA” chip on SBC: 93°C (199°F)**
 - ii. SBC Heatsink top surface 88°C (190°F)
 - iii. Power supply hottest temp on capacitor: 52°C (125°F)

2. After being in use scanning for about 2 hours, in room temp,

- a. ... in ambient air temp ~25°C (77°F), 42%RH, on a wooden frame... Jul 3, 2024
- b. External surface temperatures (measured w/ thermal imager):
 - i. USB port with USB3.0 stick: 63°C (145°F)
 - ii. USB port with no USB stick: 45°C (113°F)
 - iii. Panel above SBC: 45°C (113°F)

3. After being in use scanning for about 2 hours, in warm ambient temperature (29-35C / 85-95F),

- a. External surface temperatures (measured w/ thermal imager):
 - i. USB port with Samsung USB3.1 stick: 61°C (141°F)
 - ii. Panel above SBC: 52°C (125°F)

Internal temperatures measured w/ thermocouples & 4chK thermometer

1. After being in use for several hours, then idle for an hour,

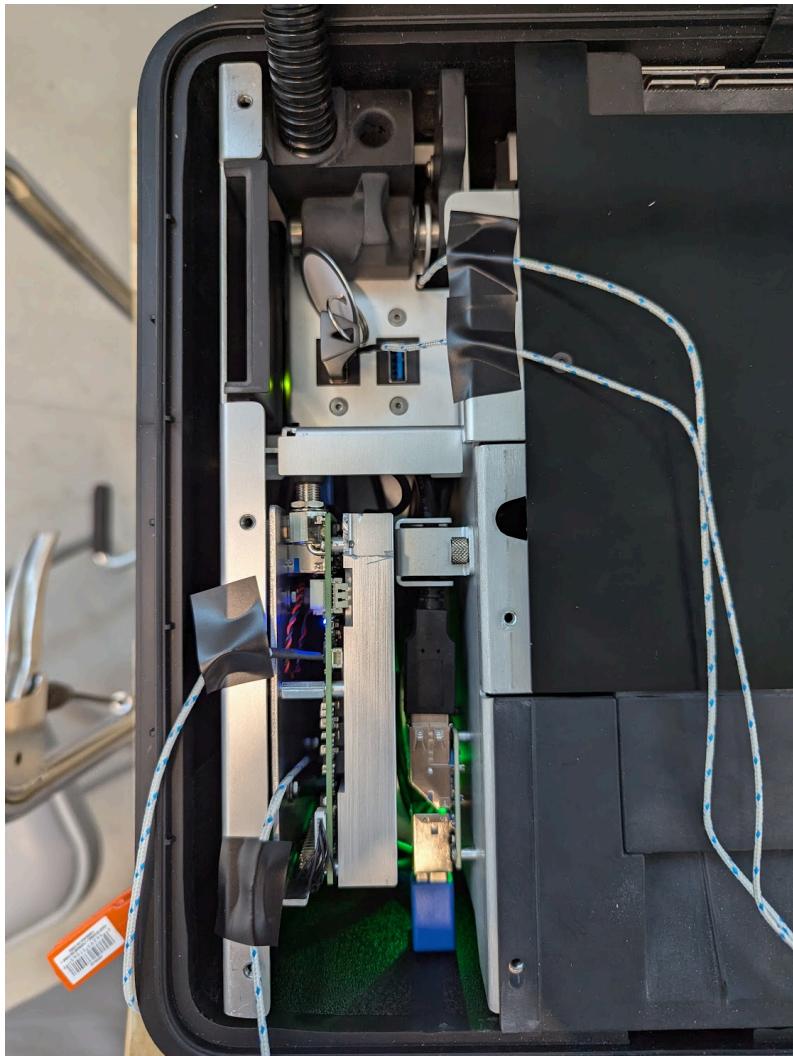
- a. ...in ambient air temp ~21.0°C (69.8°F), 42%RH, on a wooden frame... Jul 5, 2024
- b. Under USB hub panel ~0.5" deep
 - i. Air temperature: 38.1°C (101°F)
 - ii. Difference from ambient of +17.1°C (+30.8°F)
- c. On USB drive, Samsung USB 3.1, ~0.25" above base
 - i. Surface temperature: 42.8°C (109°F)
 - ii. Difference from ambient of +21.8°C (+39.2°F)
- d. Between SBC board and left bracket, ~1" deep
 - i. Air temperature: 62.1°C (144°F) → exceeds 60°C max operating spec
 - ii. Difference from ambient of +41.1°C (+74.0°F)
- e. On SBC chip "RAA" close to top
 - i. Surface temperature: 85.1°C (185°F)
 - ii. Difference from ambient of +64.1°C (+115°F)
- f. Under infeed tray, ~1" deep
 - i. Air temperature: 30.4°C (115°F)
 - ii. Difference from ambient of +9.4°C (+16.9°F)
- g. Right of scanner, near power board, ~2" deep
 - i. Air temperature: 32.8°C (86.7°F)
 - ii. Difference from ambient of +11.8°C (+21.2°F)

h. Inside card reader

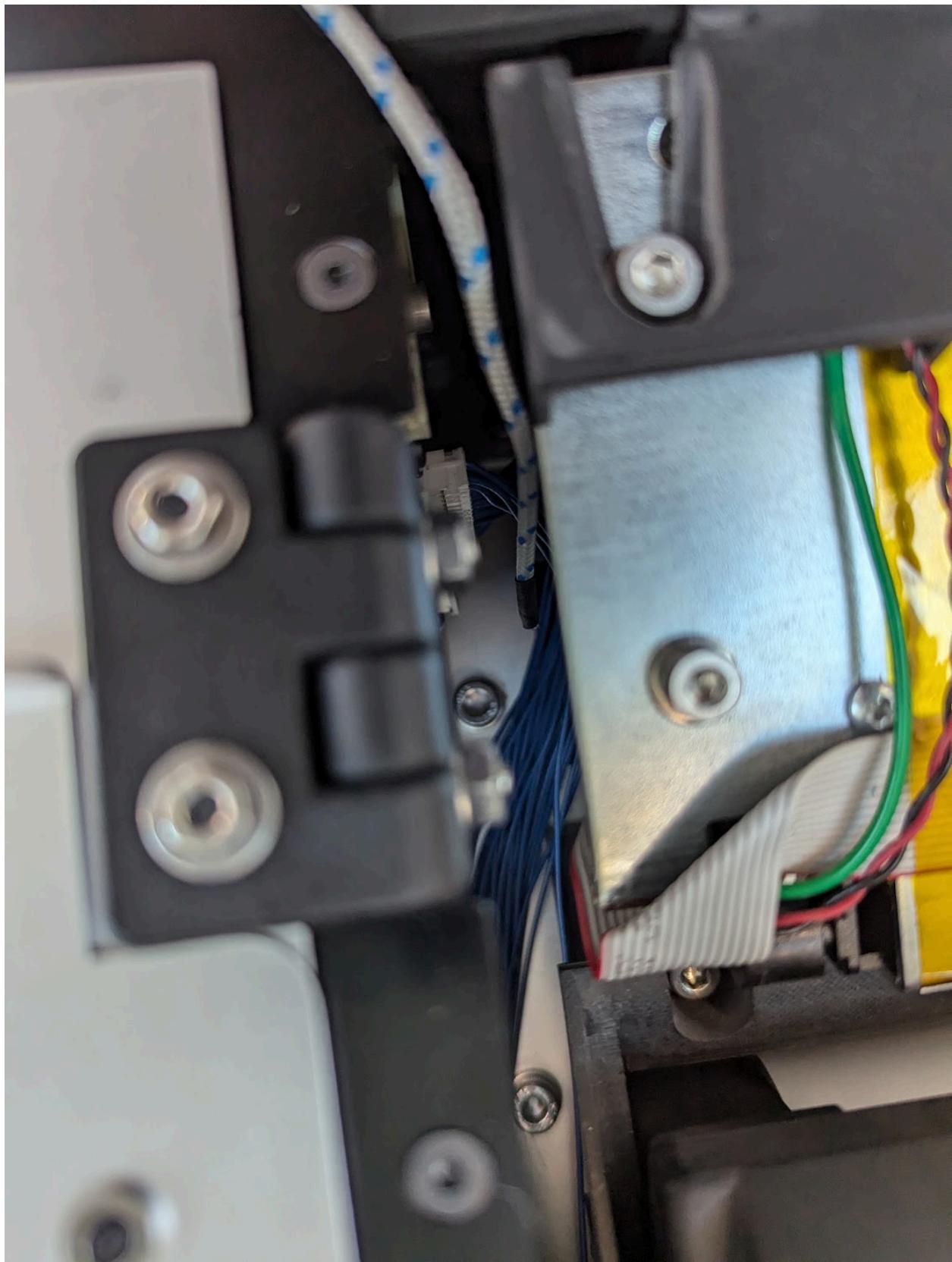
- i. ~1-2" deep: 37.8°C (100°F)
- ii. Difference from ambient of +16.8°C (+30.2°F)

Measurement Setup Details

- Thermometer 4-channel system: <https://www.amazon.com/gp/product/B00M9Z3JJ8>
- K-type thermocouples: <https://www.amazon.com/dp/B08NP37JZR>









Applied Mitigations

Sep 27, 2024 Drew Hayes

- High SBC temperatures are mitigated in subsequent builds with the addition of an internal fan-based cooling system
- High USB drive temperatures are mitigated in subsequent builds with the addition of an internal fan-based cooling system and changing the USB drive recommendation to a drive without a metal chassis