Allied Vision

APPLICATION NOTE

Optimum Heat Dissipation for Housed Alvium Cameras

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Scope

Cameras heating up during operation result in a loss of performance. Excessive heat can even damage cameras. Heat dissipation reduces the housing temperature during operation. This document describes the correlation between ambient temperature and camera body temperature.

Calculating camera temperature

Newton's law of cooling for free convection defines the differential between camera housing temperature (T_H) and ambient temperature (T_A).

$$Q = H_C \cdot A \cdot (T_H - T_A)$$

Q	Rate of heat loss in [W]. This is equal to camera power consumption.
H_C	Heat-transfer coefficient of the air, measured in [W/m^2 °C]. Values vary depending on the density and humidity of the air.
A	Camera's exposed area.
T_H	Camera housing temperature. Because the bottom face of the camera is the hottest point, it is the typical reference for lab tests.
T_B	Board temperature for cameras without a housing, so-called bare board cameras.
T_A	Ambient temperature. Defines the air temperature surrounding the camera, not influenced by the heat radiating from the camera itself. For lab tests, T_A is measured at a constant distance to the camera body.

Consider the formula is only an approximation to estimate values. We recommend additional testing for real values.

Surface areas for Alvium cameras

Alvium CSI-2 cameras

The following table provides surface areas for Alvium CSI-2 cameras.

Housing	Lens mount		
	S-Mount	CS-Mount	C-Mount
Open housing	3335 mm^2	3153 mm^2	3633 mm^2

Table 1: Surface areas for Alvium CSI-2cameras

Alvium USB cameras

The following table provides surface areas for Alvium USB cameras.

USB connector angle	Housing	Lens mount		
		S-Mount	CS-Mount	C-Mount
90°	Open housing	4232 mm^2	4049 mm^2	4530 mm^2
90°	Closed housing	4741 mm^2	4558 mm^2	5039 mm^2
180°	Open housing	4219 mm^2	4036 mm^2	4517 mm^2
180°	Closed housing	4751 mm^2	4568 mm^2	5049 mm^2

Table 2: Surface areas for Alvium USB cameras

Calculating the surface area for individual housings

If you design your housed Alvium camera into a closed housing, the surface area is calculated as follows: For any mechanical component added to the standard camera surface (A), you must add the surface area of the added components. Calculated values are an approximation, because added components may have different heat dissipation properties than the components of the standard camera.

Example

We used the following setup for temperature testing for closed housing Alvium USB cameras.

Test setup

Tests were performed In a climate chamber with no air flow. The cameras were heated up to the maximum value of 60 °C. Values were measured while the camera was cooling down. Cameras were streaming images properly.

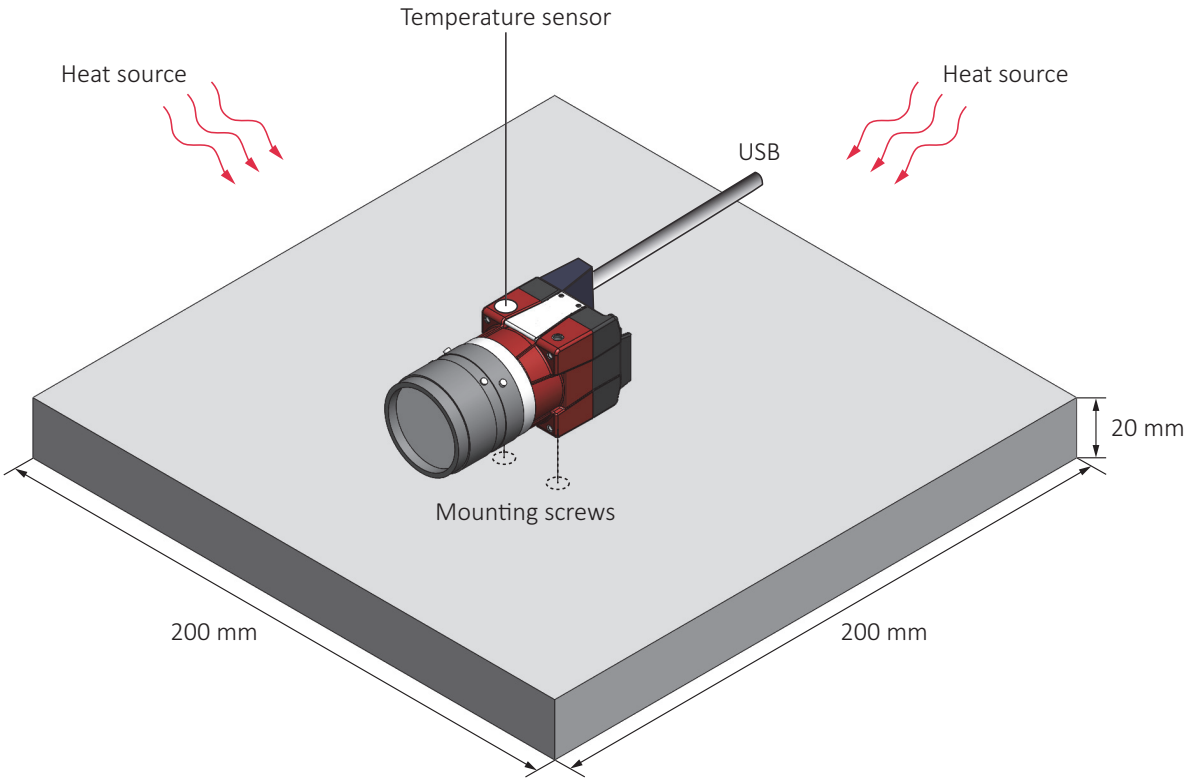


Figure 1: Testing temperature for closed housing Alvium cameras

Figure 1 shows the setup with an Alvium USB camera. CSI-2 cameras were tested the same way. The camera housing temperature is measured at the upper corner, which is the hottest spot.

Measurement results

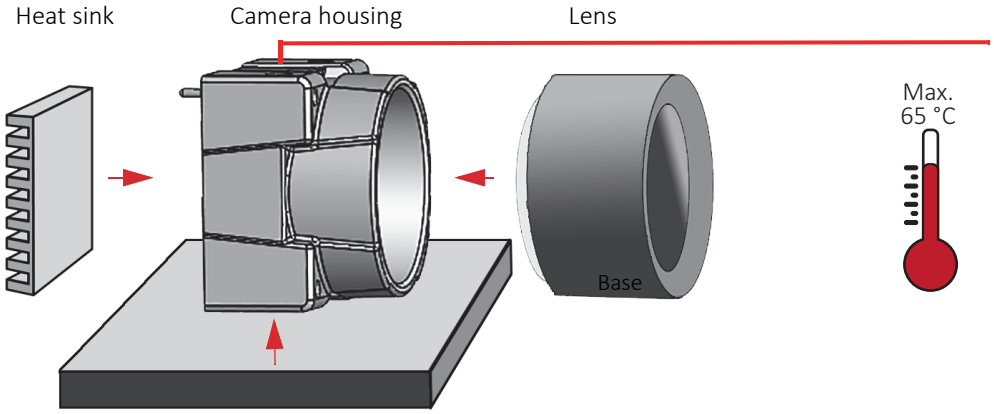
Camera housing temperature is about 5 °C to 15 °C above ambient temperature. As the camera is switched off above a housing temperature of 65 °C, it can be operated at an ambient temperature of maximum 50 °C. These values are approximations. Individual values vary between sensors and depends on factors, such as heat dissipation provided by lenses.

Additional heat dissipation reduces cameras heating up significantly. Moreover, operating the camera with lower frame rates reduces the housing temperature.

Best practice rules for heat dissipation

Consider the following to reduce camera temperature:

- Operate cameras only with lens mounted.
- Operate open housing cameras only with heat sink mounted.
- Use mounting bases and heat sinks with large surface areas.
- Use mounting bases with a high thermal conductivity.
- Reduce ambient temperature (T_A). For example, in an outdoor application with direct sunlight, provide shading by a ventilated enclosure.
- Provide ventilation or other active cooling of camera, mounting base, and heat sink.



Conclusion

Heat testing proves that housed Alvium cameras can easily be designed into applications to meet requirements for heat dissipation. Calculations enable individual design-ins for open housing cameras and for closed housing cameras into encompassing housings.

Contact

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