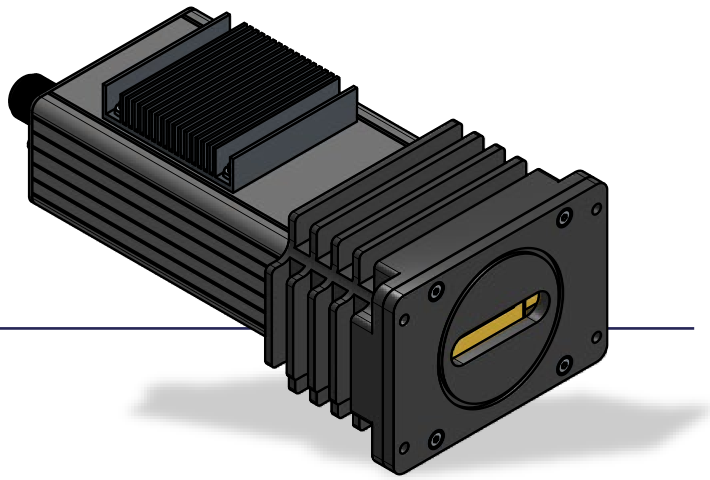
Glaz LineScan-I-Gen2

G11478-512WB

User guide

Overview

This document provides a user guide to get optimal results with the *LineScan-I-Gen2 G11478*-512WB. For more information regarding the *LineScan-I-Gen2* please refer to the LineScan-I-Gen2 manual.



Software requirements

- Glaz UI: Version 12.6 or higher
- Glaz Labview driver: Version 9.14 or higher
- Glaz API: Version 9.14 or higher

Specifications

Characteristic	Value	Unit
PC Interface		
PC interface	USB 2.0 (high-speed)	
Data transfer rate[1]	15	MB/s
Maximum USB cable length	3	m
Linear sensor		
Sensor type	InGaAs	
Supported sensors	Hamamatsu S10142-1107S-01	
Optical integration time	0.01 – 60,000	s
Hamamatsu G11478-512WB		
Pixel count	512	
Maximum line rate	8000	lines/s
Spectral response range	900 - 2300	nm
Conversion efficiency	16 (low gain) 160 (high gain)	nV/e^-
Full well capacity	175 (low gain) 17.5 (high gain)	Me^-
Dynamic range	6200	
ADC		
Resolution	16	bit
ENOB (effective number of bits)	14.5	bit
TEC driver		
Maximum current	1.9	A
Cooling	Passive	
Control method	PI	
Maximum settling time[2]	20	s
Temperature range	-15 – 10	°C
Temperature resolution	1	°C
Temperature set point accuracy	±0.05	°C

Table 1 Specifications for *LineScan-I-Gen2 G11478-512W.*

[1] Using dedicated USB 2.0 port.

[2] Time to settle within 0.1 °C from 25 °C to a target set point temperature of -10 °C after turning on the TEC driver.

Hardware description

Dimensions

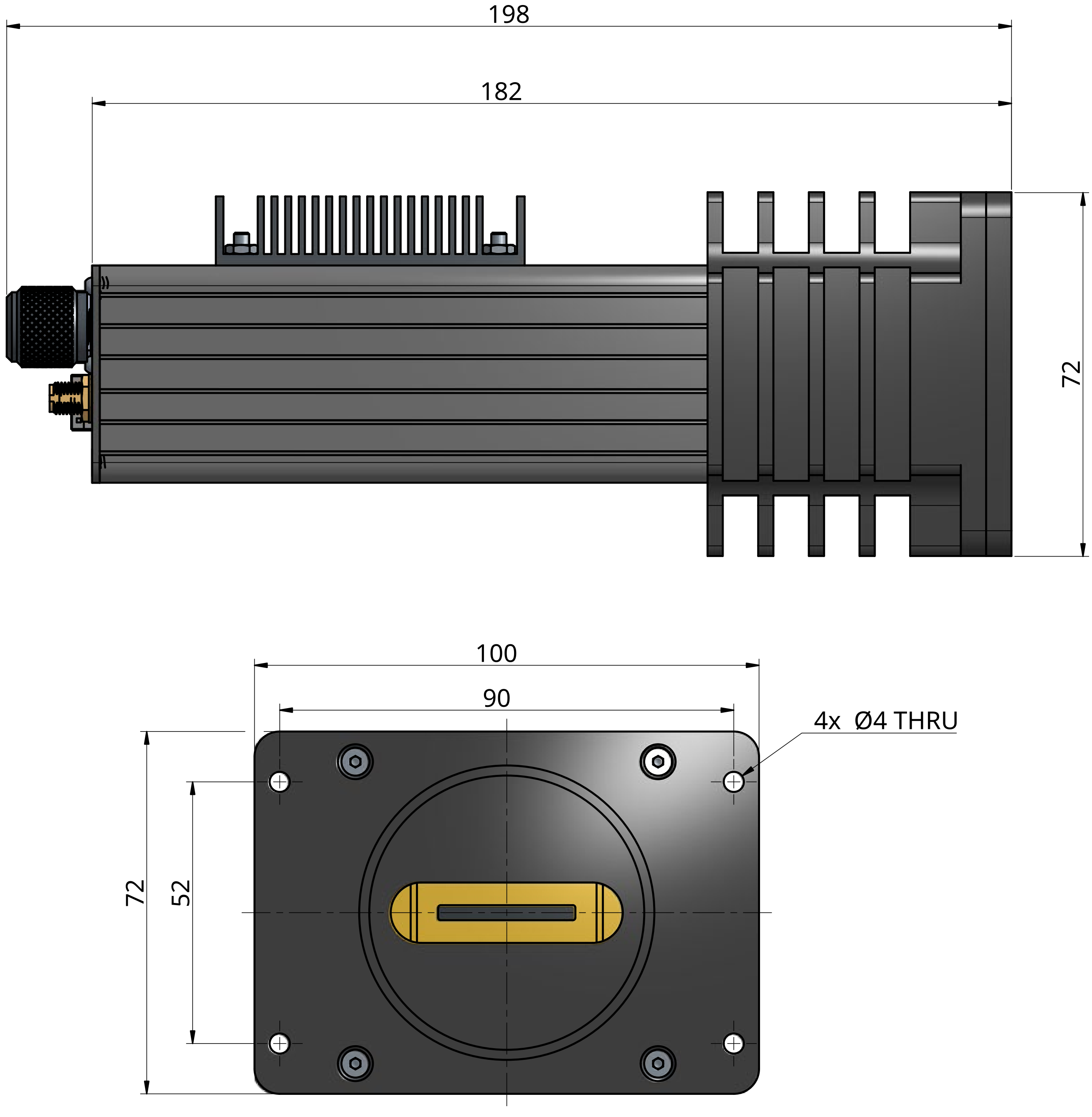


Figure 1 Mechanical dimensions.

Sensor position

The sensor's photosensitive area is centred in the XY-plane of the camera front plate and located 10 mm from the front plate surface (see Figure 2).

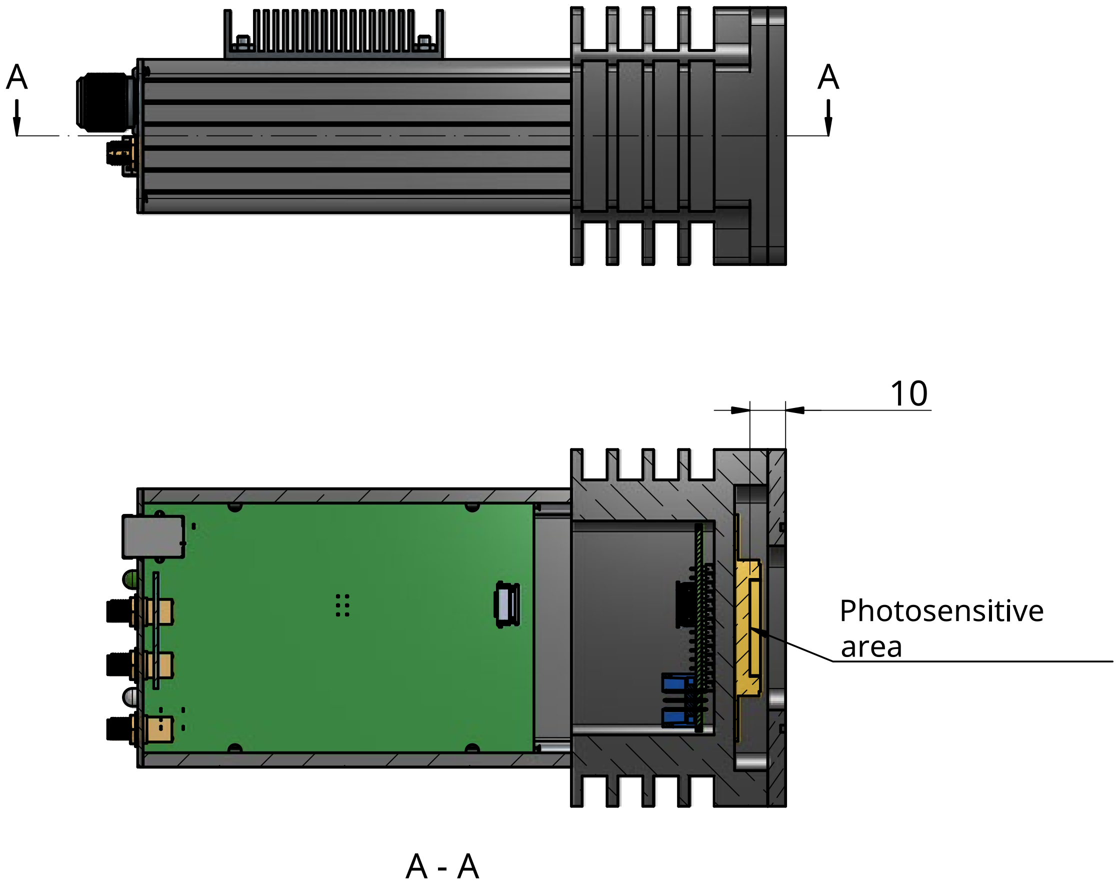


Figure 2 Sensor position.

Back plate

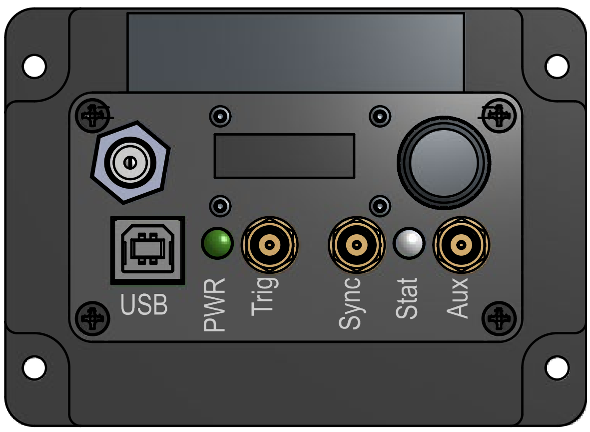


Figure 3 Back plate legend.

Ports

Port	Type	Dir	Function
USB	USB-B	–	Data connection to a PC. Also provides the camera with power.
Trigger	SMA	I	External trigger input.
Sync	SMA	I/O [3]	Configurable open collector IO mainly used for synchronising with other cameras.
Aux	SMA	I/O [4]	Configurable auxiliary input/output
5 VDC	Power	I	Power connection for external 5 V DC supply to power TEC driver

Table 2 Connectors.

See the LineScan-I-Gen2 manual for more information.

LEDs

LED	States	
Power LED	off green	no power camera has power.
Stat LED	off green green to red	idle waiting for trigger triggered and busy scanning

Table 3 LEDs.

The colour of the *Stat* LED is an indication of how busy the cameras is. When the camera is not busy (i.e. not triggered) the LED will be green. When the camera is working close to its maximum line rate, the LED will be red. For lower line rates, the camera will be yellow.

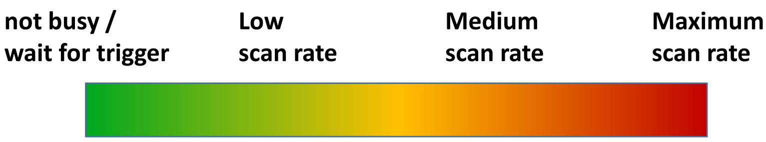


Figure 4 Ready/Busy LED colour legend.

See the LineScan-I-Gen2 manual for more information.

[3] Open collector input/output

[4] Configurable as TTL output or as high-impedance TTL input

G11478-512WB video outputs

The G11478-512WB features two video outputs – one for even pixels and one for odd pixels (see Figure 5).

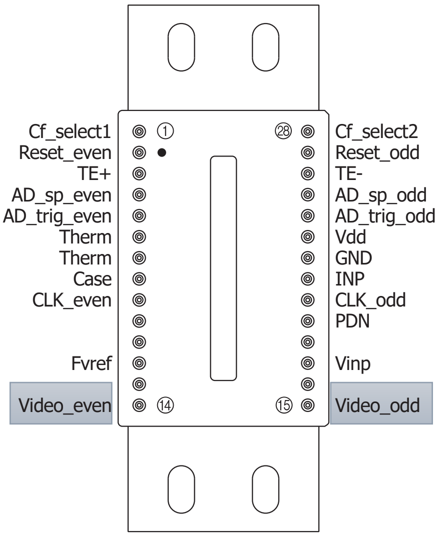


Figure 5 G11478-512WB video outputs.

The dark output voltage of the two outputs is not identical and will cause a triangular waveform distortion of the measurement between the odd and even pixels (see Figure 6 and Figure 7).

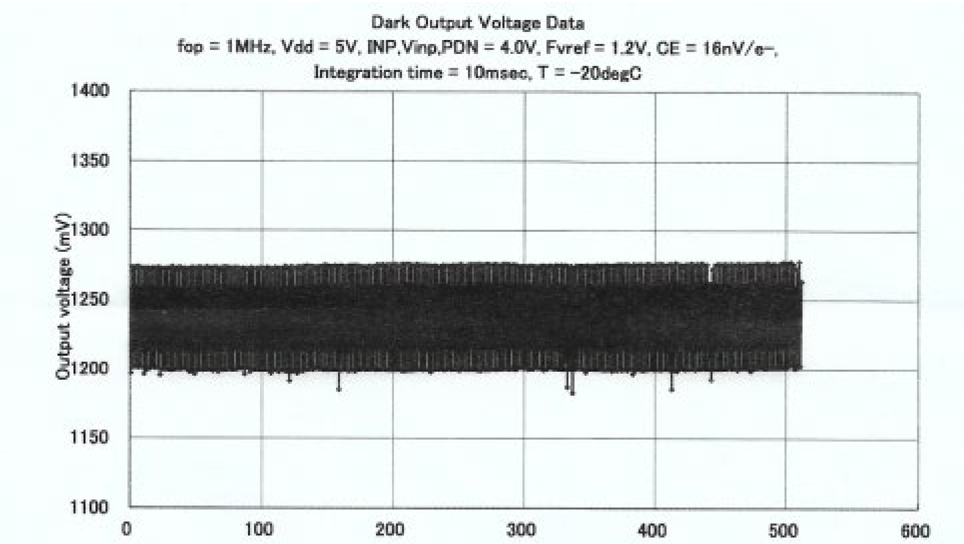


Figure 6 Odd-Even pixel dark output difference from Hamamatsu test sheet.

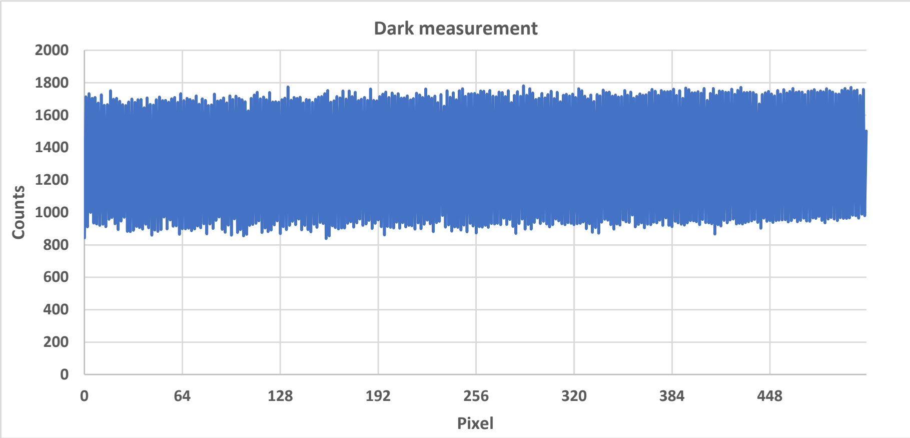


Figure 7 Odd-Even pixel dark output difference in Glaz UI.

Eliminating dark output differences

The dark output difference is significant and results in between 300 to 700 counts between the odd and even pixels with the 16-bit ADC of the *LineScan-I-Gen2*. Figure 8 shows a measurement without dark background subtraction.

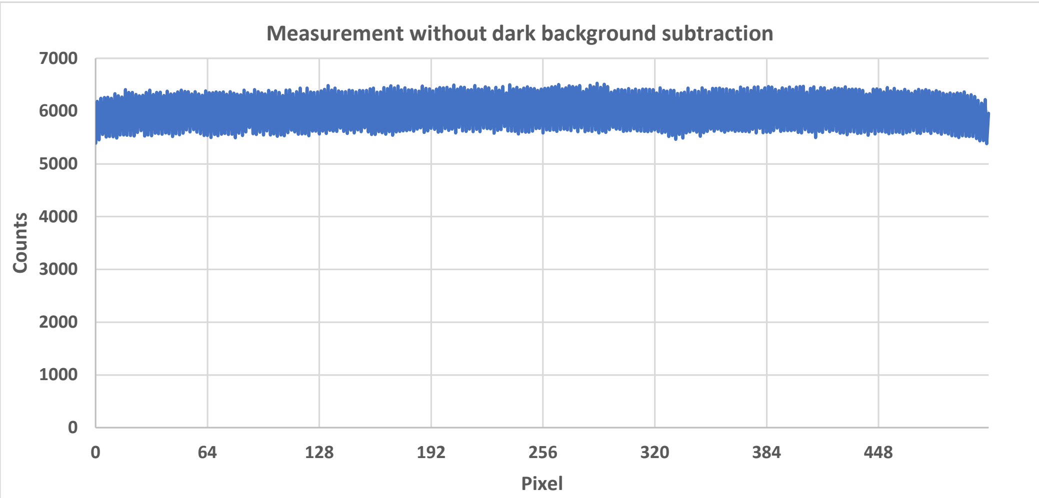


Figure 8 Measurement without dark background subtraction.

⚠ The dark offset is a function of the sensor temperature and it is important to ensure thermal stability before performing dark output compensation.

Follow these steps to eliminate odd/even dark output differences:

1. Set the desired integration time.
2. Specify the desired gain in the script file.
3. Set the target sensor temperature via the TEC control unit and turn on the TEC driver.
4. Wait for the sensor temperature to stabilise at the target temperature. This should take around 20 seconds.
5. Capture the dark background. Use a `scanCount` for the background capture that is at least 2 to 5 times larger than the measurement `scanCount`. For example, if measurements are performed with a `scanCount` of 100 (i.e. 100 averaged measurements), then it is recommended to capture the background with a `scanCount` of between 200 and 500. This will reduce noise from the captured background. To use background subtraction, the background

subtraction pre-processor must be specified in the Glaz script file. For example (with low sensor gain):

```
<!DOCTYPE GlazScript>
<config>
    <camera serial="SYBP03301XXXX" number="1" master="1" binning="0" gain="lo"/>
    <preprocessor camera="1" type="subtract_background"/>
    <calculation name="Camera on" keepscans="0">
        <measurement camera="1"/>
    </calculation>
</config>
```

6. Optional: For improved performance it is recommended to wait with the background capture until the camera reaches thermal equilibrium. At thermal equilibrium the camera heatsinks and housing temperature stabilises. Equilibrium is reached after approximately 15 minutes.

The measurement with dark background subtraction is depicted in Figure 9.

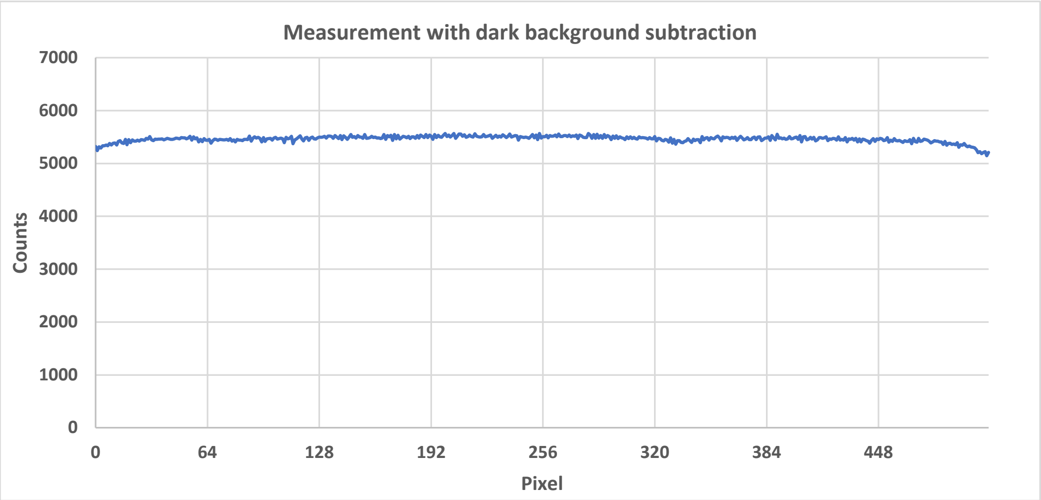


Figure 9 Measurement with dark background subtraction.

Using the TEC driver

The G11478-512W incorporates a two-stage thermos-electric cooler (TEC). The *LineScan-I-Gen2* provides an integrated TEC driver. The TEC driver interface is shown in Figure 1.

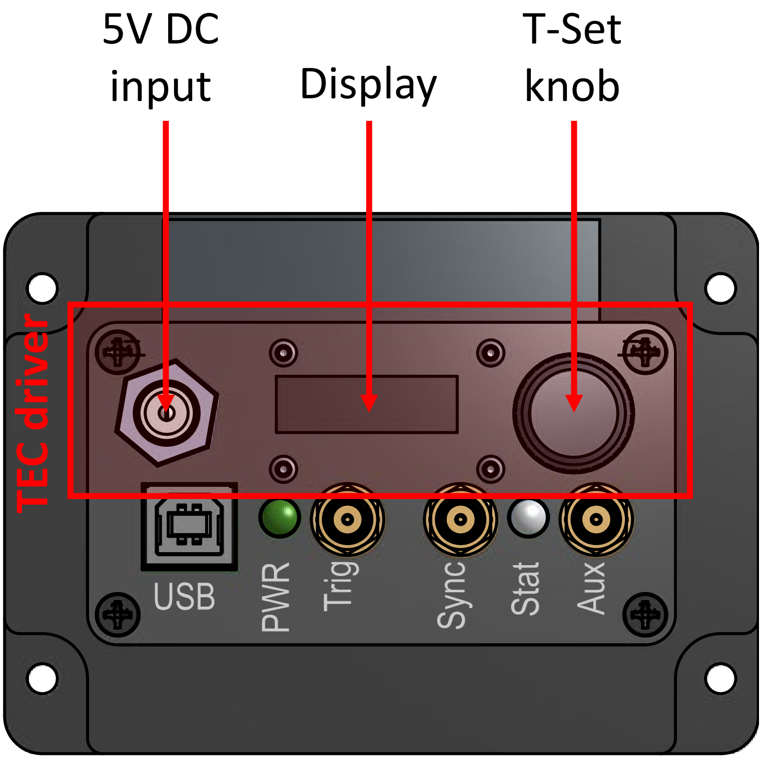


Figure 10 TEC driver interface.

Interface	Functions
5V DC input	The TEC driver is powered by an external 5V DC supply and the supply is delivered together with the camera.
Display	Information and settings of the TEC driver are displayed on a high-visibility OLED display
T-Set knob	Turn the T-Set knob to set the desired target temperature. Push the T-Set knob to turn the TEC driver on and off.

Table 4 TEC driver interface functions.

TEC display

When providing power to the TEC driver, it is initially in the off state as shown in Figure 11. The TEC displays the previously set target temperature. Turn the T-Set knob to change the target temperature.

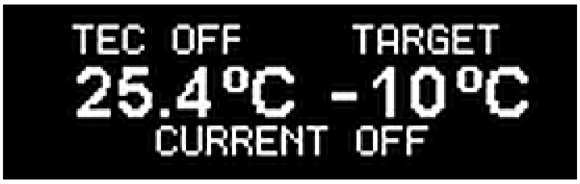


Figure 11 TEC display in the off state.

Press the T-Set knob to turn the TEC driver on. The display changes as shown in Figure 12 and indicates the sensor temperature, target temperature and TEC current. Press the T-Set knob again to turn the TEC driver off. The target temperature can be changed while the TEC driver is on.

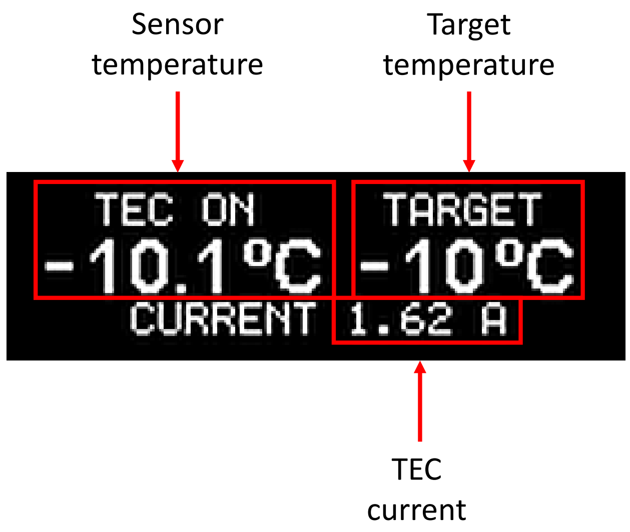


Figure 12 TEC display in the on state.

Mounting the camera for improved cooling

Cooling is improved by mounting the camera horizontally (see Figure 13).

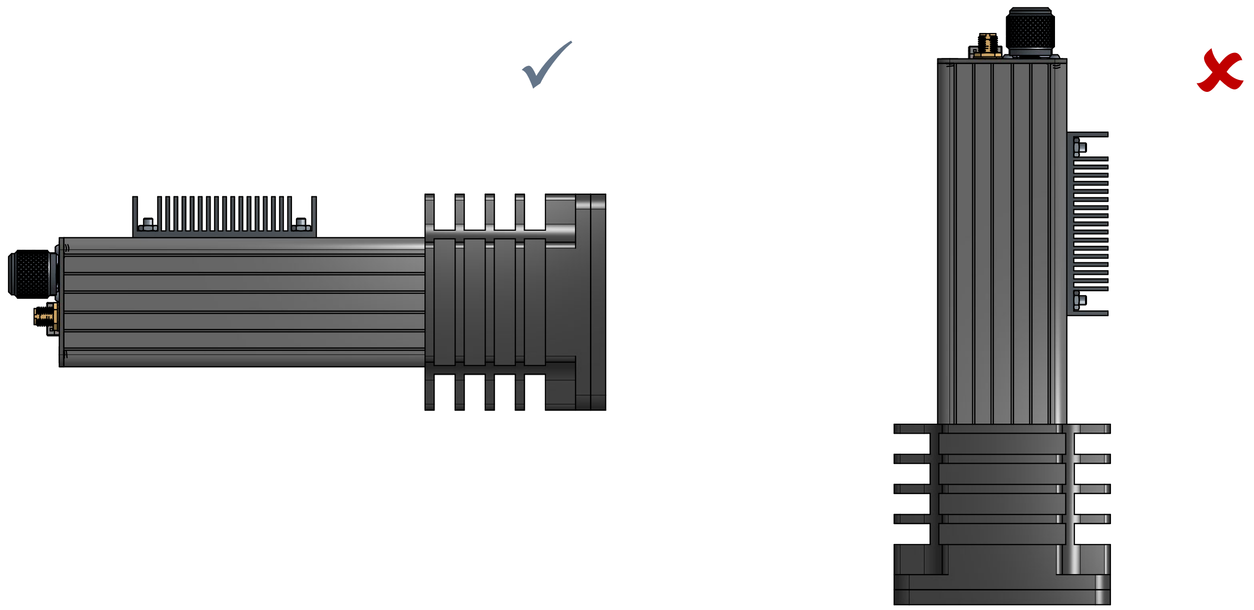


Figure 13 Mounting orientation.

TEC driver performance and stability

The camera was designed with passive cooling to reduce complexity. The camera was tested with an ambient temperature of 23 °C. The results are summarised in Table 5.

Characteristic	Value	Unit
Maximum current	1.9	A
Cooling	Passive	
Control method	PI	
Maximum settling time[5]	20	s
Response time to perturbations[6]	3	s
Temperature range[7]	-15 – 10	°C
Recommended temperature range	-8 – 10	°C
Temperature set point accuracy	±0.05	°C
Thermal equilibrium of camera[8]	15	minutes

Table 5 TEC driver performance.

For the best performance (averaging more than 1000 lines with a resulting dynamic range of more than 100,000) it is recommended to:

- Set the target temperature to at most -8 °C. For lower temperatures, an external fan is required to cool down the camera.
- Wait 15 minutes before performing a dark background measurement. This allows the camera to reach thermal equilibrium.
- Make sure that the TEC driver current is less than 1.8 A.
- Ensure a stable lab temperature.

⚠ These steps are not required if a dynamic range of 20,000 or less is sufficient with averaging of 500 lines or less.

[5] Time to settle within 0.1 °C from 25 °C to a target set point temperature of -10 °C after turning on the TEC driver.

[6] Changes in environmental temperature (e.g. sudden draft or aircon switching on).

[7] With external fan cooling.

[8] Camera heatsinks and housing reach constant temperature of 33 °C.

IMPORTANT NOTICE

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