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TOREO-P650

Hardware User Manual

Version 2

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TOREO-P650 – Hardware User Manual

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Subject to change without notice. Errors excepted.

Table of Contents

The information herein is given to describe certain components and shall not be considered as a guarantee of characteristics.

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Information

For further information on technology, delivery terms and conditions and prices please contact BECOM Systems
www.becom-group.com

Warning

Due to technical requirements components may contain dangerous substances.

1 General Information

This guide applies to the TOREO-P650 from BECOM Systems. Follow this guide chapter by chapter to set up and understand your product. If a section of this document only applies to certain camera parts, this is indicated at the beginning of the respective section.

1.1 Symbols Used

This guide makes use of a few symbols and conventions:

Warning

Indicates a situation which, if not avoided, could result in minor or moderate injury and/or property damage or damage to the device.

Caution

Indicates a situation which, if not avoided, may result in minor damage to the device, in malfunction of the device or in data loss.

Note

Notes provide information on special issues related to the device or provide information that will make operation of the device easier.

Procedures

A procedure always starts with a headline

1. The number indicates the step number of a certain procedure you are expected to follow.
   Steps are numbered sequentially.

This sign ➤ indicates an expected result of your action.

References

This symbol  indicates a cross reference to a different chapter of this manual or to an external document.

1.2 Certification

1.2.1 CE Declaration

BECOM Systems hereby declares that this TOREO-P650 product is in compliance with the essential requirements and other relevant provisions of Directive 2014/35/EU.

CE

1.2.2 Eye Safety

Illumination: LEDs	**Wavelength**	850nm (typ)	In accordance with EN62471:2008 resp. IEC62471:2006
	Output power	TBD	

1.3 Safety instructions

Important

This manual is part of the device and contains information and illustrations about the correct handling of the device and must be read before installation or use. Observe the operating instructions. Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or handling can affect the safety of people and machinery.

The installation and connection must comply with the applicable national and international standards. Responsibility lies with the person installing the unit.

1.4 Electrical connection

Note

The unit must be connected by a qualified electrician.
Device of protection class III (PC III).
The electric supply must only be made via PELV circuits.
The device must only be powered by a limited energy source (≦ 30V; ≦ 8A; ≦ 100VA).
Disconnect power before connecting the unit.

2 TOREO-P650 Components

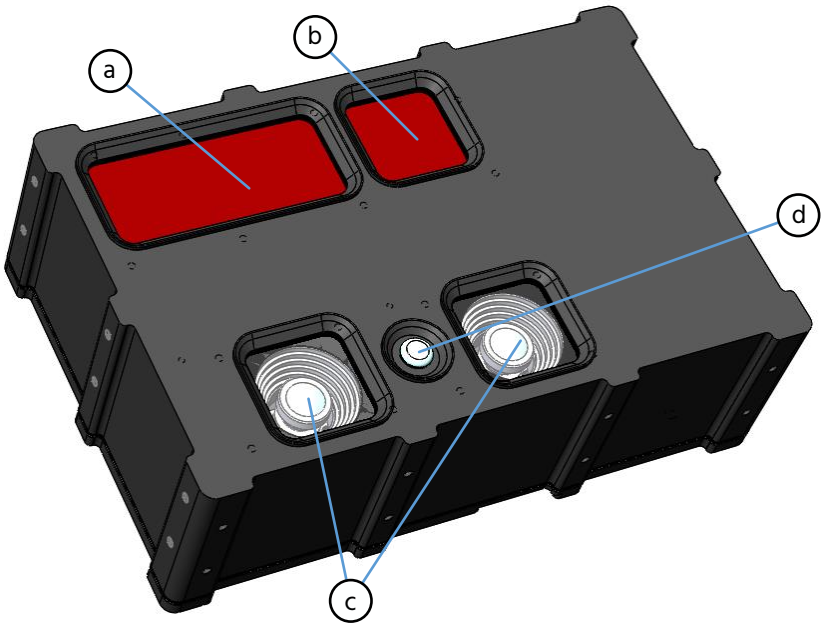

Figure 2-1 TOREO-P650 components (frontside)

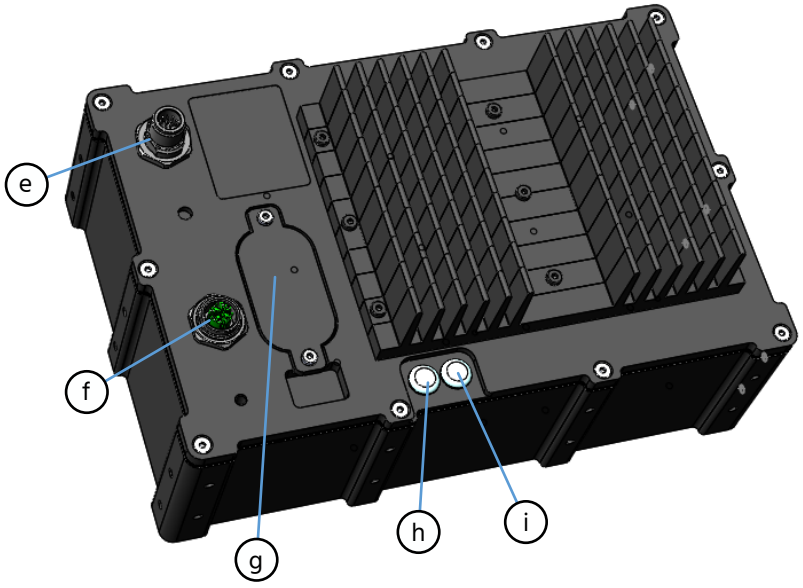

Figure 2-2 TOREO-P650 components (backside)

a. Illumination window

b. ToF sensor window

c. RGB sensors

d. Status LED

e. IP67 compliant M12 connector for power supply and I/Os

f. IP67 compliant M12 connector for gigabit Ethernet

g. Service opening

h. Ethernet activity LED

i. Ethernet link status LED

3 Mechanical Description

3.1 Dimensions

All dimensions are in mm, tolerance +/-0,2mm.

3.1.1 Front view

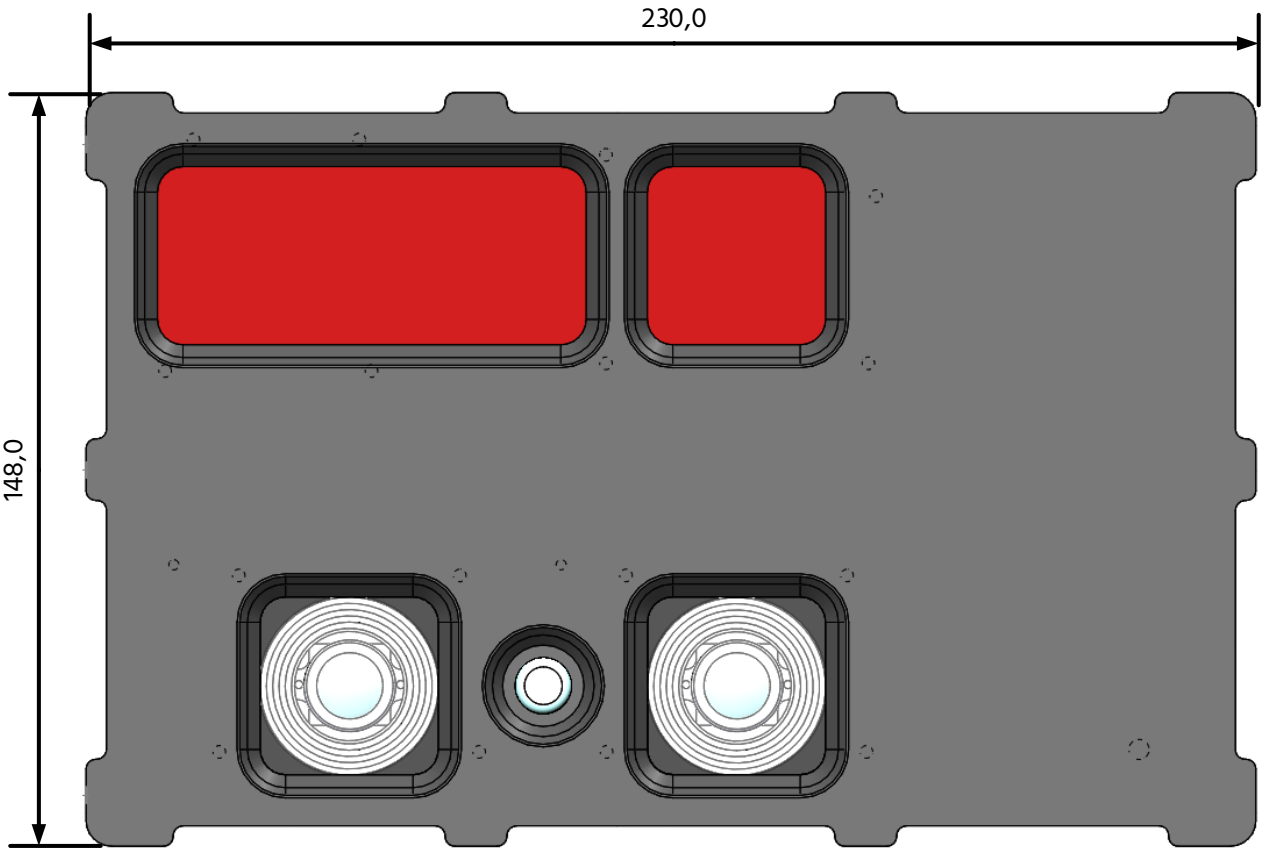

Figure 3-1: Front view dimensions

3.1.2 Long side view

Mounting hole size: M4

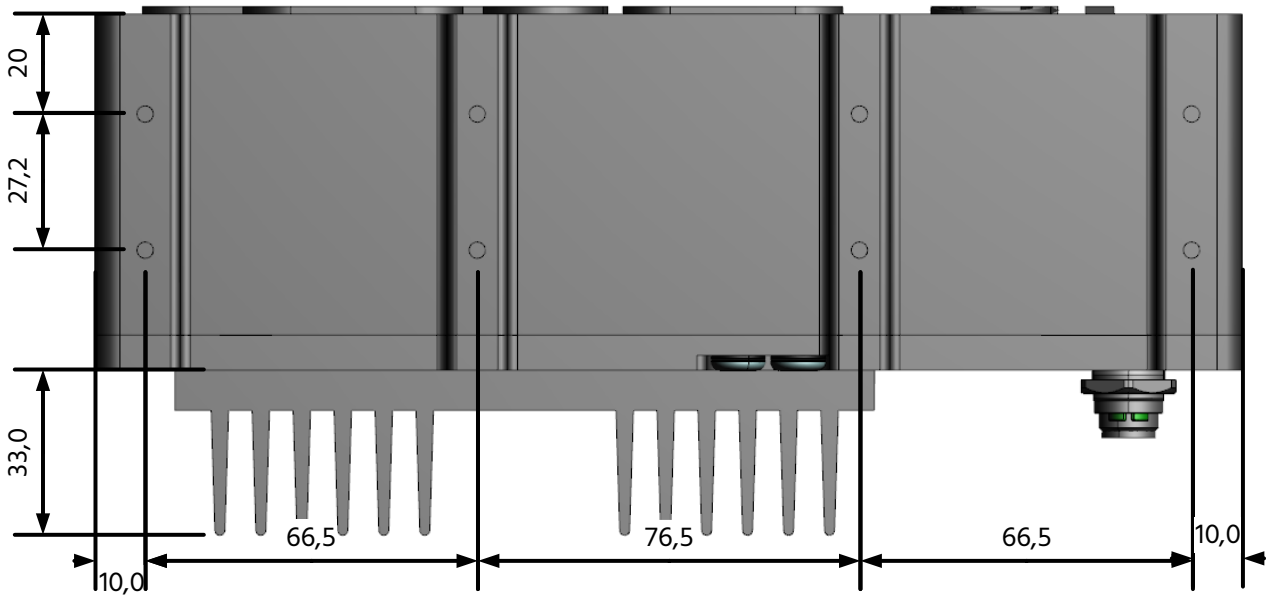

Figure 3-2: Long side view with mounting holes dimensions

3.1.3 Short side view

Mounting hole size: M4

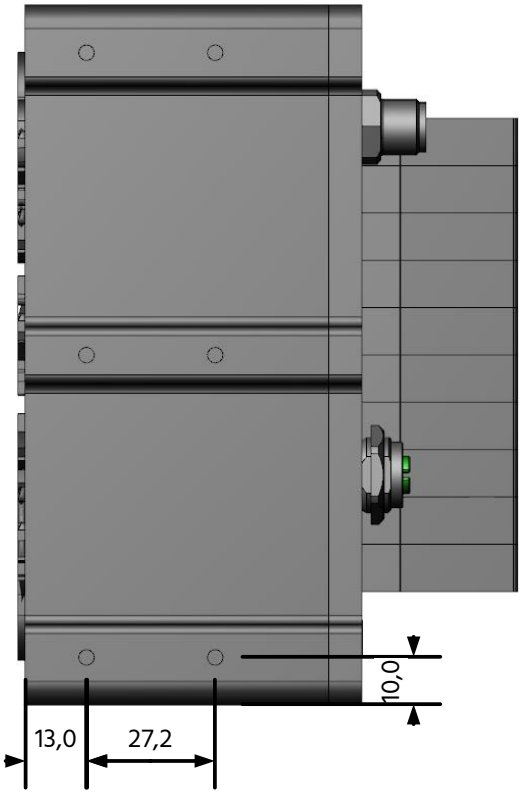

Figure 3-3: Short side view

3.1.4 Mount Spacing

Caution

Case may become hot!
The user is responsible to take care for an appropriate cooling.

To prevent the TOREO-P650 from overheating, it is recommended, to keep away nearby objects. This guarantees a constant airflow for proper cooling. This bounding box may be violated, when other cooling techniques are provided.

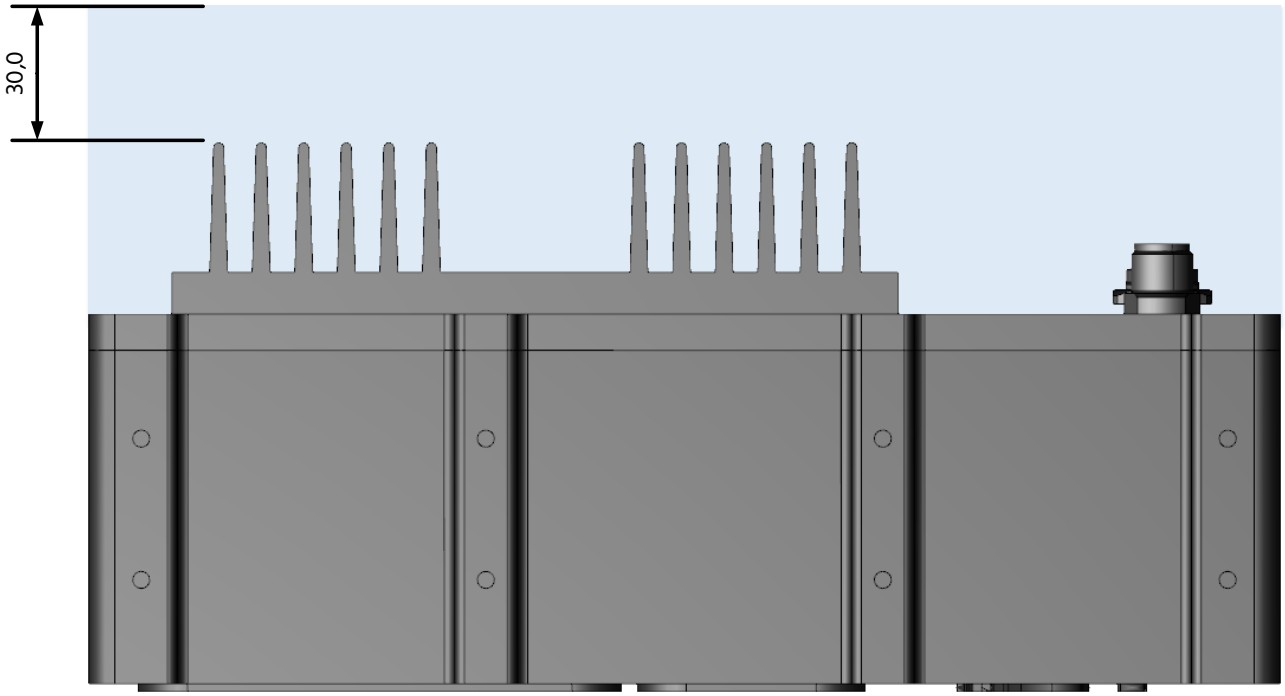

Figure 3-4: Bounding box

4 Interface Description

4.1 Signal naming

Signal names are usually written in capital letters. They are noted in positive logic (positive asserted). If the signal is negative asserted an "n" will be added as prefix to the signal name.

Type:

The type describes the electrical characteristics of the signal. The following types are available:

- I Input
- O Output
- DN Negative Differential I/O
- DP Positive Differential I/O
- P Power supply
- 3.3V TTL TTL compatible signal with 3.3V high level and 0V low level.
- 50V tolerant Accepts input voltage levels up to 50V (2.5V high voltage threshold)

4.2 Connector Description

The TOREO-P650 has two IP67 compliant connectors: An eight pole X-coded M12 connector used for gigabit ethernet communication, and a twelve pole M12 connector for power supply, and IOs.

Figure 4-1 M12 ethernet connector pinout

Pin No.	Name	Description
1	A -	Gigabit Ethernet Lane A negative
2	A +	Gigabit Ethernet Lane A positive
3	C -	Gigabit Ethernet Lane C negative
4	C +	Gigabit Ethernet Lane C positive
5	D -	Gigabit Ethernet Lane D negative
6	D +	Gigabit Ethernet Lane D positive

Pin No.	Name	Description
7	B -	Gigabit Ethernet Lane B negative
8	B +	Gigabit Ethernet Lane B positive

Table 4.1: M12 ethernet connector description

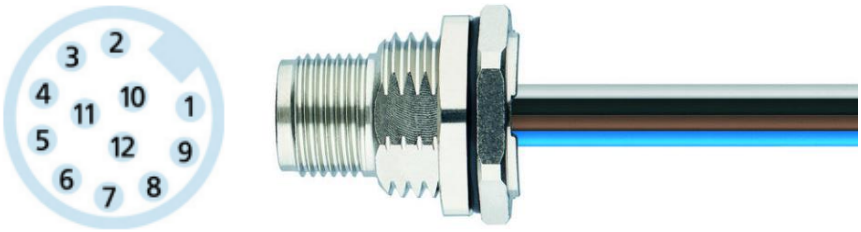

Figure 4-2 M12 power and IO connector Pinout

Pin No.	Name	IO-Type	Description
1	Vin	PWR	Positive Power Supply
2	Vin	PWR	Positive Power Supply
3	Vin	PWR	Positive Power Supply
4	TRIGGER	I	External trigger input / Recovery boot selection
5	nRESET	I	Camera reset input
6	OUT1	O	Solid state relay output 1
7	DGND	PWR	Reference ground for reset and trigger signals
8	OUT2	O	Solid state relay output 2
9	OUT_COM	O	Solid state relay common
10	GND	PWR	Power Ground
11	GND	PWR	Power Ground
12	GND	PWR	Power Ground

Table 4.2: M12 power and IO connector description

4.3 Digital Inputs and Outputs

4.3.1 Input Stage

The implementation of the input stages for both digital inputs (reset and trigger) are shown in Figure 4-3.

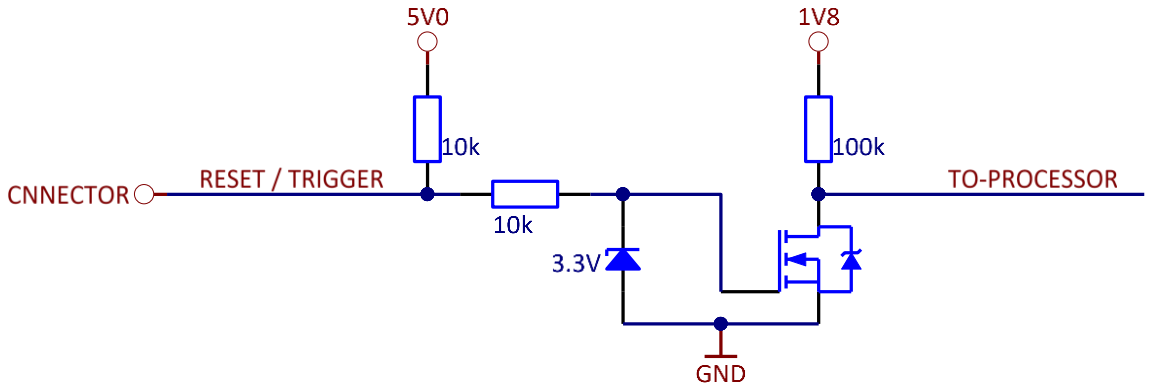

Figure 4-3 Input Stage

The internal 10 kΩ pull-up resistor allows to assert the signals by just shorting the pin to the corresponding reference ground. But also applying a voltage (limited to 36 V) to the pin is acceptable. The on/off threshold is 1.05 V.

4.3.2 Output Stage

The implementation of the output stages is shown in Figure 4-4.

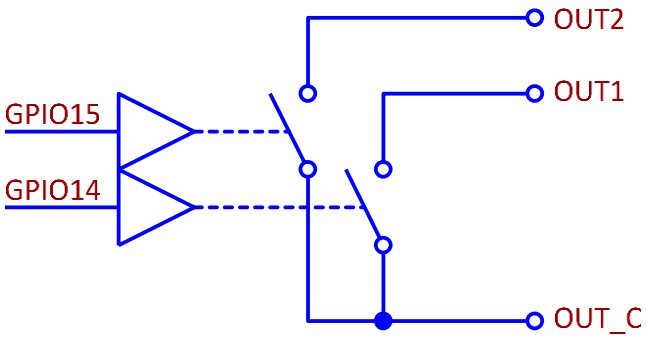

Figure 4-4 Output Stage

The GPIOs 14 and 15 are routed to a dual solid-state relay (SSR) with one common pin. All three pins are electrically isolated from the others on the M12 connector. The maximum current through each SSR is limited to 200 mA, the maximum allowed clamp voltage is 50 V.

4.4 Power supply

The operational voltage range is 20 V to 30 V. To prevent internal components from being damaged, the power supply protection circuit turns off the power supply, if it is not within the specified boundaries.

1) Note
Use inherently limited power sources only!

2) Note
The power protection circuit delays the camera supply by approx. 5 s after the external supply is turned on.

5 Electrical Specification

5.1 Absolute maximum rating

Stresses above the absolute maximum ratings listed in Table 5.1 may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameter	Conditions	Min	Max	Unit
V_{IN}	DC supply voltage		-40	40	V
V_{IRST}	Reset Input		-0.3	36	V
V_{ITRG}	Trigger Input		-0.3	36	V
T_A	Ambient temperature		-40	60	°C

Table 5.1: Absolute maximum ratings

5.2 Operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_{IN}	DC supply voltage		20	30	V
I_{IN_INT}	Input supply current during integration	Vin = 24 V		6.55	A
I_{IN_IDL}	Input supply between integration phases	Vin = 24 V		0.4	A
P_{INT}	Peak Input Power during integration	Vin = 24 V		157.2	W
V_{IH}	Reset and trigger input high level		1.2	30	V
V_{IL}	Reset and trigger input low level		1.2	30	V
I_{SR}	Solid state relay input current		0	200	mA
R_{SR_ON}	Solid state relay on resistance		10		Ω

Table 5.2: Operating conditions

6 Software

6.1 Firmware

For a description of the firmware related interfaces, protocol descriptions, register settings, etc. please refer to the Software User Manual.

6.2 Demo Application

For the first evaluation of the camera and to evaluate different settings and configurations a .NET demo application for Microsoft Windows is provided: BLT-ToF-Suite. The demo application can be downloaded from our support web site http://systems.becom-group.com/support.

6.3 Getting Started Software Development Example

To facilitate the integration of the Argos module in your own application a getting started example will be available on our download site. Please refer to our support site http://systems.becom-group.com/support.

7 Appendix

7.1 Operating Conditions

7.1.1 Input current

The average input current depends on the selected frame-rate (fps) and the integration time (t_{INT}). The following figure shows typical values. The values on the x axis shows the FITP which has been calculated with the following equation:

$$FITP = t_{INT}\ [ms] \cdot fps\ \left[\frac{1}{s}\right] \cdot 4$$

TBD

Figure 7-1: Input current @24V depending on frame-rate integration time product

7.1.2 Temperature at the case

The following figure shows the expected case temperature @ 25°C ambient temperature depending on the frame-rate integration time product (FITP). The FITP has been calculated as follow:

$$FITP = t_{INT}\ [ms] \cdot fps\ \left[\frac{1}{s}\right] \cdot 4$$

TBD

Figure 7-2: Expected cooling plate temperature depending on frame-rate integration time product

The temperature on the casing can be reduced by mounting an additional heat sink on the cooling plate.

Caution

The user is responsible to take care for an appropriate cooling if the Argos camera is mounted into a case.

Caution

Be careful to not stress the device beyond the limits, otherwise you may damage the device.

7.2 Optical Characteristics

Symbol	Parameter	Min	Typical	Max	Unit
#LDs	Amount of VCSEL laser diodes		16		
$\Lambda_{CENTROID}$	Centroid-Wavelength of Illumination		850		nm
$\Delta\lambda$	Spectral Bandwidth		30		nm
I_e	Radiant intensity		TBD		W/sr
FoV-ToF$_H$	Horizontal Field of View		60		Deg
FoV-ToF$_V$	Vertical Field of View		TBD		Deg
FoV-RGB$_H$	Horizontal Field of View		TBD		Deg
FoV-RGB$_V$	Vertical Field of View		TBD		Deg
RES$_{ToF}$	Spatial resolution ToF		640 x 480		Pixels
RES$_{RGB}$	Spatial resolution RGB		13M		Pixel

Table 7-1: Sensor Characteristics

7.3 Performance

7.3.1 Measurement Conditions

All the following measurements have been acquired at the following constant environmental conditions.

Parameter	Value
Temperature	23 °C
Humidity	35 %
Ambient light	500 Lux

Table 7-2: Environmental Specification

The camera parameters for the ToF sensor are as follow:

Parameter	Value
Modulation Frequency	60 MHz
Frame-rate	20 fps
Integration time	0,6ms
Target Reflectivity	24%

Table 7-3: Camera Parameters

7.3.2 Precision

The following graph shows the standard deviation over 100 samples.

TBD

Figure 7-3: Precision

7.3.3 Accuracy

The following figures has been determined by a frame-rate of 30fps and an integration time of 3,5ms with a reflectivity of 90%.

TBD

Figure 7-4: Accuracy

7.4 Sensor Location

Figure 7-5: Location of optical center of sensor

8 Support

8.1.1 General Support

General support for products can be found at BECOM Systems' support site

Support Link

http://systems.becom-group.com/support

8.1.2 Contact

BECOM Systems GmbH

Email: support.systems@becom-group.com

Tel. +43 1 9142091 0

9 Product History 10-0104

9.1 Ordering Guide

Article Number	Name	Description
150-3086-1	TOREO-P650	

Table 9-1: Ordering guide

9.2 Related Products

Article Number	Name	Description
150-3089-1	TOREO Tripod Mounting Kit	Mounting plate with 3/8”-16 UNC tripod mount
510-0104	Power Supply	24VDC-3.75A, 100-240VAC

Table 9-2: Related products

9.3 Version Information

9.3.1 TOREO-P650

Version	Type	Release date
V1.0.0	(X-Grade)	September 2021

Table 9-3: Overview TOREO-P650 product changes

Note

Please refer to our support site for additional information about product changes.

9.4 Anomalies

Applies to	Date	Description
V1.0.0		No anomalies reported yet.

Table 9-4: Product anomalies

10 Document Revision History

Version	Date	Document Revision
1	2021 09 02	First preliminary of the document
2	2021 10 01	“Related Product List” changed

Table 10-1: Revision history

A List of Figures and Tables

Figures

Tables