BLUETECHNIX
Embedding Ideas

Argos3D – P100

User Manual

Version 1.5

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Argos®[3D] – P100 – User Manual

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Applicable to: SDK release ≥ 2.2

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 Bluetechnix (http://www.bluetechnix.com).

Warning

Due to technical requirements components may contain dangerous substances.

1 General Information

This guide applies to all smart cameras based on the Argos® smart camera platform from Bluetechnix GmbH. Follow this guide chapter by chapter to set up and understand your product. If a section of this document only applies to certain camera models, 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 an 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 CE Declaration

Bluetechnix GmbH hereby declares that this Argo[3D]-P100 product is in compliance with the essential requirements and other relevant provisions of Directive 2004/108/EC.

(http://www.bluetechnix.com/goto/argos3d-p100)

CE

1.3 FCC Declaration

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

(http://www.bluetechnix.com/goto/argos3d-p100)

FC

FCC ID: SSZ-A3DP100150200
Trade Name: Bluetechnix GmbH
Model: Argos3D - P100

Classification of ITE (EN55022)

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

1.4 Eye Safety

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

2 Overview

2.1 In the box

- Argos[3D] - P100
- Micro-USB Cable
- 5V/3A power supply*
- Tripod
- Quick Start Guide

2.2 Interfaces & Connectors

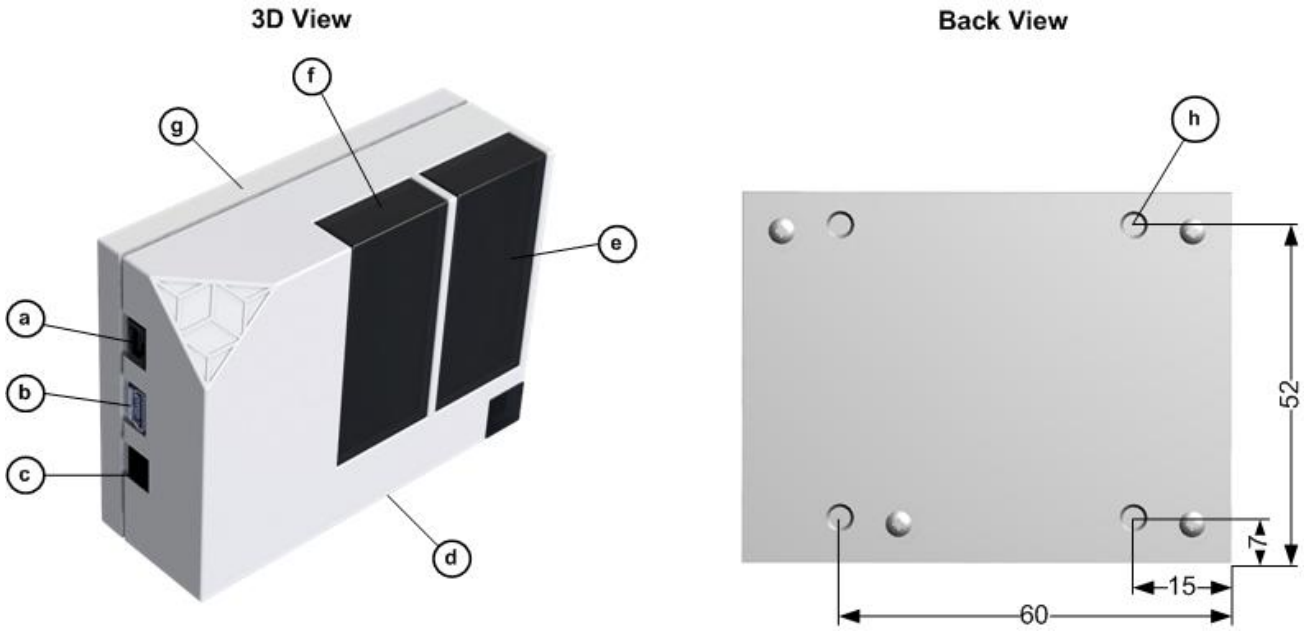

Figure 2-1: Argos[3D] – P100 views

a. Modulation Light Interface
b. USB Micro B Connector
c. Power Connector
d. Tripod Socket
e. Camera Window
f. IR LED Window
g. Cooling Plate
h. Mounting Holes (Use M4 screws for mounting the device to an additional heat sink)

* The socket-outlet shall be installed near the equipment and shall be easily accessible.

3 Quick Start

Your Argos[3D] - P100 comes with a printed Quick Start Guide. Please follow this guide for your first installation. The Quick Started Guide can also be found on our support page:

Quick Start

https://support.bluetechnix.at/wiki/Argos%C2%AE3D_P100_Camera

4 Hardware Installation

Caution

Cooling plate may become hot!

If the Argos[3D] - P100 is used without any additional heat sink attached to the cooling plate, the recommended minimum spacing between casing and surrounding is 10mm in each direction.

Note

By mounting the camera onto a heat sink, it's allowed to decrease the recommended minimum spacing. In this case the customer is responsible for an adequate cooling.

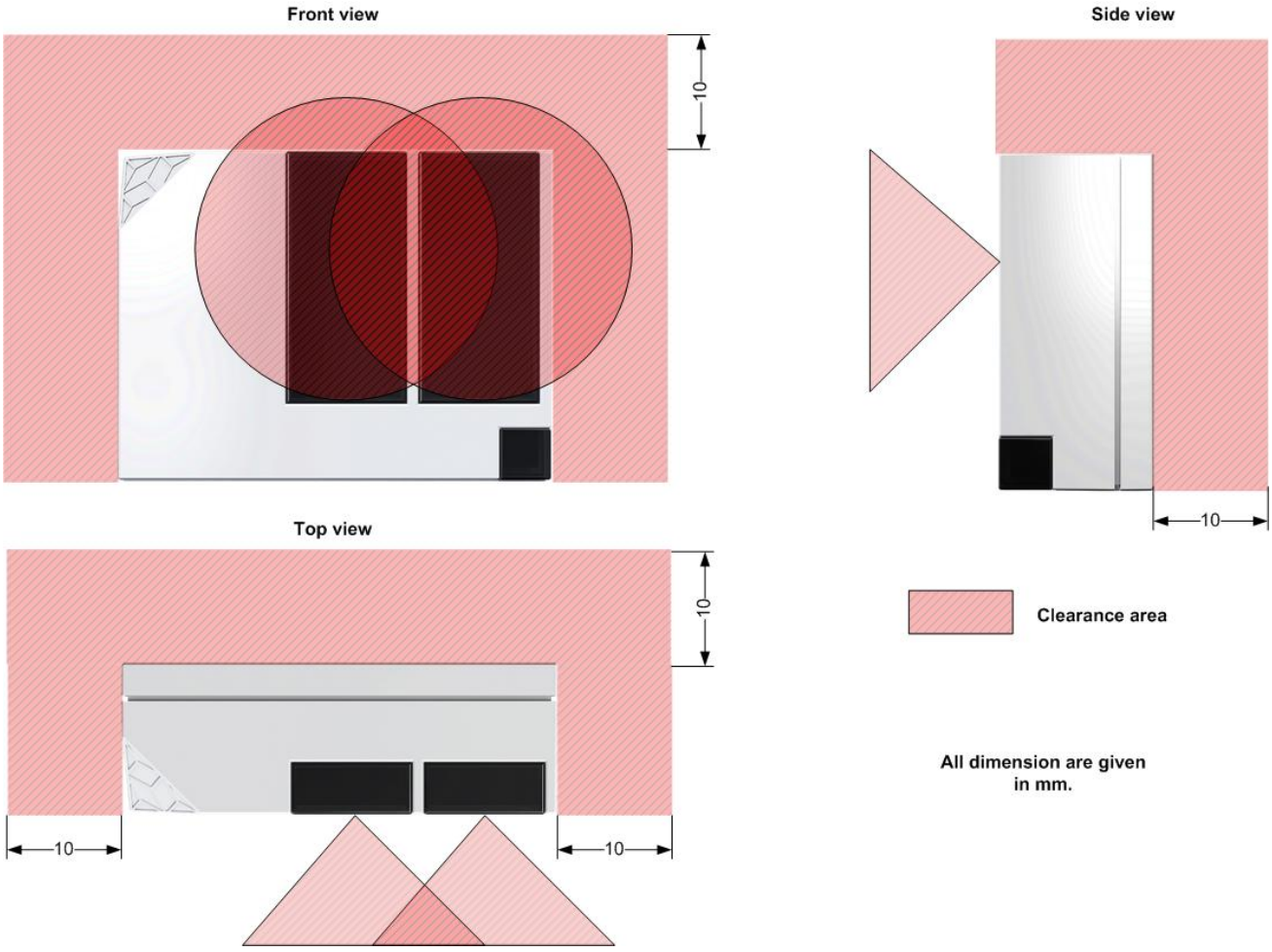

Figure 4-1: Recommended minimum spacing for air circulation

5 Software

5.1 Demo Application

For the first evaluation of the camera and to evaluate different settings and configurations a demo application is provided. The demo application can be downloaded from our support web site. Refer to the “Quick Start Guide” for more information and visit our support site.

Software and documentation

https://support.bluetechnix.at/wiki/Argos%C2%AE3D_P100_Camera

5.2 Software Development Kit (SDK)

To evaluate the camera and to integrate it in your own application a powerful software development kit is provided. The software development kit runs under Linux and Windows. Refer to our support site for downloading the SDK and for additional information and documentation.

Software and documentation

https://support.bluetechnix.at/wiki/Argos%C2%AE3D_P100_Camera

6 Camera Features

6.1 Camera Data Format

The camera provides an array of depth data in meters and an array of grayscale values for each pixel. In addition also a 3D XYZ point-cloud is provided. The following image shows the coordinate system from a cameras point of view:

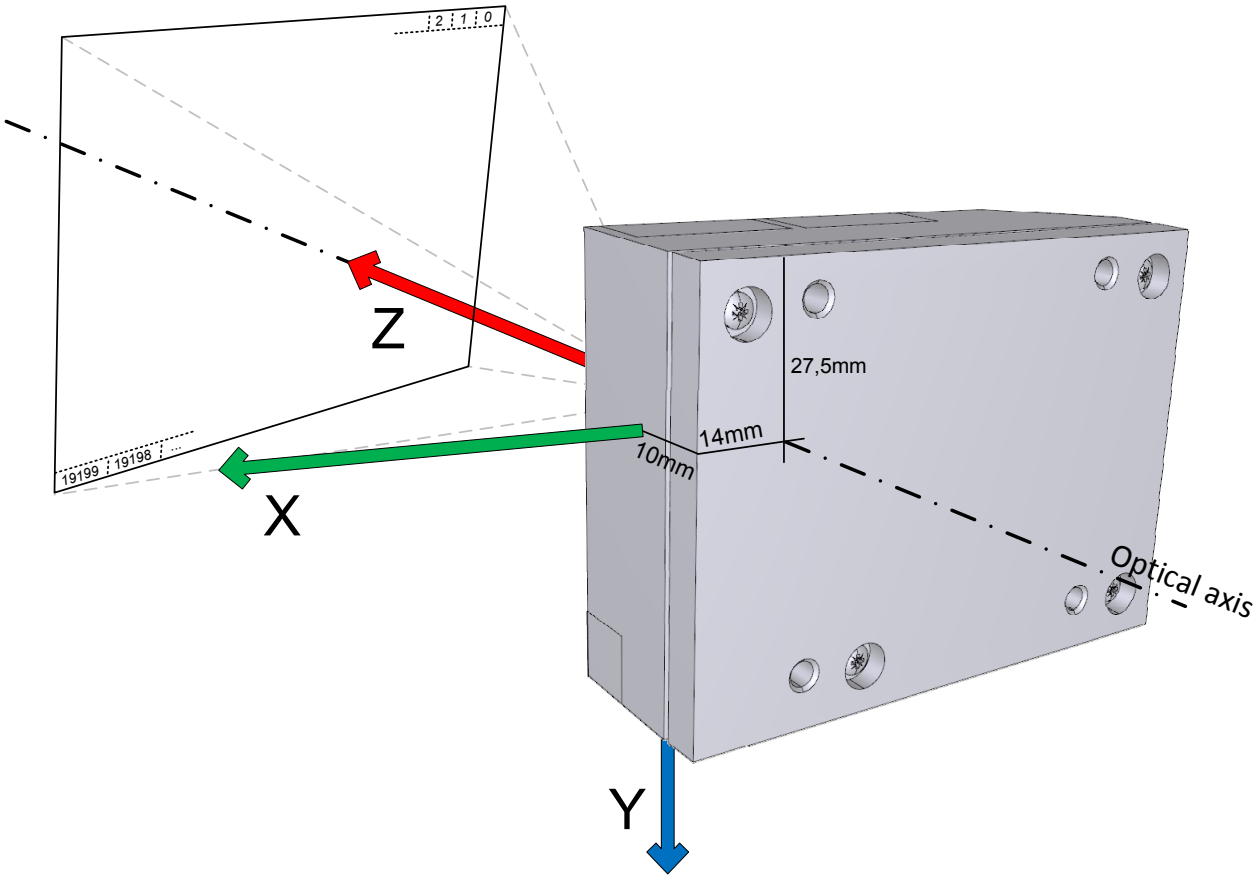

Figure 6-1: Argos-P100 Coordinate System

For information about the data and buffer format please refer to the software documentation site.

Support Link

https://support.bluetechnix.at/wiki/Argos%C2%AE3D_P100_Camera

6.2 Modulation Frequency

The modulation frequency is set to 30 MHz per default. Other modulation frequencies can be set using the SDK. Be aware that this changes also the ambiguity range of the camera. Refer to our software documentation to see how to change the modulation frequency.

Software and documentation

https://support.bluetechnix.at/wiki/Argos%C2%AE3D_P100_Camera

6.3 Ambiguity Range

The ambiguity range of the camera is per default approximately 5m. If you have objects which are more than 5 meters away from the camera, they will be shown as to be very close to the camera. If you need an enhancement of the ambiguity range without changing the modulation frequency please contact our support team at support@bluetechnix.com.

6.4 Frame-rate vs. Integration Time

The camera integration time is limited by default to 2.7ms. It can be enhanced by using the command *DisableIntegrationTimeCheck (*Refer to 7.7.1).

Caution

Be careful when disabling the integration time limit.
Higher integration times may require enhanced cooling. Be aware to provide enough cooling in that case! (Refer to 7.4.2).

6.5 External Trigger and Modulation Signal Interface

6.5.1 External Modulation Signal

The camera provides an external connector (refer to 7.5.1) where the modulation signal is provided as LVDS signal to synchronize with an external light source. This signal must be enabled by software before it can be used. Please refer to our software documentation (see 7.7.1) to see how to activate the external modulation signal.

6.5.2 External Hardware Trigger Signal

The camera provides an external connector (Refer to 7.5.1) where a hardware trigger can be applied. The hardware trigger must be enabled by software. Please refer to our software documentation (see 7.7.1) to see how to enable the hardware trigger. Refer to 7.5.1 for the signal description.

7 Appendix

7.1 Operating Conditions

Symbol	Parameter	Min	Typical	Max	Unit
V_{IN}	Input supply voltage	4.9	5.0	5.2	V
I_{IN}	Input current [1)]	TBD	900 [1)]	TBD	mA
T_{OP}	Operating Temperature	0		+55[2)]	°C
T_{STG}	Storage Temperature	-40		+125	°C
FITP[3)]	Frame-rate Integration Time Product			550	

Table 1: Operating Conditions

Note

Valid for a frame-rate of 40fps and an integration time of 1500µs. The input current depends on the applied frame-rate and integration time. Please refer to 7.1.1.

Note

The maximum operating temperature depends on the frame-rate and integration time. Refer to Figure 2-1 for recommended integration time to frame-rate combinations. The specified max. temperature is in combination with an external heat sink (which is not part of the original delivery box refer to chapter 2.1 above) dimension 61 x 58 x 36 (L x W x H) and specified heat conductance value of minimum. 2.2 K/W.

Warning

Furthermore, the operating temperature can be increased to max. +65°C with an extra-large sized heat sink. Precautions must be taken to protect the heat sink by touching because of exceeding heat sink temperature higher than +70°C (max. allowed temperature of external surfaces of equipment that may be touched).

Note

Refer to 7.4.2 for valid frame-rate to integration time combinations.

7.1.1 Input current

The input current depends on the selected frame-rate (fps) and the integration time (t_{INT}). The following figure shows typical values. The values for the x axis shows the Frame-rate Integration Time Product (FITP) which is calculated as follow:

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

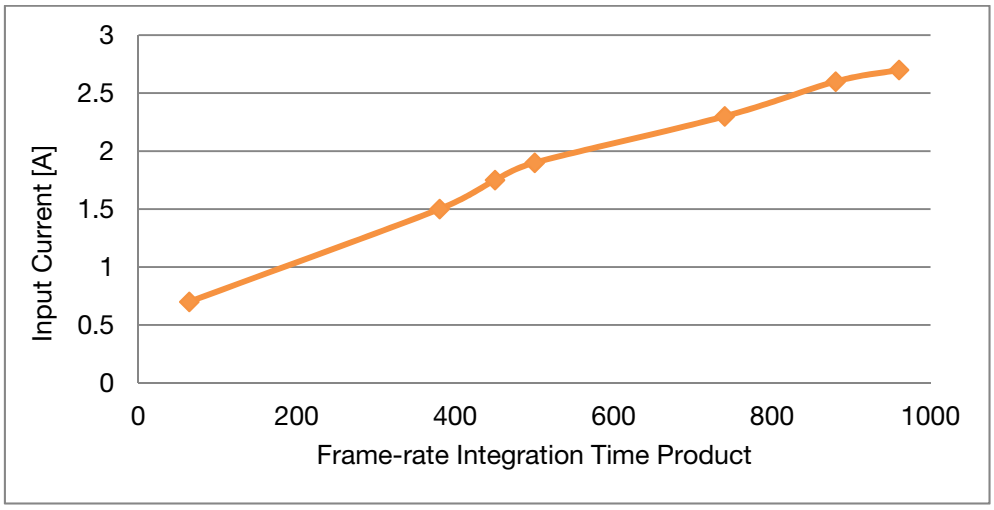

Figure 7-1: Input current depending on frame-rate integration time product

7.2 Optical Characteristics

Symbol	Parameter	Min	Typical	Max	Unit
#LEDs	Nr. of LEDs		2		
$\Lambda_{CENTROID}$	Centroid-Wavelength of Illumination		850		nm
$\Delta\lambda$	Spectral Bandwidth		30		nm
I_e	Radiant intensity				W/sr
FoV_H	Horizontal Field of View		90		Deg
FoV_V	Vertical Field of View		67,5		Deg

Table 2: Optical Characteristics

7.3 Measurement Specifications

7.3.1 Measurement Environmental Conditions

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

Parameter	Value
Temperature	23 °C
Humidity	35 %
Ambient light	2 kLux
Modulation Frequency	30 MHz
Frame-rate	15 fps

Table 3: Environmental Specification

7.3.2 Typical Reproducibility

The following table shows the standard deviation over 100 samples.

Measuring range [mm]	White target (90%) [mm]	Integration time [ms]	Gray target (18%) [mm]	Integration time [ms]
100			±1,5	0,5
300	±0,5	0,5	±1,5	0,5
500	±1	0,5	±3	0,5

Measuring range [mm]	White target (90%) [mm]	Integration time [ms]	Gray target (18%) [mm]	Integration time [ms]
700	±2	0,5	±3	1,0
900	±3,5	0,5	±7	1,0
1100	±2,5	1,0	±7	1,5
1300	±3,5	1,0	±11	1,5
1500	±5	1,0	±11	2,0
1700	±5	1,5	±12	5,0 [1)]
1900	±5	1,5	±14	5,0[1)]
2100	±6,5	1,5	±14	10,0[1)]
2300	±6,5	2,0	±15	10,0[1)]
2500	±9	2,0	±23	10,0[1)]
2700	±10	2,0	±31	10,0[1)]
2900	±14	2,0	±49	10,0[1)]

Table 4: Typical Reproducibility

1) Note
The integration time limit can be disabled with the source command *DisableIntegrationTimeCheck*. Otherwise the max integration time is limited to 2,7ms. Refer to our support internet site for information how to apply this command (see 7.7.1).

7.3.3 Typical Integration Time

Measuring range [mm]	Integration time for white target (90%) [ms]	Integration time for gray target (18%) [ms]
500	1,0	1,0
1000	1,0	1,5
1500	1,5	2,0
2000	1,5	3,0
2500	2,0	5,0 [1)]
3000	2,5	10,0 [1)]

Table 5: Typical Integration Time

7.3.4 Typical Range

Integration time [ms]	Minimum distance for white target (90%) [mm]	Maximum distance for white target (90%) [mm]	Minimum distance for gray target (18%) [mm]	Maximum distance for gray target (18%) [mm]
0,5	300	1500	100	500
1,0	300	2000	100	1000
1,5	300	2000	300	1500
2,0	500	3000 [1)]	300	2000
2,5	500	3000 [1)]	300	2000
3,0 [1)]	500	3000 [1)]	300	2000
5,0 [1)]	500	4000 [1)]	300	3000 [1)]
10,0 [1)]	500	6000 [1)]	500	3000 [1)]

Table 6: Typical Range

1) Note

The integration time limit can be disabled with the source command *DisableIntegrationTimeCheck*. Otherwise the max integration time is limited to 2,7ms. Refer to our support internet site for information how to apply this command (see 7.7.1).

7.3.5 Accuracy of Distances

The following table has been determined by calibrating the device at a distance of 1500mm and an integration time of 1,5ms. For applications with specific environment optimized calibration may improve the error results.

Measuring range [mm]	White target (90%) [mm]	Integration time [ms]	Gray target (18%) [mm]	Integration time [ms]
500	±5	1,0	±10	1,0
1000	±1	1,0	±1	1,5
1500	±1	1,5	±5	2,0
2000	±1	1,5	±10	3,0 [1)]
2500	±20	2,0	±25	5,0 [1)]
3000	±20	2,5	±80	10,0 [1)]

Table 7: Accuracy of Distances

1) Note

The integration time limit can be disabled with the source command *DisableIntegrationTimeCheck*. Otherwise the max integration time is limited to 2,7ms. Refer to our support internet site for information how to apply this command (see 7.7.1).

7.4 Environmental considerations

7.4.1 Case Temperature

The following figure shows the expected case temperature depending on the frame-rate and integration time product (FITP). The values for the x axis are calculated as follow:

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

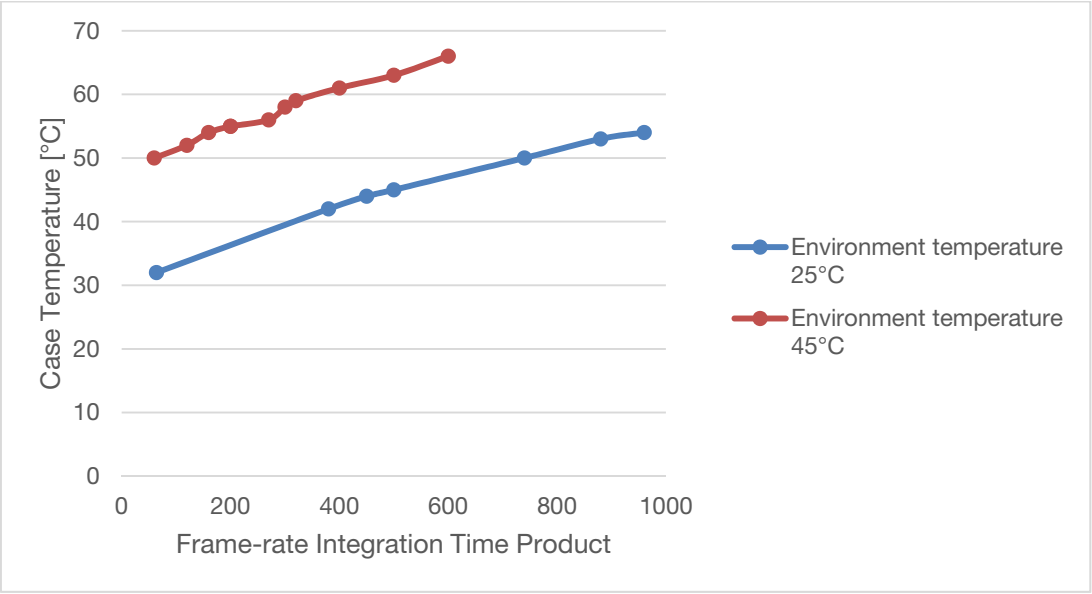

Figure 7-2: Expected case temperature depending on frame-rate integration time product (FITP)

7.4.2 Integration Time vs. Frame-rate

The following table shows recommended frame-rate integration time combinations depending on the environment temperature.

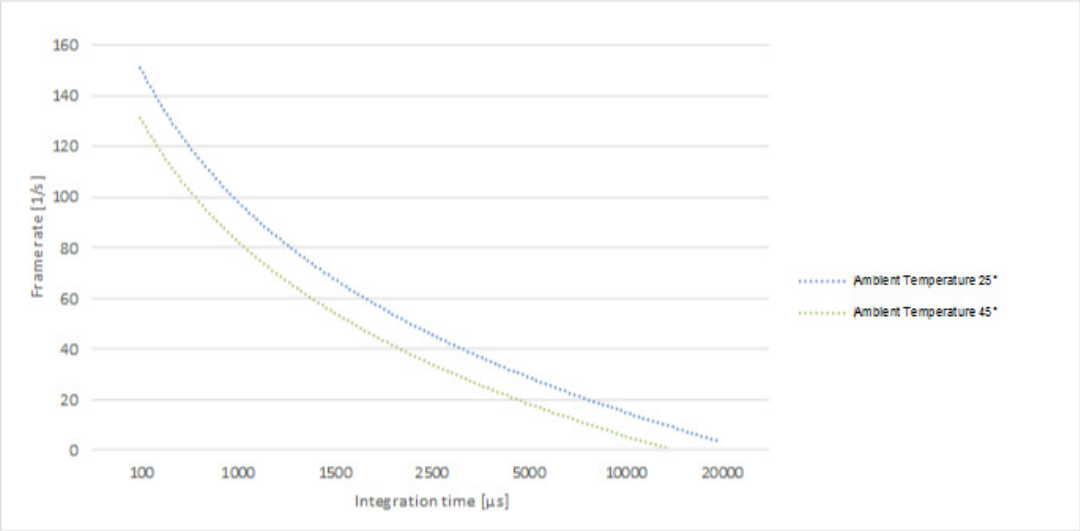

Figure 7-3: Integration Time vs Frame-rate

The limit of the frame-rate and integration time combinations is given by the Frame-rate Integration Time Product (FITP) which is calculated as follow: $FITP = t_{INT}\ [ms] \cdot fps\ \left[\frac{1}{s}\right] \cdot 4.$

The maximum possible FITP at 25°C for the Argos-P100 is 550!

Caution

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

7.5 Connector Description

7.5.1 Modulation Light Interface (a)

Mating Connector Type: **MQ172X-4SA-CV**

The Modulation Light Interface provides the modulation signal for an external illumination module (differential LVDS, 3V).

Caution

Overvoltage on the Modulation Light Interface will destroy the Argos[3D] - P100.

Pin No.	Signal Name	Power Domain	Type	Description
1	HARDWARE_TRIGGER [1)]	3V	I	Camera trigger input

Pin No.	Signal Name	Power Domain	Type	Description
2	EXT.MOD_N	3V	DP	Modulation signal output-
3	EXT.MOD_P	3V	DP	Modulation signal output+
4	SGND	-	PWR	Ground

Table 8: Modulation Light Interface

7.5.1.1 Timing diagram of the Hardware-Trigger signal

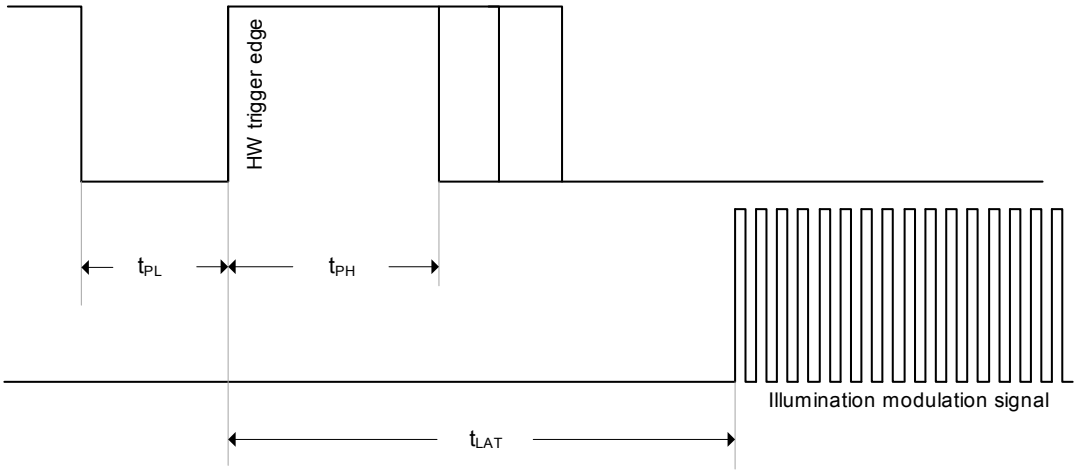

Figure 7-4: Timing diagram of the hardware trigger signal

Timing value	Description	Min	Typical	Max	Unit
t_{PL}	Pulse Low Time before Trigger	50			ns
t_{PH}	Pulse High Time	50			ns
t_{LAT}	Trigger Edge to Frame Capture Latency	TBD	60	TBD	µs

Table 9: Timing specification for the hardware trigger signal

7.5.2 USB Micro B Connector (b)

A standard micro USB B Connector is used for connecting the Argos[3D] - P100 to a host computer.

7.5.3 Power connector (c)

Connector Type: 2.1mm ID / 5.5mm OD

Polarity: 

Note

Only use the provided power supply.

The socket-outlet shall be installed near the equipment and shall be easily accessible

7.5.4 Tripod Socket (d)

A ¼ inch tripod socket can be placed on the bottom of the Argos[3D] - P100.

7.5.5 Mounting Holes (h)

There are four M4 mounting holes on the backside of the Argos[3D] - P100, for mounting the camera onto a heat sink.

7.6 Mechanical Outline

All dimensions are given in mm.

Figure 7-5: Mechanical Outline

7.7 Support

7.7.1 General Support

General support for products can be found at Bluetechnix' support site

Support Link

https://support.bluetechnix.at/wiki/Argos%C2%AE3D_P100_Camera

7.8 Software Packages

Software packages and software downloads are for registered customers only

Software Package

https://support.bluetechnix.at/wiki/Argos%C2%AE3D_P100_Camera

8 Product History

8.1 Version Information

8.1.1 Argos3D – P100

Version	Release date	Firmware Version
1.0.0	April 2013	26022013

Table 10: Overview Argos3D – P100 product changes

8.2 Anomalies

Applies to	Date	Description
Hardware V1.0 and Firmware Version 26022013	2013 02 14	Setting a register in the camera will have a latency of approximately 100ms to 200ms. During this time the camera stops capturing frames.
Hardware V1.0 and Firmware Version 26022013	2013 02 14	Reducing the frame-rate using the SetPhaseTime command may increase motion artifacts.

Table 11 – Product anomalies

8.3 Document Revision History

Version	Date	Document Revision
1	2013 02 14	First release V1.0 of the Document
2	2013 03 14	Temperature tables added; 3D coordinate figures added; current consumption added; Some minor changes;
3	2013 03 26	Added Class A note.
4	2013 04 19	Added storage temperature added; added optical characteristics; some changes to chapter “Frame-rate vs. Integration Time”; some typos corrected.
5	2013 05 23	Added safety information, thermal resistance, heat sink information

Table 12: Revision history

9 Index

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