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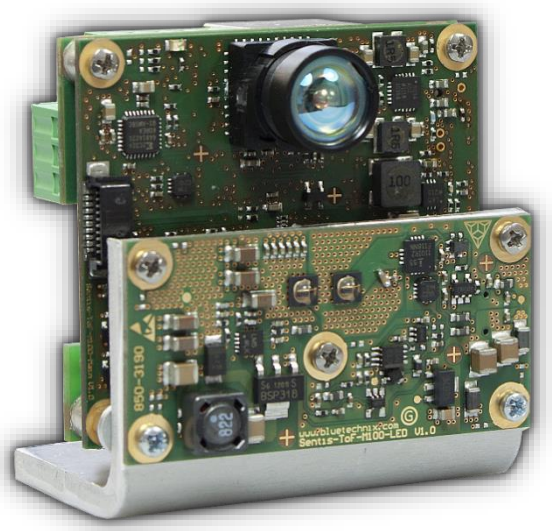
Sentis-ToF-M100

Hardware User Manual



Version 0.10

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Sentis-ToF-M100 – Hardware User Manual

Document No.: 900-308 / A

Publication date: January 26, 2015

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Table of Contents

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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 the Sentis-ToF-M100 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 parts, this is indicated at the beginning of the respective section.

The document applies to X-Grade product from V0.2.0.

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

X-Grade Version

X-Grade version of the products are not intended for sale and have therefore no certifications. The user is responsible for a correct usage in order with federal laws.

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.

Overview

1.5 Components

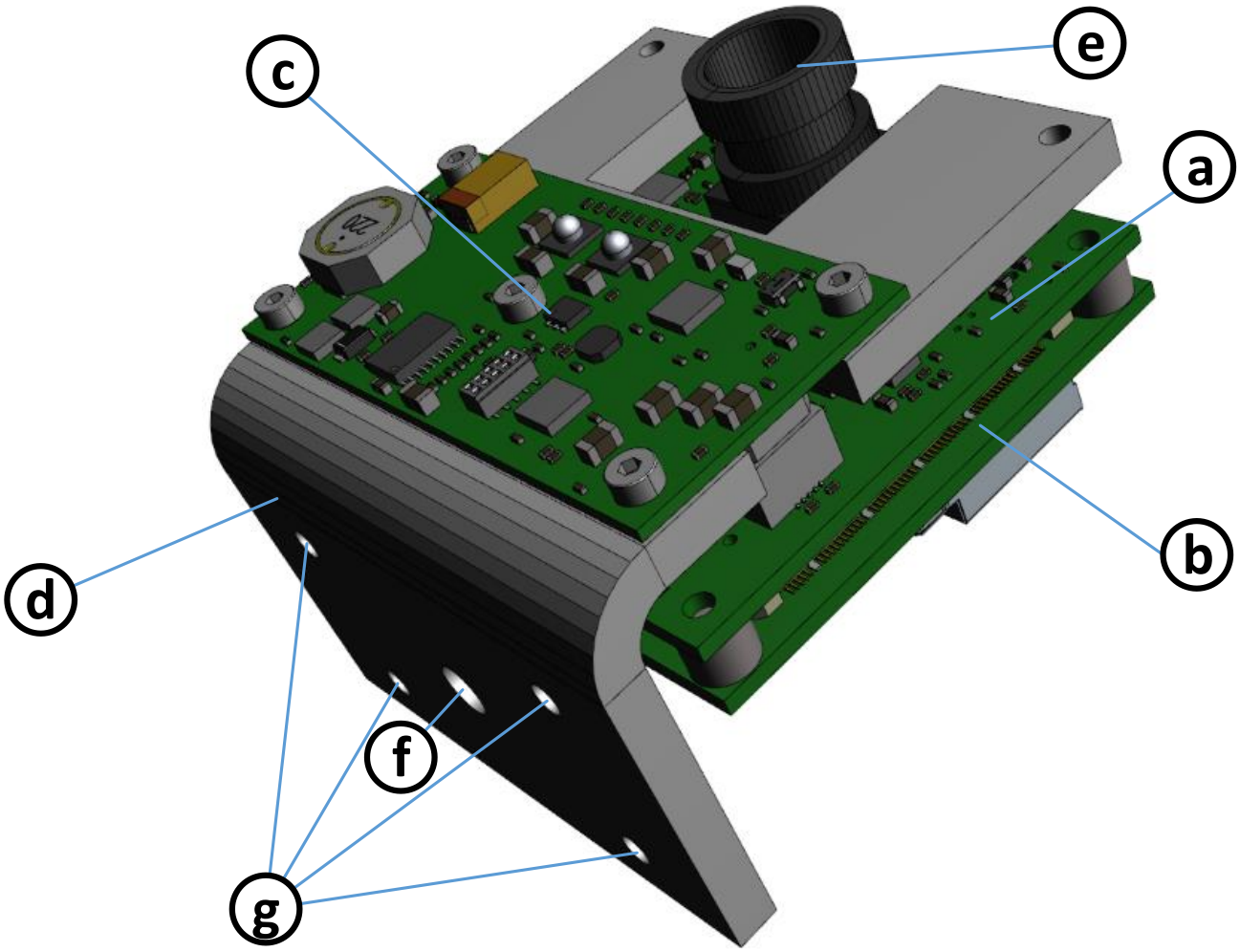

Figure 0-1: Sentis-ToF-M100 components

a. Main-Board
b. Interface-Board
c. LED-Board
d. Cooling Plate
e. Sensor Lens
f. Tripod Socket
g. Mounting Holes (Use M3 screws for mounting the device to an additional cooling plate)

1.6 Interfaces and Connectors

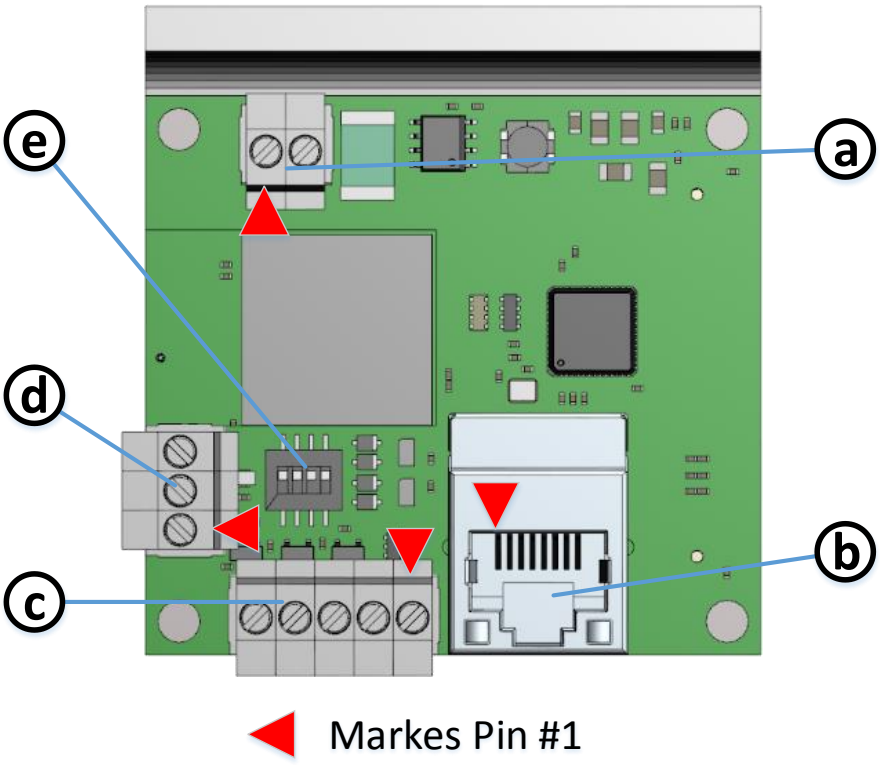

Figure 0-2: Sentis-ToF-M100 connectors and interfaces

a. Power Supply
b. Ethernet (RJ45) 10/100Base-T
c. GPIOs
d. RS232/485
e. Configuration DIP-Switch

2 Hardware Installation

2.1 Mounting

Caution

Cooling plate may become hot!

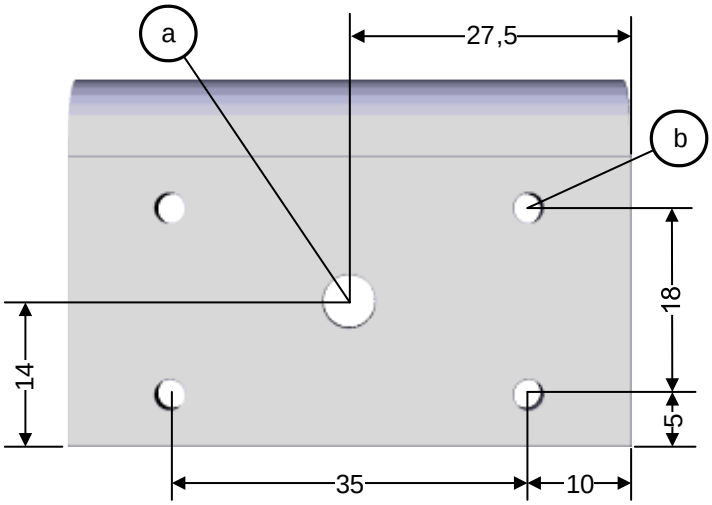

Figure 2-1: Mounting Holes for the Cooling Plate

2.1.1 Tripod Socket (a)

This is a ¼”-20 screw thread, which allows mounting the Sentis-ToF-M100 to any standard camera tripod.

2.1.2 Mounting Holes (b)

The cooling plate has four M3 screw threads that allows mounting the Sentis-ToF-M100 to a heat spreader.

2.1.3 Mount Spacing

If the Sentis[ToF] - M100 is used without any additional heat sink attached to the cooling plate, the recommended minimum spacing between hardware 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.

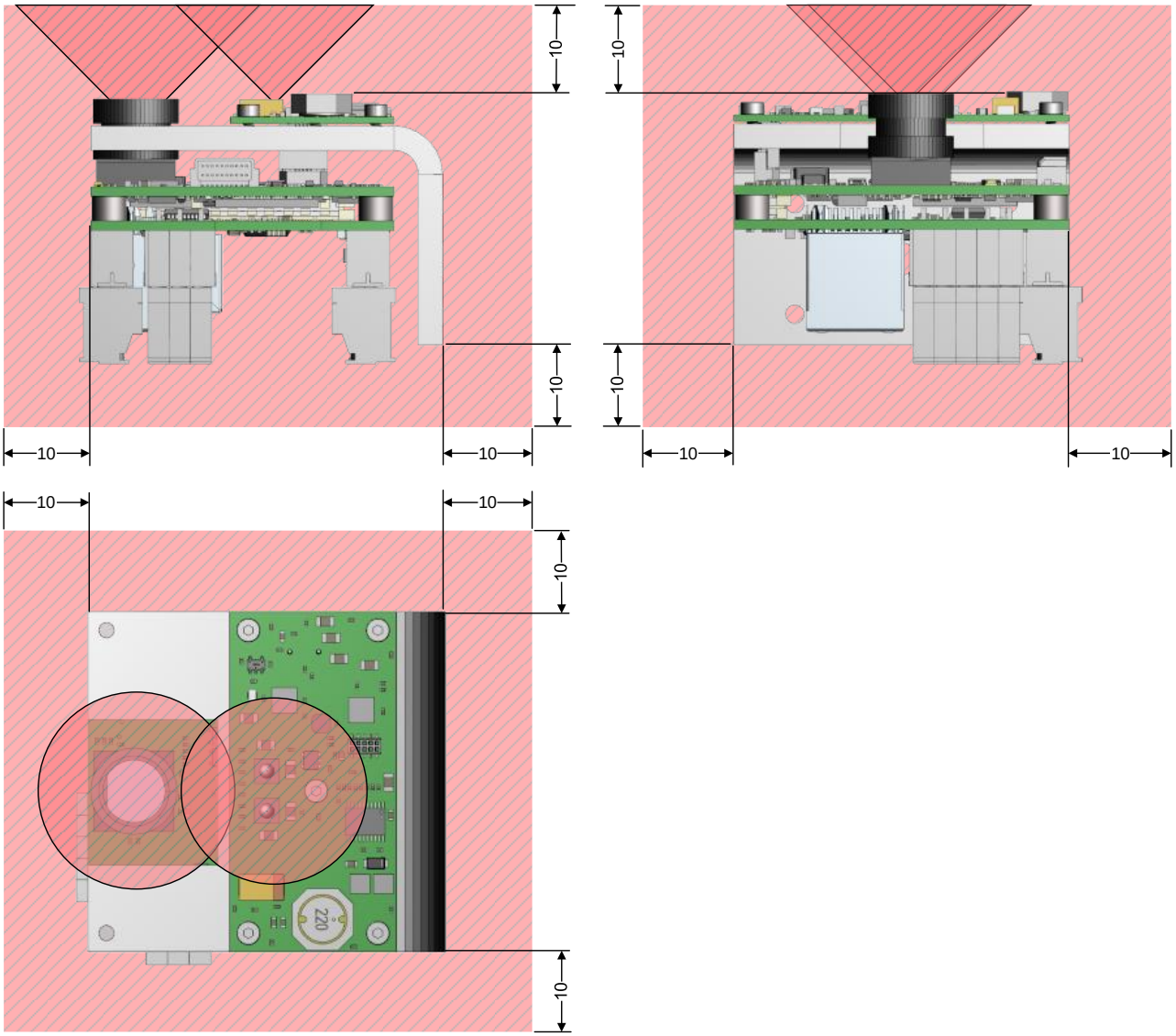

Figure 2-2: Recommended minimum spacing for air circulation

2.2 Processor cooling

In harsh environment or when the Sentis[ToF] - M100 is used within a case without appropriate cooling it may be necessary to provide a head sink for the processor. Therefore the Interface-Board has a cut-out for gluing an appropriate heat sink onto the processor as shown in the Figure 2-3.

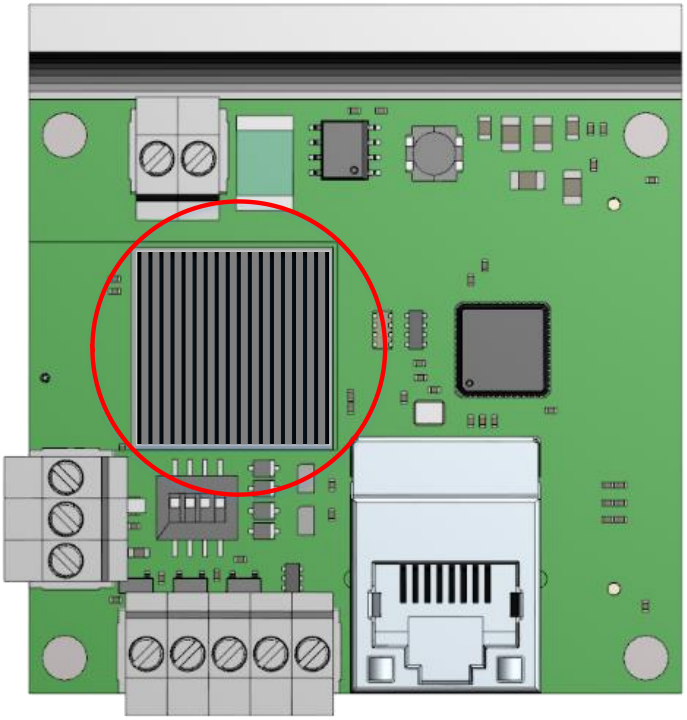

Figure 2-3: Processor with glued heat sink

2.3 Optical Isolation (a)

To prevent direct irradiation from the LED into the camera lens, an optical barrier has to be applied. The following pictures shows the maximum height of two types of such an isolation, dependent of the mounting position.

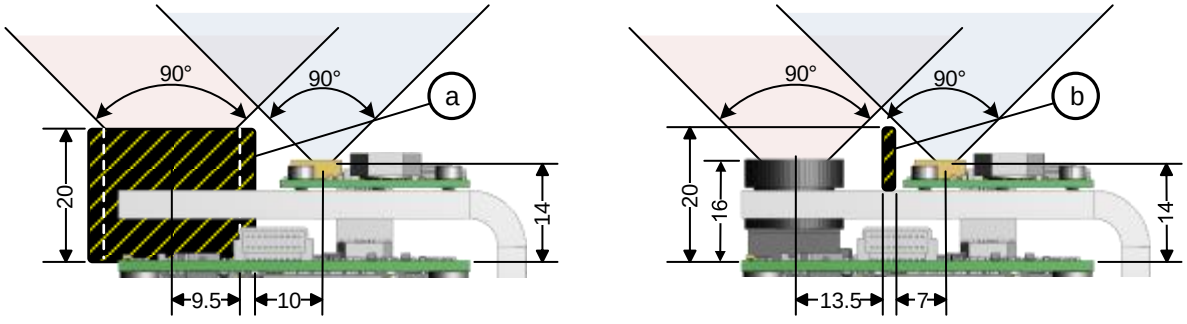

Figure 2-4: Optical Barrier

The isolation can be implemented as a straight barrier (Figure 2-4 b), or a surrounding rectangle barrier (Figure 2-4 a). Figure 2-5 shows a 3D model of both possibilities.

Caution

The optical barrier has to be completely non-transparent for infrared light. Be aware, that many black materials may be transparent for infrared light!

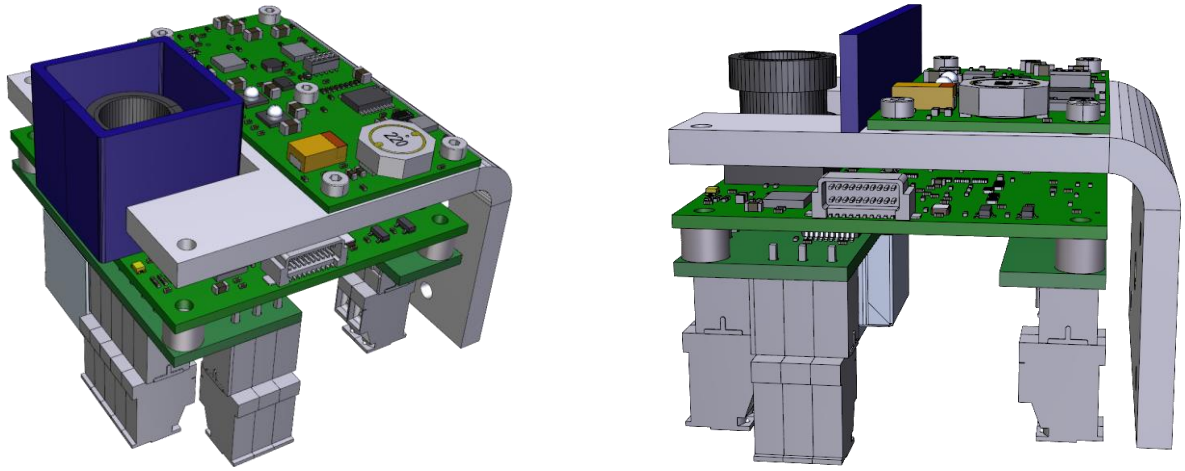

Figure 2-5: Optical Barriers (3D Model)

Figure 2-6 shows the recommended dimension of a surrounding optical isolator. On the PCB in the rectangle shown, there are no components placed, therefore the barrier can go down to the PCB.

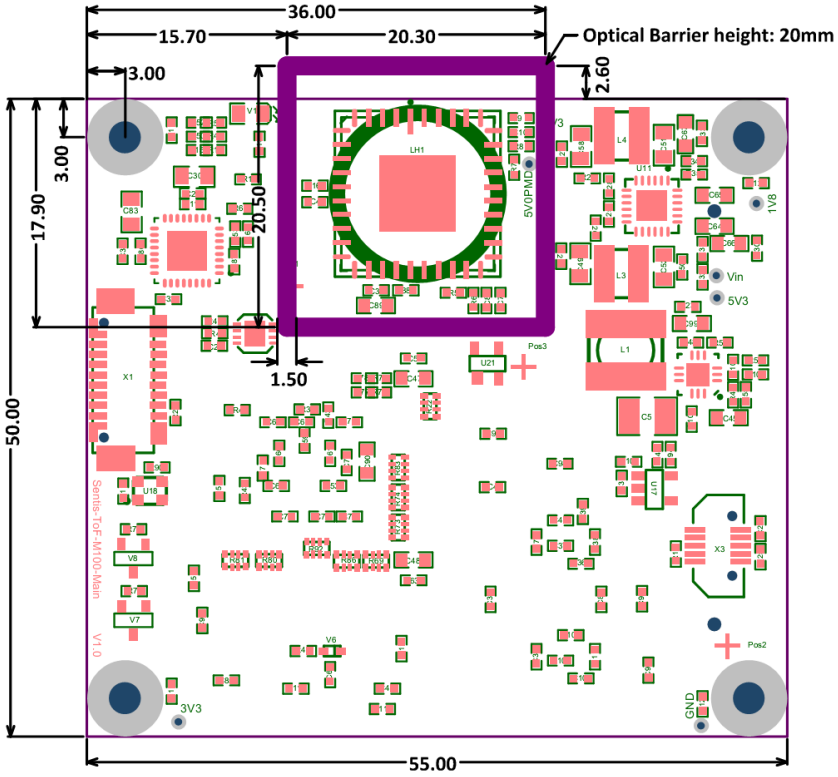

Figure 2-6: Mechanical dimensions for a sensor surrounding optical barrier

2.4 Lens and focus

The M12 lens is not glued onto the lens holder so you can use other lenses or change the focus. If you use other lenses they should be of type “fast lens”. Be aware that in that case you may have to recalibrate the sensor.

The sensor array is 7.2mm x 5.4mm.

2.5 External ToF-Flash

In case you want to use the external ToF-Flash or another external light source you can connect them to the Sentis-ToF-M100 by mounting an appropriate adapter board. Please refer to 3.4.1 to see how to mount the adapter board.

3 Board Description

3.1 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 Output
- DP Positive Differential Output
- P Power supply
- 3.3V TTL TTL compatible signal with 3.3V high level and 0V low level
- 5V tolerant Accepts 5V input level

3.2 Connector Numbering

All pins no. 1 of each connector are marked in the figures with a red arrow. The connector numbering always starts at this pin, continuing in this row, and going backwards at the opposite side.

3.3 Main-Board

The Main-Board can be used in connection with a customized daughter-board. In that case you have the possibility to develop a customized board with the interfaces of your need. The Sentis[ToF] - M100 Main-Board in that case must be connected with the daughter-board using the 100pol board to board connector.

3.3.1 Interface-Board Connector

Mating connector: FX10A-100P/10-SV from Hirose

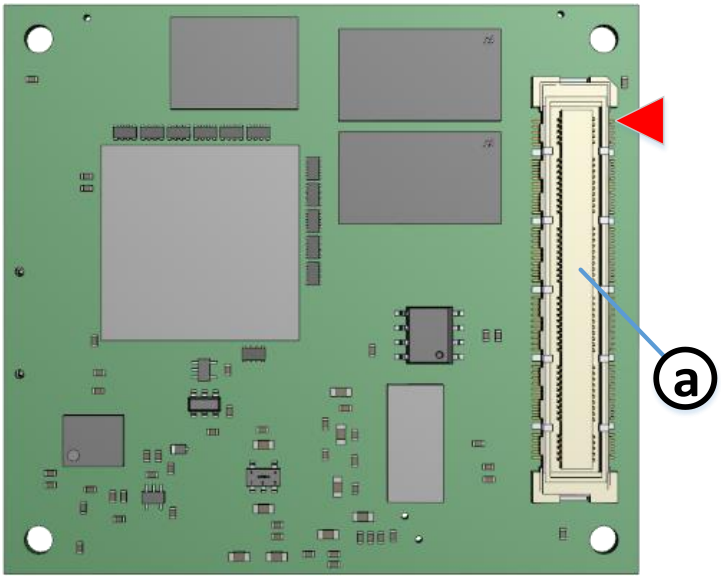

Figure 3-1: Main Board Interface Connector Location

Note

This mezzanine connectors are not reverse polarity protected.

No	Signal	Type	Description
1	GND	P	Power Ground
2	GND	P	Power Ground
3	GND	P	Power Ground
4	GND	P	Power Ground
5	GND	P	Power Ground
6	A1	O	Asynchronous Memory Address 1
7	A2	O	Asynchronous Memory Address 2
8	A3	O	Asynchronous Memory Address 3
9	A4	O	Asynchronous Memory Address 4
10	A5	O	Asynchronous Memory Address 5
11	A6	O	Asynchronous Memory Address 6
12	A7	O	Asynchronous Memory Address 7
13	A8	O	Asynchronous Memory Address 8
14	A9	O	Asynchronous Memory Address 9
15	A10	O	Asynchronous Memory Address 10
16	GND	P	Power Ground
17	nAMS1	O	Asynchronous Memory Select 1
18	nAMS2	O	Asynchronous Memory Select 2
19	GND	P	Power Ground
20	SPI.MOSI	O	Serial Peripheral Interface Data Output
21	SPI.MISO	I	Serial Peripheral Interface Data Input
22	SPI.SCLK	O	Serial Peripheral Interface Serial Clock
23	SPI.SS	O	Serial Peripheral Interface Slave Select
24	GND	P	Power Ground
25	I2C.A0	I	I²C Slave Address Selection 0
26	I2C.A1	I	I²C Slave Address Selection 1

No	Signal	Type	Description
27	PEN	I	Power Enable
28	I2C.SDA	IO	I²C Data IO
29	I2C.SCL	I	I²C Clock Input
30	BM1	I	Boot-Mode Selection
31	GND	P	Power Ground
32	PPI.CLK	I	Parallel Peripheral Interface Clock Input
33	PPI.SYNC1	IO	Parallel Peripheral Interface Frame Sync 1
34	PPI.SYNC2	IO	Parallel Peripheral Interface Frame Sync 2
35	PPI.D7	IO	Parallel Peripheral Interface Data 7
36	PPI.D6	IO	Parallel Peripheral Interface Data 6
37	PPI.D5	IO	Parallel Peripheral Interface Data 5
38	PPI.D4	IO	Parallel Peripheral Interface Data 4
39	PPI.D3	IO	Parallel Peripheral Interface Data 3
40	PPI.D2	IO	Parallel Peripheral Interface Data 2
41	PPI.D1	IO	Parallel Peripheral Interface Data 1
42	PPI.D0	IO	Parallel Peripheral Interface Data 0
43	IV2	I	Interface Board Version Control 2
44	IV1	I	Interface Board Version Control 1
45	IV0	I	Interface Board Version Control 0
46	3V3	P	3.3V Power output (max. 200mA)
47	3V3	P	3.3V Power output (max. 200mA)
48	GND	P	Power Ground
49	GND	P	Power Ground
50	GND	P	Power Ground
51	VIN	P	Main Supply Voltage (12V to 30V)
52	VIN	P	Main Supply Voltage (12V to 30V)
53	VIN	P	Main Supply Voltage (12V to 30V)
54	GND	P	Power Ground
55	GND	P	Power Ground
56	SSDI.MnS	I	Synchronous Serial Data Interface Master/Slave selection
57	SSDI.nSS	IO	Synchronous Serial Data Interface Slave Select
58	SSDI.DIN	I	Synchronous Serial Data Interface Data Input
59	SSDI.CLK	IO	Synchronous Serial Data Interface Clock
60	SSDI.DOUT0	O	Synchronous Serial Data Interface Data Output 0
61	SSDI.DOUT1	O	Synchronous Serial Data Interface data Output 1
62	nRST_OUT	O	Reset Output
63	nRST_IN	I	Reset Input
64	EXT.MOD_N	DN	Differential Modulation Signal for External Flash
65	EXT.MOD_P	DP	Differential Modulation Signal for External Flash
66	OWI	IO	One Wire Interface
67	PF40	IO	GPIO
68	PF39	IO	GPIO
69	PF38	IO	GPIO
70	PF37	IO	GPIO
71	PF36	IO	GPIO
72	PF11	IO	GPIO
73	UART.TX	O	UART transmit data
74	UART.RX	I	UART receive data
75	GND	P	Power Ground
76	nARE	O	Asynchronous Memory Read Enable
77	nAWE	O	Asynchronous Memory Write Enable

No	Signal	Type	Description
78	nAOE	O	Asynchronous Memory Output Enable
79	GND	P	Power Ground
80	D15	IO	Asynchronous Memory Data 15
81	D14	IO	Asynchronous Memory Data 14
82	D13	IO	Asynchronous Memory Data 13
83	D12	IO	Asynchronous Memory Data 12
84	D11	IO	Asynchronous Memory Data 11
85	D10	IO	Asynchronous Memory Data 10
86	D9	IO	Asynchronous Memory Data 9
87	D8	IO	Asynchronous Memory Data 8
88	D7	IO	Asynchronous Memory Data 7
89	D6	IO	Asynchronous Memory Data 6
90	D5	IO	Asynchronous Memory Data 5
91	D4	IO	Asynchronous Memory Data 4
92	D3	IO	Asynchronous Memory Data 3
93	D2	IO	Asynchronous Memory Data 2
94	D1	IO	Asynchronous Memory Data 1
95	D0	IO	Asynchronous Memory Data 0
96	VLED	P	LED Supply Voltage (12V to 30V)
97	VLED	P	LED Supply Voltage (12V to 30V)
98	VLED	P	LED Supply Voltage (12V to 30V)
99	VLED	P	LED Supply Voltage (12V to 30V)
100	VLED	P	LED Supply Voltage (12V to 30V)

Table 3-1: 100-pole Main Board Connector Description

3.3.2 Debug Interface

The debug interface is only needed if you want to develop your own application running on the Sentis[ToF] - M100. Please refer to 4.4.

The mating connector types are: IL-WX-20PB-VF-BE (straight)
IL-WX-20PB-HF-HD-S-BE (right angle)

Note

This connector is not reverse polarity protected.

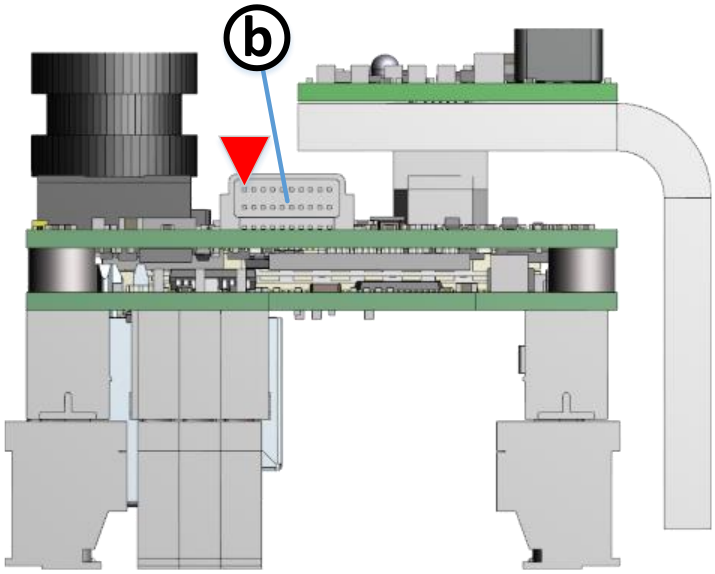

Figure 3-2: Debug Connector Location

No	Signal	Type	Description
1	SSDI.TCLK	IO	Synchronous Serial Data Interface Clock
2	SSDI.DTPRI	O	Synchronous Serial Data Interface Clock
3	SSDI.DRPRI	I	Synchronous Serial Data Interface Clock
4	SSDI.TFS	IO	Synchronous Serial Data Interface Frame Synchronization
5	JTAG.EMU	O	Blackfin JTAG Interface
6	JTAG.TMS	I	Blackfin JTAG Interface
7	JTAG.TCK	I	Blackfin JTAG Interface
8	JTAG.TRST	I	Blackfin JTAG Interface
9	JTAG.TDI	I	Blackfin JTAG Interface
10	JTAG.TDO	O	Blackfin JTAG Interface
11	3V3	P	3.3V Power Output (max. 50mA)
12	GND	P	Power Ground
13	Reserved		Leave this pin unconnected
14	Reserved		Leave this pin unconnected
15	GND	P	Power Ground
16	Reserved		Leave this pin unconnected
17	Reserved		Leave this pin unconnected
18	PF38	IO	Blackfin GPIO
19	PF39	IO	Blackfin GPIO
20	GND	P	Power Ground

Table 3-2: Debug Connector Interface Description

3.3.3 LED-Board Interface

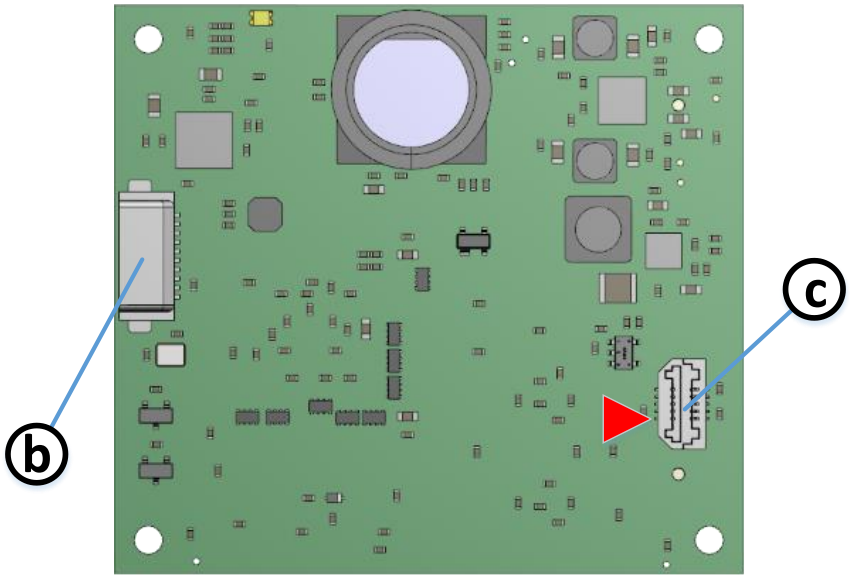

Figure 3-3: LED-Board Interface Connector Location

No	Signal	Type	Description
1	I2C.SDA	IO	I²C Data IO
2	I2C.SCL	O	I²C Clock Output
3	LED.EN0	O	LED Enable
4	LED.MOD_N	DN O	Negative LVDS Modulation Signal
5	LED.MOD_P	DP O	Positive LVDS Modulation Signal
6	VLED	P	LED Voltage Supply
7	VLED	P	LED Voltage Supply
8	GND	P	Power Ground
9	GND	P	Power Ground
10	3V3	P	3.3V Supply (max. 50mA)

Table 3-3: LED-Board Interface Description

3.4 ToF-Flash Adapter

3.4.1 Adapter Assembling

In case it would be necessary to use an external illumination to extend the range of the Sentis[ToF] - M100 you can use the modulation signal interface to synchronize this light source with the Sentis[ToF] - M100. There ate two Adapters, one with the connector facing inside the module, the other facing outside. Perform the following steps to modify the Sentis[ToF] - M100 for external illuminations.

1. Remove the two mounting screws at the board edge as shown in the picture below

2. Remove the LED-Board while leaving the Cooling Plate.

3. Attach the modulation light interface adapter

4. Screw the adapter with two of the LED-Board screws

3.4.2 Modulation Signal Interface

Once the adapter is mounted you can connect an external illumination module using the “Modulation Signal Interface” connector (a) on the Adapter.

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

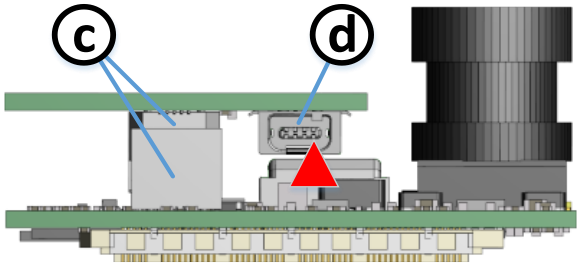

Figure 3-4: Modulation Light Connector Location

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

Caution

Overvoltage on the Modulation Light Interface will destroy the Sentis-ToF-M100.

Pin No.	Signal Name	Type	Description
1	DATA_EX[1)]	IO (3.3V TTL)	Data exchange signal
2	EXT.MOD_N	DN	Modulation signal output-
3	EXT.MOD_P	DP	Modulation signal output+
4	GND	P	Reference ground

Table 3-4: Modulation Signal Interface

1) Note
The usage of this pin may depend on the firmware version.

3.5 Interface-Board

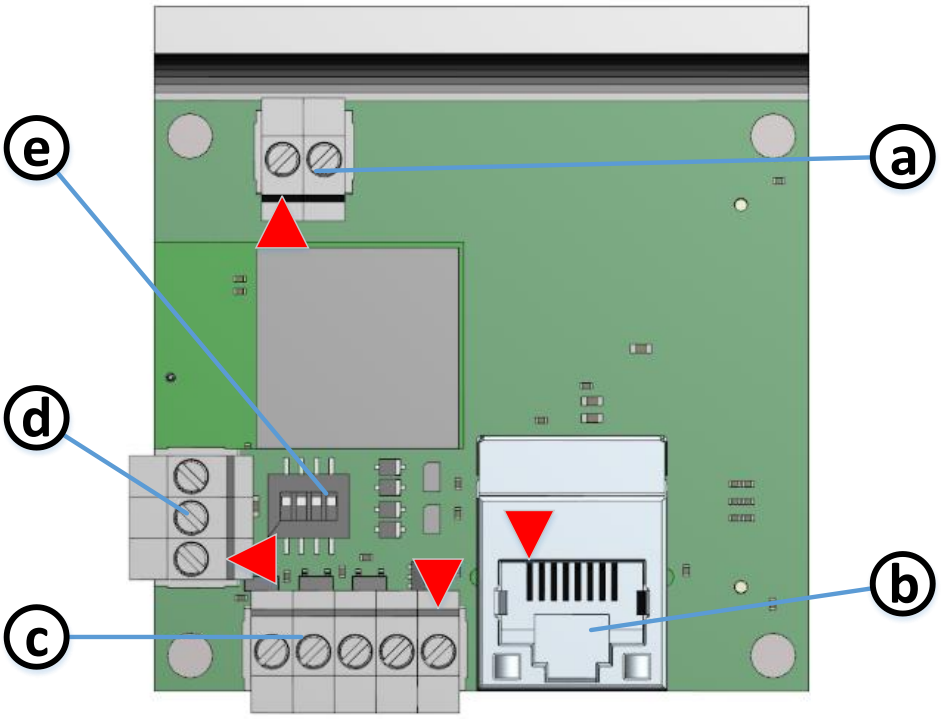

Figure 3-5: Interface Board Connector Location

3.5.1 Main-Board Connector

The Main-Board Connector is described in chapter 3.3.1.

3.5.2 Power Connector (a)

This 3.5mm terminal connector allows plugging a cable entry plug like: **691361100002** from Würth Elektronik. Compatible connectors from other manufacturers may be found as well.

Pin #1 is the positive supply voltage, pin #2 is power ground. This pins are protected against wrong polarity.

Voltage range: 12V to 30V.

Note
Use inherently limited power sources only!

3.5.3 Ethernet (b)

This is a standard straight RJ45 10/100 Base-T compatible Ethernet connector.

3.5.4 GPIO (c)

This 5 pole 3.5mm terminal connector allows plugging a cable entry plug like: **691361100005** from Würth Elektronik.

No.	BF561 Signal	Type	Description
1	GND	P	Signal Ground
2	PF38	I	General Purpose Input
3	PF37 PF47	I O (open drain)	General Purpose Input and Output
4	PF36 PF40	I O (open drain)	General Purpose Input and Output
5	PF11 PF39	I O (open drain)	General Purpose Input and Output

Table 3-5: GPIO Connector Description

For the software usage of this GPIOs please refer to the Software User Manual.

This GPIO pins have 12V tolerant inputs. If they are used as outputs, they must be externally pulled up to the IO-voltage.

Caution

Overvoltage on the GPIO input pins (12V max) may permanently damage the device.

3.5.5 RS232/RS485 (d)

This 3 pole 3.5mm terminal connector allows plugging a cable entry plug like: **691361100003** from Würth Elektronik.

No.	Signal	Type	Description
1	GND	P	Signal Ground
2	RS232 RxD[1)] RS485 A/Y	IO DN	RS232 Receive Data RS485 Negative Differential Data
3	RS232 TxD[1)] RS485 B/Z	IO DP	RS232 Transmit Data RS485 Positive Differential Data

Table 3-6: GPIO Connector Description

1) Note
The Interface-Mode can be selected with the DIP-Switch 1 (see table below).

Both interfaces are running in half duplex mode only.

3.5.6 DIP-Switch (e)

The DIP-Switch allows configuring the RS232/RS485 transceiver. The following table shows the functionality of each switch.

No.	Name	Description
1	Boot Mode	ON: Boot from 8-bit/16-bit flash OFF: Boot from SPI serial EEPROM
2	RS485 Enable	ON: Transceiver works in RS485 mode OFF: Transceiver works in RS232 mode
3	NU	Not Used
4	RS485 Termination	ON: Enables the 120Ω RS485 termination resistor OFF: No termination resistor is active

Table 3-7: DIP-Switch Description

Note
Make sure that the termination resistor is always disabled, if the driver runs in RS232 mode.

4 Software

4.1 Firmware

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

4.2 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/Sentis-ToF-M100_Camera

4.3 Getting Started Software Development Example

To facilitate the integration of the Sentis module in your own application a getting started example will be available on our download site. Please refer to our support site.

Software and documentation

https://support.bluetechnix.at/wiki/Sentis-ToF-M100_Camera

4.4 Camera Firmware Development KITs

The camera offers the possibility to develop your own firmware or to bring your application on the Sentis-ToF-M100. Using the dual-core processor ADSP-BF561 from Analog Devices Inc., one core is reserved for the calculation of the depth data, the other one can be used by the customers for their own applications.

Two different types of packages will be available for developing applications for the Sentis-ToF-M100.

4.4.1 VDSP++ Development Package

VDSP++ is an Integrated Devlopment Environment (IDE) provided by Analog Devices Inc. for the Blackfin processors. Bluetechnix provides a VDSP++ project where the user can put his own application code.

Refer to our support site for more information.

Software and documentation

https://support.bluetechnix.at/wiki/Sentis-ToF-M100_Camera

4.4.2 µCLinux Development Package

Bluetechnix provides a µCLinux Board Support Package (BSP) for the Sentis-ToF-M100 which can be used by delevopers to delevop there own Linux based applications which directly runs on the Sentis-ToF-M100.

Refer to our support site for more information.

Software and documentation

https://support.bluetechnix.at/wiki/Sentis-ToF-M100_Camera

5 Appendix

5.1 Operating Conditions

Symbol	Parameter	Min	Typical	Max	Unit
V_{IN}	Input supply voltage	18	24	30	V
I_{IN}	Input current [1)]	TBD	TBD [1)]	TBD	mA
	Input current without Interface-Board [1)]	TBD	TBD	TBD	mA
	Input current (Mainboard only) [3)]	TBD	TBD	TBD	mA
T	Operating Temperature [2)]	TBD		TBD[2)]	°C
T	Storage Temperature	-40		+125	°C
FITP[4)]	Frame-rate Integration Time Product			TBD	
A_{OUT}	Maximum current on open drain output			50	mA

Table 5-1: Operating Conditions

1) 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 5.1.1.

2) Note

The maximum operating temperature depends on the frame-rate and integration time. Refer to Figure 0-1 for recommended integration time to frame-rate combinations.

3) Note

The typical value is measured with both BF561 cores active and medium CPU load.

4) Note

Refer to 0 for valid frame-rate to integration time combinations.

5.1.1 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 FITP which has been calculated with the following equation:

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

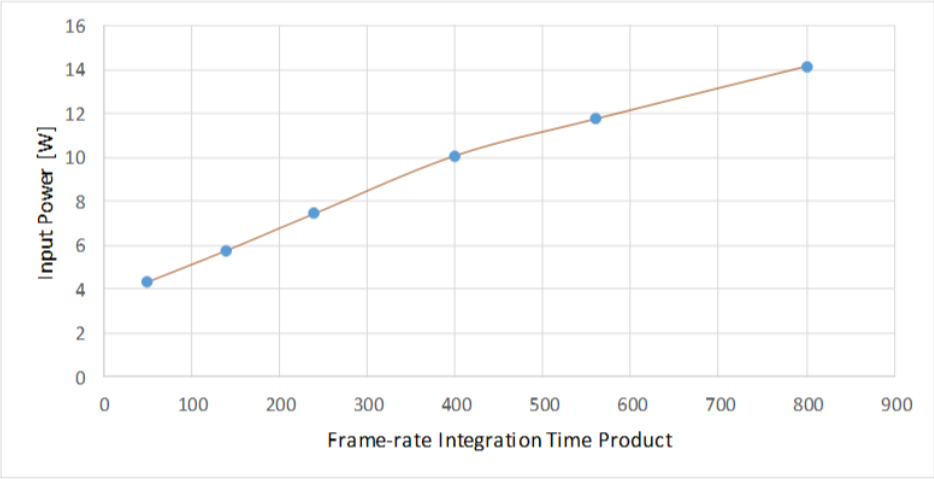

Figure 5-1: Input power depending on frame-rate integration time product

5.2 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

5.3 Measurement Specifications

5.3.1 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	20 MHz
Frame-rate	25 fps

Table 5-2: Environmental Specification

5.3.2 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			TBD	0,5
300	TBD	0,5	TBD	0,5
500	TBD	0,5	TBD	0,5
700	TBD	0,5	TBD	1,0

Measuring range [mm]	White target (90%) [mm]	Integration time [ms]	Gray target (18%) [mm]	Integration time [ms]
900	TBD	0,5	TBD	1,0
1100	TBD	1,0	TBD	1,5
1300	TBD	1,0	TBD	1,5
1500	TBD	1,0	TBD	2,0
1700	TBD	1,5	TBD	5,0
1900	TBD	1,5	TBD	5,0
2100	TBD	1,5	TBD	10,0
2300	TBD	2,0	TBD	10,0
2500	TBD	2,0	TBD	10,0
2700	TBD	2,0	TBD	10,0
2900	TBD	2,0	TBD	10,0

Table 5-3: Typical Reproducibility

5.3.3 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
3000	2,5	10,0

Table 5-4: Typical Integration Time

5.3.4 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	500	3000 [1)]	300	2000
5,0	500	4000 [1)]	300	3000 [1)]
10,0	500	6000 [1)]	500	3000 [1)]

Table 5-5: Typical Range

5.3.5 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	TBD	1,0	TBD	1,0
1000	TBD	1,0	TBD	1,5

Measuring range [mm]	White target (90%) [mm]	Integration time [ms]	Gray target (18%) [mm]	Integration time [ms]
1500	TBD	1,5	TBD	2,0
2000	TBD	1,5	TBD	3,0
2500	TBD	2,0	TBD	5,0
3000	TBD	2,5	TBD	10,0

Table 5-6: Accuracy of Distances

5.4 Environmental considerations

5.4.1 Temperature on the Cooling Plate

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

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

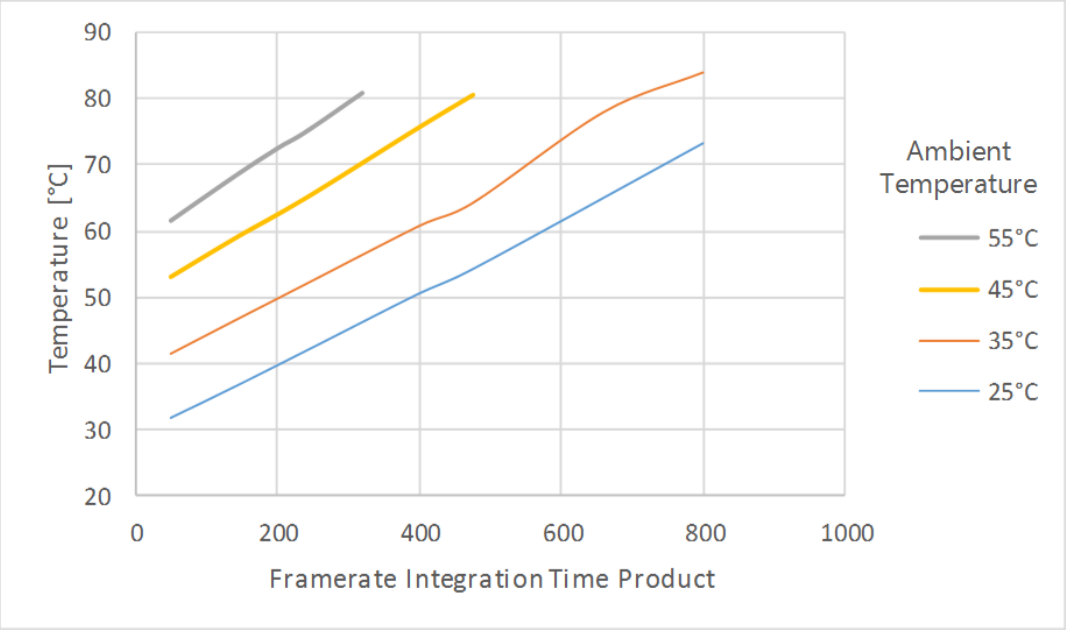

Figure 5-2: Expected cooling plate temperature depending on frame-rate integration time product

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

5.4.2 Integration Time vs. Frame-rate

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

Caution

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

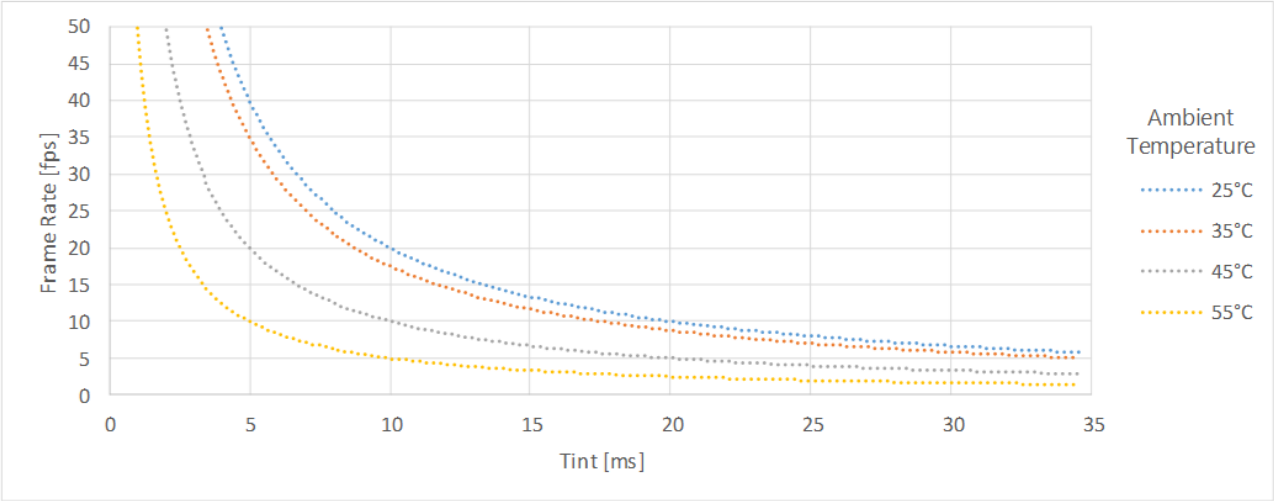

Figure 5-3: Integration time vs. frame-rate

The diagram takes care to limit the FITP in a way that the temperature on the cooling plate doesn't exceed 70°C. Using an appropriate heat sink higher values of the FITP may be applied.

Caution

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

5.5 Mechanical Outline

All dimensions are given in mm.

Mechanical outline of the 'Bounding Box':

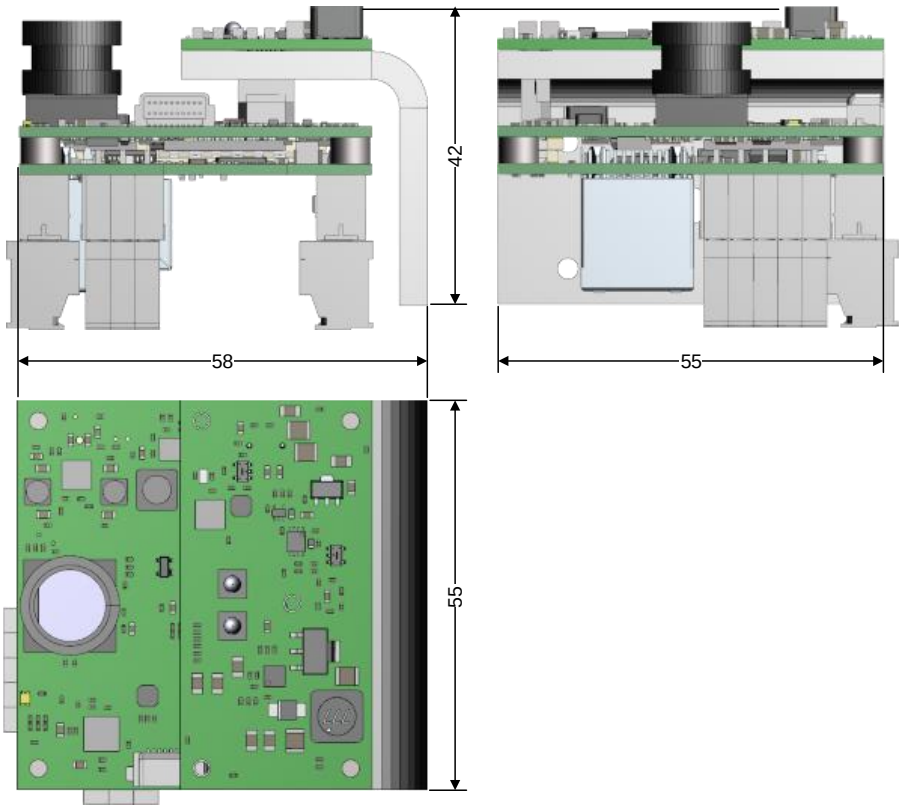

Figure 5-4: Mechanical Outline of the Bounding Box

6 Support

6.1.1 General Support

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

Support Link

https://support.bluetechnix.at/wiki/Sentis-ToF-M100_Camera

6.2 Software Packages

Software packages and software downloads are for registered customers only

Software Package

https://support.bluetechnix.at/wiki/Sentis-ToF-M100_Camera

6.3 Related Products

- ToF-Flash
- ToF-Flash Adapter
- Debug Adapter

7 Product History

7.1 Version Information

7.1.1 Sentis-ToF-M100

Version	Release date	Firmware Version
X-Grade	May 2013	V0.1.0

Table 7-1: Overview Sentis-ToF-M100 product changes

Note

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

7.2 Anomalies

Applies to	Date	Description
Interface Board V2.0.0	2014 04 14	GPIO inputs are 12V tolerant only.

Table 7-2 – Product anomalies

7.3 Document Revision History

Version	Date	Document Revision
1	2013 06 05	First preliminary of the document
2	2013 07 08	ImageDataFormat field in image header corrected. Some typos corrected. Figure for TopOpeningAngle and BottomOpeningAngle added. Incorrect over- and underexposure data values corrected. Figure 5-2 updated. Offset registers added. Some corrections to register description table.
3	2013 09 03	Wrong UDP protocol header version corrected. High- and low-word mismatch in “Registers for Ethernet” corrected.
4	2013 09 12	Frame header table entries corrected. CmdExecPassword register added. Description for CRC calculation added.
5	2013 01 07	Document split into two separate manuals. Software part removed from this manual.
6	2013 03 07	Formatted
7	2013 03 24	Figure 2-1 corrected
8	2014 04 14	GPIO input voltage corrected.
9	2014 07 20	Maximum open drain current added. Power supply information added.
10	2015 01 26	Input supply minimum changed to 12V

Table 7-3: Revision history

8 Index