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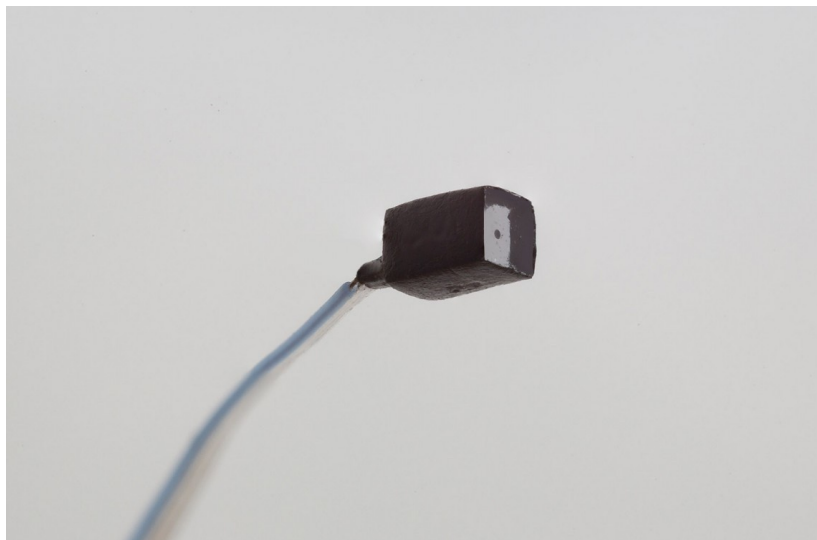
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NanEye
NanEye Stereo
Module

AWAIBA

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NanEye Module and NanEye Stereo Module

Modifications and Updates

Version	Date	Modifications	Author
4.3	09-06-15	Updated Document	Fátima Baptista
4.4	06-10-15	Updated Package Options	Fátima Baptista
4.5	27-12-16	Updated Cable Pinout	José Félix
4.6	01-03-17	Updated Table 1 and Table 3	Fátima Baptista

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1. Overview

NanEye is a tiny camera module which consists of a CMOS image sensor with a footprint size of 1mm x 1mm and, optionally, adapted miniature optics. The device is mounted on a flat ribbon cable measuring up to 2m in length that connects to the Awaiba base station. However, if the customer requirements are discussed, it may be possible to assemble a slightly longer cable (up to 3m). The base station is connected to a PC with a standard USB cable measuring up to 5m.

NanEye Stereo offers the smallest physical dimensions of a digital 3D, a true system on chip camera head with fully self timed readout sequencing, AD conversion to 10 bit and bit serial data transmission over LVDS. With it's 2 x 250 x 250 pixels at 3um pitch the sensors provide clear and sharp images with outstanding MTF in a very compact size. Footprint of just 2.2x1mm and height of 1.6mm (with integrated optics), due to Wafer Level packaging high precision of the 2 camera heads.

Note: The NanEye Module and NanEye Stereo Module system is NOT supplied sterile! Medical use of the system may lead to serious harm, illness or death!

2. NanEye Block Diagram

The NanEye image sensor is based on CMOS technology and is a system on chip, which means that no external component close to the sensor is needed to run the sensor, not even an external capacitor.
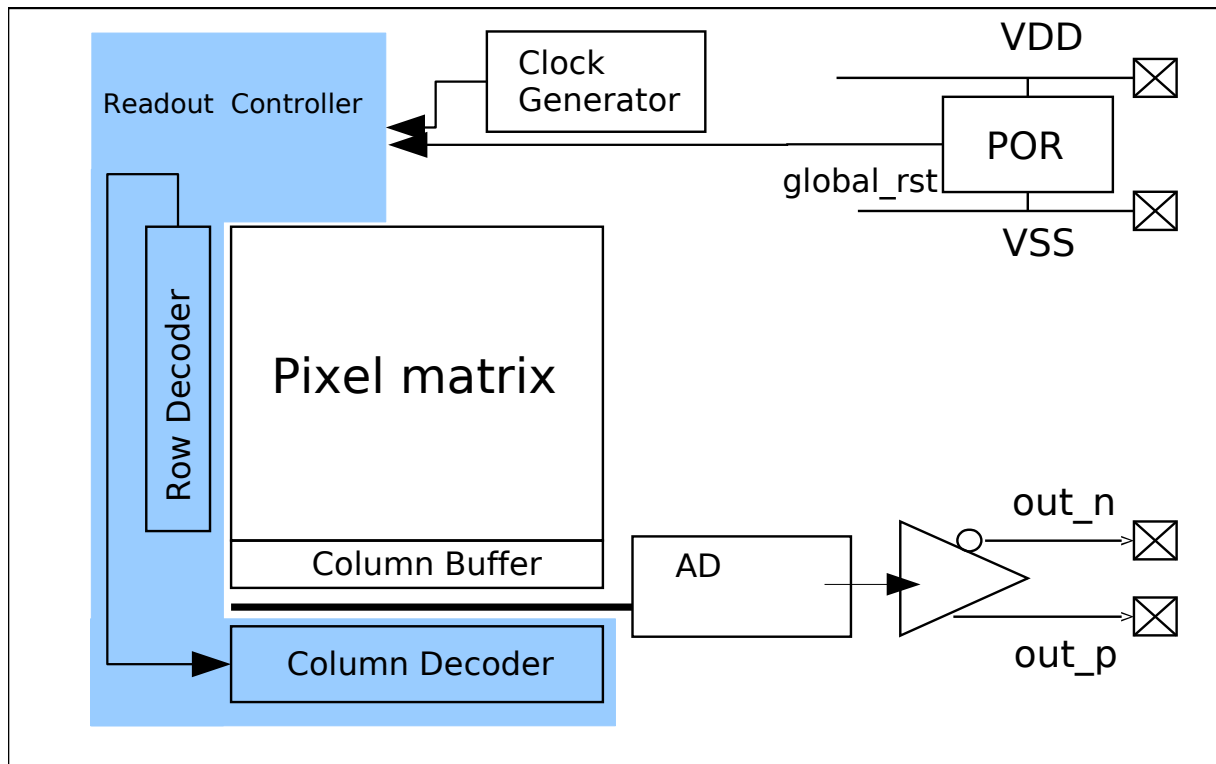

Figure 1: NanEye Simplified Block Diagram

3. NanEye and NanEye Stereo Specifications

Parameter	NanEye	NanEye Stereo	Remark
Number of Pixels	62k - 249 x 250	125KP – 500 x 250	
Pixel size	3µm x 3µm		
Colour	Bayer Pattern RGB		B&W version on request
Shutter	Rolling		
Dynamic range	58dB		gain = 1
Programmable Gain Range	- 1.5dB ± 6dB ± 2dB		in 4 steps
Responsivity at nominal gain	5,5DN/nJ/cm²		gain = 1
Responsivity max gain	11,5DN/nJ/cm²		gain = 3
Full well capacity	15Ke-		gain = 1
Full well capacity	6Ke-		gain = 3
DSNU	<0.4%		gain = 1
PRNU	<5%		gain = 1
Data output	10bit digital LVDS		
Supply Range	1.8V – 2.4V		
Frame rate	42Fps – 55Fps		Adjustable over power supply
Size (footprint)	1000µm x 1000µm	2200µm x 1000µm	
Number of pads	4	8	VDD, VSS Data+, Data-

Table 1: NanEye and NanEye Stereo Specifications

4. NanEye Power Consumption

The table below shows the NanEye power consumption.

Voltage (V)	Current (mA)	Power (mW)
1.8	1 to 2	3.6
2.1	2	4.2
2.4	3	7.2

Table 2: NanEye Power Consumption

5. Spectral Response
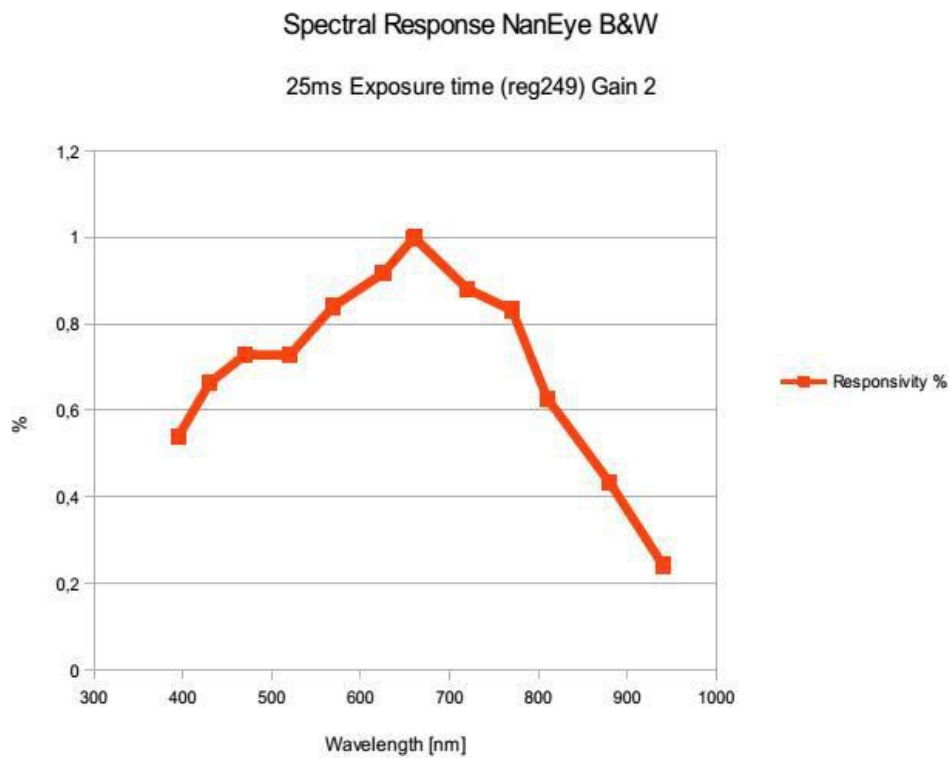
5.1 Relative Spectral Response

Figure 2: Relative Spectral Response

5.2 Color Matrix

The pixels are placed in a square matrix of 250x250 pixels. The Pixel matrix features a Bayer pattern colour filter array. The CFA and u-Lens shift are optimized for a chief ray angle (CRA) of the optics.
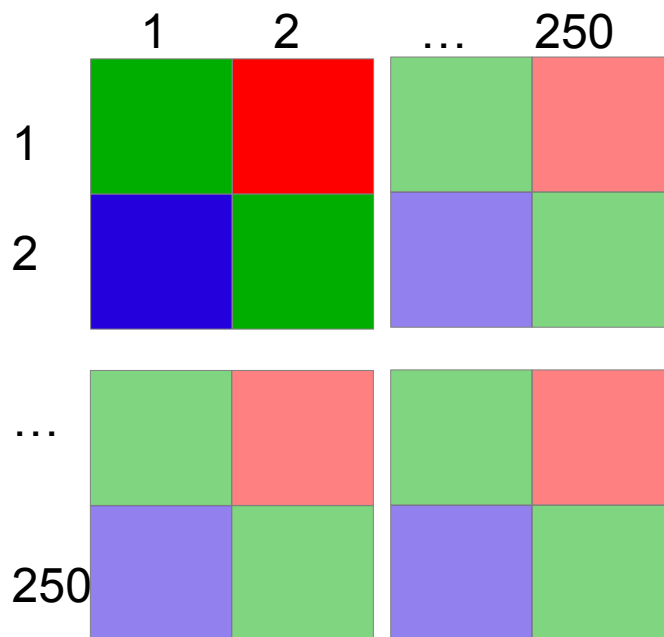

Figure 3: Coloured Versions Bayer Pattern Matrix

5.2.1 Filter transmission for RGB Bayer pattern sensor versions
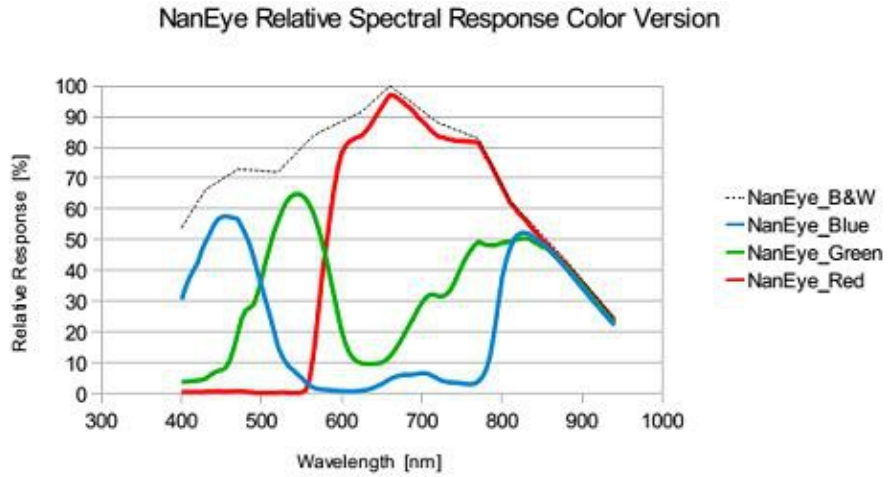

Figure 4: Filter Relative Responsivity

6. Frame Rate

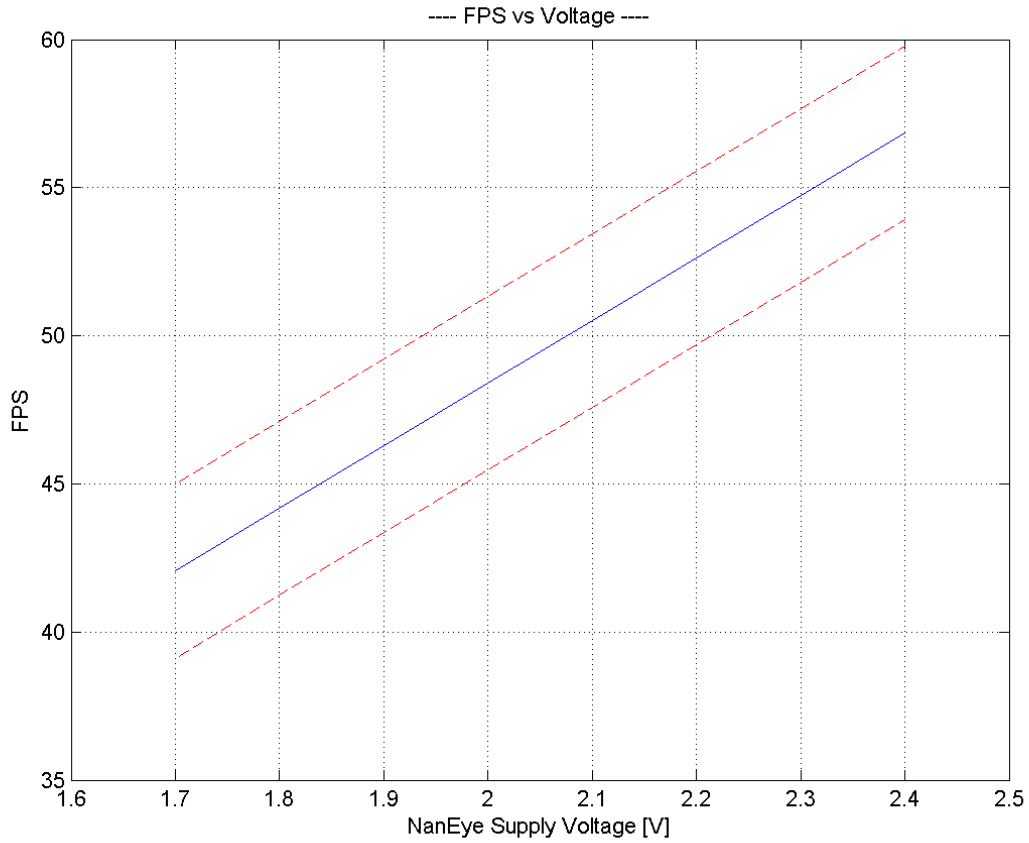## 6.1 Relation FPS vs Voltage

Figure 5: Relation between FPS and Voltage. Blue - typical, Red - max and min values

7. Cable Pinout
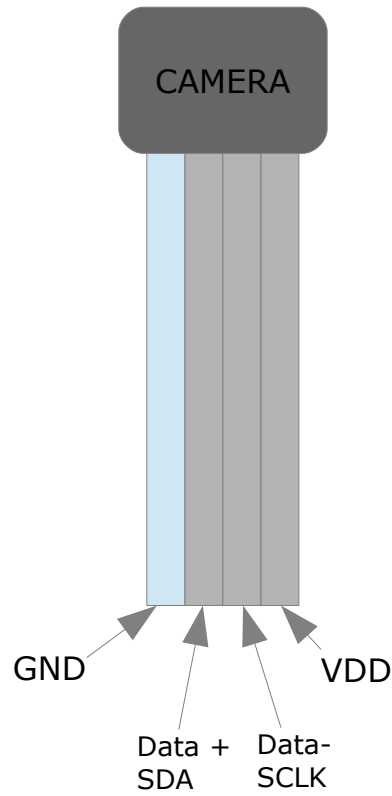
Figure 6: Identification of cable pin out for 4 cables (GND is normally colour marked)
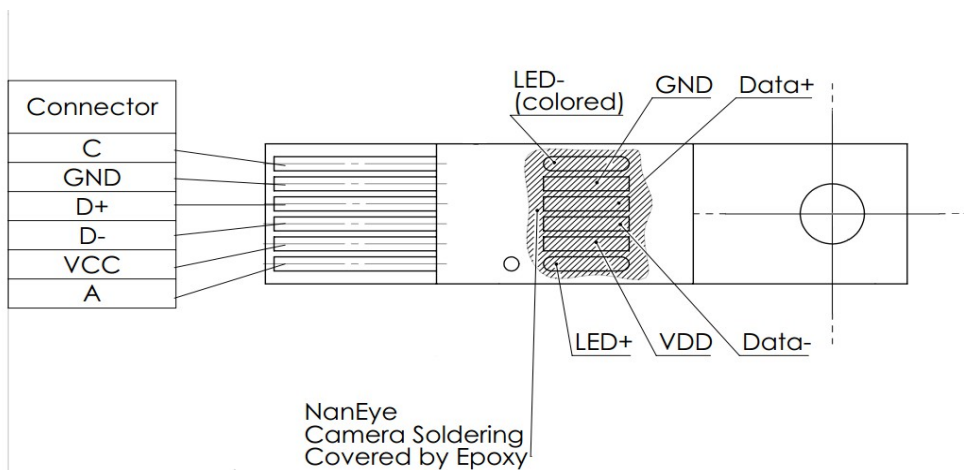
Figure 7: Identification of cable pin out for 6 cables (FLEX PCB connector)

8. Mechanical Dimensions

8.1 NanEye with Lens and Cable Soldered Dipped (Bended)

Lens	X (mm)
F2.7	1,69
F4.0	1,72
F6.0	1,74
F2.8	1,48
F2.4	1,4

A – B
(Cable cross section)

0,72 +/-0.1

0,188 +/-0.013

0,18

0,54 +/-0.075

NOTES

Conductor: 41 AWG, 0.0028" (71 um) Silver Plated Copper

Insulation: PFA, 0.00215" (54.6 um) Wall Thickness

Color: Natural

R1.5

1,1 +0.1 (incl. Paint)

□1,0 -0.01/+0.03

0,1 -0.05

1,41 +0.06

Figure 8: Measurements of the NANEYE module

8.2 NanEye with Lens and Cable Soldered Dipped 90º (Not Bended)

Lens	X (mm)
F2.7	1,69
F4.0	1,72
F6.0	1,74
F2.8	1,48
F2.4	1,4

Figure 9: Measurements of the NANEYE module

8.3 NanEye Stereo
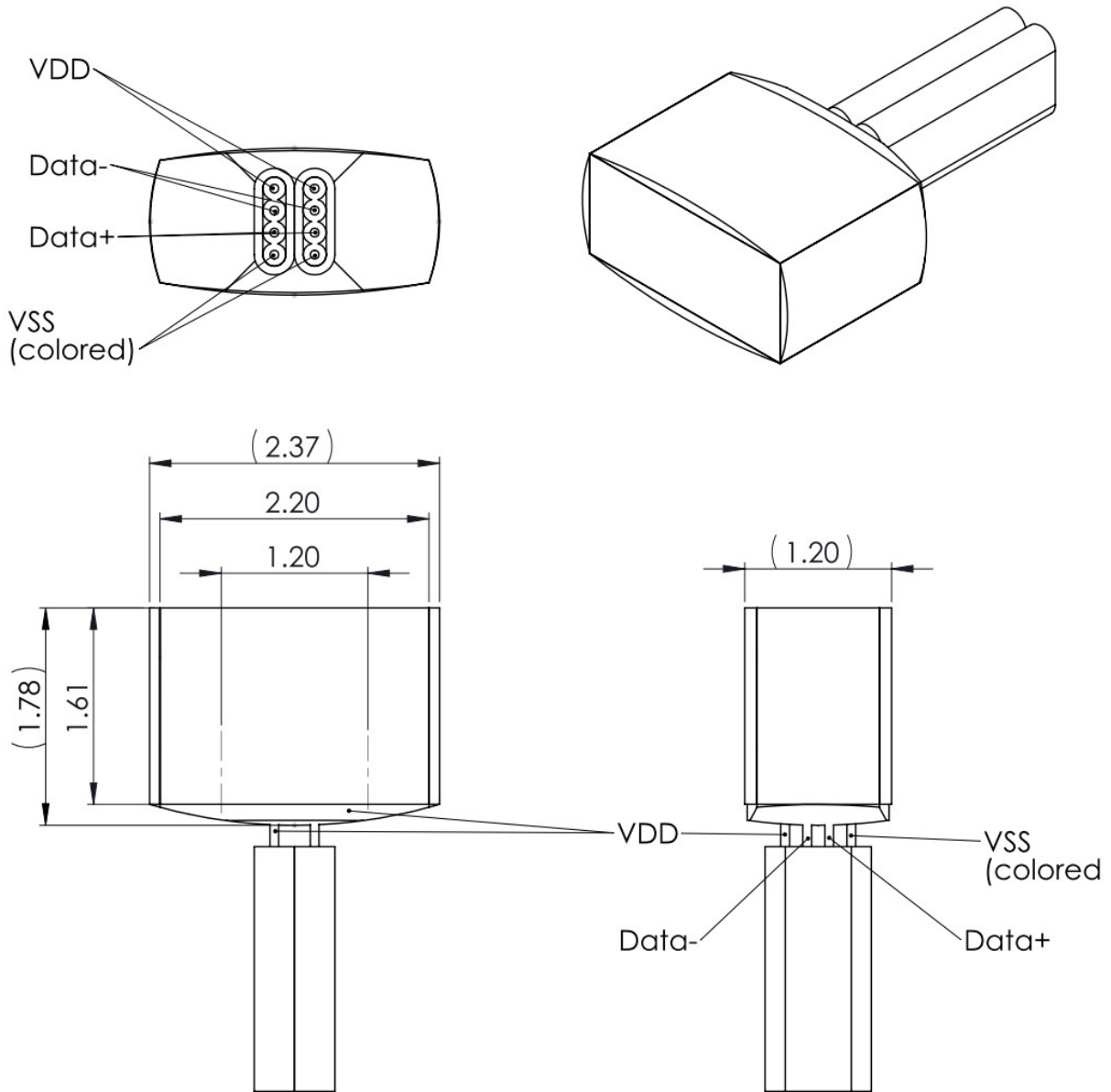
Figure 10: Measurements of the NANEYE Stereo module (in mm)
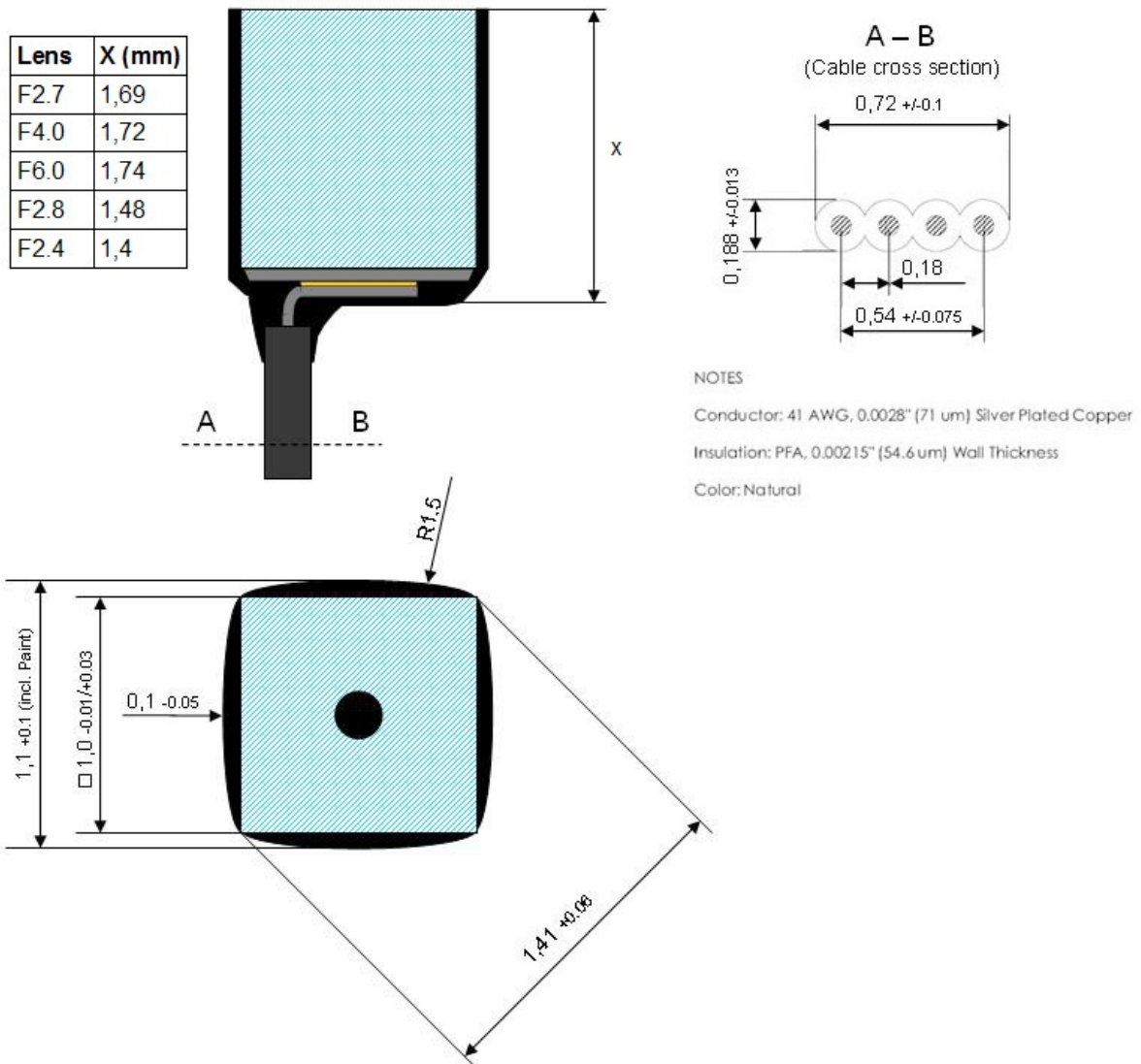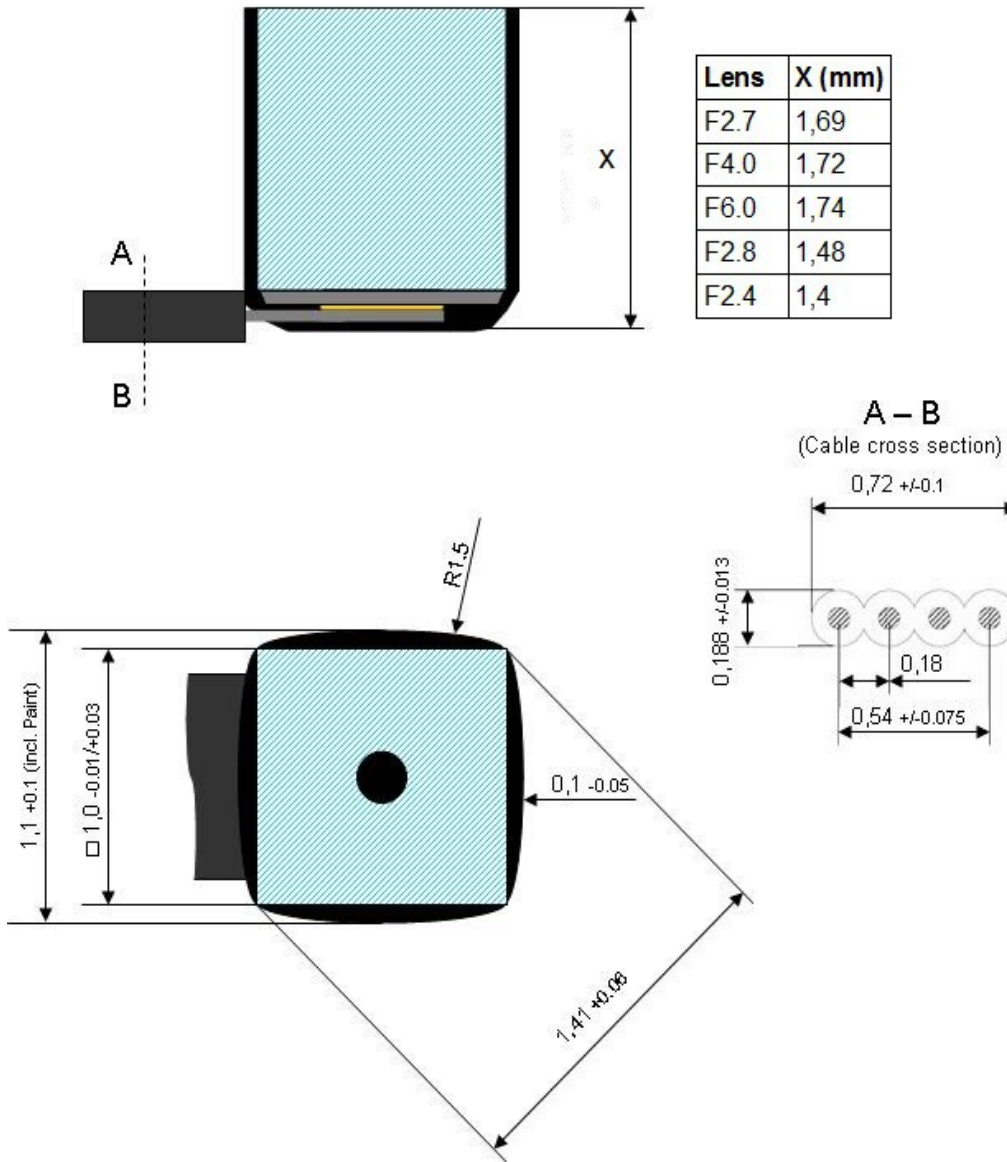
9. Optic

The optional optics available for the sensor is a high performance miniature lens module. It will be directly mounted on the image sensor and has its best focus position defined by design, so no mechanical set of focus is needed. The material is based on B33 (Borofloat glass). The design is made in such way that the surface towards the object is flat, so the lens performance is not influenced by the medium between the object and lens. Only the opening angle of the lens is reduced when the system operates in water.

Different lens configurations are available.

	F#2.7 FOV90º ▪	F#4.0 FOV90º	F#6.0 FOV90º	F#2.8 FOV120º	F#4 FOV120º	F#2.4 FOV160º
F# Number	2.7	4.0	6.0	2.8	4	2.4
FOV (diagonal in air)	90° *	90°	90°	120°	120º	160º
FOV (diagonal in water)	62° *	62°	62°	86°	86°	95°
Max Distortion (diagonal in air)	23%	23%	23%	50%	50%	80%
Max Distortion (diagonal in water)	7.5%	7.5%	7.5%	16%	16%	20%
EFL (mm)	0.66	0.66	0.66	0.5	0.5	0.45
Aperture (um)	220	176	120	176	120	180
MTF @ Nyquist @ Center	25%	28%	30%	45%	45%	50%
MTF @ Nyquist @ 80% horizontal field	15%	18%	20%	15%	15%	12%
Best Focus (mm)	15	5	5	8	8	5
Depth of focus (mm)	5 – 40	3.5-30	3 – 50	4 – 40	3-50	4-50
Size (incl. image sensor, cover glass) (mm)	1 x 1 x 1.69 2.2 x 1.0 x 1.69 •	1 x 1 x 1.72	1 x 1 x 1.74	1 x 1 x 1.48	1 x 1 x 1.43	1 x 1 x 1.40

Table 1: Lens configuration

▪ At the moment, we have available for NanEye Stereo the lens NanEye_FOV90_F2.7, *two times for NanEye Stereo, ✱ For NanEye Stereo

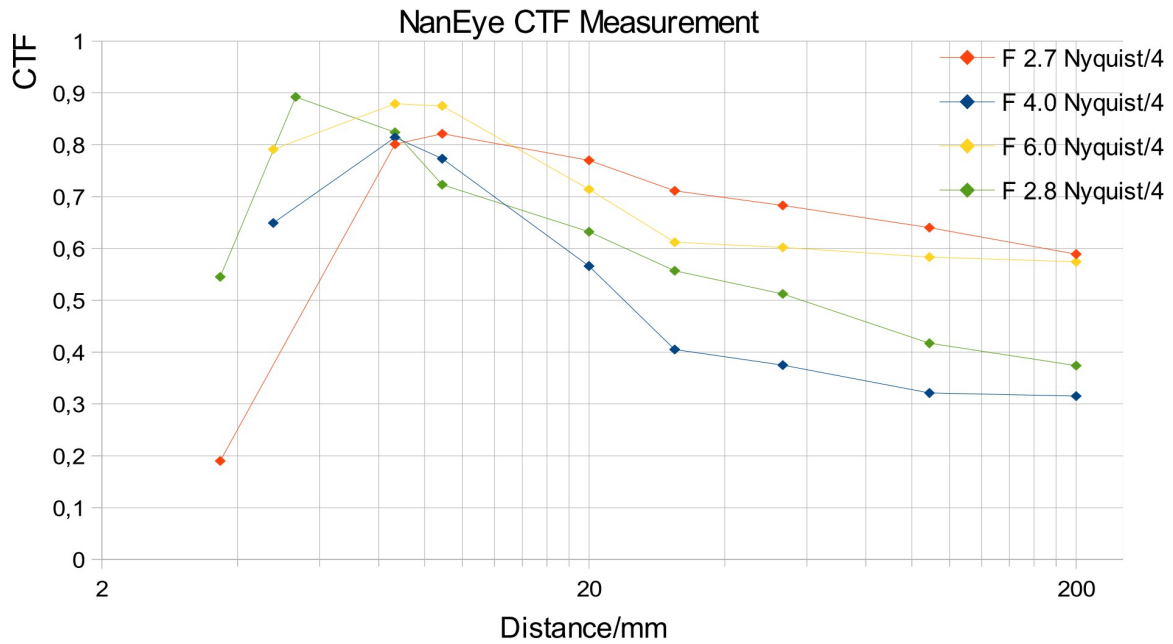The following image shows the CTF measures for different lens.

Figure 11: NanEye CTF measures

10. Package Options

10.1 NanEye and NanEye Module

	Chip	Chip + Lens + Cable
Colour	B&W, RGB	B&W, RGB
Package	BGA	Chip + Lens + Cable
Lens	N/A	F#2.7 FOV 90°
		F#4.0 FOV 90°
		F#6.0 FOV 90°
		F#2.8 FOV 120°
		F#4.0 FOV 120°
		F#2.4 FOV 160º
Cable Length	N/A	15cm
		1m
		2m
		3m
Cable Bend	N/A	Bended
		Not Bended
Sidewall Paint	N/A	Painted
		Not Painted

Table 3: Package Options for NanEye and NanEye Module

10.2 NanEye Stereo Module

	Chip + Lens + Cable
Colour	B&W, RGB
Lens	FOV 90° F#2.7
Cable Length	2m
Cable Bend	Bended
Sidewall Paint	Black Painted

Table 4: Package optins for NanEye Stereo Module

11. Miscellaneous

Optionally with the NanEye Module and NanEye Stereo Module, AWAIBA provides a base station and software to run the device on a PC in real-time with all necessary image corrections. The complete system consists of the module, the USB base station and the PC software.

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