

# Concept of the calibration box 2 – fiber box

by *pmdtechnologies*

## Abstract

This document gives an overview of the concept of the second calibration box (fiber box). This box is intended to perform wiggling calibration for pmd camera modules.

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## 1. Functional Description

This calibration box is intended to perform wiggling calibration for pmd camera modules. The different target distances required for wiggling calibration are emulated by fiber optics of different length.

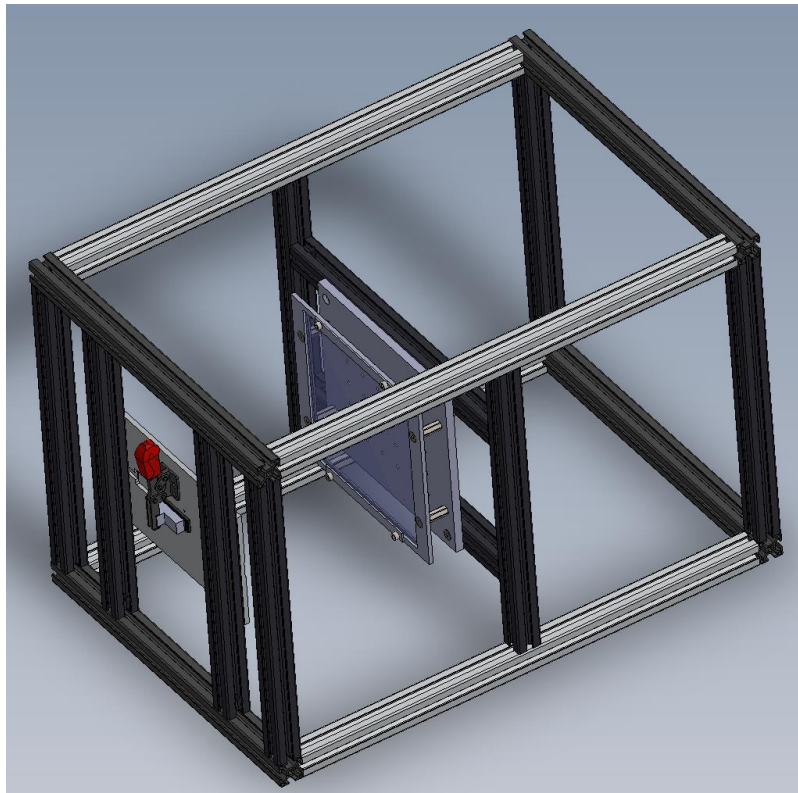


Figure 1: CAD construction drawing

## 2. Mechanical Construction

This calibration box is an open-frame construction, made from aluminum profiles which can be ordered machined and cut-to-length from the company Bosch-Rexroth<sup>1</sup>. The frame is intentionally open for testing and easy access. In a production environment, the sides of the box should be closed to avoid dust.

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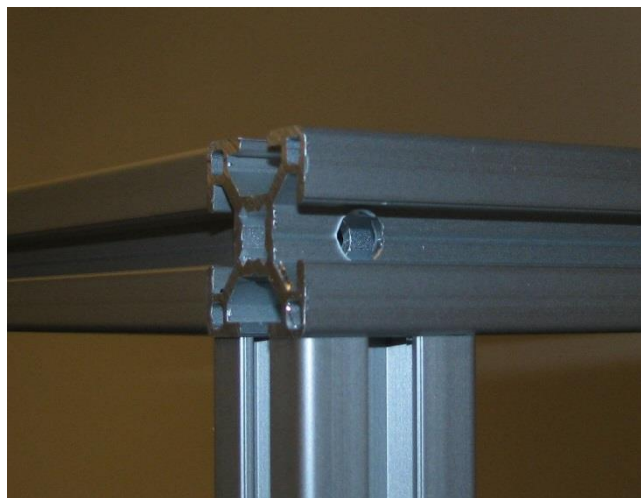
<sup>1</sup> There are other vendors available for these profiles, but the exact dimensions may change slightly, so it is strongly recommended to check the construction when changing the vendor.

## 2.1. Frame



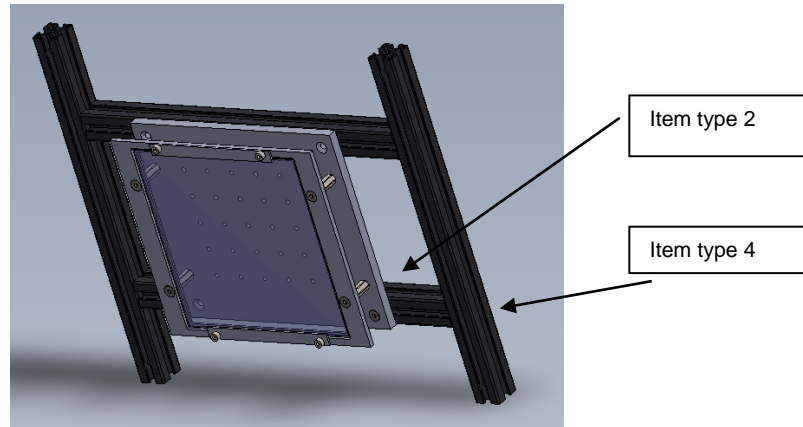
**Figure 2: Basic frame construction**

The frame is constructed from 3 types of Strut profiles, quantity is 4 pieces each. The part numbers of the profiles are No. 1 for the blue profile, No. 3 for the red profile, and No. 5 for the green profile. The profiles are connected with 24 pieces of self-tapping central bolts, part No. 6 in the BOM. See Table 1 for the bill of material.



**Figure 3: Detail view of strut profile connection**

## 2.2. Optical Fiber Target

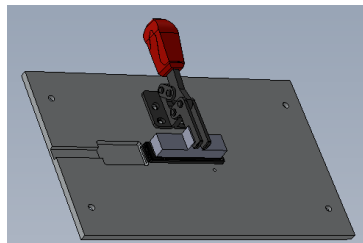


**Figure 4: Target Plate with optical fibers, held by strut profiles**

The mounting plate for the fiber optics (target) is held by 4 strut profiles, two of them of the BOM item 2 type and two of them of the BOM item 4 type. They are connected to each other using quick connectors (BOM item 7, 4 pieces) for quick and easy adjust. Using four distance pieces (BOM item 28), the holder (BOM item 26) for the diffuser (BOM item 27) is mounted to the fiber mounting plate. The diffuser serves to have homogenous uniformly large spots.

The target assembly is mounted to the horizontal struts using 4 sliding blocks (BOM item 9) and M6 screws (BOM item No. 25).

## 2.3. Camera Mounting/Coupling



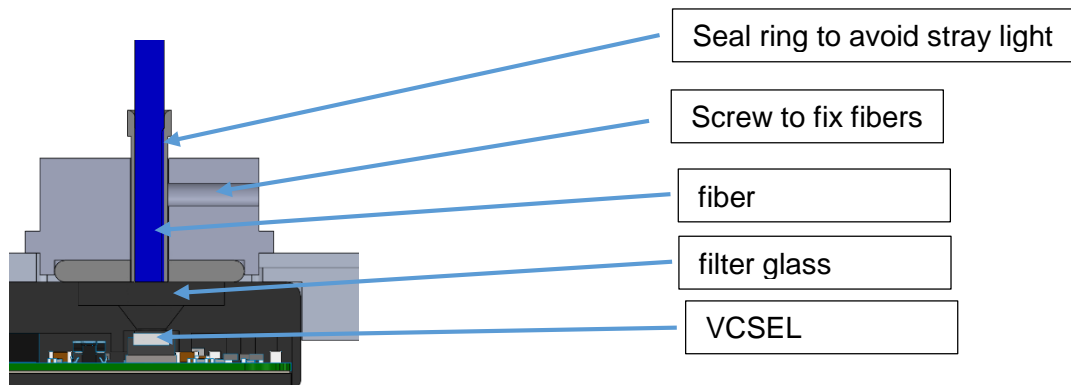
**Figure 5: Camera Mounting**

The mounting assembly for the camera module (BOM item 23) and Fiber-optic coupling assembly will be mounted to two strut profiles (BOM No. 2) with 4 Sliding Blocks (BOM No. 9) and 4 M6 screws.

## 3. Fiber optics

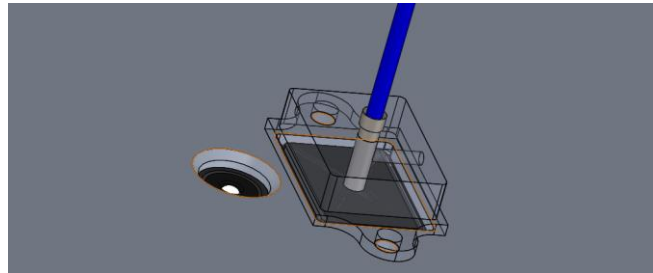
The fiber optic system is built from 30 fiber optics, which are assembled together at one end and coupled to the VCSEL light source of the pmd camera. Each of the fibers has its individual length. There is a separate assembly specification for the fiber bundle, please cf. this documentation!

Figure 6 and Figure 7 show the coupling element, BOM item 14. It fixes the fiber bundle and couples the light emitted by the VCSEL into the fiber bundle directly. The distance between fiber bundle and VCSEL must be as close as possible. This element is device-specific.



**Figure 6: VCSEL coupling**

The coupling's housing prevents the emitted light from illuminating the diffusor directly.



**Figure 7: VCSEL coupling - do not shadow the FoV of the lens**

#### 4. Stray Light Avoidance and Covering

- It is advisable to protect the box against dust, dirt and ambient light. For this purpose, pmd recommends black acrylic glass (BOM item 29), which is mounted onto the outer side of the strut profiles. As this material reflects IR light, however, it is important to glue absorbing material (e.g. cellular rubber, BOM item 30) onto the inner side of these side elements.
- In particular, such an anti-reflection protection must be applied to the part of the camera tray, which is oriented to the inner of the box. The POM material used for our reference tray appears black in the visible spectrum, but it *does* reflect in the IR spectrum!
- The strut profiles need to be covered by cellular rubber as well. Black anodic treatment does not help much in the IR spectrum.

### 5. Tables

No.	QTY	Description	Drawing/ Source	pmd	Customer
1	4	Strut profile, 30x30x900mm <sup>3</sup>	Bosch-Rexroth No. 3 842 990 720/900	-	Order component or define alternative product from local supplier
2	4	Strut profile, 30x30x900mm <sup>3</sup> Machined with 11mm hole	Bosch-Rexroth No. 3 842 990 725/900	-	Order component or define alternative product from local supplier
3	4	Strut profile, 30x30x700mm <sup>3</sup> Machined with 2x 8mm blind hole	Bosch-Rexroth 3 842 992 965/700	-	Order component or define alternative product from local supplier
4	2	Strut profile, 30x30x640mm <sup>3</sup> Machined with 11mm Hole	Bosch-Rexroth No. 3 842 990 725/640	-	Order component or define alternative product from local supplier
5	4	Strut profile, 30x30x600 <sup>3</sup>	Bosch-Rexroth No. 3 842 990 720/600	-	Order component or define alternative product from local supplier
6	24	Self-tapping central bolt, S8x25-T40	Bosch-Rexroth No. 3 842 527 174	-	Order component or define alternative product from local supplier
7	12	Quick connector, 8/10 mm slot, 90°,	Bosh-Rexroth No. 3 842 535 465	-	Order component or define alternative product from local supplier

8	1	Mounting plate for fiber optics	Drawing: Mountig_plate_for_fiber_optics_V0100.PDF Model: Mountig_plate_for_fiber_optics_V0100.STEP	Share all relevant design data	Find a local CNC manufacturer
9	8	Sliding block, swivel-in, with spring 8mm slot, M6	Bosch-Rexroth No. 3 842 529 296		Order component
13	1	Right Angle Mirror	Edmund Optics Order-No. #65-844		Order component
14	1	VCSEL coupling	Drawing (to be done after receiving final bracket design!):	Share all relevant design data	Find a local CNC manufacturer
17	1	fibre bundle	See fibrebundle_specification.pptx	Share all relevant design data	Find a local manufacturer
18	1	ferrule clamp	Drawing: Ferrule_Bündel_V6.pdf	Share all relevant design data	Find a local CNC manufacturer
21	4	Hexagon Socket Head Screw M6x20	-	-	Order component
22	2	Hexagon Socket Head Screw M6x25	-	-	Order component
23	1	Camera Mounting Plate	Drawing (to be done after receiving final bracket design!!)	Share all relevant design data	Find a local CNC manufacturer
24	4	Hexagon socket countersunk head screw M6x12	-	-	Order component
25	4	Hexagon socket countersunk head screw M6x16	-	-	Order component
26	1	Diffusor holder	Drawing: LWL_Diffusor_Frame_V0200.pdf	Share all relevant design data	Find a local CNC manufacturer
27	1	Diffusor	200 x 200mm 120 Grit Ground Glass Diffuser Edmond part no #83-386	-	Order component

28	4	Distance pieces	M6x40 distance pieces, e.g. <a href="#">Wegertseder part no. 2262-376</a>	-	Order component
29	6m <sup>2</sup>	Acrylic glass	Plexi glass 9H01 from <a href="http://www.hs-kunststofftechnik.de/index.php?id=2">http://www.hs-kunststofftechnik.de/index.php?id=2</a>	-	Order component or define alternative product from local supplier
30	30m	Cellular rubber	<a href="http://www.gummiprofile24.de/epages/64048014.sf/de_DE/?ObjectPath=/Shops/64048014/Products/80230">http://www.gummiprofile24.de/epages/64048014.sf/de_DE/?ObjectPath=/Shops/64048014/Products/80230</a>	-	Order component or define alternative product from local supplier

**Table 1: Bill of Material**



## Appendix

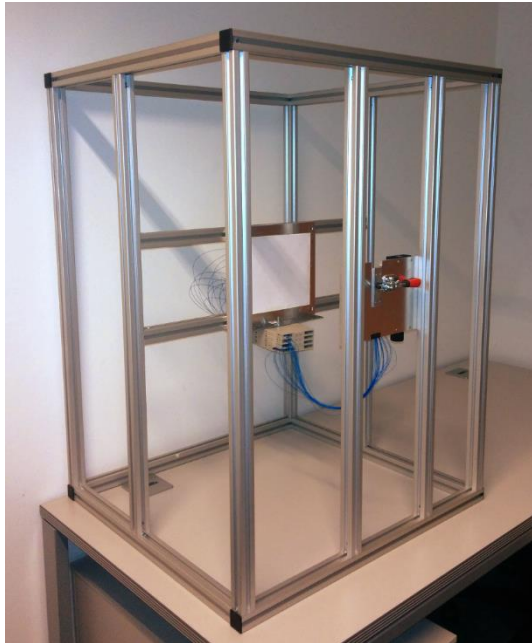


Figure 8: Box 2 front view



Figure 9: Box 2 side view

## Document History

Document title: Calibration Box 2 – Cal-1-3-AN

Revision	Origin of Change	Submission Date	Description of Change
0	SBe	2016-04-13	New Application Note
1	OLo	2016-09-28	Edit Bill of Material
2	SMa	2016-11-11	Update VCSEL coupling

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