Validation Box – Concept

*by **pmd**technologies*

Abstract

This document describes the validation box hardware. It contains the mechanical construction and the bill of material for the box.

Table of Contents

List of Figures

List of Tables

1. Functional Description

The validation box is intended to verify the calibration data for pmd camera modules inside the final OEM device. It consists of a frame, a camera tray and a planar target which has a homogeneous matte surface.

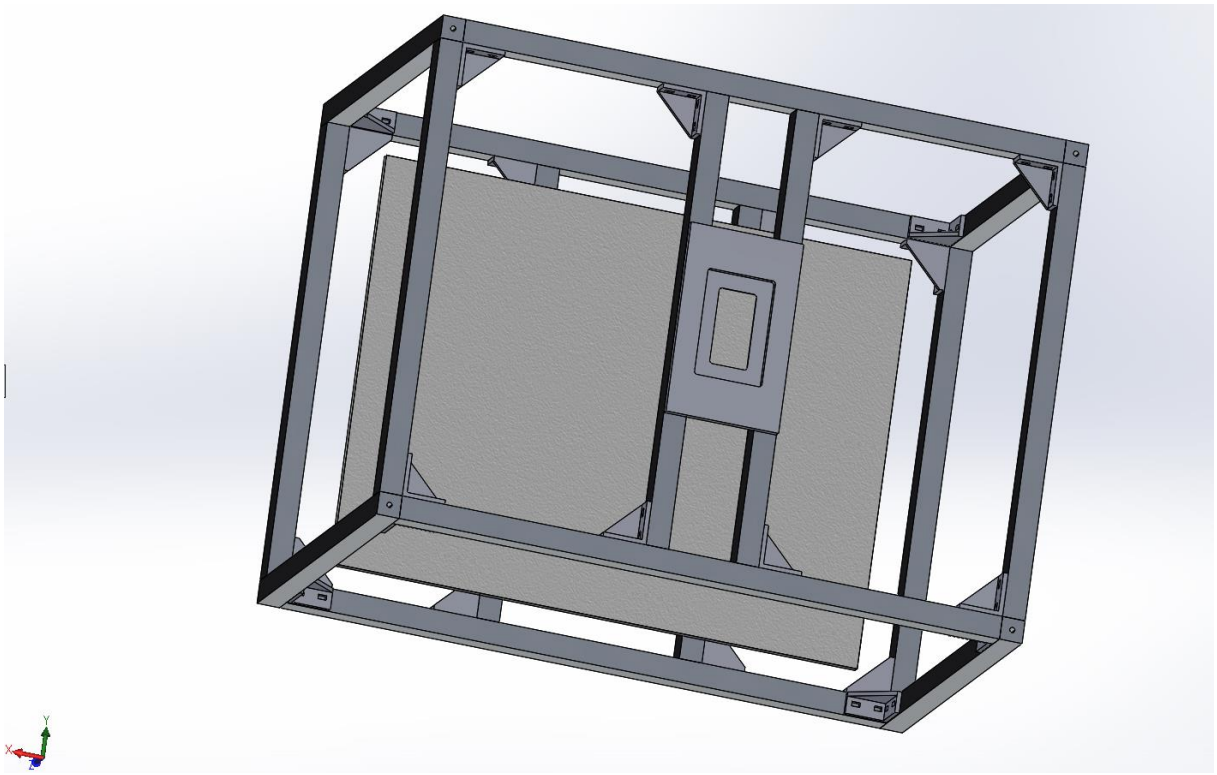

Figure 1: CAD construction drawing

2. Mechanical Construction

This validation box is an open-frame construction, made from aluminum profiles which can be ordered machined and cut-to-length from the company Bosch-Rexroth[1]. The sides of the box are closed to avoid dust and interfering like ambient light or nearby devices from other boxes (especially relevant in mass production).

[1] 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. Bottom Frame

The bottom frame consists of two 800mm long Strut profiles (blue) and four 600mm long Strut profiles (red). 8 gussets (green) connect them in a perpendicular way.

The planar target (gray) contains M6 countersunk screw holes to connect it onto two Strut profiles (red). After screwing together and filling the leftover screwing holes with putty, a special foil (BOM item 6) is glued on top of this plate. This foil needs to have a very homogeneous matte surface.

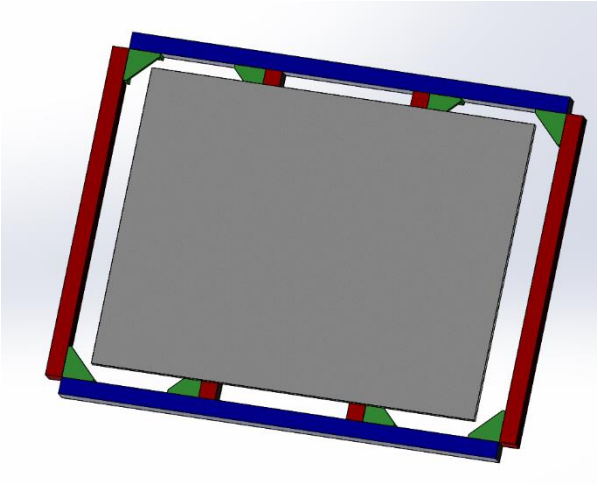

Figure 2: Bottom Frame CAD construction

The part numbers for the 2 blue profiles are No. 1, for the 4 red profiles No. 2, for the 8 green gussets No 4. The profiles are connected to the gusset with 32 hexagon socket head screws M6x14 (included in part No. 4) and 32 sliding blocks, swivel-in (included in part No. 4). The planar target (part No. 5) is connected with 6 Hexagon socket countersunk head screw M6x16 (part No. 16) and 6 sliding blocks, swivel-in (part No. 19). The putty is part No. 14 and the foil part No. 6.

See Table 1 for the bill of material.

2.2. Top Frame

The top frame is constructed in the same way the bottom frame is. The only difference is the grey drawn part – instead of a planar target a tray (for later fixing the final device to verify). The tray has to be mounted in that way, that the ToF module's lens is centered above the planar target.

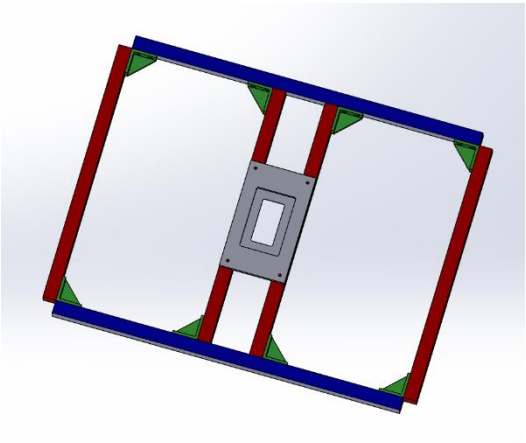

Figure 3: Top frame CAD construction

Consider that in this figure only a tray dummy is shown and this has to be adapted to the actual device. The connecting to the Strut profile is realized via 4 M6 screw holes.

The part numbers for the 2 blue profiles are No. 1, for the 4 red profiles No. 2, for the 8 green gussets No 4. The profiles are connected to the gusset with 32 hexagon socket head screws M6x14 (included in part No. 4) and 32 sliding blocks, swivel-in (included in part No. 4). The tray (part No. 13) is connected with 4 Hexagon socket head screw M6x20 (part No. 17) (in case the tray has a thickness of 10mm) and 4 sliding blocks, swivel-in (part No. 19).

See Table 1 for the bill of material.

2.3. Feet

Bottom and top frame are connected via four 54mm long Strut profiles (yellow) and 8 gussets (green), one for each profile and one each for top and bottom connection.

Alignment of the profiles is flush mounted to top and bottom frame each, resulting in a distance of exactly 50cm between the top of the planar target and the top of the box, where the TOF device is located.

The part number for the 4 yellow profiles is No. 3, for the 8 green gussets No 4. The profiles are connected to the gusset with 32 hexagon socket head screws M6x14 (included in part No. 4) and 32 sliding blocks, swivel-in (included in part No. 4).

See Table 1 for the bill of material.

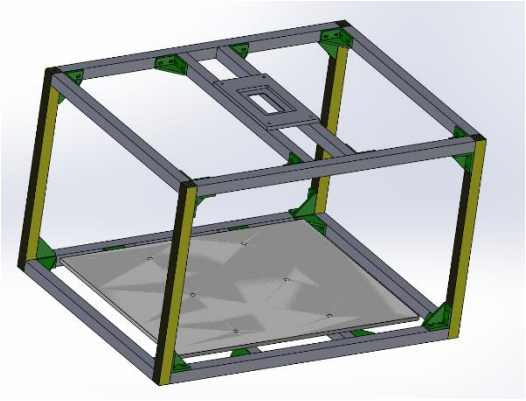

Figure 4: Feet connect bottom and top frame

2.4. The tray

The tray must be designed in that way, that later on the front part of the TOF module's lens (green) is at the same level as the tray (yellow side) is. This guarantees an exact distance of 50cm between lens and planar target. The bottom has to be low reflective (coated with cellular rubber, no blinking or highly reflective aluminum parts).

Tray design is done by OEM (BOM list part No. 13). The part number for the cellular rubber is No 11.

See Table 1 for the bill of material.

Coating

All parts of the struts in the inner part of the box have to be coated to avoid any reflections of the VCSEL modulated light. Same operation has to be made to all the gussets and the bottom part of the tray. Alternatively, matte paint or varnish can be used for hard-to-reach parts of the gussets.

The part number for the cellular rubber is No 11 and 12.

See Table 1 for the bill of material.

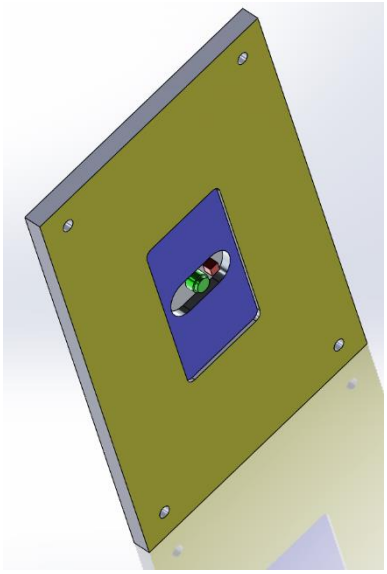

Figure 5: Example design for a tray

2.5. Side walls

To avoid dust and interfering like ambient light or nearby devices from other boxes (especially relevant in mass production), the box itself is closed (red) to all six sides (including bottom).

The side walls consist of 3mm thick black Acrylic glass (red in the figure).

From the inside, the walls are all covered with cellular rubber (especially the top plate has to be covered).

The walls are connected to the Strut profiles via lentils-tapping screws into plastic rails that are pressed inside the Strut profiles structure. The bottom plate is additionally screwed with 4 self-tapping central bolts at each corner inside the Strut profile to work as small feet preventing the box from lying on the bottom plate.

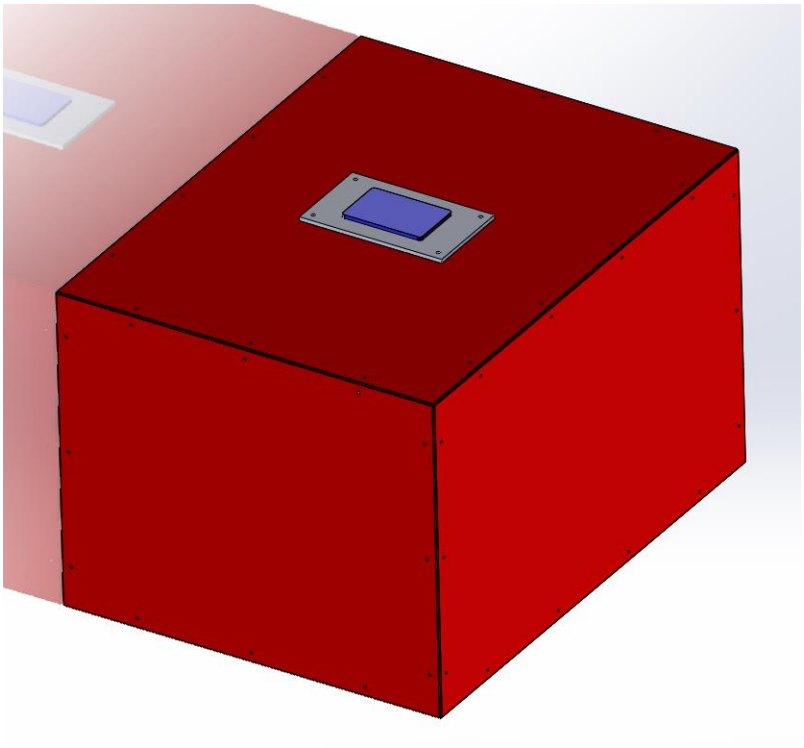

Figure 6: CAD design of the box covered with side walls

The part number for the 2 large side walls is No. 7, for the 2 small side walls is No. 8, and for the bottom plate is 9. The top plate design has to be done by OEM after finished the tray design to best fit the plate to the tray (BOM part No. 10). The 80 lentils-tapping screws M3.5x13 are part No. 18, the 16m mounting strips part No. 15 and the 4 self-tapping central bolts are part No. 20. The part number for the cellular rubber is No 11.

See Table 1 for the bill of material.

3. Tables

No.	QTY	Description	Drawing/ Source	pmdtec	OEM
1	4	Strut profile, 30x30x800mm³	Bosch-Rexroth No. 3 842 990 720/800	-	Order component or define alternative product from local supplier
2	8	Strut profile, 30x30x600mm³	Bosch-Rexroth No. 3 842 990 720/600	-	Order component or define alternative product from local supplier

No.	QTY	Description	Drawing/ Source	pmdtec	OEM
3	4	Strut profile, 30x30x540mm³ Machined with 2x 8mm blind hole	Bosch-Rexroth No. 3 842 990 723/540	-	Order component or define alternative product from local supplier
4	24	30x60 gusset with fasteners	Bosch-Rexroth No. 3 842 523 541	-	Order component or define alternative product from local supplier
5	1	Aluminum plate, 540x700x10mm³	Drawing validation_box_plane_V0101.pdf	Share all relevant design data	Find a local CNC manufacturer
6	1qm	Special matte foil: Synthetic Paper Banner SK	http://www.rauch-papiere.de/fileadmin/downloads/Preislisten/DE/159_D.pdf No. 0941016433	Share all relevant design data	Order component or define alternative product from local supplier
7	2	Black Acrylic glass side wall, 860x540x3mm³	Plexi glass 9H01 from http://www.hs-kunststofftechnik.de/index.php?id=2 Drawing wall_large_V0101.pdf	Share all relevant design data	Order component or define alternative product from local supplier and find a local CNC manufacturer
8	2	Black Acrylic glass side wall, 660x540x3mm³	Plexi glass 9H01 from http://www.hs-kunststofftechnik.de/index.php?id=2 Drawing wall_small_V0101.pdf	Share all relevant design data	Order component or define alternative product from local supplier and find a local CNC manufacturer
9	1	Black Acrylic glass bottom, 860x660x3mm³	Plexi glass 9H01 from http://www.hs-kunststofftechnik.de/index.php?id=2 Drawing wall_bottom_V0101.pdf	Share all relevant design data	Order component or define alternative product from local supplier and find a local CNC manufacturer
10	1	Black Acrylic glass side wall, 860x660x3mm³	Plexi glass 9H01 from http://www.hs-kunststofftechnik.de/index.php?id=2 Drawing Wall_top_V0101.pdf DEPENDS ON TRAY DESIGN BY OEM	Share all relevant design data	Order component or define alternative product from local supplier and find a local CNC manufacturer
11	2m²	Cellular rubber	http://www.gummiprofile24.de/epages/64048014.sf/de_DE/?ObjectPath=/Shops/64048014/Products/62102-SK	Help with translation to English	Order component or define alternative product from local supplier

No.	QTY	Description	Drawing/ Source	pmdtec	OEM
12	15m	Cellular rubber	http://www.gummiprofile24.de/epages/64048014.sf/de_DE/?ObjectPath=/Shops/64048014/Products/80230	Help with translation to English	Order component or define alternative product from local supplier
13	1	tray	-	-	Design the tray (take information from section 2.4 into account)
14	20g	Two Component putty	-	-	Order component or define alternative product from local supplier
15	16m	Mounting strip, 8mm	Bosch-Rexroth No. 3 842 524 069		Order component or define alternative product from local supplier
16	6	Hexagon socket countersunk head screw M6x16	-	-	Order component or define alternative product from local supplier
17	4	Hexagon socket head screw M6x20	-	-	Order component or define alternative product from local supplier
18	80	M3.5x13 black zinc plated lentils-tapping screws	-	-	Order component or define alternative product from local supplier
19	10	Sliding block, swivel-in, with spring 8mm slot, M6	Bosch-Rexroth No. 3 842 529 296	-	Order component or define alternative product from local supplier
20	4	Self-tapping central bolt, S8x25- T40	Bosch-Rexroth No. 3 842 527 174	-	Order component or define alternative product from local supplier

Table 1: Bill of Material

Document History

Document title: Validation Box – Cal-1-1-AN

Revision	Origin of Change	Submission Date	Description of Change
0	SMa	2016-04-01	New Application Note
1	SMa	2016-04-11	Edit Bill of Material
2	BAl	2016-05-06	Correct internal reference