Industrial 3D Robotics - Deimos Stereo Camera Datasheet

Overview

Deimos is a low-cost stereo vision camera with an integrated NIR pattern projector for improved matching in close-range featureless scenes. Deimos is built around a pair of WVGA cameras, capable of operating at 60 fps over a USB3.0 interface. The cameras use a global shutter and are suitable for imaging moving targets.

Deimos weighs just 110 g and is therefore suitable for robotic applications, such as mounting on arms, where payload is critical. Two M4 mounting holes on the base of the unit are provided, these are compatible with standard optical post mounts.

A software toolkit is provided which allows users to re-calibrate the cameras, acquire and match stereo imagery, and view/output 3D point clouds. The system is compatible with OpenCV and ROS and is therefore straightforward to integrate into any vision application.

General Information

Interface	USB2.0/3.0
Camera resolution (px)	WVGA 752 x 480
Pixel Size	6 µm x 6 µm
Bit depth	Monochrome 10-bit
Sensor (x 2)	ON Semiconductor® MT9V024 (1/3 “)
Pixel size (micron)	6 x 6
Framerate	30 fps (USB2) / 60 fps (USB3)
Focal length	4.3 mm
Focus*	30 cm to infinity
Shutter type	Global
Synchronisation	Hardware triggered
Exposure range	0.1 – 10000 ms
Software compatibility	Windows 7+, Linux (inc Rasp. Pi). UVC compliant, OpenCV compatible, ROS

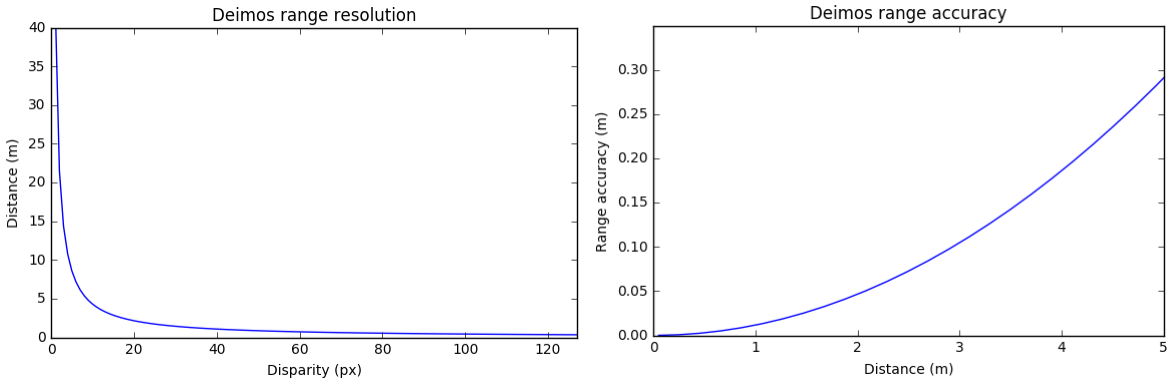
* The cameras may be focused extremely close (several cm), however below 20 cm there is not sufficient overlap for stereo matching. Deimos units are factory-focused at around 30 cm, to allow focus up to infinity

Stereo information

Z axis indicates depth, perpendicular to the camera sensor plane.

Baseline	60 mm
Depth resolution at 1 m ($\in_z = \frac{z^2}{fB} \in_d$), $\in_d = 0.25px$	6 mm
X/Y resolution at 1 m	0.3 mm
Field of view at 1 m	1.04 x 0.67 m
Example matching speed (Intel i5 3.2GHz)	30 fps using OpenCV Block Matcher 7 fps using OpenCV SGBM Matcher Depends on PC specification, choice of matching algorithm and typically size of disparity search window.

Theoretical performance graphs are shown below, these are derived for Deimos assuming nominal calibration parameters and typical matching accuracy of 0.5 px using well-textured imagery.



Given a point (X, Y, Z) which is located at (x, y) in the left image and a known disparity, d, along with the camera separation (baseline) b and focal length f:

$$x = \frac{fX}{Z}, y = \frac{fY}{Z}, Z = -\frac{bf}{d}$$

Stereo range resolution therefore determined by disparity, for a fixed b and f, as shown in Figure 1. These are representative of the performance of Deimos, but should be regarded as theoretical. Stereo range accuracy (σZ) is (quadratically) distance dependent, for a fixed b and f:

$$\sigma Z = \frac{Z^2}{bf}\sigma d$$

Where σd is the uncertainty in disparity measurement, nominally a quarter pixel. This is dependent on the choice of stereo matcher. This performance is typical of a short-baseline stereo system. Users

who require higher accuracy at longer ranges should request information about i3DRs upcoming Phobos range of stereo systems.

Projector

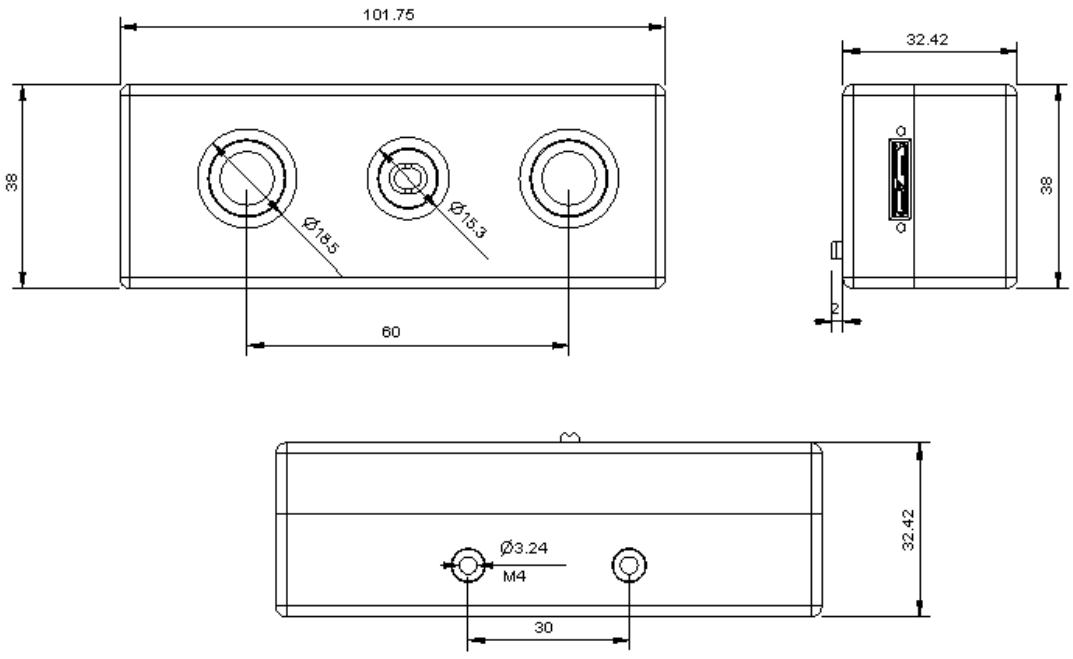
Deimos integrates a NIR (invisible) laser pattern projector, operating at 830 nm. The laser is Class 1M (eye safe beam). However, users should follow good laser safety practice and never stare into the projector while the laser is turned on. The projector is turned on/off using a switch on the rear of the device. When using the projector, the pattern will be visible in your images. The projector has a usable range of a few metres depending on the reflectivity of the surface, working best on featureless surfaces like walls.

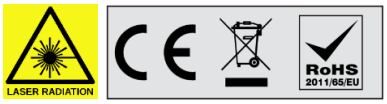
Mechanical and Electrical Information

Dimensions	38 x 101.75 x 32.42 mm
Manufacturing tolerance	±1 mm
Weight without cable	110g
Mounting	2x M4 on base
Temperature range	5 – 50 C
Voltage	5V (USB)
Power draw	Idle: < 100 mA Camera only: 160mA Camera and projector: 350 mA

The Deimos unit is not environmentally sealed. The unit can be used outdoors, but is not designed for rugged/dusty/humid environments. Additional housing is required for these conditions.

Dimensional drawing, all dimensions in millimetres. This drawing is reproduced here for reference, please contact us for a higher resolution copy or CAD models.





This product conforms to 2012/19/EU (WEEE), 2011/65/EU (RoHS) and 2014/30/EU (EMC Compatibility).