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## **CamBoard pico monstar**

### Getting Started



Technical information subject to change without notice. This document may also be changed without notice.

Created: 2017-03-22 By:JBI  
Changed: 2017-11-02 By:ASt  
Released: 2021-01-28 By:TNe

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## **1. Preliminary note / Vorbemerkung**

**EN** This document is intended for specialists. These specialists are persons who are qualified by their training and their experience to see risks and to avoid possible hazards during operation or maintenance of the device. The document contains information about the correct operation of the device.

Read this document before operation. Familiarise yourself with operating conditions and installation. Keep this document during the entire life time of the device.

For a detailed description of the device please read the document "Getting Started Guide".

**DE** Das Dokument richtet sich an Fachkräfte. Dabei handelt es sich um Personen, die aufgrund ihrer einschlägigen Ausbildung und ihrer Erfahrung befähigt sind, Risiken zu erkennen und mögliche Gefährdungen zu vermeiden, die der Betrieb oder die Instandhaltung des Gerätes verursachen kann. Das Dokument enthält Angaben zum korrekten Umgang mit dem Gerät.

Lesen Sie dieses Dokument vor dem Einsatz, damit Sie mit den Einsatzbedingungen und der Installation vertraut werden. Bewahren Sie das Dokument während der gesamten Einsatzdauer des Gerätes auf.

Für eine detaillierte Beschreibung des Gerätes lesen Sie bitte das Dokument „Getting Started Guide“.

## **2. Safety Instructions / Sicherheitshinweise**

These instructions are part of the device. They contain texts and figures about the correct operation of the device and must be read before installation or operation. Obey the safety instructions. Use the device in accordance with its designated operation.

**EN**

The installation and connection must obey the applicable national and international standards. Responsibility lies with the person installing the device. Only the electric signals indicated in the technical data or on the device label may be supplied to the connections or wires.

Only the manufacturer or a person authorized by the manufacturer can open the device. An exception to this rule is the replacement of the screws to attach the fixation bar by a qualified specialist. During the replacement of the screws it should be avoided to open the housing.

Diese Anleitung ist Bestandteil des Gerätes. Sie enthält Texte und Abbildungen zum korrekten Umgang mit dem Gerät und muss vor einer Installation oder dem Einsatz gelesen werden. Beachten Sie die Sicherheitshinweise. Verwenden Sie das Gerät bestimmungsgemäß.

**DE**

Der Einbau und Anschluss muss den gültigen nationalen und internationalen Normen entsprechen. Die Verantwortung trägt derjenige, der das Gerät installiert. An den Anschlüssen dürfen nur die in den technischen Daten, bzw. auf dem Geräteaufdruck angegebenen Signale eingespeist werden.

Das Gerät darf nur vom Hersteller oder von einer durch den Hersteller autorisierten Person geöffnet werden. Eine Ausnahme stellt hier nur die Entfernung der Schrauben zum Anbringen des Befestigungsbügels durch eine qualifizierte Fachkraft dar. Auch bei diesem Vorgang sollte das Öffnen des Gehäuses vermieden werden.

### 3. Intended Use / Bestimmungsgemäße Verwendung

**EN** The **CamBoard pico monstar** is a Time-of-Flight camera module for the operations on a USB port. The camera module can be used under the following conditions:

- The **CamBoard pico monstar** is intended for indoor use only.
- Do not use the **Camboard pico monstar** in hot, cold, dusty or humid environment.
- Keep the **CamBoard pico monstar** away from moisture.
- Only connect the **CamBoard pico monstar** to a USB compliant port.
- For the trigger signal connector you must use only cable, which were manufactured by **pmd** or according to the instructions from **pmd**.
- Do not touch the lens with your hand or any sharp objects.
- Use only clean, dry, soft cloth for cleaning.

### Highly divergent laser radiation

- Unauthorized opening of the device will void all liability and warranty claims. The manufacturer assumes no liability for any resulting damage.
- Only qualified persons are allowed to open the backside of the enclosure when the fixation bar should be attached.

This should only be done in a clean environment after disconnecting the camera from all electrical connections. Make sure that nothing gets in the device during the process. Conductive materials in the device could deactivate the safety circuits of the laser.



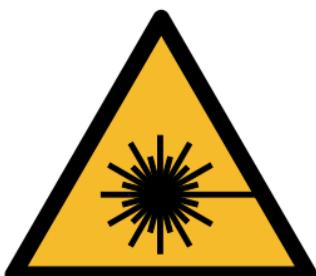
Das **CamBoard pico monstar** ist eine Time-of-Flight-Kameramodul für den Betrieb an einem USB-Port. Das Kameramodul darf unter folgenden Bedingungen genutzt werden:

DE

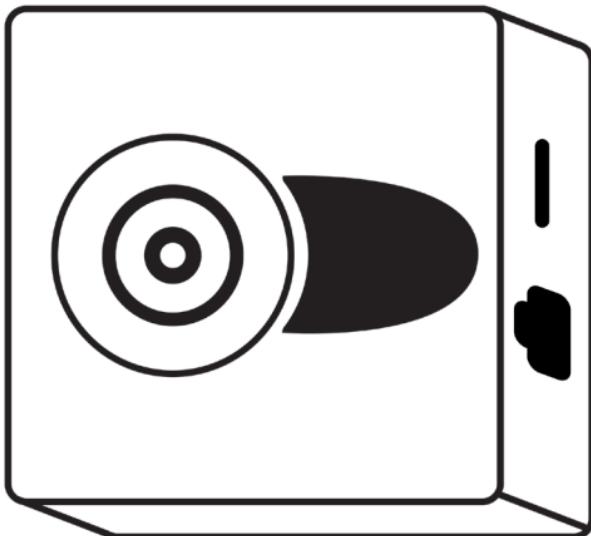
- Das **CamBoard pico monstar** ist ausschließlich zum Betrieb in geschlossenen Räumen bestimmt.
- Verbinden Sie dieses Modul ausschließlich mit standardkonformen USB-Ports.
- Benutzen Sie für das Triggersignal nur von **pmd** bereitgestellte oder nach der **pmd**-Vorgabe erstellte Anschlussleitungen.
- Nutzen Sie das **CamBoard pico monstar** nicht in heißen, kalten, staubigen oder feuchten Umgebungen.
- Halten Sie das **CamBoard pico monstar** von Feuchtigkeit fern.
- Berühren Sie die Linse nicht mit Ihrer Hand oder scharfen Gegenständen.
- Reinigen Sie das Modul ausschließlich mit einem sauberen, trockenen, weichen Tuch.

## **Hochdivergente Laserstrahlung**

- Bei unautorisiertem Öffnen des Gerätes erlöschen jegliche Haftungs- und Gewährleistungsansprüche. Der Hersteller übernimmt keine Haftung für dadurch entstandene Schäden.
- Wenn zur Anbringung des Befestigungsbügels die Rückseite des Gehäuses zu öffnen ist, so darf dies nur durch qualifiziertes Personal erfolgen. Öffnen Sie das Gehäuse nur in einer sauberen Umgebung, nachdem Sie die Kamera von allen elektrischen Anschlüssen getrennt haben. Achten Sie darauf, dass während des Prozesses nichts in das Gehäuse eindringen kann. Leitende Materialien könnten z.B. dazu führen, dass die Schutzschaltung des Lasers außer Betrieb gesetzt wird.



## 4. Electrical connection / Elektrischer Anschluss



MICRO USB 3.0  
CONNECTOR

CONNECTOR  
FOR TRIGGER  
IN/OUT

## 5. Approvals & Standards / Zulassungen & Normen

The EU declaration of conformity is available at:  
[pmdtec.com/picofamily/conformity](http://pmdtec.com/picofamily/conformity)

EN



The **CamBoard pico monstar** is CE compliant. It conforms to EN61010-1:2010, EN 55032 Kl. A:2012, EN 55024:2010 and EN 61326-1:2013/IEC 60825-1: 2007 / IEC 60825-1: 2014, RoHS compliant 2011/65/EU.

**Warning:** This device meets the requirements of the class A according to CISPR 32. This device may cause radio interference in the residential area.



This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

**DE** Die EU-Konformitätserklärung ist abrufbar unter:  
[pmdtec.com/picofamily/conformity](http://pmdtec.com/picofamily/conformity)



Das **CamBoard pico monstar** ist CE konform. Es entspricht der EN61010-1:2010, EN 55032 Kl. A:2012, EN 55024:2010 und EN 61326-1:2013/IEC 60825-1: 2007 / IEC 60825-1: 2014; Das **CamBoard pico monstar** ist RoHS konform gemäß 2011/65/EU

Das **CamBoard pico monstar** genügt den Anforderungen der Klasse A nach CISPR 32. Diese Einrichtung kann im Wohnbereich Funkstörungen verursachen.

## **6. Items supplied**

1. CamBoard pico monstar



2. USB cable



3. Fixation bar incl. Screws



4. Getting Started manual

## 7. Installation

Please use the **software download** on the bottom of [www.pmdtec.com/picofamily](http://www.pmdtec.com/picofamily) to download the software package including full API documentation for the **CamBoard pico family**.

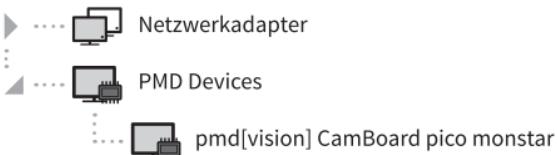
**SOFTWARE  
DOWNLOAD**

**Password: Sh!2CBpf**

Unpack the ZIP file. You will find several packed files inside that correspond to the supported OS platforms. Choose the file for your OS and unpack it to a location of your choice e.g. your desktop.

### 7.1. Windows

- There are installers for installing software and drivers for the **CamBoard pico family** (libroyale-3.9.0.X-WINDOWS-x86-64Bit.exe and libroyale-3.9.0.X-WINDOWS-x86-32Bit.exe).
- Please follow the instructions of the installation assistant. Choose “Weiter”/“Continue” on the first screen, then accept the license agreement on the second screen (“Annehmen”/“Accept”).
- Make sure that the checkboxes for Desktop icon and install of the drivers on the third screen are checked.
- On the fourth screen you may change the installation path.
- After successful installation you may
  - » Connect the **CamBoard pico monstar** to your PC via USB.
  - » Open the device manager (on a console or in the Win8-search type „mmc devmgmt.msc“ and hit RETURN)
  - » The **CamBoard pico monstar** should show up in the „PMD Devices“ section. For each connected **CamBoard pico monstar** an entry should exist.



## 7.2. Linux

Please extract the Linux package (will result in a “libroyale-3.9.0.X-LINUX-x86-64Bit” or “libroyale-3.9.0.X-LINUX-x86-32Bit” folder). Then transfer the complete folder to your computer.

Make sure that you have proper permissions to the USB device. The installation package contains a proper rules file which can be used. It is located in the /driver/udev directory. Make sure to read the README file for more details.

## 7.3. Mac OS X

For Mac OS X please extract the zip package (will result in a “libroyale-3.9.0.X-APPLE-x86-64Bit” folder). Then transfer the complete folder to your computer. You will find the Royale viewer app in the /bin subfolder.

# 8. API documentation (Royale documentation)

The **Royale** software package provides a light-weight camera framework for time-of-flight (ToF) cameras. While being tailored to pmd cameras, the framework enables partners and customers to evaluate and/or integrate 3D TOF technology on/in their target platform. This reduces time to first demo and time to market.

The full html documentation can be found within the doc subfolder in the installation path (Windows) or in the unpacked folder (Linux and Mac OS X).

- C:\Program Files\libroyale\3.9.0.X\doc\html\index.html
- libroyale-3.9.0.X-[platform]\doc\html\index.html

## 9. Royale viewer

Once the **CamBoard pico monstar** is attached to a free USB port, and the drivers are in place, you may start the Royale viewer application which gives you a first indication, if the **CamBoard pico device** is working on your target system. The Royale viewer displays a 2D and a 3D representation of the captured depth data.

## 10. Use cases

Please note that these settings are initial proposals. When investigating your specific application do not hesitate to try a different use case, in order to verify whether it provides more beneficial data.

Nr.	Use case	Name	Range(*) (m)	Frame-rate	max. Exposure Time (us)
1	Indoor room reconstruction	MODE_9_5FPS_1900	0.9 - 6.0	5 fps	1900
2	Room scanning, indoor navigation	MODE_9_10FPS_900	0.7 - 5.2	10 fps	900

<b>3</b>	3D object reconstruction	MODE_9_15FPS_600	0.5 - 4.3	15 fps	600
<b>4</b>	Medium size object recognition, face reconstruction	MODE_9_25FPS_300	0.5 - 3.4	25 fps	300
<b>5</b>	Remote collaboration, step by step instruction, table-top gaming	MODE_5_35FPS_500	0.5 - 3.4	35 fps	500
<b>6</b>	Small object/product recognition, Hand tracking	MODE_5_45FPS_400	0.5 – 3.0	45 fps	400
<b>7</b>	Hand tracking	MODE_5_60FPS_300	0.5 – 2.6	60 fps	300
<b>8</b>	Mixed Mode	MODE_MIXED_30_5		30/5fps	270/970
<b>9</b>	Mixed Mode	MODE_MIXED_50_5		50/5fps	210/850

(\*) Typical values for lambertian reflection of 90% without ambient light, center of image; due to the wide FoV the depth performance may decrease for non-central pixel.

These are no hard limits. Depending on the reflectivity of the scene also further and closer distances might be visible.

### **10.1. Indoor room reconstruction**

pmd sensors are a viable solution to locate objects or people inside large environments, such as buildings. This use case is optimized for long range scanning at a maximum data quality. By making use of multiple frequencies the ambiguity range of the sensor signal can be increased by several magnitudes. At the same time this sampling methods leads to an increase in data confidence and applications with very high demands in data quality can be realized.

### **10.2. Room scanning, indoor navigation**

For mapping applications demanding an enhanced situational awareness quick response times are a necessity. These demands are met by increasing the framerate at a minimum cost in data quality.

### **10.3. 3D object reconstruction**

Scanning and reproduction of man-sized objects in close proximity demands high data confidence equal to environmental mapping. Since in general the objects of interest are in closer proximity, the range requirements and necessary integration time can be lowered in favor of faster scanning speed.

### **10.4. Medium size object recognition, face reconstruction**

In general, the quality demands of applications in the field of pattern and object recognition are less demanding than metrological applications. On the other hand, a quick system response time is mandatory. Therefore, the integration time and correspondingly the data quality is lowered in favor of faster framerates.

### **10.5. Remote collaboration, step by step instruction, table-top gaming**

For modern gaming and collaborative applications a quick system response is even more important. Since the range requirement can

be lowered and the noise performance of pmd sensors is directly related to the object distance, higher framerates at equal data quality can be realized.

### **10.6. Small object/product recognition**

For hand-size objects and products the necessary range requirements can be further limited and only one scanning frequency is sufficient. Therefore the framerate can be almost doubled and vice versa the overall scanning speed.

### **10.7. Hand tracking**

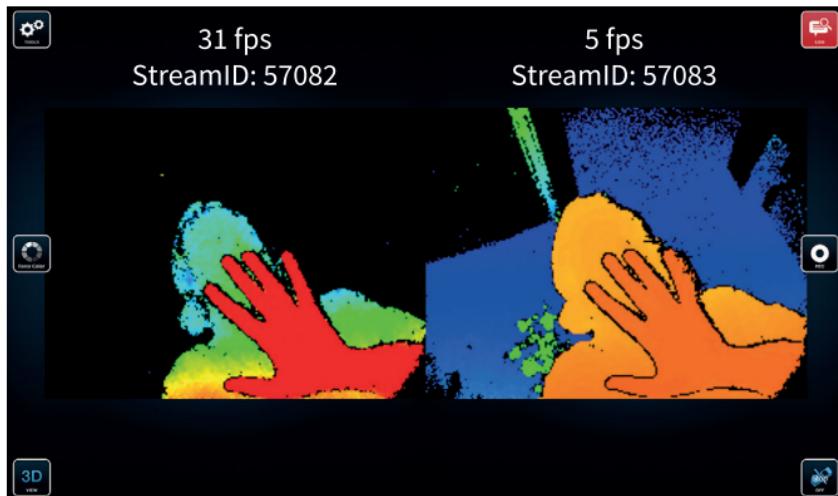
The precise detection and recognition of hand gestures in 3D space is very demanding, both in data quality and processing speed. Hence a special use case has been devised offering optimum setting for this special application.

### **10.8. Mixed Modes**

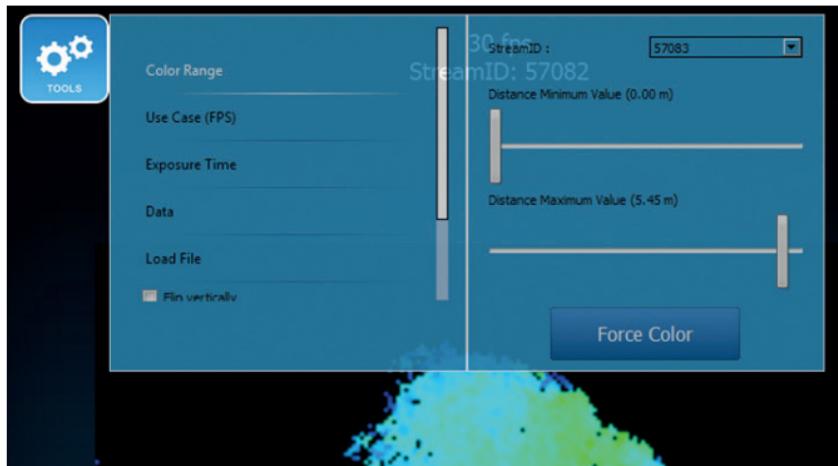
The mixed modes can be used to run two or more different modes at the same time, by capturing frames that fit into separate use cases.

For the **CamBoard pico monstar**, Royale offers mixed modes that are a combination of short range/high fps (e.g. for hand tracking) and long range/low fps (environmental scanning). They can be selected like any other use case; to enable the application to distinguish the different use cases the frames will be delivered as separate streams.

In the Royale viewer application this is visualized like this:



If you're using one of the mixed modes some settings will require you to select a StreamId:



## 11. Troubleshooting/ Known Bugs/ Errata

Problem	Possible solution
Camera not recognized (“CX3” in device manager)	Install drivers as described in chapter 4.
Camera not functional on USB3 port	Try using another USB cable. (Recommended: USB-to-microUSB3).
Nothing happens after pressing start in the royale viewer.	Starting the visualization might take a few seconds. Please click the “Info” Button to check if the camera was found. If the camera was not found please install drivers as described in chapter 4.
Far distances are shown as close distances.	<p><b>a.</b> Switch to a MODE_9 use case to extend the unambiguity range <b>b.</b> Decrease the exposure time</p> <p>Technical Explanation: Due to the periodicity of the frequency modulation the unambiguous range for the distance calculation is limited. Therefore in some use cases (MODE_9...) two modulation frequencies are combined to extend the unambiguity range. The combination of both frequencies yields in an extended unambiguity range of approx. 7,5m. Some use cases only use one modulation frequency (MODE_5...) in order to achieve higher frame-rates. In those Use Cases the unambiguity range is approx. 2,5m. Due to the illumination power of the camera module points in the scene beyond 2,5m may be visible. Those will be mapped into the unambiguity range.</p>

## 12. Tested configurations

OS	Comment
Windows 7	Tested with Windows 7 Enterprise (SP1), 32 bit
Windows 8	
Windows 8.1	
Windows 10	
Linux (Ubuntu 15.04, Ubuntu 14.04 + Qt5.5)	Tested with Ubuntu 15.04 32/64 bit
Mac OS X	No special action required

## **Notes**

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