ZED

Getting Started

Contents

Getting Started with the ZED

Introduction

Welcome to the ZED Camera Getting Started Guide.

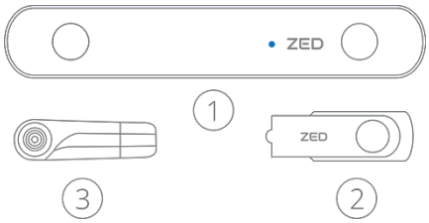
Please read the following instructions carefully to make sure you get the best experience out of the ZED Camera. This first part describes how to set up and use your ZED Camera for the first time. That includes:

- Installing the required runtime packages prior to installation.
- Installing the ZED drivers and software.
- Configuring your ZED Camera and loading calibration files.
- Testing the ZED Camera with the ZED Viewer

For further information about the ZED SDK and code structure please refer to the following section “Getting Started with the ZED SDK” page 8.

What’s In The Box ?

Make sure your ZED package is complete when you open the box for the first time.



1. ZED Stereo Camera
2. USB Drive for Drivers and SDK
3. Mini Tripod Stand

The ZED Camera has an integrated 2.0m / 6.5 feet USB3.0 cable. On the provided ZED USB Drive you will find the setup files for the ZED Camera and ZED SDK software. If you have lost the USB drive, you can find all the necessary files in our developer zone at stereolabs.com. Feel free to check our website often since we release updates on a regular basis.

System Requirements

This section describes the minimum system requirements to use the ZED SDK, we recommend to use a high performance hardware to ensure reliable computation time.

Operating Systems The ZED SDK 0.9.x currently supports Windows 7, 8 and 8.1 (64 bits) as well as Linux Ubuntu 14.04 and Linux4Tegra (Jetson OS).

Minimum System Requirements

In order to run the ZED SDK you need to have at least the following configuration:

- Dual-core 2,3GHz or faster processor
- 4 GB RAM or more
- NVIDIA GPU with Compute Capabilities > 2.0
- CUDA 6.5 (Linux) / 7.0 (Windows)
- USB 3.0 port
- Windows 7, Windows 8, Windows 8.1 (64 bits), Ubuntu 14.04, L4T21.3/4

In order to take full advantage of the ZED SDK you need a modern and powerful NVIDIA GPU. We currently support CUDA 6.5 (Linux) / 7.0 (Windows) and all the compute capabilities from 2.0 to 5.2. We will provide a newer version of the SDK as soon as possible when the next version of CUDA is released.

Recommended configuration:

- Dual-core 2,5GHz processor or faster
- 4 GB of RAM
- NVidia GTX 560
- CUDA 6.5 (Linux) / 7.0 (Windows)
- USB 3.0 port
- Windows 7, Windows 8, Windows 8.1 (64 bits), Ubuntu 14.04, L4T21.3/4

Additionally, if you plan to record high resolution footage –i.e 3840x1080 @ 30fps – we recommend having a fast SSD with transfer speeds easily reaching 250 MB/s. If you are recording on your OS disk, we strongly recommend at least 256GB capacity. The videos are recorded with no compression to ensure the best quality in playback. An available USB 3.0 port is mandatory.

If you don't have an NVIDIA GPU – i.e: Intel HD Graphics or AMD chip - you can still use the tools such as the ZED Explorer to view and record side by side 3D video but you will not be able to visualize depth or use any of the samples. If you are looking for a portable workstation, the Nvidia GT 640M inside a PC Laptop provides minimal graphics power to run the samples.

ZED Camera Setup

Prior to launching the ZED SDK Setup wizard provided in the ZED USB drive, please make sure the following installation prerequisites are installed.

Important Installation Prerequisites

Before you start developing applications with the ZED, make sure the following assets are installed.

- Latest USB 3.0 drivers.
- Latest NVIDIA Display Driver.
- NVIDIA CUDA 6.5 (Linux) / 7.0 (Windows) Toolkit.
- Visual Studio 2012 and 2013 Redistributable Packages

An up-to-date Nvidia GPU is required to use the samples and develop applications for the ZED.

Installing the ZED SDK – Windows

1. Plug your ZED into an **USB 3.0** port and **make sure** the computer has an internet access.
2. Launch the installer ZED_SDK_WinSetup_vX.Y.exe which you will find in the ZED USB Drive and follow the instructions.
3. Finish the setup procedure, **unplug your ZED** and restart your computer.
4. If you have experienced an issue because your ZED wasn't detected or internet access wasn't found, please refer to the **Camera Calibration Settings** section below.

Internet access is required since the installer will fetch your camera calibration file from our online database.

- If you don't have an internet access only during setup, your firewall blocks access or you experience an issue during setup, please refer to the **Camera Calibration Settings** section below.
- If you don't have an internet access at all on your computer you can still use the ZED SDK but depth measurement won't be accurate.

! Make sure you unplug your ZED **BEFORE** restarting your computer. On some computers, we have noticed that USB 3.0 devices could prevent from rebooting.

Installing the ZED SDK – Linux

Before you start developing applications with the ZED, download and install **CUDA 6.5 (Linux) / 7.0 (Windows) toolkit**. Compile and install **OpenCV 2.4.9** : This version can be downloaded here. Tutorial available here.

1. Plug your ZED into an **USB 3.0** port and **make sure** the computer has an internet access.
2. In a terminal, launch the installer and follow the **instructions** :
    - ex : *user@ubuntu1404:/path/to/sdk$./ZED_SDK-Linux-x86_64-vX.X.run*

Internet access is required since the installer will fetch your camera calibration file from our online database.

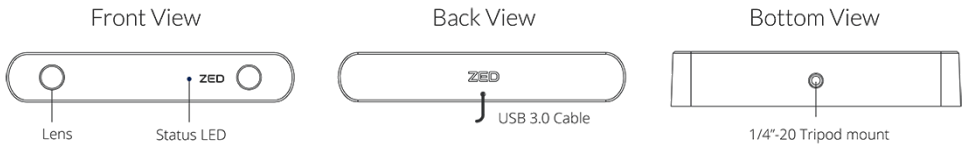
- If you don't have an internet access at all on your computer you can still use the ZED SDK but depth measurement won't be accurate.
- The **SDK** will be installed in /usr/local/zed/, the installer shouldn't be launched at root to avoid access right issues on the installation folder (the "chown" or "chmod" command can resolve the problem if encountered)

Getting to know your ZED Camera

The ZED Stereo Camera is a lightweight depth sensor based on passive stereovision. It outputs a high resolution side-by-side video on USB 3.0 that contains two synchronized left and right video streams. Using the ZED SDK, the graphics processing unit (GPU) from a host machine computes the depth map from the side-by-side video in real-time (assuming you have a powerful GPU).

The ZED SDK provides three types of data:

- A side by side synchronized 3D RGB **video stream** (left stream+right stream)
- A **depth map** computed on the GPU from the video stream (and the disparity map)
- A **confidence map** which represents a score depicting the confidence of the measure.

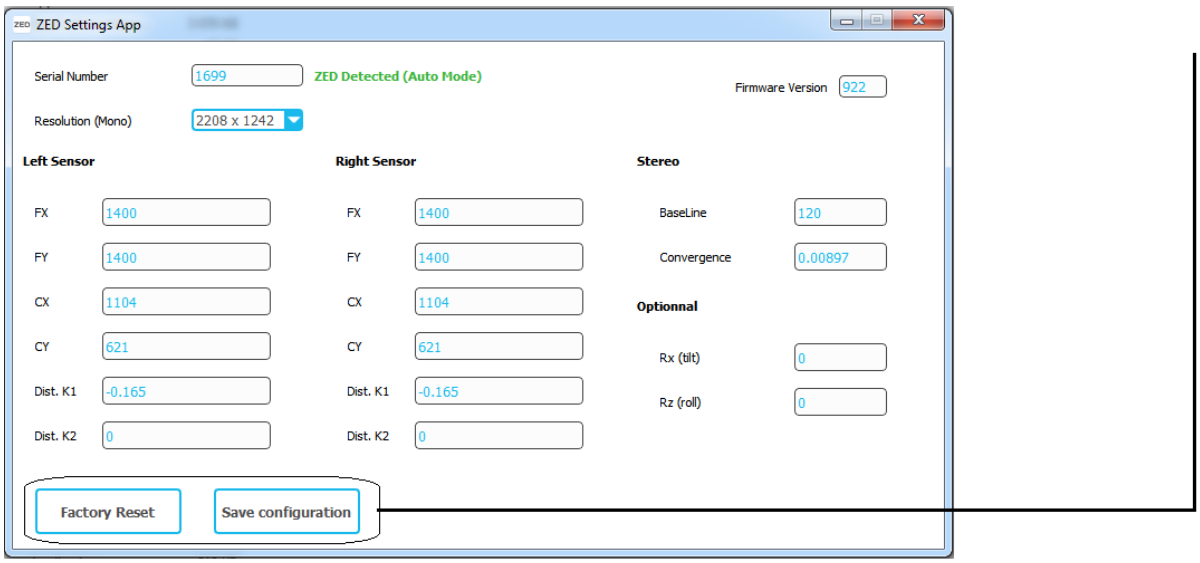


The Status LED shows the stream state of the ZED. When the ZED camera streams images, the LED turns solid blue.

Camera Calibration Settings

The ZED camera is factory calibrated, meaning you will not have to calibrate the camera each time you power it on. Each ZED camera has its own calibration data enclosed in a calibration file. This file is fetched automatically from our online database during the ZED SDK Setup. If you have experienced an issue during setup or you didn't have internet access during setup, please follow the following steps to manually fetch your specific calibration file from our online database.

1. Ensure your computer is connected to the internet.
2. Plug your ZED into a USB 3.0 port
3. Launch the **'ZED Settings App'** and click on **'Factory Reset'**, then **'Save Configuration'**. The Settings App will thus fetch your camera calibration file from our online database and load it into the software.



The ZED Settings App lets you control the calibration data for the ZED camera, you can view and tune various calibration settings for each resolution.

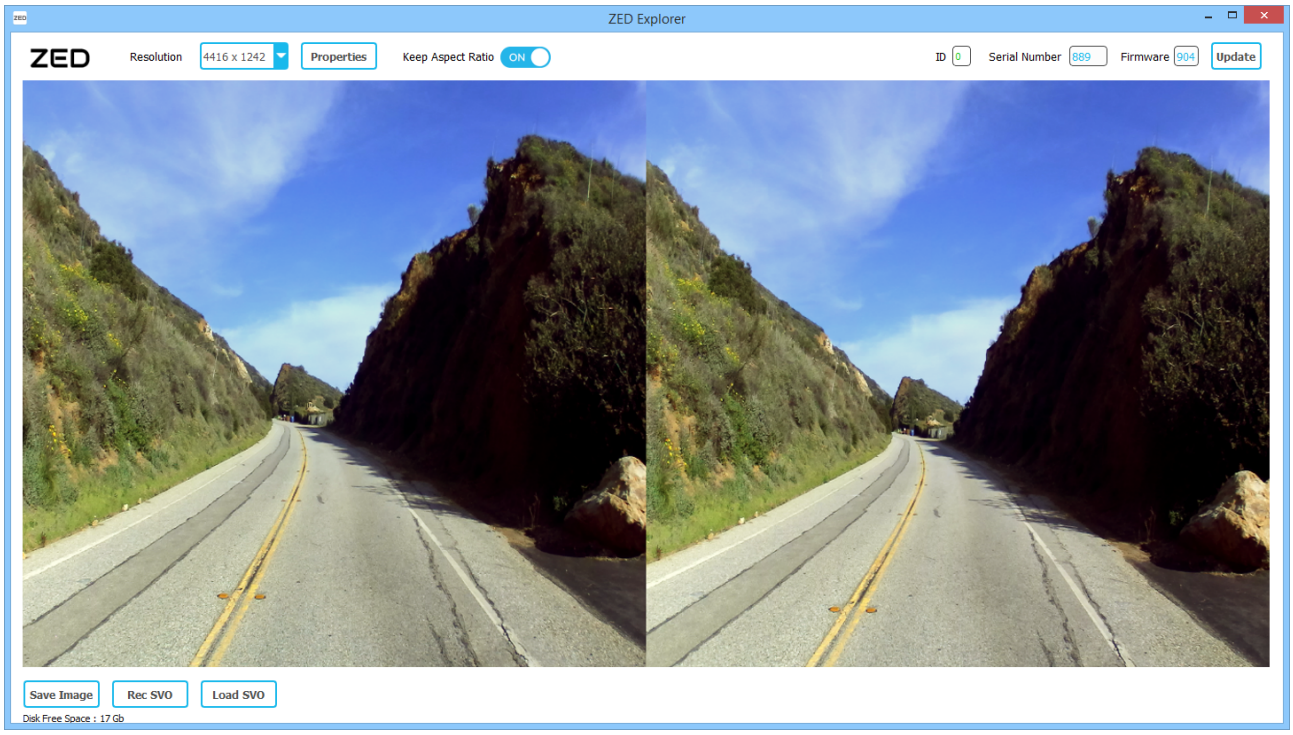
Updating the firmware

You can update the ZED Camera firmware in the ZED Explorer tool – with your ZED Camera plugged in - by clicking on the Update button and selecting the latest firmware (it can be downloaded on our website, as a .bin file).

! **DO NOT** unplug the ZED Camera while the firmware is being uploaded. Doing that can permanently damage your ZED Camera

Testing the ZED using the ZED Explorer

The ZED Explorer is an application for ZED video preview and recording. The application also lets you change video resolution, aspect ratio and camera control parameters. It also allows you to capture full resolution snapshots and video with the ZED.



Double click on the 3D image to toggle Full Sceen mode.

Video Modes

You can switch between four different video modes:

Video Mode	Output Resolution (SBS)	Framerate	Field of View
2.2K	4416x1242	15fps	Wide
1080p	3840x1080	30fps	Wide
720p	2560x720	60fps	Extra Wide
VGA	1280x480	100fps	

Please note that the field of view is linked to the video mode.

Recording Video

The ZED Explorer records feeds in a Stereolabs SVO format that is compatible with the ZED SDK functions. With SVO files, you can record stereo feeds from the ZED and compute later the depth map for these feeds using the SDK. You can convert SVO files to Side by Side or 2D+Depth AVI files using the **SVO Decoder** Sample provided in the SDK.

For further information on how to convert SVO files refer to the dedicated **ZED SVO Decoder** Sample section.

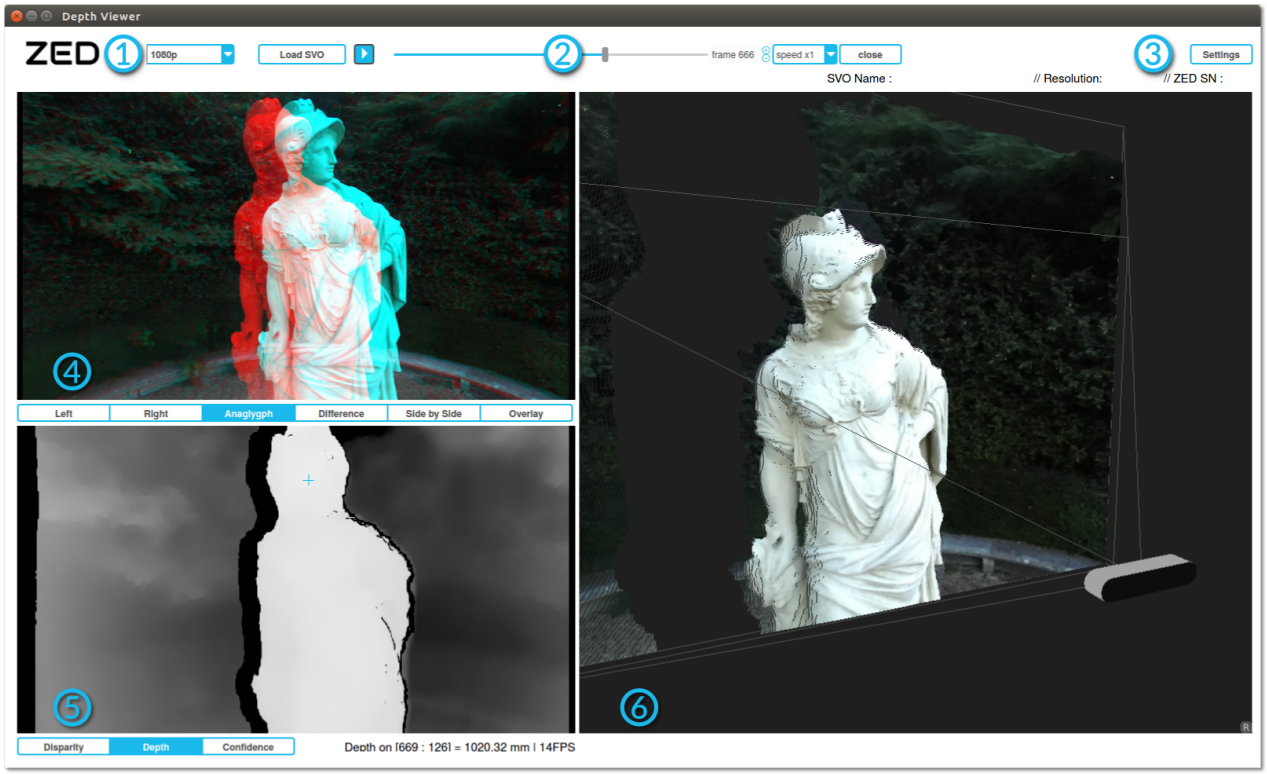
Saving Still Images

You can save a Side by Side raw PNG image by clicking on the **Save Image** button.

Other Tools

ZED Depth Viewer

The ZED Depth Viewer tool allows you to visualize Depth and Point Cloud computed from the ZED Camera or from an SVO File.



1. ZED Camera Resolution (in Live Mode only)
2. SVO Control Panel (in SVO Mode only)
3. Settings
4. RGB Frame
5. Depth Frame
6. 3D Point Cloud Visualizer

ZED Camera Resolution

You can choose the **Resolution** between **2K** / **1080p** / **720p** and **VGA**.

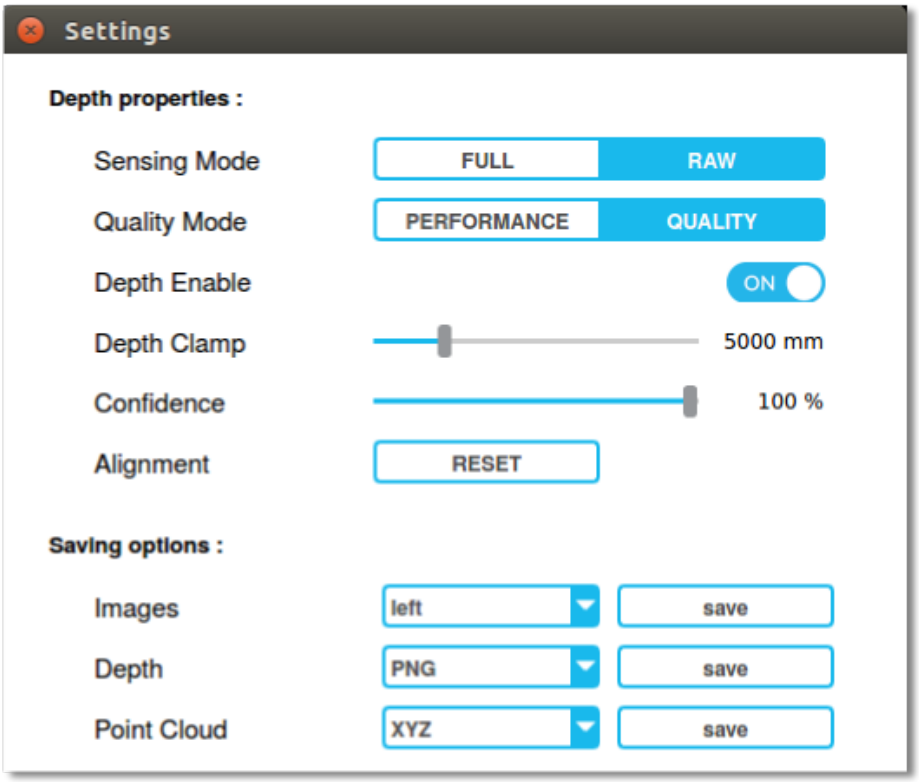
SVO Control Panel

This panel allows you to:

- **Load** an SVO File. You can also directly **Drag & Drop** the file
- **Play/Pause** the video
- Select a frame with the **slider** or with the **+/-** buttons
- Select the video **speed**
- **Close** the file

Settings

This is the Settings panel:



Several Depth properties are customizable such as Sensing Mode and Quality.

You can also save RGB Images, Depth and Point Cloud in different file formats.

NB: The 3D Point Cloud visualization is **not available** with **FULL** Sensing Mode.

Saving options

Images	Depth	Point Cloud
Left	PNG	PCD
Right	PGM	PLY
Anaglyph	PFM	XYZ
Difference		VTK
Side by Side		
Overlay		

RGB Frame

By default, this frame displays the **Anaglyph** view. You can also switch between **Left** View / **Right** View / **Gray Scale Difference** View/ **Side by Side** View and **Overlay** View.

Depth Frame

By default, this frame displays the **Depth map** (with real world depth information). You can also visualize the **Disparity Map** (without real world depth information) or the **Confidence Map** (for confidence of disparity estimation).

3D Point Cloud Visualizer

In this frame you can visualize and move around the **3D Point Cloud**.

Keyboard Controls

Key	Description
R	**Reset** the view
T	**Top** view
P	**Increase** point size
M	**Decrease** point size

ZED SVO Editor

The ZED SVO Editor tool allows you to cut a part of an SVO file and also merge multiple SVO files into a single one.

Running the program

This program must be run in a command prompt.

Cut an SVO file:

```
./ZED\ SVOEditor -cut SVOToCut.svo -s 100 -e 200 Output.svo
```

Merge multiple SVO files:

```
./ZED\ SVOEditor -merge SVO1.svo SVO2.svo ... Output.svo
```

Available Options

Option	Description	Arguments
--help	Display help message	
-inf	Print SVO file information	**path** to an SVO file
-cut	Cut an SVO file between **-s** and **-e** frames	**path** to an SVO file
-s	Starting frame. If not specified, first frame will be taken	**int**
-e	Ending frame. If not specified, last frame will be taken	**int**
-merge	Merge up to 32 SVO files together	**paths** to SVO files. Last argument is the **path** of the output SVO file

Troubleshooting

General Messages

Why is the ZED Explorer display window black or the video frame rate low?

This problem occurs when the ZED is connected on a USB 2.0 port. Please connect the ZED to a USB 3.0 port and make sure that USB 3.0 drivers are installed.

The depth values displayed in the samples seem erroneous.

Follow the MANUAL CALIBRATION FILE DOWNLOAD procedure.

When I record and play an SVO Video File, the video is skipping frames.

This is due to the speed of your recording/playback media. If you record at high resolution, make sure you are using an SSD drive.

Common Error Messages

“MSVCP100.DLL”, “MSVCP110.DLL” or “MFC110U.DLL missing”

In order to fix the issue you may install the latest Microsoft Visual C++ 2012 and 2013 Redistributable Packages. You can download these packages from Microsoft website or find them on the ZED USB drive.

“CUDART32_65.DLL missing”

You need to have an NVIDIA graphics card and NVIDIA CUDA installed to run the samples included in the SDK. To fix this issue, download and install CUDA 6.5 (Linux) / 7.0 (Windows) from NVIDIA website or from the ZED USB drive.

“GPU Device Not Found”

Your NVIDIA Display Driver is probably out of date, please update your graphics card display driver with the latest version available on NVIDIA website.

“ZED Found / ZED Not Available”

This problem can occur if your computer does not supply enough power through USB to the ZED. Try another USB 3.0 port available.

“Autocalibration Failed”

Make sure the ZED has a clear field of view when you start the sample. It’s also recommended to avoid pointing at objects less than 1 m away from the camera, or towards the ground.

Legal Terms

PRODUCT WARRANTY AND SOFTWARE LICENCE

PRODUCT WARRANTY

BY USING YOUR ZED CAMERA YOU AGREE TO THIS WARRANTY. BEFORE SETTING IT UP, PLEASE READ THIS WARRANTY CAREFULLY. IF YOU DO NOT ACCEPT THIS WARRANTY, DO NOT USE YOUR ZED CAMERA. RETURN IT UNUSED TO STEREOLABS FOR A REFUND. Contact STEREOLABS at contact@stereolabs.com

1. Definitions

"ZED Camera" means a new ZED Camera purchased from STEREOLABS.
"Warranty Period" means 1 year from the date You purchased Your ZED Camera.
"You" means the original end-user.
"Normal Use Conditions" means ordinary consumer use under normal home conditions according to the User Guide for the ZED Camera.

2. Warranty

2.1. During the Warranty Period, STEREOLABS warrants, only to You, that the ZED Camera will not malfunction under Normal Use Conditions.
2.2. This is the only warranty STEREOLABS gives for Your ZED Camera and STEREOLABS gives no other guarantee, warranty, or condition. No one else may give any guarantee, warranty, or condition on STEREOLABS's behalf.

3. How to Get Warranty Service

3.1. Before starting the warranty process, please use the trouble-shooting tips at http://www.stereolabs.com.
3.2. If the troubleshooting tips don't resolve Your problem, then follow the online process at http://www.stereolabs.com.

4. STEREOLABS's Responsibility

4.1. After You return Your ZED Camera, STEREOLABS will inspect it.
4.2. If STEREOLABS determines that the ZED Camera malfunctioned during the Warranty Period under Normal Use Conditions, STEREOLABS will (at its option) repair or replace it, or refund the purchase price to You. Repair may use new or refurbished parts. Replacement may be with a new or refurbished unit.
4.3. After repair or replacement, Your ZED Camera will be covered by this warranty for the longer of the remainder of Your original Warranty Period, or 95 days after STEREOLABS ships it to You.
4.4. STEREOLABS'S RESPONSIBILITY TO REPAIR OR REPLACE YOUR ZED CAMERA, OR TO REFUND THE PURCHASE PRICE, IS YOUR EXCLUSIVE REMEDY.
4.5. If Your ZED Camera malfunctions after the Warranty Period expires, there is no warranty of any kind. After the Warranty Period expires, STEREOLABS may charge You a fee for its efforts to diagnose and service any problems with Your ZED Camera.

5. Warranty Exclusions

5.1. damaged by use with products not sold or licensed by STEREOLABS (including, for example, games and accessories not manufactured or licensed by STEREOLABS, and "pirated" games, etc.);
5.2. used for commercial purposes (including, for example, rental, pay-per-play, etc.);
5.3. opened, modified, or tampered with (including, for example, any attempt to defeat any ZED Camera technical limitation, security, or anti-piracy mechanism, etc.), or its serial number is altered or removed;
5.4. damaged by any external cause (including, for example, by being dropped, used with inadequate ventilation, etc., or failure to follow instructions in the instruction manual for the ZED Camera); or
5.5. repaired by anyone other than STEREOLABS.

6. EXCLUSION OF CERTAIN DAMAGES

STEREOLABS IS NOT RESPONSIBLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES; ANY LOSS OF DATA, PRIVACY, CONFIDENTIALITY, OR PROFITS; OR ANY INABILITY TO USE YOUR ZED CAMERA. THESE EXCLUSIONS APPLY EVEN IF STEREOLABS HAS BEEN ADVISED OF THE POSSIBILITY OF THESE DAMAGES, AND EVEN IF ANY REMEDY FAILS OF ITS ESSENTIAL PURPOSE

7. Additional Terms

If You attempt to defeat or circumvent any ZED Camera technical limitation, security, or anti-piracy system, You may cause Your ZED Camera to stop working permanently. You will also void Your warranty, and make Your ZED Camera ineligible for authorized repair, even for a fee. French law governs the interpretation of this warranty and any claim that STEREOLABS has breached it, regardless of conflict of law principles.

SOFTWARE LICENSE

BY USING YOUR ZED CAMERA YOU AGREE TO THIS SOFTWARE LICENSE. BEFORE SETTING IT UP, PLEASE READ THIS SOFTWARE LICENSE CAREFULLY. IF YOU DO NOT ACCEPT THIS SOFTWARE LICENSE, DO NOT USE YOUR ZED CAMERA. RETURN IT TO UNUSED TO STEREOLABS FOR A REFUND. Contact STEREOLABS at contact@stereolabs.com

1. **Definitions**
   "Authorized Accessory" means a STEREOLABS branded ZED, and a STEREOLABS licensed, third party branded, ZED hardware accessory whose packaging bears the official "Licensed for ZED" logo. The ZED Camera is an Authorized Accessory solely for purpose of this Software license.
   "Software" means the Software Development Kit, pre-installed in the ZED USB flash drive included in the ZED packaging, and including any updates STEREOLABS may make available from time to time.
   "Unauthorized Accessories" means all hardware accessories other than an Authorized Accessory.
   "Unauthorized Software" means any software not distributed by STEREOLABS.
   "You" means the user of a ZED Camera.

2. **License**

a. The Software is licensed to You, not sold. You are licensed to use the Software only as pre-installed in Your ZED USB flash drive, and updated by STEREOLABS from time to time. You may not copy or reverse engineer the Software.
b. As conditions to this Software license, You agree that:
i. You will use Your Software with ZED Camera only and not with any other device (including). You will not use Unauthorized Accessories. They may not work or may stop working permanently after a Software update.
ii. You will not use or install any Unauthorized Software. If You do, Your ZED Camera may stop working permanently at that time or after a later Software update.
iii. You will not attempt to defeat or circumvent any Software technical limitation, security, or anti-piracy system. If You do, Your ZED Camera may stop working permanently at that time or after a later Software update.
iv. STEREOLABS may use technical measures, including Software updates, to limit use of the Software to the ZED Camera, to prevent use of Unauthorized Accessories, and to protect the technical limitations, security and anti-piracy systems in the ZED Camera.
v. STEREOLABS may update the Software from time to time without further notice to You, for example, to update any technical limitation, security, or anti-piracy system.

3. **Warranty**
   The Software is covered by the Limited Warranty for Your ZED Camera, and STEREOLABS gives no other guarantee, warranty, or condition for the Software. No one else may give any guarantee, warranty, or condition on STEREOLABS's behalf.

4. **EXCLUSION OF CERTAIN DAMAGES**
   STEREOLABS IS NOT RESPONSIBLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES; ANY LOSS OF DATA, PRIVACY, CONFIDENTIALITY, OR PROFITS; OR ANY INABILITY TO USE THE SOFTWARE. THESE EXCLUSIONS APPLY EVEN IF STEREOLABS HAS BEEN ADVISED OF THE POSSIBILITY OF THESE DAMAGES, AND EVEN IF ANY REMEDY FAILS OF ITS ESSENTIAL PURPOSE.

5. **Choice of Law**
   French law governs the interpretation of this Software license and any claim that STEREOLABS has breached it, regardless of conflict of law principles.