

# ZED X



## ZED X Camera and SDK Overview

The **ZED X** stereo camera combines powerful hardware and intelligent software to create an unrivaled solution in terms of performance, functionality and design.

Designed to function efficiently in harsh environments, the IP66-rated ZED X stereo camera with its robust aluminum body withstands severe conditions with high particulate content, and water ingress, making it ideal for industrial applications such as agriculture, manufacturing, pharmaceuticals and many more.

The ZED X covers the entire spectrum of applications from robotics and spatial analytics to interactive experiences.



# ZED X | General Specification

## Wide-Angle 3D AI Camera

Combine long-range depth perception with AI to perceive your environment in 3D with up to a 120° wide-angle field of view.

## High Quality Lenses

Wide-angle 9-element all-glass dual lens with optically corrected distortion, and optional polarizing filter.

## IP66-rated Enclosure

Resistant to dust, water and humidity, the new ZED X is designed for outdoor applications and challenging medical, industrial, agricultural environments, and more.

## Multi-camera synchronization

Hardware synchronisation for multiple connected cameras at frame-level within 100 microseconds. Capture RGB and depth images of the same scene with multiple cameras all triggered at the same time.

## High-performance IMU

The all-new IMU combines a 16-bit triaxial accelerometer and gyroscope with vibration resistance, ultra low noise and bias for exceptional motion tracking

## Secure GMSL2 Connection

GMSL2 connectivity is ideal for robotics. Transmit video without EMI and high data rate through a lockable interface to a Jetson Orin over a distance of up to 15M with low latency.

### General Specifications

Output Resolution	Side by Side
1200p	2x(1920x1200) @60fps
600p	2x(960x600) @120fps
Interface	GMSL2
Baseline	
ZED X	12cm (4.72")
ZED X Mini	5 cm (1.97")
Image Sensors	
Size	1/2.6" sensors with high low-light sensitivity
Resolution	Dual 2.3M pixels sensors with 3-micron pixels
Format	Native 16:10 format for a greater vertical field of view
Shutter Sync	Electronic Synchronized Global Shutter
Motion Sensors	400Hz 16-bits Accelerometer (up to 12g) 400Hz 16-bits Gyroscope (up to 1000°/s)
Warranty	2-year hardware warranty
In the Box	ZED X Stereo camera 1.5m long GMSL2 cable

### Physical

Dimension	
ZED X	163 x 30 x 37 mm (6.46 x 1.26 x 1.46")
ZED X Mini	94 x 30 x 37 mm (3.70 x 1.26 x 1.46")
Weight	
ZED X	240 g (0.53 lb)
ZED X Mini	150 g (0.33 lb)
Connector	Serial Coax GMSL2 connector - FAKRA Z type
Mounting Options	1/4"-20 UNC thread mount 2x M3 threads (bottom) 4x M4 threads (back)
Operating Temp.	-20°C to +55°C (-4°F to 131°F)
Power	Power via GMSL2 (PoC)

### System Requirements

System	NVIDIA Jetson AGX Orin NVIDIA Jetson AGX Xavier NVIDIA Jetson Orin NX, Xavier NX
OS	Jetson L4T 35.x

# ZED X | Lens Options

## Focal Lengths available



### 2.2mm

The 2.2mm fixed focal lens provides an ultra wide field of view with optically corrected distortion for increase image quality.

### 4mm

If you need increased resolution and depth accuracy at longer range, select the 4mm focal length lens.

## No More Reflections with Polarizing Filters.

Benefit from the highest possible image quality with a built-in polarizing filter when working outdoors. This filter helps reduce glare and reflections and increases color depth and quality as well.



## ZED X/XM Available models

Specifications	ZED X/XM 2.2mm w/o Polarizer	ZED X/XM 2.2mm with Polarizer	ZED X 4mm w/o Polarizer	ZED X 4mm with Polarizer
Reference	ZED X22 ZED XM22	ZED X22P ZED XM22P	ZED X40	ZED X40P
Polarizer	None	Built-in Polarizer	None	Built-in Polarizer
Focal Length	2.2mm (0.008")		4mm (0.16")	
Field of View	Max.110°(H) x 80°(V) x 120°(D)		Max.75°(H) x 50°(V) x 83°(D)	
Aperture	f/2.2		f/2.2	
TV Distortion	<4.9%		<4.9%	
Depth Range	0.3 m to 20 m (ZED X) 0.1 m to 8 m (ZED X M)		1.5 m to 35 m	
Depth Accuracy	< 1% up to 3m < 5% up to 15m		< 2% up to 10m < 7% up to 30m	
Object Detection	Up to Max Depth (3D)		Up to Max Depth (3D)	
Skeleton Tracking	Up to 8m (ZED X) / 6m (ZED X M)		Up to 15m	

# ZED X | Sensor stack specifications

The ZED family of depth cameras is a multi-sensor platform. The cameras have built-in sensors to add position and motion-assisted capabilities to your app, from accelerometer and gyroscope sensors to temperature, barometer, magnetometer and more.

The sensors can be used to detect camera movements, compute the camera orientation according to the north magnetic pole, detect relative altitude variations, analyze external weather conditions, and much more.

## Dual Image Sensors

### Sensors

Sensor Type	1/2.6" 2.3MP RGB
Array Size	1928 x 1208 pixels
Pixel Size	3µm x 3µm
Shutter	Electronic synchronized global shutter
Output Resolution (Side by Side)	(2x) 1920x1200@60fps (2x) 960x600@120fps
Output Format	RAW10
Max S/N Ratio	38 dB
Dynamic Range	71.4dB
Responsivity	22.3Ke-/Lux-sec
Baseline	
ZED X	12 cm (4.72")
ZED X Mini	5 cm (1.97")

## Sensors API

You can access these sensors and acquire sensor data by using the **Sensors API**.



## Motion/Environmental Sensors

### Temperature Sensors

Temperature Range	-40 to 125°C
Abs. Temperature Accuracy	+/-0.5 °C
Output Data Rate	25 Hz

### Inertial Measurement Unit

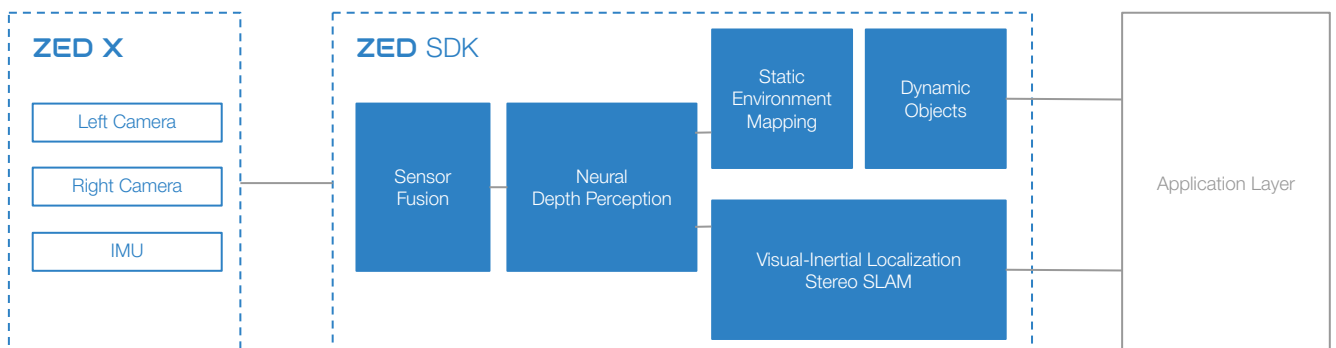
Accelerometer Range	+/- 12G
Accelerometer Resolution	0.36mg
Accelerometer Noise Density	3.2 mg
Gyroscope Range	+/- 1000 dps
Gyroscope Resolution	0.03 dps
Gyroscope Noise Density	0.10 dps
Sensitivity Error	+/- 0.5%
Output Data Rate	400 Hz

## General SDK Description

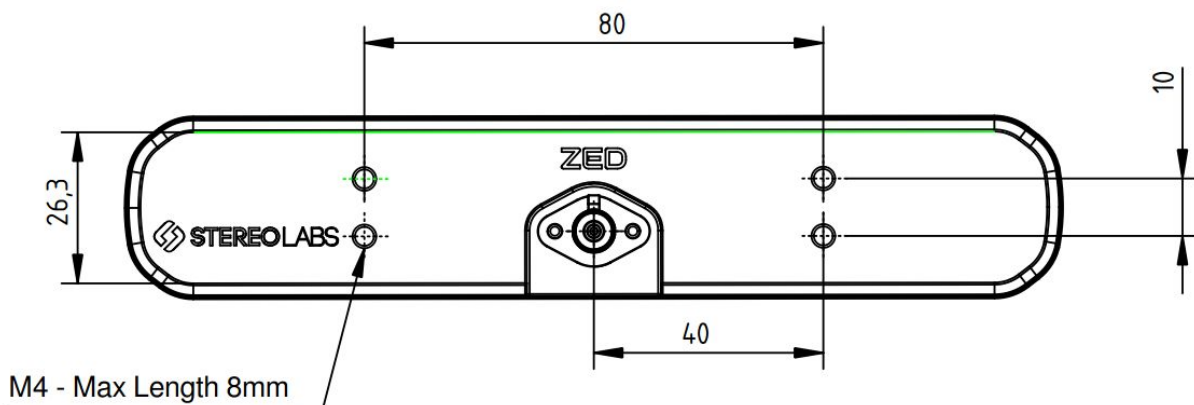
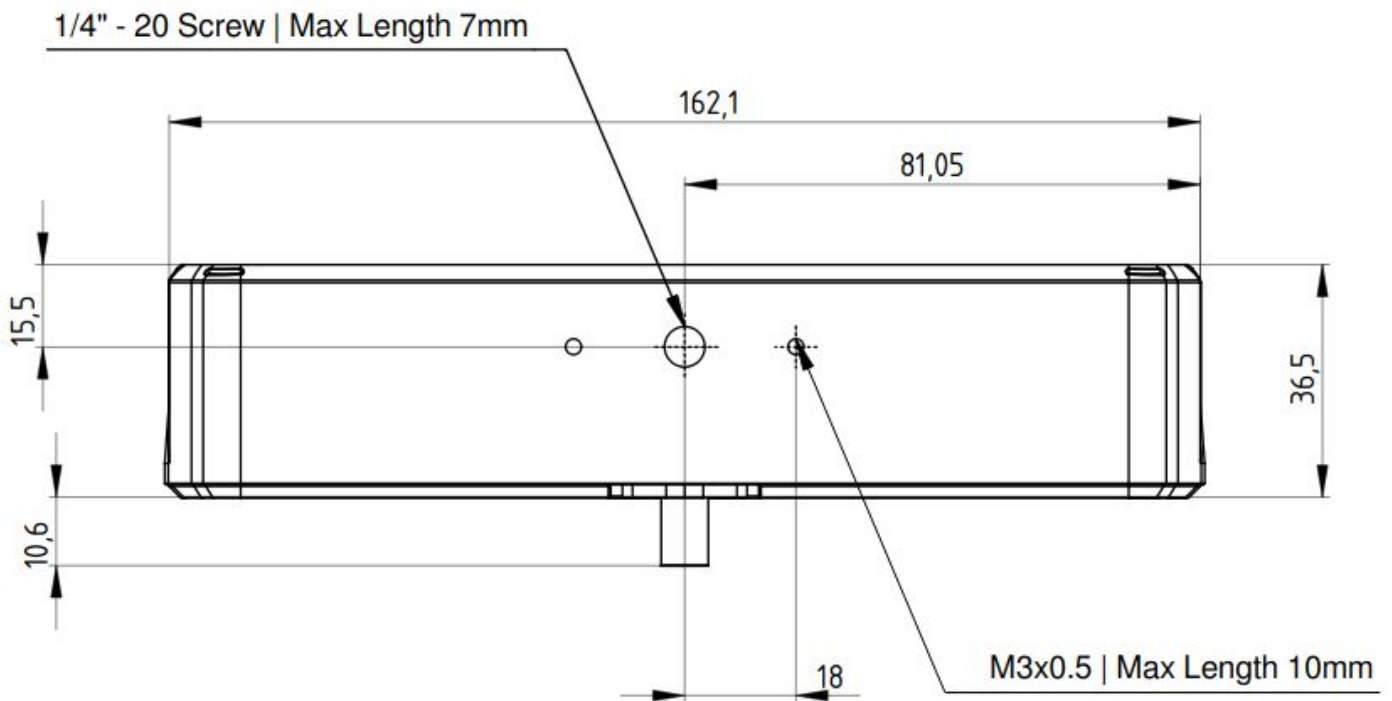
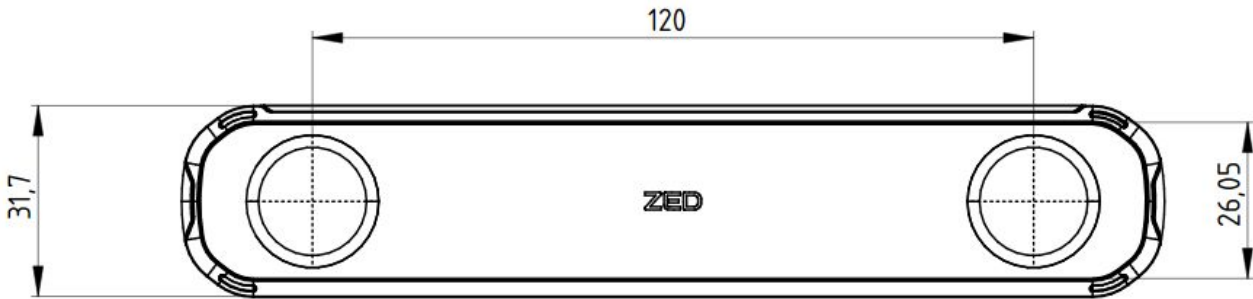
### SDK Modules

Stereo Capture	The ZED X is a camera with dual lenses. It captures high-definition 3D video with a wide field of view and outputs two synchronized left and right video streams, processed by the ISP of the Jetson. Images are provided in RGB format on the host.
Depth Sensing	<b>Depth Map</b> Depth maps captured by the ZED X store a distance value (Z) for each pixel (X, Y) in the image. The distance is expressed in metric units (meters for example) and calculated from the back of the left eye of the camera to the scene object. <b>3D Point Cloud</b> Another common way of representing depth information is by a 3-D point cloud. A point cloud can be seen as a depth map in three dimensions. While a depth map only contains the distance or Z information for each pixel, a point cloud is a collection of 3D points (X,Y,Z) that represent the external surface of the scene and can contain color information.
Positional Tracking	The ZED X uses visual tracking of its surroundings to understand the movement of the user or system holding it. As the camera moves in the real-world, it reports its new position and orientation. This information is called the camera 6DoF pose. Pose information is output at the frame rate of the camera, up to 100 times per second in WWGA mode.
Spatial Mapping	The ZED continuously scans its surroundings and creates a 3D map of what it sees. It updates this map as the device moves around and captures new elements in the scene. Since the camera perceives distances beyond the range of traditional RGB-D sensors, it can quickly reconstruct 3D maps of large indoor and outdoor areas.
Object Detection	Object detection is the ability to identify objects present in an image. Thanks to depth sensing and 3D information, the ZED camera is able to provide the 2D and 3D position of the objects in the scene. Since ZED SDK 3.6, a custom detector can be used with the API. The 2D detection are ingested and 3D informations such as position, 3D bounding box and more are computed. More informations in the Custom Detector page.
Body Tracking	Body tracking module focuses on skeleton bone detection and tracking. A detected bone is represented by its two end points also called keypoints. The ZED camera provides 2D and 3D information for each keypoint as well as local rotation. The ZED SDK supports two body formats: 18 or 34 keypoints.

## Functional SDK Diagram

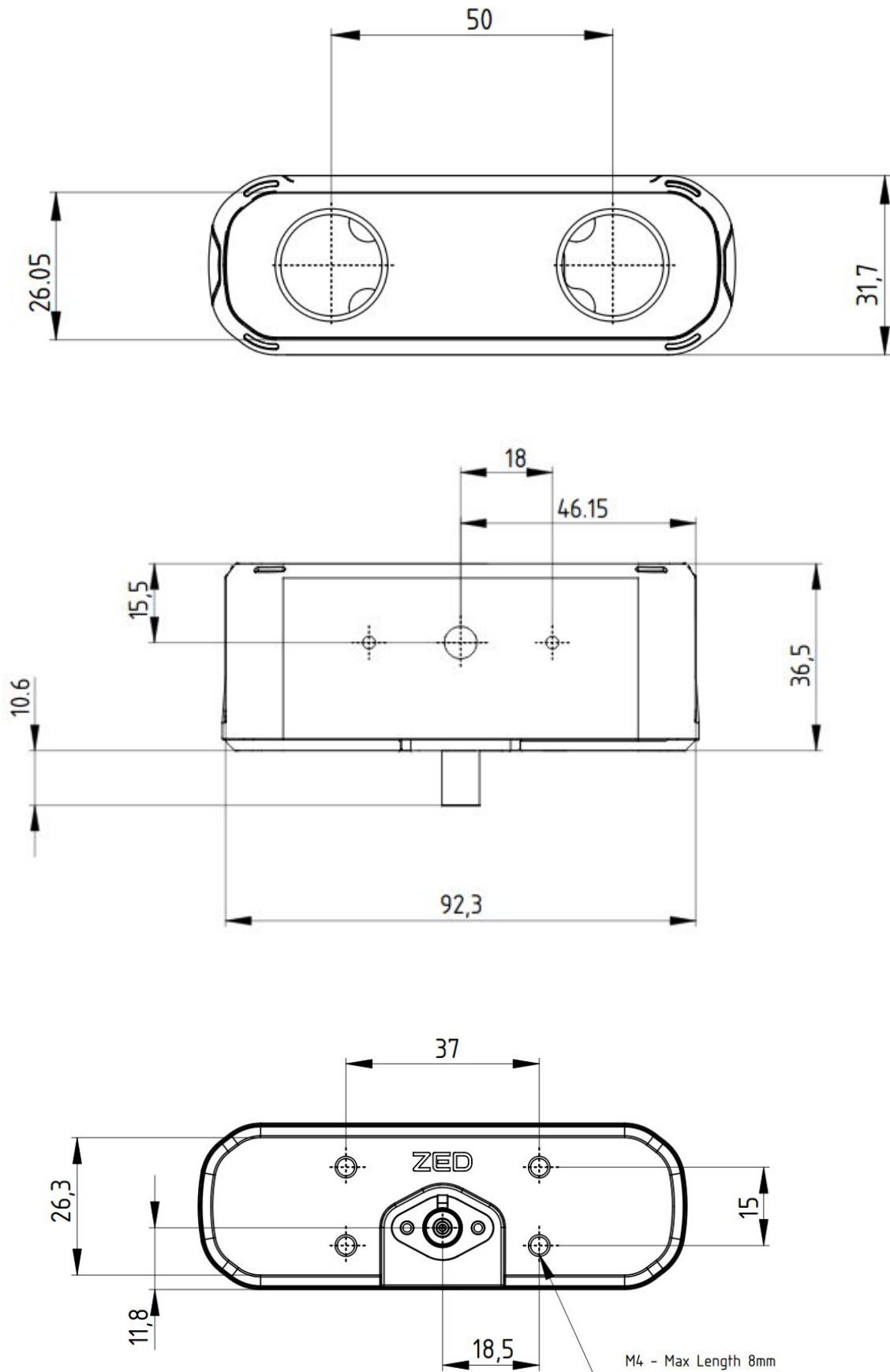


# ZED X | Technical Drawings





# ZED X Mini | Technical Drawings



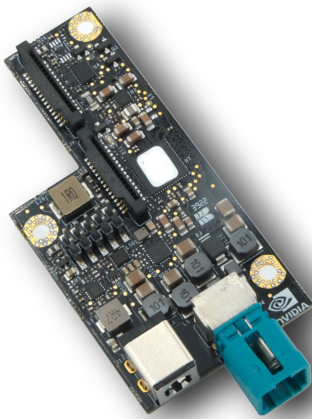
## FAKRA Z Cable



For many applications of the ZED X, longer distance between the camera and host computer are often needed.

Length	Reference
Female to Female	
0.3m (0.98ft)	CBLFFZEDX30
5m (16.4ft)	CBLFFZEDX500
10m (32.8ft)	CBLFFZEDX1000
Male to Female (Extender)	
1.5m (4,92ft)	CBLMFZEDX30
5m (16.4ft)	CBLMFZEDX500
10m (32.8ft)	CBLMFZEDX1000

## Capture Card



To be able to capture the ZED X on NVIDIA Jetson AGX platform, one of the solution is to use the GMSL2 capture card that connects directly to the CSI port of the Jetson.

Compatibility	NVIDIA Jetson Xavier/Orin Platform
Max number of cameras	2 ZED X cameras
Deserializer	MAX96712
Power	Via Samtec CSI port of the Jetson AGX
Availability	March 2023