ORBBEC

Gemini 2 XL

Datasheet v1.0

1. Product Brief

Product Overview

The Orbbec Gemini 2 XL marks Orbbec's debut in long-range 3D cameras suitable for outdoor use. The camera is designed with a depth Field of View (FoV) of up to 101° diagonally, and advanced depth processing for conquering complex and demanding application scenarios.

Gemini 2 XL is easy to set up and operate with the Orbbec SDK, and the camera delivers extremely accurate and reliable data in various lighting conditions from pitch black to outdoor.

Product Features

- Global shutter for RGB and IR cameras
- Wide Field of View at 91° Horizontal and 66° Vertical
- High quality depth data output from 0.4m to 20m
- USB 2.0 Type-C & Gigabit Ethernet data connectivity
- Internal IMU
- Multi-camera synchronization

2. Product Specifications

Parameter	Specifications
Model	G30056-66 /G30056-86 (PoE)
VID/PID	0x2BC5/0x0671
Technology	Infrared Enhanced Stereo
Shutter Type	IR: Global Shutter; Color: Global Shutter
Wavelength	850nm

Mode	Resolution	FoV	FPS	Range	Format
Unbinned Dense Default	1280 x 800	H 91° V 66°	5, 10	0.4m – 20m Optimal Range: 0.40m – 10m	Y16/RVL
	640 x 400		5, 10		
Unbinned Sparse Default	1280 x 800		5, 10	0.4m – 20m Optimal Range: 0.40m – 10m	
	640 x 400		5, 10		
Binned Sparse Default	640 x 400		5, 10, 15, 20	Optimal Range: 0.4m – 5.0m	
RGB*	1280 x 800	H 94° V 68°	5, 10, 15, 20		RGB888/ MJPEG
	1280 x 720		5, 10, 15, 20		
	800 x 600		5, 10, 15, 20		
	640 x 400		5, 10, 15, 20		RGB888/ YUYV/ MJPEG
	640 x 360		5, 10, 15, 20		

Depth Accuracy: ≤ 2% (1280 x 800 @ 4m & 81% ROI).
The test object has a reflectivity > 80% plane, and the reference range is 81% FoV (81% FoV is the remaining center 81% of the depth map area after cropping 5% of the top and bottom of the depth map). The root mean square of the distance sequence from all valid points in the area to the best-fit point of the fitted plane is calculated.
Depending on the application environment, the camera can provide depth measurement data of more than 60m (with a depth unit set to 1mm), and the actual accuracy varies with distance and the object being measured.
* Acquisition of RGB images at 15/20fps is supported only in Binned Sparse Default mode.

Parameter	Specifications
Baseline	100mm
IMU	6 DoF; Frequency range: 50-2,000Hz. Data format: float
Mirror Mode	Supported, non-mirror by default
Processing	OBox Computing Module
Data Connection	USB 2.0 USB Type-C/Gigabit Ethernet
Operating Modes	Unbinned Dense Default: High accuracy and High-density depth data. Unbinned Sparse Default: Balanced depth accuracy and power consumption. Binned Sparse Default: Low power mode, supports 20fps.
Power Input	DC: 12V/2A PoE+: 802.3at (30W Max)
Power Consumption	DC: Average < 6W (Peak 12W) PoE: Average < 7W (Peak 14W)
Operating Environment	0°C – 40°C, < 90%RH (non-condensing), Indoor/Outdoor
Supported Functions	D2C, Multi-Camera Sync
Dimensions (W*H*D)	Camera: 124mm x 29mm x 26mm OBox: 130mm x 22.5mm x 71mm
Weight	Camera: 152g OBox: 279g
Certifications	Class 1, RoHS, FCC, CE, Reach
Installation	Camera: 1 x ¼-20UNC, 2 x M4 OBox: 4 x M3

3. Product Information
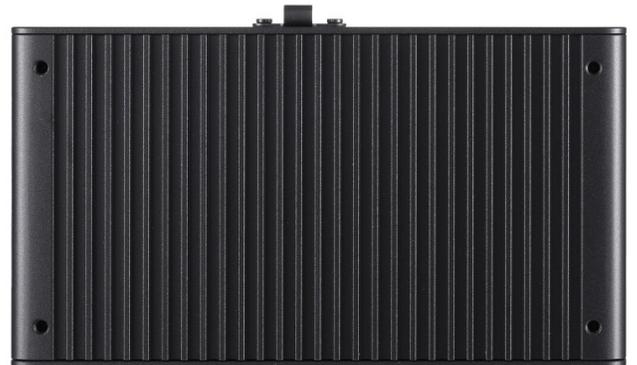
3.1 Product Images

Product Picture

OBox Top View

Gemini 2 VL Front View

OBox Bottom View

Gemini 2 VL Rear View

OBox Rear View

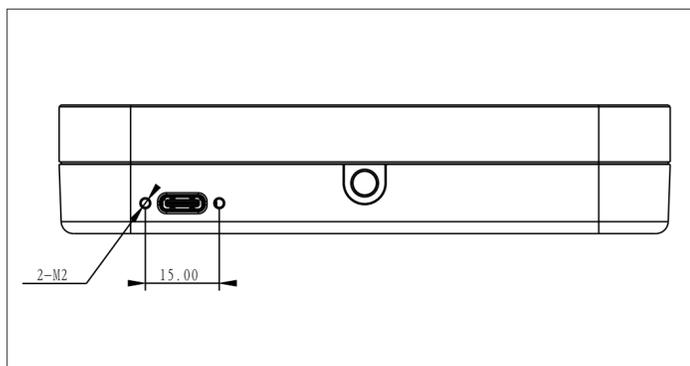**Product Information** (continued from previous page):

3.2 Product Components

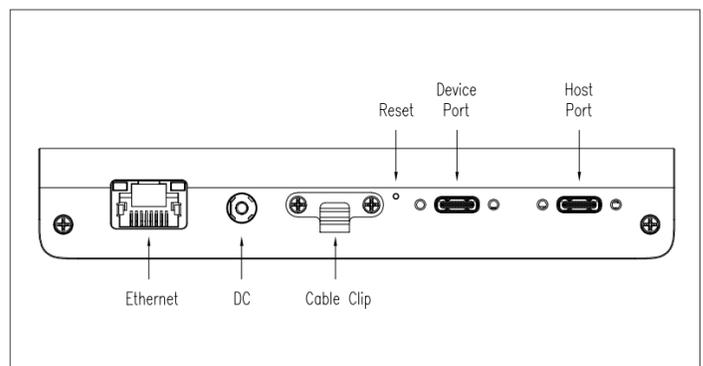Gemini 2 VL Components

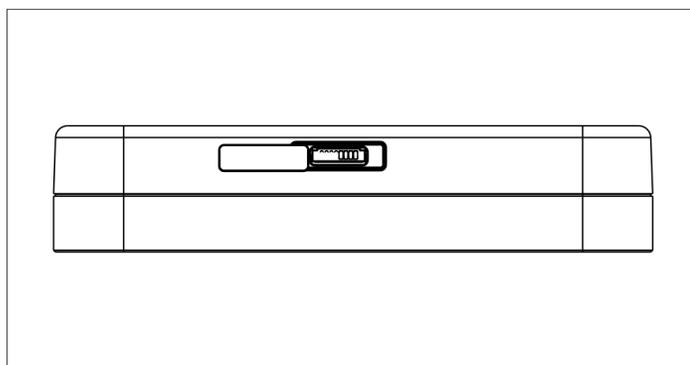## 3.3 Product Interfaces

The hardware interfaces of Gemini 2 VL camera and OBox are shown in the figure below.

Gemini 2 VL USB2.0 Type-C

OBox Hardware Interfaces

Gemini 2 VL 8-Pin Multi-Camera Synchronization Port

3.4 Connection Type

	Supported Connection Type		Data Transmission
3	Ethernet with PoE	\	Ethernet
4	DC	USB Type-C	USB Type-C
6	DC	Ethernet without PoE	Ethernet

4. Software Development Kit (SDK)

Orbbec SDK is a flexible and modular platform for easy camera setup and runs on Linux/Windows with a rich set of APIs. It supports camera access, device setup and configuration, data stream reading, processing, viewing, RGB–D registration and frame synchronization.

The functions include:

- Access and control of camera devices.
- Control of frame synchronization and alignment..
- Acquisition of point cloud data.
- Orbbec Viewer for camera testing.

Please check https://www.orbbec.com/developers/orbbec-sdk/ for the latest SDK.

Temperature sensor and recording

The temperature of camera core components – including laser temperature, IR sensor temperature and IMU sensor temperature – can be obtained through API commands.

5. Camera Setup and Operation

Packing List

- Orbbec Gemini 2 XL device (Gemini 2 VL + OBox)
- 12V/2A Power Supply
- USB Type–C To Type–A Cable (To Host)
- USB Type–C To Type–C Cable (Camera to OBox)
- Tripod

Initialization and Operation

- Connect Gemini 2 XL to the host PC via the USB cable.
- Check both indicators on the camera and validate that all cameras are enumerated correctly in Windows device manager.
- Download the Orbbec SDK from https://www.orbbec.com/developers/orbbec-sdk/
- Validate that the cable can stream reliably on all sensors in the Orbbec Viewer, with the following settings:
  - Depth work mode: Unbinned Sparse Default
  - Depth camera:1280 x 800@10FPS Y16
  - Depth units:1.0
  - RGB Camera: 1280 x 800@10FPS MJPEG
  - IR Camera:1280 x 800@10FPS Y8
  - IMU enabled
- If the camera is not responding or not being detected for some reason, please unplug all cables from the camera and replug to the host PC to reset the camera state.

6. Installation Guide

Use outside of the specified conditions could cause the device to fail and/or function incorrectly. These conditions are applicable for the environment immediately around the device under all operational conditions. When used with an external enclosure, active temperature control and/or other cooling solutions are recommended to ensure the device is maintained within these ranges.

6.1 Installation Recommendations

1. When using an external housing around the camera for dust proofing, use foam inserts or rubber gaskets between the front of the camera and the external housing.
2. Avoid the application of external forces to the camera chassis during the installation process.
3. Disassembling the chassis and mounting brackets will void the warranty.

6.2 Heat Dissipation

1. Avoid any direct heat sources around the camera.
2. Maximizing the space inside the external housing may help lower operating temperature.

6.3 Cable Design Guide

There are two types of USB cables for Gemini 2 XL (TYPE-C to TYPE-C cable and TYPE-A to TYPE-C cable). The TYPE-C to TYPE-C cable serves as the connection cable between the Gemini 2 VL and the OBox, with one end connecting to the Gemini 2 VL, and the other end connecting to the Device port (labeled: to Device) of the OBox. The TYPE-A to TYPE-C cable is used as the connection cable between Gemini 2 XL and host computer, one end of which is connected to the Host port (labeled: to Host) interface on OBox, and the other end is connected to the host computer. The two cables are for signal data transmission, not for power supply.

Considering the influence of signal quality, the two cables should not exceed 2 meters in a single connection path and should pass the USB eye diagram and EMC test.
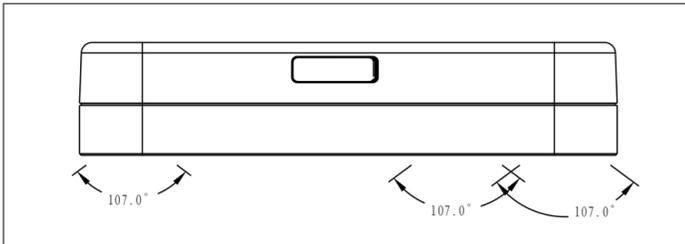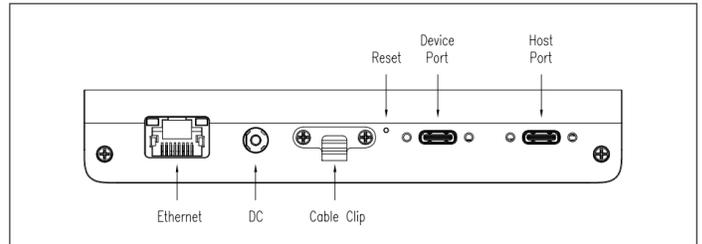
7. Product Drawings
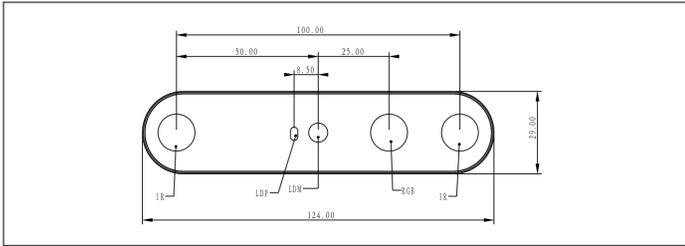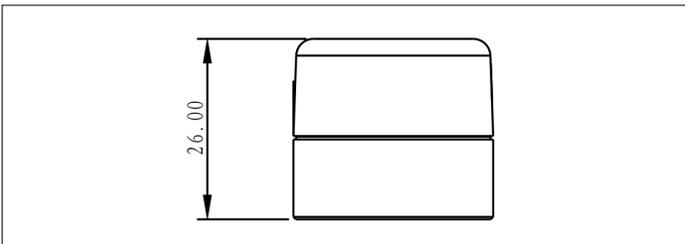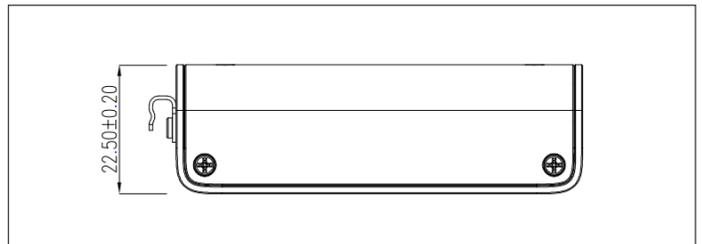

Gemini 2 VL Front View
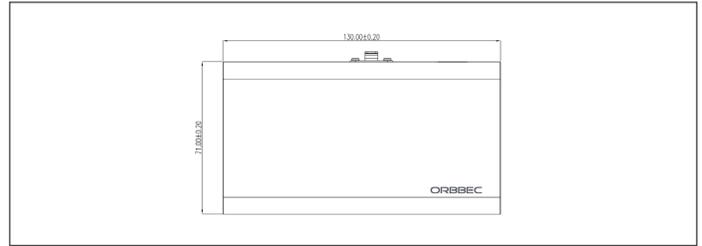
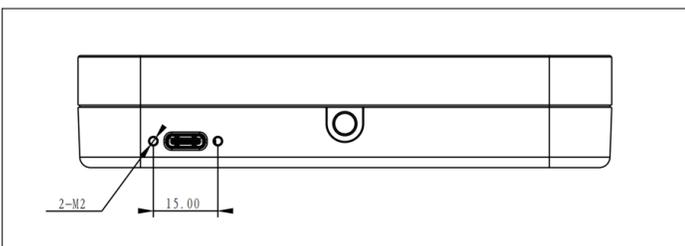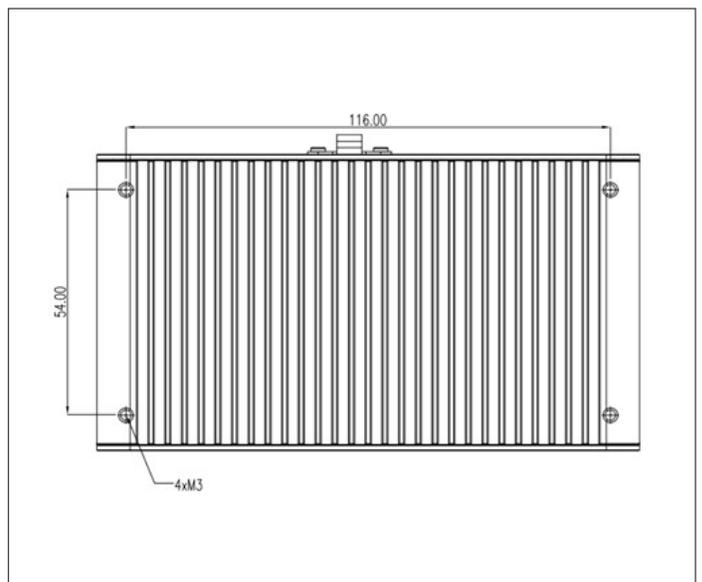OBox Top View

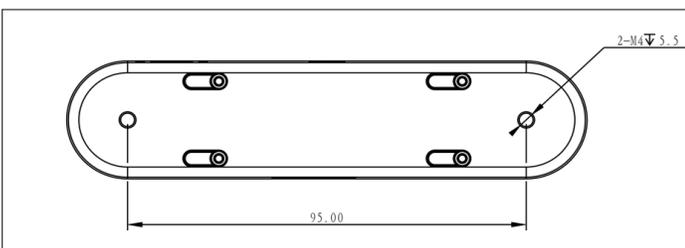Gemini 2 VL Top View

OBox Rear View

Gemini 2 VL Side View

OBox Side View

Gemini 2 VL Bottom View

Gemini 2 VL Rear View

OBox Bottom View

8. Multi-Camera Synchronization

9. Safety and Handling

Each depth camera device is equipped with a synchronization interface that enables multiple camera sychronizations. The use of multiple depth camera devices allows for a wider range of needs, including:

- Increase camera coverage in the given space and fill in the occlusions where a single camera may have blind spots.
- Capture multiple images of the same scene and scan objects from different angles.
- Increase the effective frame rate to greater than 30 frames per second (FPS).

Using an 8-pin connector and matching cable, a multi-camera and multi-sensor network can be designed. (Please follow the instructions in the SDK).

Multi-camera and multi-sensor synchronization in different configurations can be designed with the optional Orbbec Multi-Camera Sync Hub Dev and Multi-Camera Sync Hub Pro accessories.

Synchronization Interfaces of Gemini 2 XL Camera

| Pin	Definitions	Description
Pin_1	VCC	The default is 1.8V. When 3.3V or 5V drive voltage is provided on the VCC interface, the I/O level setting can be adjusted to 3.3V or 5V as required
Pin_2	GPIO_OUT	Synchronization drive signal: Active high. The high-level interval coincides with the IR exposure time. Typical application is to drive external fill light.
Pin_3	VSYNC_OUT	Synchronous trigger signal: Active high. The high level provides the triggering signal for the secondary devices.
Pin_4	TIMER_SYNC_OUT	Pulse signal source, reset hardware timestamp of secondary devices.
Pin_5	RESET_IN	Hardware reset signal: Triggers the camera to power down and automatically power up and reset. Detect the input signal: 20Hz / 50% duty cycle / more than 5 consecutive cycles, that is, judged as normal input signal, other signals filtered out; allowed fluctuations for frequency ± 1Hz, duty cycle ± 2%.
Pin_6	VSYNC_IN	Synchronous trigger signal: Active high. Generated for the triggering/sync signal by the primary device, with a duration of 1ms.
Pin_7	TIMER_SYNC_IN	Hardware timestamp reset signal input, hardware timestamp clearing
Pin_8	GND	Ground
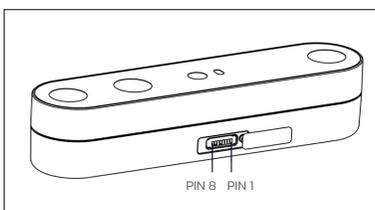
Gemini 2 XL Multi-camera synchronization Pin sequence diagram

1. Follow the camera operation instructions. Improper operation may cause damage to internal components.
2. Do not drop or subject the camera to external force.
3. Do not attempt to modify the camera as modifications may cause permanent damage or inaccuracies.
4. The camera temperature may increase during long periods of continuous usage.
5. Do not touch the lens. Fingerprints on the lens may affect image quality.
6. Keep the product beyond the reach of children or animals to avoid accidents.
7. If the camera is not recognized by the computer, check if the cable meets the power/data transfer requirements and reinsert the USB for reconnection.
8. This product uses a Class 1 laser. Looking at the laser for more than 20s is not recommended.

10. Field of View Illustration

The image below shows the depth camera field–of–view, or the angles that the sensors "see". This diagram shows the IR camera.
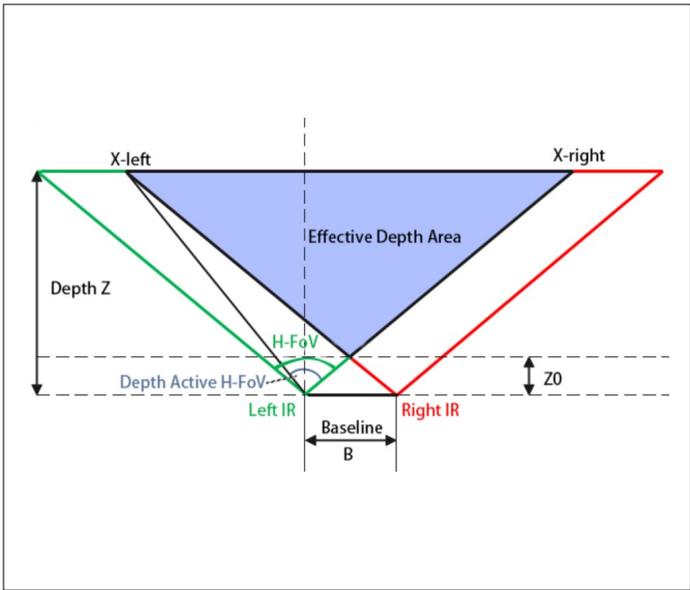
Depth Field of View (Depth FOV) at any distance (Z) can be calculated using the following equation:

$$\text{Depth Active H-FoV} = \arctan\left(\frac{cx}{fx} - \frac{B}{Z}\right) + \arctan\frac{\text{width-1-cx}}{fx}$$

$$H - FoV = \arctan\frac{cx}{fx} + \arctan\frac{width - 1 - cx}{fx}$$

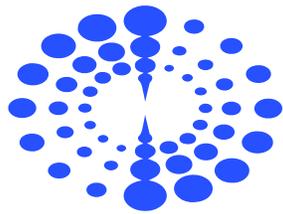$$Z0 = \frac{B}{2\left(\tan\frac{H-FoV}{2}\right)}$$

Definitions:

1. cx = X–direction image coordinates of the main point of the depth image
2. fx = Depth camera focal length
3. width = Depth image width
4. H–FoV = IR H–FoV

Note:

1. cx, fx, and width parameters are obtained through the SDK depth intrinsic for the relevant camera parameters, and each depth camera parameters are not the same.

2. At different distances, the depth FoV is different. The farther the distance, the greater the depth FoV.

11. Glossary of Terms

Term	Definition
D2C	Depth to Color function maps each pixel on a depth map to the corresponding color image according to the intrinsic and extrinsic parameters of depth camera and color camera.
Depth	Depth video streams are like color video streams except each pixel has a value representing the distance away from the sensor instead of color information.
Depth Camera	Includes the external interface and the depth imaging module, which is generally composed of the infrared projector, the infrared camera, and the depth computing processor.
FOV	Field of View (FoV) describes the angular extent of a given scene that is captured by a camera, which can be measured in horizontal, vertical, or diagonal.
I2C	I2C bus refers to a kind of simple bidirectional two-wire synchronous serial bus developed by Philips. It can be used for transferring information among devices connected to the bus with two wires.
IR Camera	Infrared camera.
IR Flood	IR floodlights are used to illuminate the environment.
ISP	Image signal processor, which is used for image post-processing.
MIPI	Mobile Industry Processor Interface (MIPI) is an open standard and specification formulated by the MIPI Alliance for mobile application processors.
PCBA	Circuit board that includes the depth computing processor, memory, and other electronic devices.
Point Cloud	A point cloud is a discrete set of data points in space.
SoC	System on Chip, an integrated circuit (IC) that integrates all components of a computing system.
TBD	To Be Determined. In the context of this document, information will be available in a later revision.