ORBBEC

Datasheet

ORBBEC®
Femto Mega Datasheet

Version	Date	Note
V1.0	November 1st, 2022	First edition

Contents

ORBBEC® Femto Mega

Product

Femto Mega is a programmable multi-mode Depth and RGB camera with real-time streaming of processed images over Ethernet or USB connections. The camera uses Microsoft's industry proven ToF technology and the NVIDIA® Jetson™ platform to deliver a software-defined Depth and RGB vision platform for computer vision and AI developers.

Product Features

- 1Mega Pixel ToF sensor
- 4K RGB
- IMU: 6DoF
- Processor: NVIDIA Jetson Nano™
- Data interfaces: Ethernet, USB-C 3.1
- Power: PoE/USB-C/DC
- Trigger/Sync Control
- OS: Windows or Linux
- Operating temperature: 10℃ ~25℃

Product Characteristics

➢ **Performance**

High resolution sensor provides detailed scene understanding.
Wide Field of View covers large area.
Various operating modes for different applications.

➢ **Programmability**

In-camera processing of advanced depth vision algorithms.
Integrated NVIDIA Jetson Nano™ system-on-module for AI processing can remove need for dedicated compute.
Orbbec SDK enables easy setup and provides a rich set of APIs for integration with various applications.

➢ **Packaging**

Depth and RGB cameras in single device.
Combined data and power with Power over Ethernet (PoE) or USB-C 3.1 connections eliminate need for multiple cables.
Can be directly connected to servers or cloud as an IoT device.
Precise synchronization trigger control uses standard Ethernet cables.

Product Specification

Camera Performance					
Mode	**Resolution**	**FPS**	**Range**	**FoV**	**Format**
WFOV Unbinned	1024 x 1024	5, 15	0.25m – 2.21m	H 120° V 120°	Y16
WFOV Binned	512 x 512	5, 15, 25, 30	0.25m – 2.88m		
NFOV Unbinned	640 x 576	5, 15, 25, 30	0.5m – 3.86m	H 75° V 65°	
NFOV Binned	320 x 288	5, 15, 25, 30	0.5m – 5.46m		
RGB	3840 x 2160	5, 15, 25	N/A	H 80° V 51°	YUY2, MJPG, H.264, H.265
	2560 x 1440	5, 15, 25, 30	N/A		
	1920 x 1080	5, 15, 25, 30	N/A		
	1280 x 720	5, 15, 25, 30	N/A		
Depth typical systematic error (accuracy)* < 11 mm + 0.1% distance Depth random error std. dev.(precision)* ≤ 17 mm, Passive-IR mode supported *15% to 95% reflectivity at 850nm, 2.2 µW/cm2/nm without multi-path interference. Depending on object reflectivity, depth may be provided outside of the operating range indicated above.					

Parameter	Specification
Model	F20364-552
VID/PID	0x2BC5/0x0669
Technology	iToF
Shutter Type	IR: Global Shutter; Color: Rolling Shutter
Wavelength	850nm
Data Connection	Type-C USB 3.0 Gigabit Ethernet

	8 Pin-Connector*[1] Micro USB*[2] *[1] for multi-device sync *[2] for firmware upgrade and device reset
Network Protocol	RTSP, RTP
Power Mode	DC/POE/Type-C
Power Input	DC 12V 2A POE+/802.3at (24W) Type-C 5V 3A
Operating Mode	DC Power + Type-C Data Type-C Power + Type-C Data*[1] POE Power + Gigabit Ethernet Data *[2] *[1] Depth & IR mode support 640 x 576 and below, Y16 format. Color mode supports 1,920 x 1,080 and below, YUY2 and MJPG format. *[2] Color mode supports H.264 and H.265 format
Power Consumption	Average*: DC power + Type-C data: 11 W Type-C power + Type-C data: 10W POE power + Gigabit Ethernet data: 13W
	Peak*: DC power + Type-C data:16W Type-C power + Type-C data:14W POE power + Gigabit Ethernet data: 17W
Operating Environment	10℃ - 25℃,8%RH - 90 %RH
Anti-flicker	50Hz & 60Hz
IMU	6 DoF
	Frequency range: 50-2,000Hz
	Data format: float
Mirror Mode	Supported, non-mirror by default
Operating Environments	Indoor/Semi-outdoor
Dimensions	145 mm × 115 mm × 40 mm ± 2mm
Weight	560g ± 3g
Certifications	ROHS, Reach, WEEE, CP65, EMC, FCC, IC, UKCA, Class 1 Laser

	Product, FDA
Installation	Bottom: 1 x 1/4-20unc Sides: 4 x M2.5

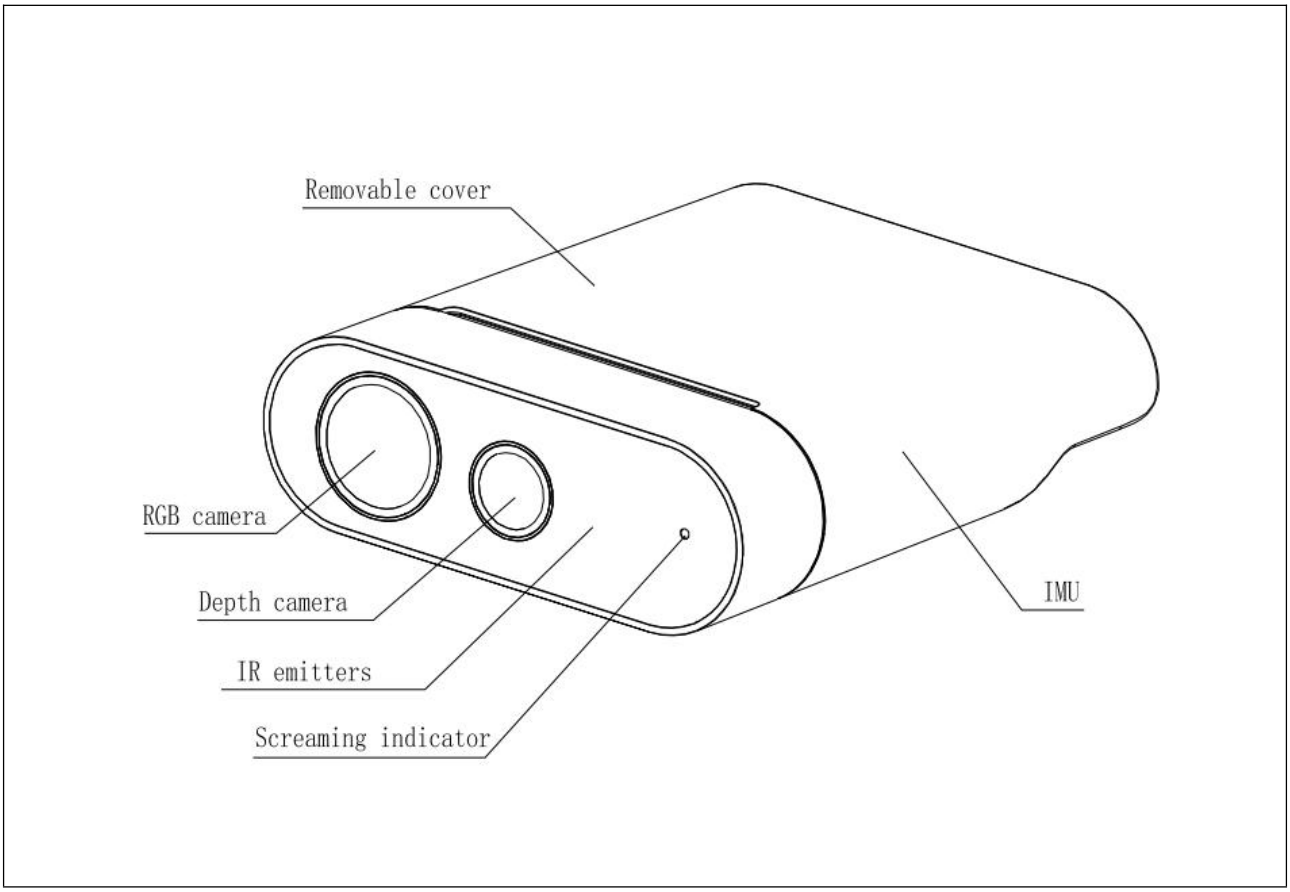
1 Product Information

1.1 Product Images

Product Picture

Rear view

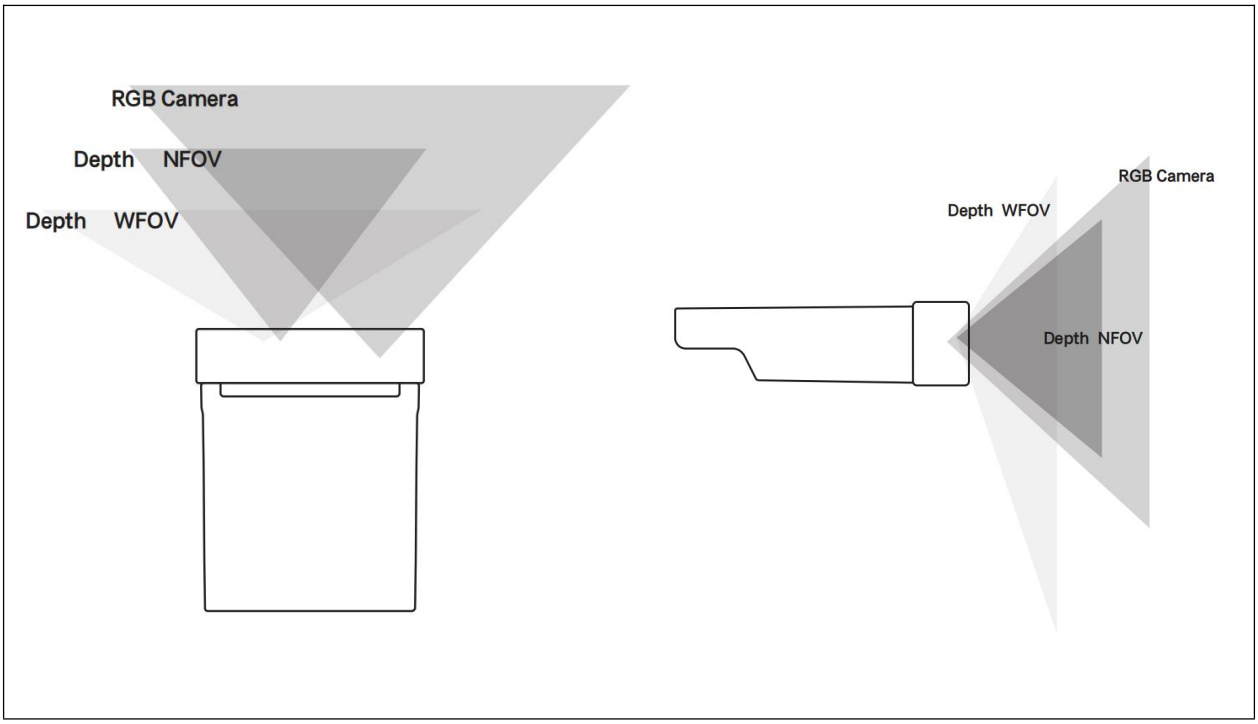
1.2 Product Components



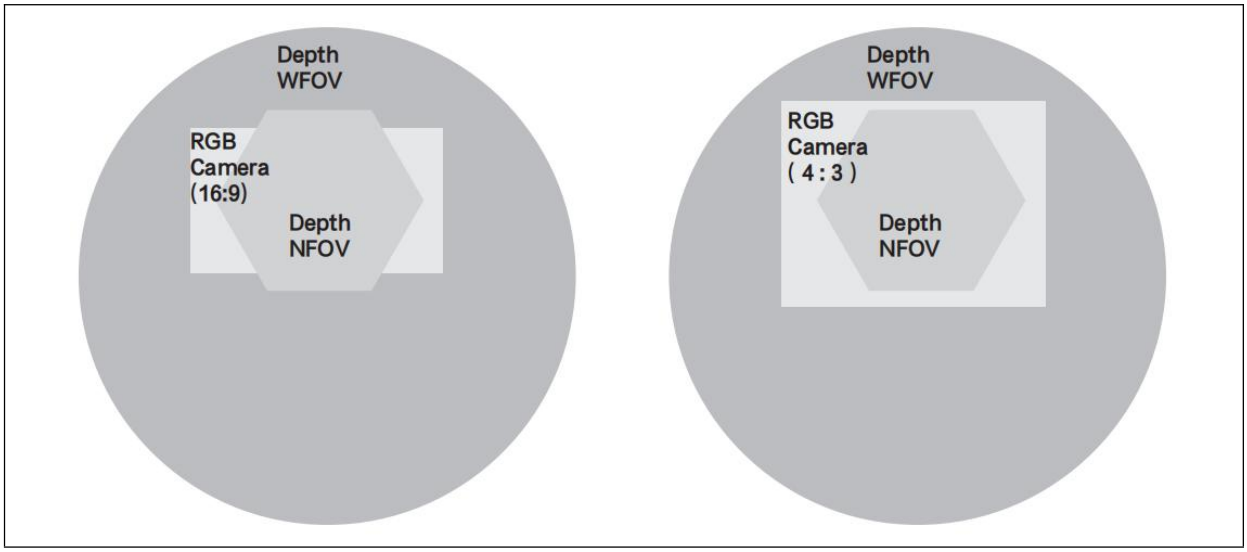
Femto Mega Components

1.3 Camera field of view

The next image shows the depth and RGB camera field-of-view, or the angles that the sensors "see". This diagram shows the RGB camera in a 4:3 mode.

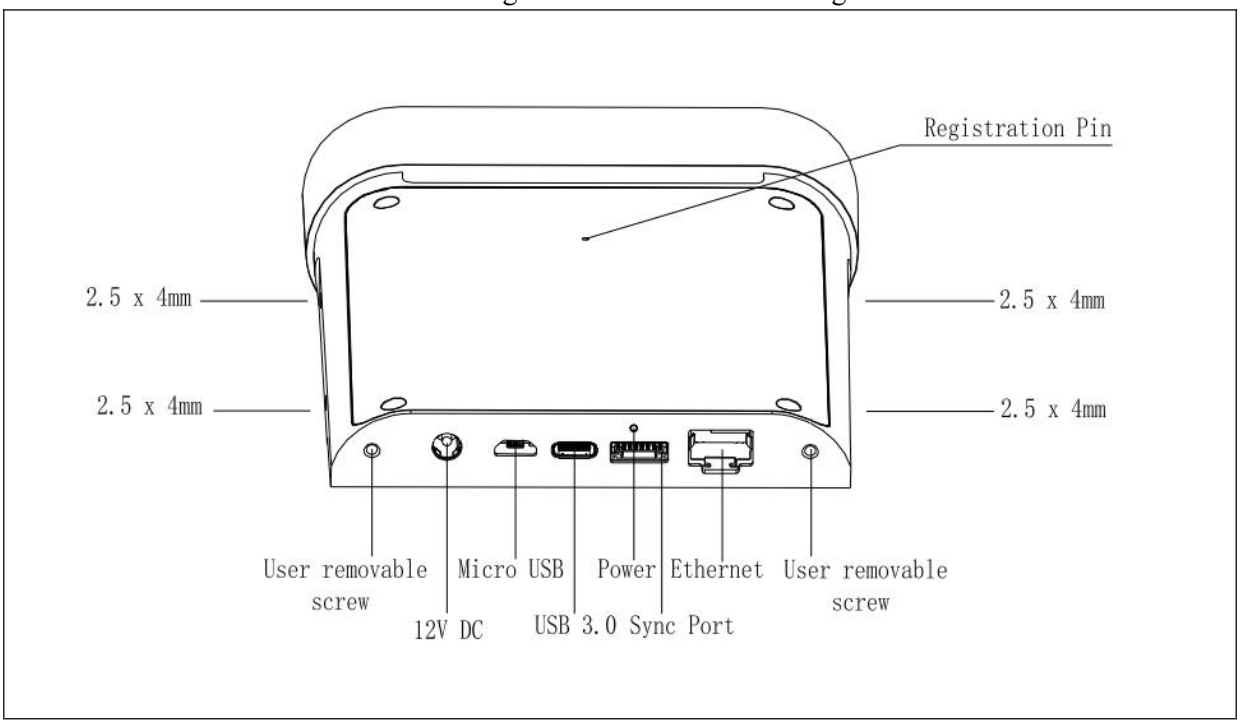


This image demonstrates the camera's field-of-view as seen from the front at a distance of 2000 mm. When depth is in NFOV mode, the RGB camera has better pixel overlap in 4:3 than 16:9 resolutions.



1.4 Product Interfaces

The hardware interfaces of Femto Mega camera is shown in the figure below.



1.5 Connection Type

	Supported Connection Type		Camera Response	Data Transmission
1	DC	\	\	Wait for data connection
2	Type-C	\	Type-C	Type-C
3	Ethernet port with POE	\	Ethernet	Ethernet
4	DC	Type-C	Type-C	Type-C
5	DC	Ethernet port with POE	Ethernet	Ethernet
6	DC	Ethernet port without POE	Ethernet	Ethernet

1.6 Camera Setup and Operation

Packing List

- Orbbec Femto Mega
- USB Type-C to Type-C data cable
- Power Adapter

Initialization and operation

- Connect Femto Mega via the cable to the host PC.
- Check both indicators on the camera and validate that all cameras enumerate correctly in Windows device manager.
- Download Orbbec SDK from https://orbbec3d.com/index/download.html
- Validate that cable can stream reliably on all sensors in the Orbbec Viewer, with the following settings:
    - Depth camera: NFOV unbinned
    - RGB Camera: 2160p
    - IMU enabled
- If for any reason that the camera is not responding or not being detected, please remove all cables from the camera and replug to the host PC for resetting the camera state.

2 Functions & Specifications

2.1 Depth to Color Alignment

Femto Mega supports depth to color registration function. It enables the alignment of depth images to corresponding color images, provided both cameras are operated at the same frame rate. The D2C function can be activated through the Orbbec SDK.

2.2 Multi-Camera Synchronization

Each Femto Mega is equipped with an 8 pin sync connector interface, which enables the connection of up to 8 additional devices. Advanced use cases and requirements can be achieved by using multiple cameras.

3 Electrical Properties

3.1 Indicators

Front: The indicator is ON by default while the device is operating and can be manually switched on/off through the SDK.

State of Indicators	Meaning	Next Steps

Solid White	Powered ON and working correctly	Use the device.
Flashing Amber	The device is in faulty state	TBD

Rear: The power indicator indicates the connection status of power supply and data. This indicator is enabled by default and cannot be turned off.

State of Indicators	Meaning	Next Steps
Solid White	Powered on and data ready	Use the device.
Flashing White	Power ready, waiting for data connection	Make sure that the round power connector cable is connected to the device and to the USB power adapter. Make sure that the USB-C cable is connected to the device and to a USB 3.0 port on your PC. Connect the device to a different USB 3.0 port on the PC. On your PC, open Device Manager (**Start** > **Control Panel** > **Device Manager**), and verify that your PC has a supported USB 3.0 host controller.
Flashing Amber	Insufficient power supply	Make sure that the round power connector cable is connected to the device and to the USB power adapter. Make sure that the USB-C cable is connected to the device and to your PC.

4. 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 and 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 Cross-platform support.
- Azure Kinect SDK Wrapper

- Orbbec Viewer for camera testing.

Please check at orbbec3d.com for the latest SDK.

Temperature sensor and recording

The temperature of camera core components can be obtained, including CPU temperature, laser temperature, IR sensor temperature and IMU sensor temperature.

```
DEVICE_TEMPERATURE params;
uint32_t len = sizeof(DEVICE_TEMPERATURE);
device->getStructuredData(OB_STRUCT_DEVICE_TEMPERATURE, &params, &len);
```

5. Firmware

5.1 Firmware Update

Femto Mega's firmware can be updated by the user. The device needs to be connected to a computer using the Micro USB interface. The device will enter the firmware update mode if user presses and holds the Registration reset button.

5.2 Update Precautions

The update tool cannot check firmware version of the current device and possible for a downgrade action, please make sure if "update" is required by checking inside the SDK.

Ensure that data stream has been closed before updating and the USB cable is securely connected during the process. Otherwise, update may fail. Unplug the power supply and plug it back in after successful update to enable the new firmware to take effect. Disconnect the power supply if update fails. Try the update process again after reconnecting power supply.

6 Installation Guide

Use outside of the ambient conditions could cause the device to fail and/or function incorrectly. These ambient 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. The device design features a cooling channel in between the front section and rear sleeve. When you implement the device, make sure this cooling channel is not obstructed.

6.1 Installation Recommendations

1. Camera is active cooled, please do not cover the venting holes of the fan.

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

6.2 Heat Dissipation

1. Avoid direct heat source around the camera.
2. Maximize the space inside the external housing may help lowering operating temperature.

Note: For further support of housing design information, please contact Orbbec 3D at info@orbbec3d.com.

6.3 Transmittance Requirements

Transmittance requirements for front cover protection lens of Femto Mega 3D camera are listed as follows:

1. RGB transmittance: 835~865nm T_{min} > 85%, 800~960nm T_{ave} > 88% and 400~700nm T_{ave} > 85%
2. RX transmittance: 420~680nm T_{min} > 97%
3. Flatness of front cover lens material: < 0.005mm.
4. Glass is recommended.

Before changing the structural design of camera, the protective lens in front of the camera lens must meet the requirements above.

6.4 Cable Design Guide

To select a good Type-C to Type-C cable:

1. It is recommended to use camera matching cable.
2. The USB certified cable must support both power and data.
3. When the cable needs power supply, should be less than 1m in length. If longer, Need to strengthen cable quality.
4. When the cable dosen't needs power supply, should be less than 1.5m in length. If longer, Need to strengthen cable quality.

6.5 Case Temperature Limit

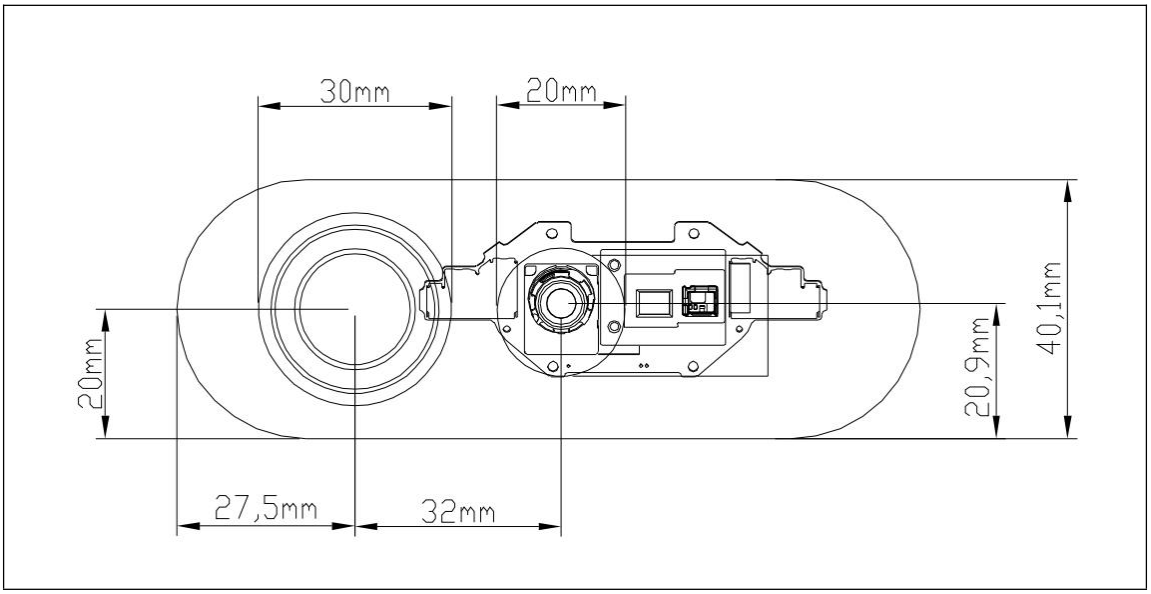
Plastic case: Lower than 43°C
Metal case: Lower than 40°C

7. Safety and Handling

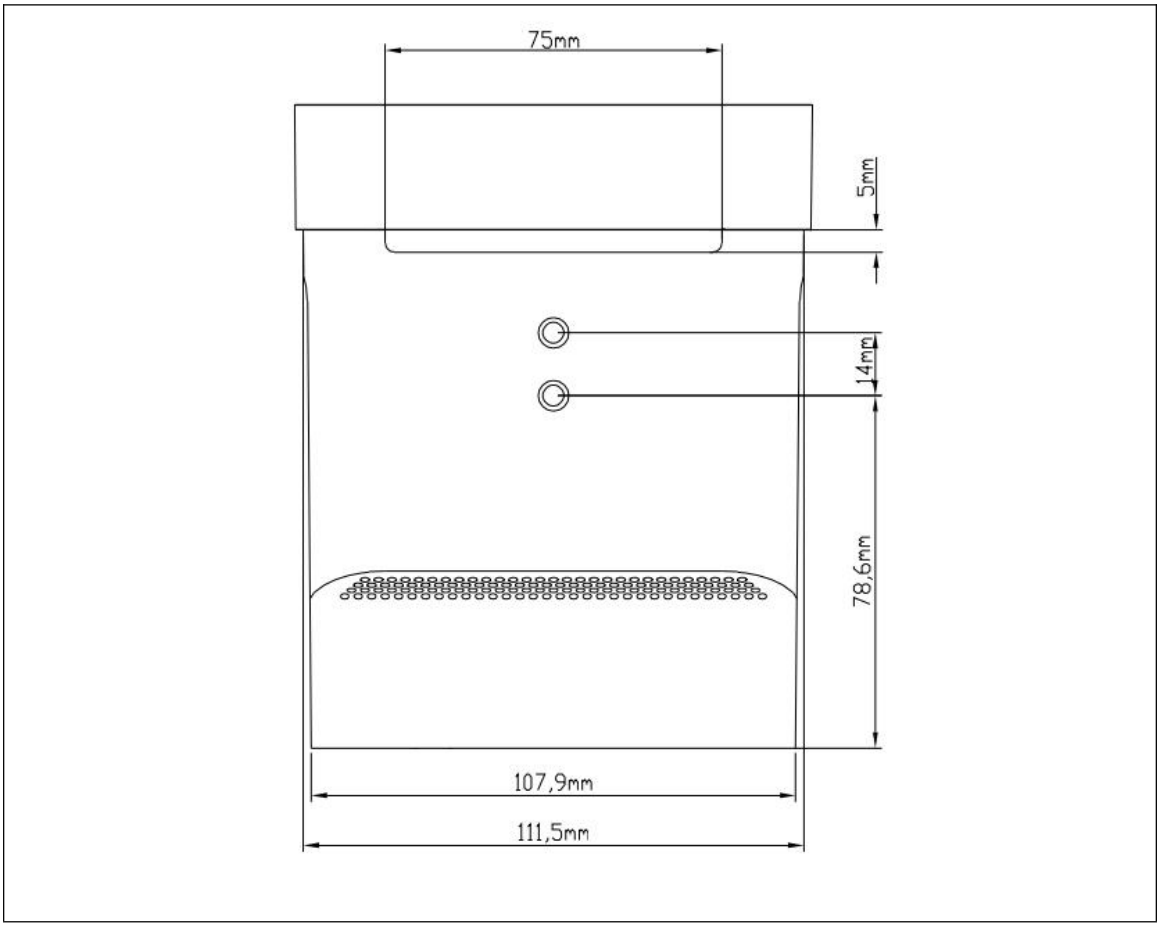
1. Please follow the instructions to operate the camera. Improper operation may cause the damage of internal components.
2. Do not drop or hit the camera with external force.

3. Do not attempt to modify the camera in any way. Modification may cause permanent damage or inaccuracy;
4. It is expected that the temperature of the camera may increase after using the camera for a period of time.
5. Do not touch the lens, or finger print may leave on the lens to affect output 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 whether the cable meets the power/data transfer requirements and reinsert the USB for inspection.
8. Class 1 laser is used in this product, but it is not recommended to look at the laser for more than 20 s to avoid discomfort.

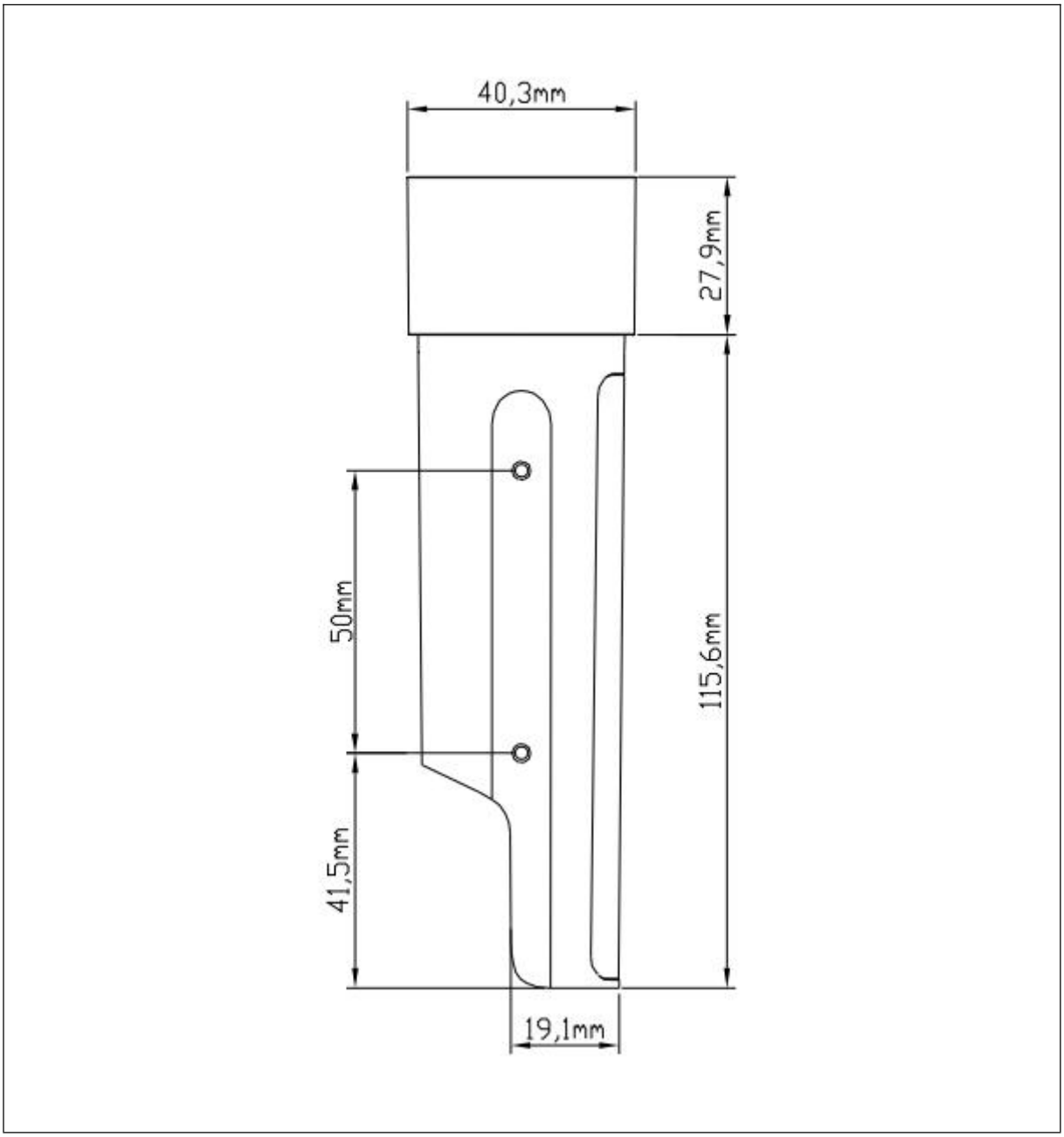
7.1 Product Drawings



7. Front View



8. Bottom View



9. Side View

8. Multi-Camera Synchronization

Advantages of multi-camera setup

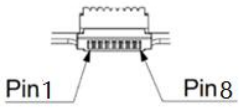
- Fill in the occlusions where one camera may have blind spots
- Scan objects in three dimensions.
- Increase the effective frame rate to a value that's greater than 30 frames per second (FPS).
- Capture multiple color images of the same scene

- Increase camera coverage within the space.

Advanced trigger control hub and 8-pin to RJ45 adapter are available to purchase. With these optional accessories, CAT 5 (or better) rated ethernet cables can be utilized as trigger cable to help with long distance triggering setup and provide the function of switching trigger level, 1.8V, 3.3V or 5V. Recommended minimum delay setting is 160us (please follow the instruction in the SDK)

Synchronization Interfaces of Femto Mega Camera

Pin	Definitions	Description
Pin_1	GND	Ground
Pin_2	TIME_SYNC_IN	Hardware timestamp Reset Signal Input
Pin_3	VSYNC_IN	Active high, used for the triggering/sync signal from primary device
Pin_4	RESET_IN	Pulse signal, power down and POR
Pin_5	TIME_SYNC_OUT	Pulse signal source, reset hardware timestamp of secondary devices.
Pin_6	VSYNC_OUT	Active high. The high level provides the triggering signal for the secondary devices.
Pin_7	GPIO_OUT	Active high. The high-level interval coincides with the IR exposure time
Pin_8	SYNC_VCC	Default Voltage is 1.8V. This voltage is sensed (3.3V or 5V) and used to set/sense the level of all signals.

*The Pin sequence is shown with camera placed in rear view. 

The synchronization function can be realized through two connection modes:

Star Topology (Sync Control Hub):

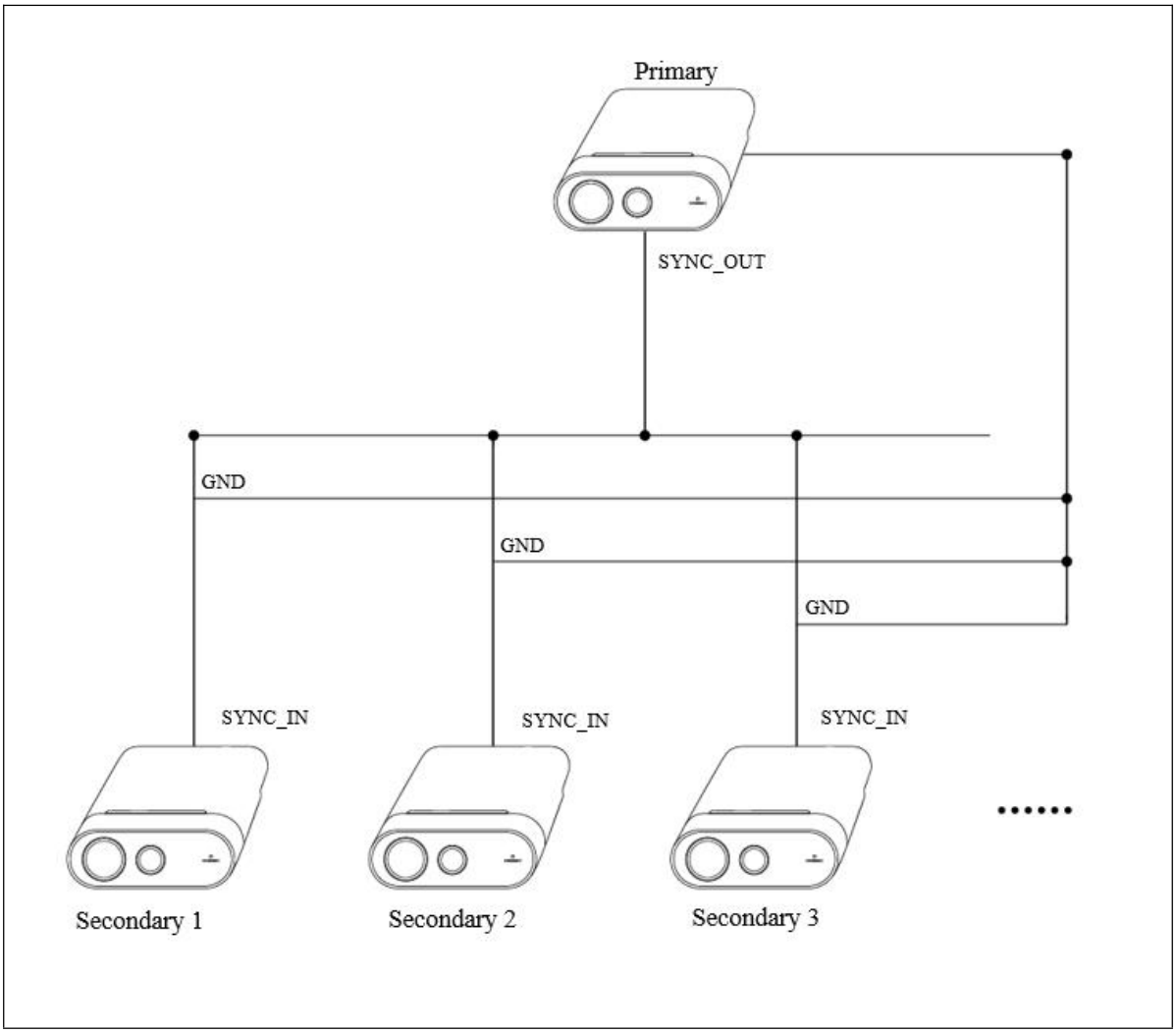


Diagram of Star Topology

Daisy Chain topology:

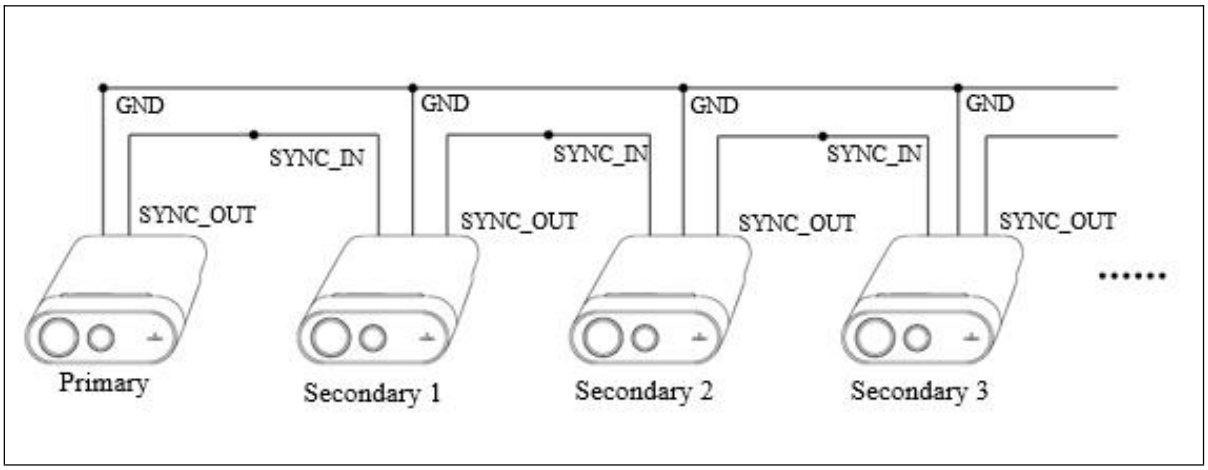


Diagram of Daisy Chain Topology

9. Glossary of Terms

Terms	Descriptions
D2C	Depth to Color function maps each pixel on 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 depth imaging module and external interface only, of which the former is generally composed of infrared projector, infrared camera and 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 tofor illuminate the environment
ISP	Image signal processor, which is used for image post-processing
MIPI	MIPI alliance, i.e., Mobile Industry Processor Interface (MIPI) Alliance. MIPI is an open standard and specification formulated by MIPI Alliance for mobile application processors
PCBA	Circuit board consists of depth computing processor, memory, and other electronic devices
SoC	System on Chip, 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.