Photoneo | Focused on 3D

MotionCam-3D

User Manual and Installation Instructions

Thank you for choosing Photoneo® MotionCam-3D. Please take a few minutes to read this manual and become familiar with the device.

For more information on our products, accessories, replacement parts, software and services, see our website photoneo.com/motioncam-3d/ or contact our team at support@photoneo.com.

Legal Information

Warning Notice System

This manual contains notices that should be observed in order to ensure personal safety, as well as prevent damage to equipment. The notices referring to personal safety are highlighted with a safety alert symbol, while notices referring only to equipment do not have a safety alert symbol. The notices are graded according to the degree of danger.

⚠ **WARNING**
Indicates that death or severe personal injury may result if proper precautions are not taken.

⚠ **CAUTION**
When a safety alert symbol is shown, it indicates that minor personal injury can result if proper precautions are not taken.

CAUTION
When no safety alert symbol is shown, it indicates that equipment damage can result if proper precautions are not taken.

NOTICE
Indicates that an unintended result or situation can occur if the relevant information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger is used. Notice warning of injury to persons with a safety alert symbol may also include a warning relating to equipment damage.

Qualified Personnel

The device described in this documentation may be operated only by **qualified personnel**. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with this device.

Installation, commissioning, use, decommissioning and disposal of this device should be done in accordance with relevant documentation, in particular, its warning notices and safety instructions.

Proper Use of Photoneo Products

Please note the following:

⚠ **WARNING**
Photoneo products may only be used in accordance with relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Photoneo. Proper transport, storage, installation, assembly, commissioning, operation, and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions for storage or operation of the device must be complied with. All information provided in the relevant documentation must be observed.

Preface

Purpose and Scope of the Manual

This manual provides information about the installation and usage of MotionCam-3D. This document is designed for engineers, installers, and electricians who possess a general knowledge of automation.

Trademarks

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Product Overview

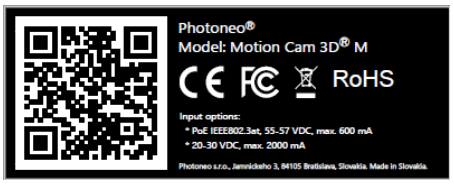
MotionCam-3D is a high accuracy and high resolution snapshot 3D area scanning device for large work areas that can be in motion.

The product is based on a patented CMOS sensor and Parallel Structured Light technology developed by Photoneo. It provides the scanning quality of structured light devices with the ability to scan dynamic scenes.

The scanning process consists of capturing the scene under the laser illumination and processing and transfer of the 3D data to the computer running the driver software (see section PhoXi Control).

General Information

General information about the device and the manufacturer can be located on the back panel of the device.



Label with manufacturer address, product name, and model, CE, FCC, WEEE and RoHS marks, country of origin and input options.

⚠ WARNING

Hot surface warning

The surface of the processing unit may become hot to touch when the device is in use. Mount the device on a metal mounting plate that will act as a thermal bridge to dissipate the heat or use the carbon body to manipulate the device.

Laser Device

⚠ **WARNING**
This device is a laser product. Do not deliberately look into the laser beam. This may cause injury to the retina. The use of protective eyewear is usually not necessary. The appropriate laser class label is present on the back of the device.

The laser projector aperture is located at the right side of the front panel of the device (Figure 1). The aperture is clearly marked with a warning label. Do not look directly into the laser projector while the device is in use.

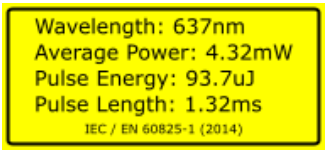
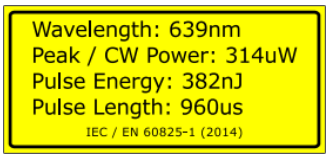
To avoid unauthorized contact with the device or unintentional viewing of the laser beam, it is recommended to locate the device in a restricted area and take measures to restrict laser light exposure to the surroundings. Although diffuse reflections are not harmful, users should remove mirrors, polished objects, and similar items from the vicinity of the device to avoid specular reflections.

All components of the device, including those sourced from 3rd party suppliers, conform fully with all applicable European directives and regulations.

Figure 1: MotionCam-3D laser aperture location

The device uses the following labels and warning systems. Apart from the laser aperture label, all are located on the back panel of the device.

Laser radiation hazard warning symbol.

	Laser aperture label. Designates the place from which laser radiation is emitted.
Laser Class 3R devices	
	Laser radiation warning with laser class label. The serial number of the device can be found above the warning labels.
	Label specifying wavelength, average power, pulse energy and pulse length of the laser. Used on MotionCam models S+, M, M+, L.
	Label specifying wavelength, average power, pulse energy and pulse length of the laser. Used on MotionCam model S.

Objects Suitable for Scanning

MotionCam-3D uses laser light to acquire 3D data. It can capture dynamic scenes as well as static ones. Smoke and particles dispensed in the air will negatively influence the 3D data. Always bear in mind that MotionCam-3D can see no more than you can see with the naked eye.

Objects most suitable for scanning are (including and not limited to):

- rough surface objects, for example, wood, rubber, etc.
- objects with a matte finish, such as sand-blasted aluminum, cast iron, etc.
- molded, un-polished plastic materials.

Some objects not suitable for scanning (including and not limited to):

- mirrors and polished metals,
- most liquids (e.g. water, oil),
- translucent and transparent objects (e.g. glass, transparent plastic)

Scope of Delivery

- Selected model of MotionCam-3D
- Desktop PoE injector (input: 90 ~ 264 VAC, output: 33.6 W, 56 V, IEEE802.3at) with power cable (1.8 m)
- Ethernet cable M12-X male - RJ45 male, 5 m, PUR

NOTICE
Software components are needed for operation of the MotionCam-3D. See section Configuration for more information.

Installation

Guidelines for Installation

MotionCam-3D has been designed to allow easy installation.

The MotionCam-3D can be mounted[1]:

- Using a mounting plate of suitable size and 4 M4 screws.
  - This is preferred mounting method to ensure rigid mounting of the device to avoid unwanted movement
- Using a M8 screw.
- On a tripod using a 3/8-16 UNC screw.

To install MotionCam-3D:

1. Mount MotionCam-3D using any preferred method. Refer to Dimensions and Illustrations.
2. When mounting MotionCam-3D, ensure that an appropriate scanning distance is set between the MotionCam-3D and the scanned object and eliminate any potential obstacles.

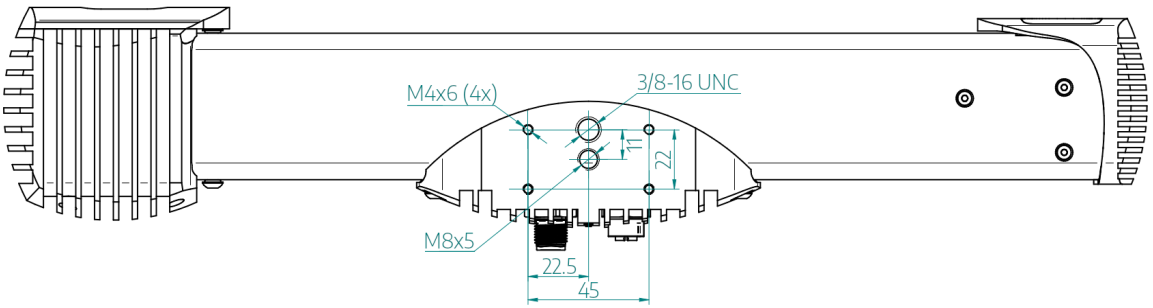


Figure 2: Mounting plate

3. Connect MotionCam-3D to the computer or local network and plug it into the power. See the section Powering the device & Data connection for more details.
4. Download and install the PhoXi Control application from the Photoneo webpage.
5. Run the PhoXi Control application and try to make your first scan. Please refer to the PhoXi Control User Guide.

Powering the Device & Data Connection

There are two possibilities to power the device:

[1] A CAD model of MotionCam-3D is available at: www.photoneo.com/dl/cad/motioncam

1. Using the M12-X Power over Ethernet (PoE) connector (providing both power and data connection)
2. Using the M12-A 24 V power connector to power the device and the M-12X connector for data transfer

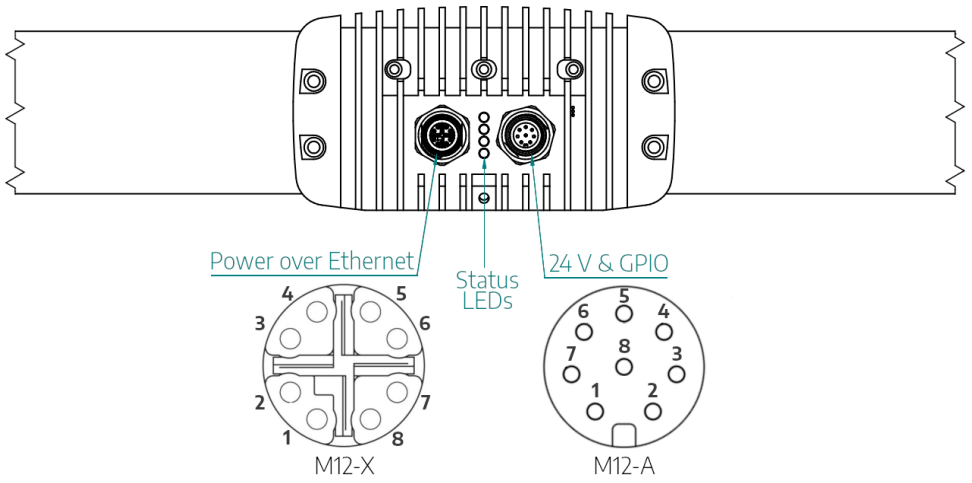


Figure 3: Back panel of MotionCam-3Ds

Powering Through PoE Connector

1. Connect 1 Gbps capable (standardly delivered) ethernet cable to the PoE injector IN port
2. Connect the M12-X RJ45 cable to MotionCam-3D and to the PoE injector OUT port
3. Plug in the power cable of the PoE injector

NOTICE
It is recommended to use PoE connection to power the device.

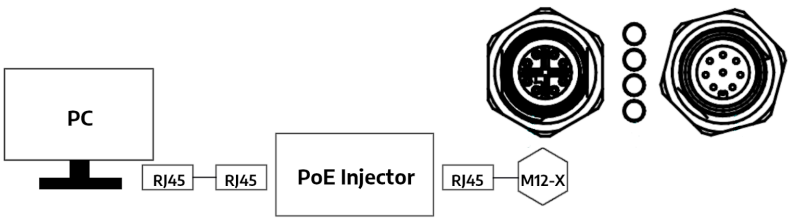


Figure 4: Connection schematics for PoE

Powering by 24 V

1. Connect the M12-X RJ45 cable to MotionCam-3D and to your computer or switch
2. Connect the M12-A to MotionCam-3D and to the 24 V adapter

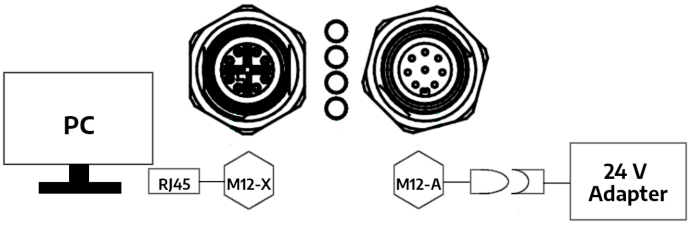


Figure 5: Connection schematics for 24 V power

Status LEDs

#	LED Name	Color	Description
1	POWER	Green Red Off	Power ON and OK Power ON, power on processing unit not OK No power
2	STATUS	Green Red Orange	Firmware ready HW fault Device is Occupied
3	ETH1	Flashing green Green Off	Activity on link No activity on link Link is down
4	ETH2	Green Off	Gigabit ethernet connected No gigabit ethernet

Figure 6: Status LEDs of correctly working device

Supported Network Topologies

The following network topologies are supported by MotionCam-3D:

- Direct connection to a computer

Figure 7: Direct connection

- Scanner connected to a switch

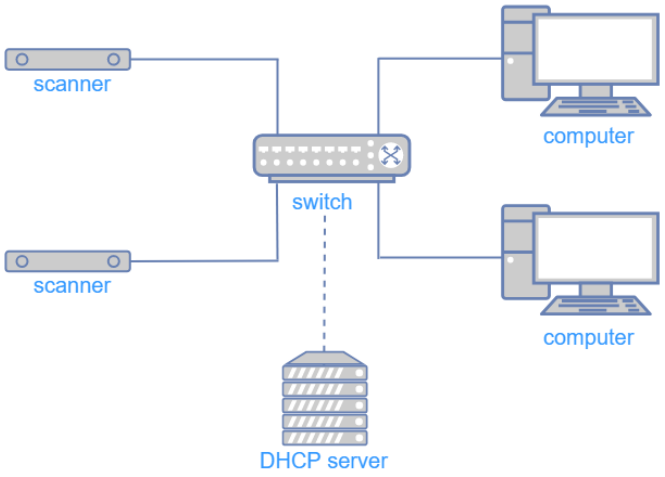


Figure 8: Connected to a switch

The following network topology is not supported by MotionCam-3D:

- Scanner connected to a router:

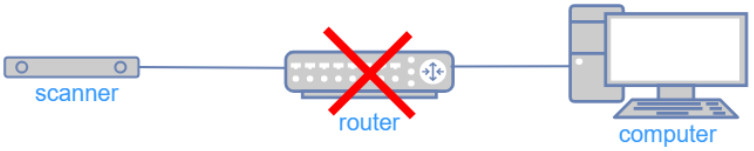


Figure 9: Connecting the Scanner through router is not supported

Note:

- Connecting to the Scanner via WiFi is not recommended as it is slower and less reliable.

NOTICE
If several MotionCam-3Ds are connected to a computer with several ethernet adapters, using static IP addresses on different subnets is recommended.

Mounting Restrictions

Movement During Scanning

NOTICE
It is allowed to mount MotionCam-3D on moving constructions or robotic arms. MotionCam-3D is able to capture dynamic scenes as well as static scenes

Strong Electric Field

As a general rule, always isolate low-voltage, logic-type devices such as MotionCam-3D from devices that are high voltage and generate high electrical noise. Carefully consider the routing of the wiring for the devices in the panel as well. Avoid placing low-voltage signal wires and communication cables in the same tray with AC power wiring and high energy, rapidly-switched DC wiring.

Clearance for Cooling and Wiring

MotionCam-3D is designed to be cooled through natural convection cooling. In order to ensure adequate cooling, a clearance of at least 25 mm above and below the device must be allowed. When planning placement of MotionCam-3D, consider placing heat-generating and electronic-type devices in the cooler areas. By reducing exposure to high-temperature environments, you can extend the operating life of the electronic devices considerably.

NOTICE
It is recommended to mount MotionCam-3D on a metal plate that will act as a thermal bridge and dissipate the heat produced by the processing unit away from it.

Configuration

PhoXi Control

PhoXi Control is a computer application that acts as a driver for the Photoneo scanning devices. It allows the user to control the MotionCam-3D manually through graphical user interface or programmatically through the provided API.

The GUI is primarily used to set up the scanning environment, to configure advanced scanning parameters and to visualize the output. In addition, the GUI can also be used as a powerful debugging tool for development with the API. Calls to the API trigger the same response in the GUI as user inputs. After triggering the scan by calling API method, the application will execute the scan, send it as an output of the call and display it simultaneously in the GUI.

The API serves as a central platform for building custom applications for PhoXi 3D Scanners and MotionCam-3Ds. In order to facilitate the development process and reduce computing demands all computations are performed on the device itself.

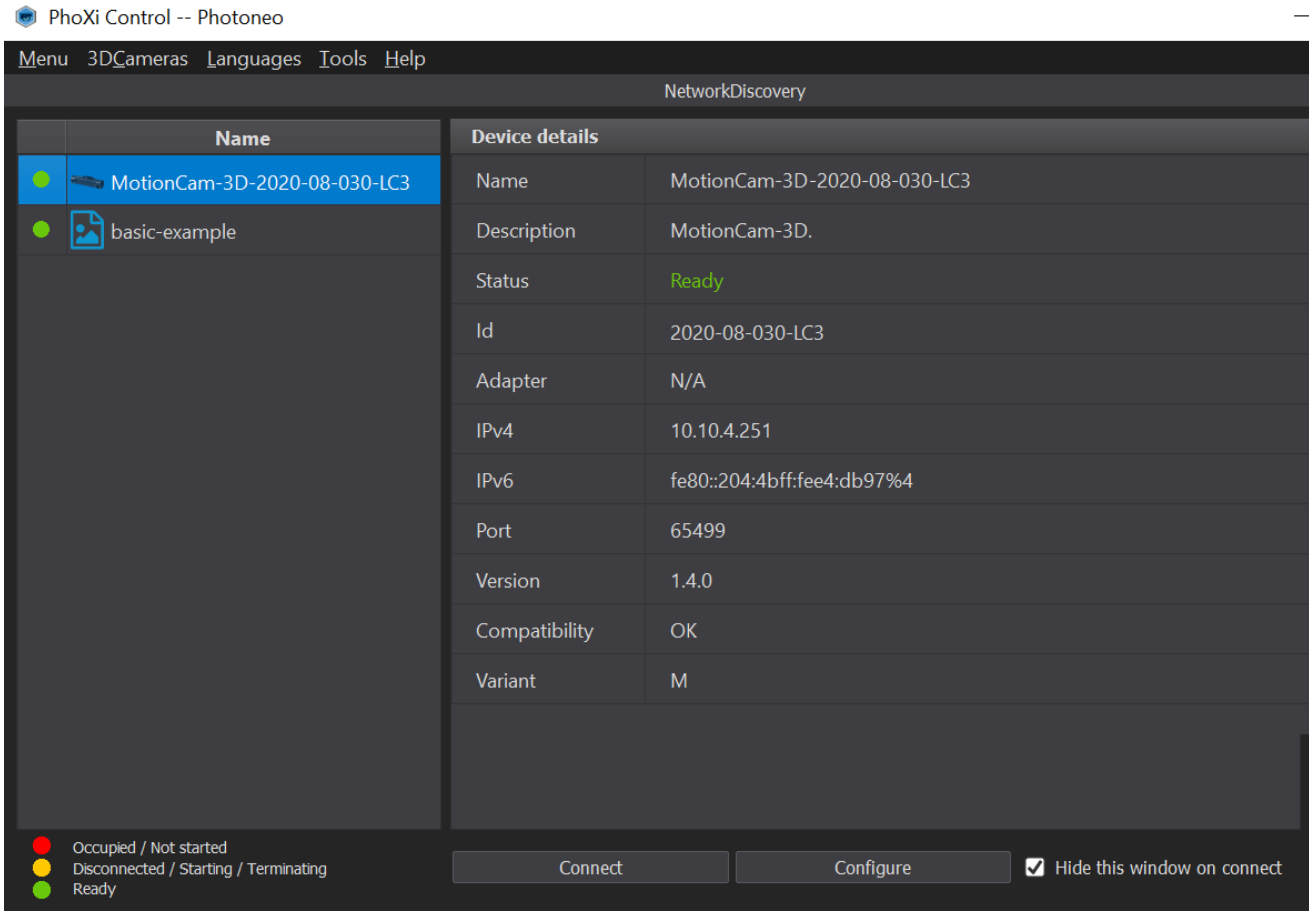


Figure 11: PhoXi Control – Network Discovery

You can download the latest version of PhoXi Control from our website
www.photoneo.com/3d-scanning-software/

For more information about the PhoXi Control application, please refer to the PhoXi Control User Guide.

Hardware Parameters

Power Over Ethernet Connector

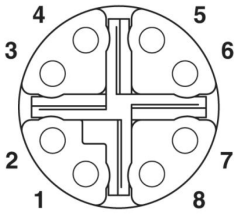


Figure 12: PoE connector pinout, view from the mating side

Connector type: M12 X coded, 1404741

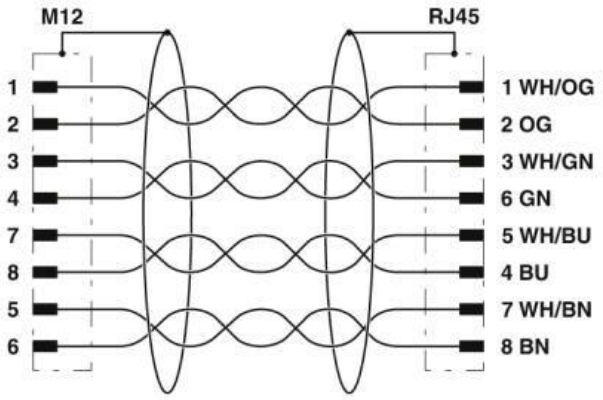


Figure 13: Contact assignments of the M12 and RJ45 plug

Powering Requirements

PoE Standard	IEEE802.3at
Operating voltage U_e DC	min. 55 V
Residual ripple maximum (% of U_e)	0.5 %
Rated operating current I_e (I_{max})	0. 360 A (0.6 A)
Minimum Power	33 W
Shielding	Fully Shielded RJ45
Transfer data rate	1 Gbit
Maximum recommended cable length	20 m

24 V Power Connector

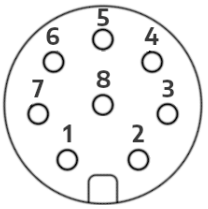


Figure 14: 24 V Power & GPIO pinout, view from the mating side

Connector type: M12 A coded, M12A-08PMMP-SF8001

Pin	Cable Color	Pinout	Function
1	White	DC_IN	+ 24 V
2	Brown	OPTO_IN2_GND	*laser interlock ground
3	Green	GND	ground
4	Yellow	OPTO_IN1	hardware trigger input signal (5 - 24 V)
5	Grey	OPTO_IN1_GND	hardware trigger input ground
6	Pink	OPTO_OUT	hardware trigger output signal (5 - 24 V
7	Blue	OPTO_OUT_GND	hardware trigger output ground
8	Red	OPTO_IN2	*laser interlock signal (5 - 24 V)

* devices with laser safety interlock needs to be ordered separately

Powering Requirements

Operating DC voltage U_e (U_{min}-U_{max})	24 V (20 - 30 V)
Residual ripple maximum (% of U_e)	2 %
Rated operating current I_e (I_{max})	1 A (2 A)
Minimum Power	60 W
Maximum recommended cable length	10 m *

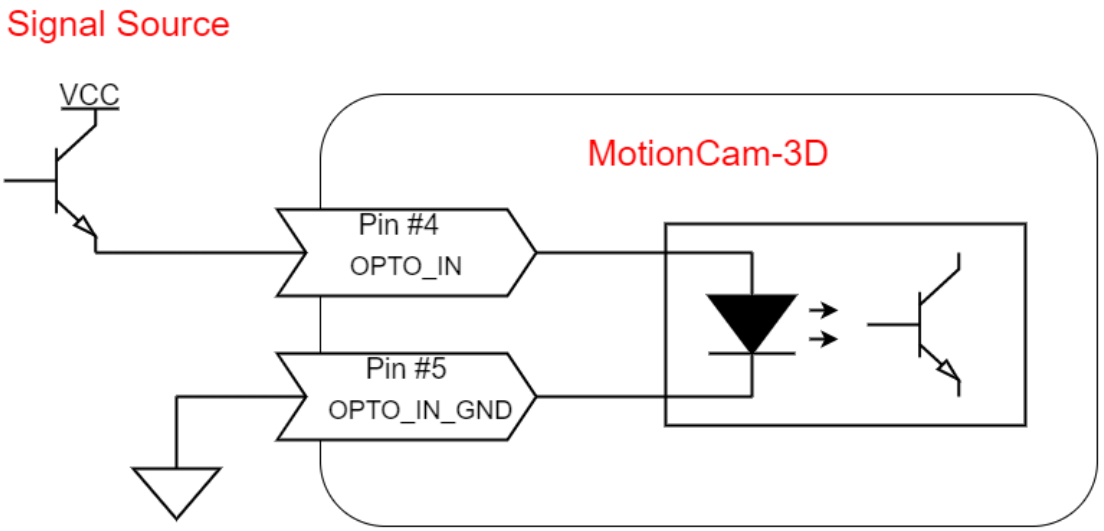
* for cable length over 10 m use 36 V DC adapter (60 W)

Hardware Trigger Characteristics

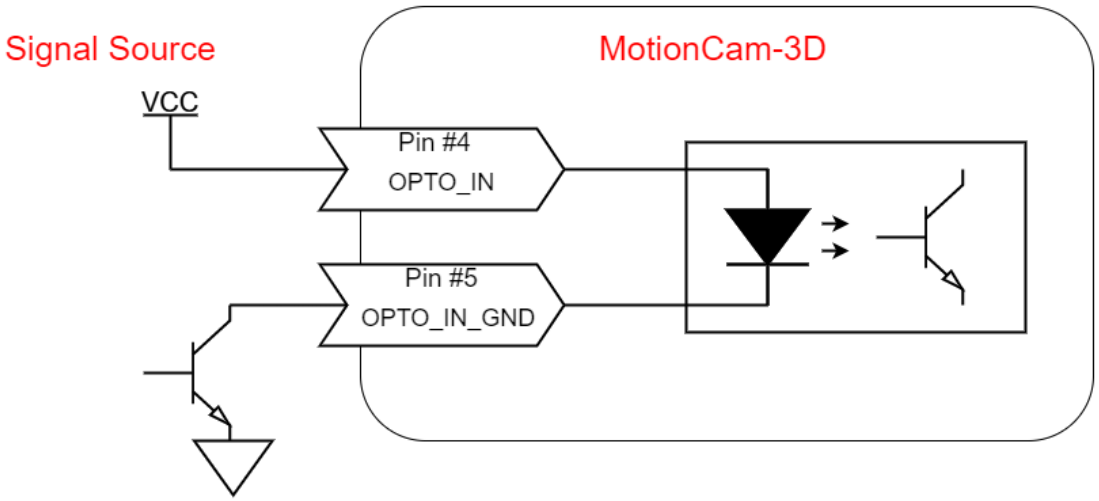
Trigger Input

Trigger input can be done as common cathode or common anode. Refer to the diagrams below.

Common Cathode



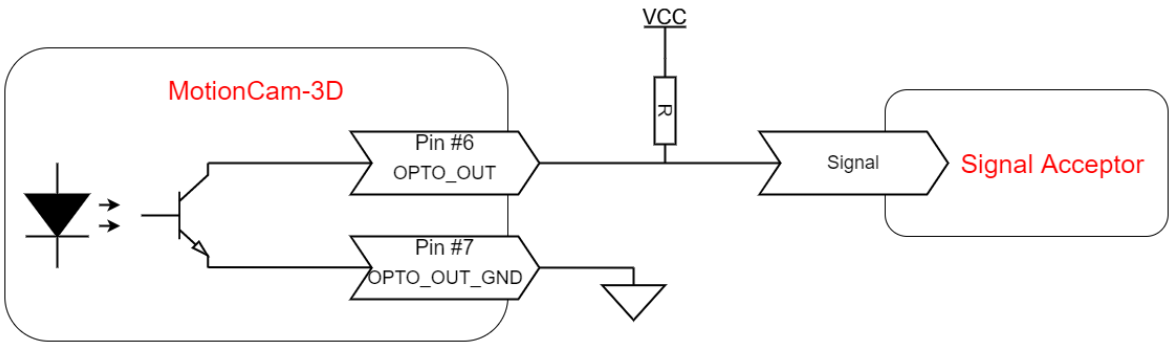
Common Anode



Trigger Output

Trigger output is read through VCC pull up. Please refer to the diagram below. Recommended resistor is 10k. If the devices are daisy-chained, then:

- For VCC = 12 V use 1k6 resistor
- For VCC = 24 V use 4k7 resistor



Projection Unit

Projection width horizontal		47.5° ± 1°
Projection width vertical		36.0°± 2°
Model	S	S+, M, M+, L
Light source	Visible red light (laser)	Visible red light (laser)
Laser class	LC3R	LC3R
Wavelength	639 nm	637 nm
Average power	0.314 mW	4.32 mW
Pulse energy	382 nJ	93.7 µJ
Pulse length	0.96 ms	1.32 ms

Environmental Conditions

Transport

Ambient temperature	From -20 °C to 50 °C (max gradient 10 °C/hour)
Humidity	From 0 % to 95 % non-condensing
Atmospheric pressure	From 1080 hPa to 660 hPa (corresponding to an altitude of -1000 m tp 3500 m)

⚠ **CAUTION**
Please ensure that the device is always transported in its original casing or that it is properly cushioned for transport.

Operation

Operating temperature for optimal scanning performance	From 22 °C to 25 °C
Overall operating temperature	From 0 °C to 45 °C
Humidity	From 0 % to 95 % non-condensing
Atmospheric pressure	From 1080 hPa to 660 hPa (corresponding to an altitude of -1000 m tp 3500 m)
Maximum acceleration	20 ms^{-2}

Scanning Parameters

General parameters	Value
Depth map resolution (static mode)	1680 x 1200
Depth map resolution (dynamic mode)	1120 x 800
Maximum FPS	20 fps
Maximum object / camera speed	40 m/s
3D points throughput	15 million points per second
GPU	NVIDIA Pascal™ Architecture GPU with 256 CUDA cores

Operation Temperature

It is recommended to let the device reach operating temperature before use by being powered on for at least 15 minutes.

MotionCam-3D S - Datasheet

Scanning range and performance	
Scanning range	366 - 558 mm
Depth range	192 mm
Scanning area	272 x 232 mm @ z = 366 mm 507 x 343 mm @ z = 558 mm
Camera mode	
Point size (@ z = 442 mm)	0.370 mm
Accuracy	0.300 mm
Temporal noise	0.100 mm
Scanner mode	
Point size (@ z = 442 mm)	0.250 mm
Accuracy	0.150 mm
Temporal noise	0.050 mm
General parameters	
Dimensions	80 x 68 x 307 mm
Weight	1300 g
Baseline	230 mm
Data acquisition time	10 ms

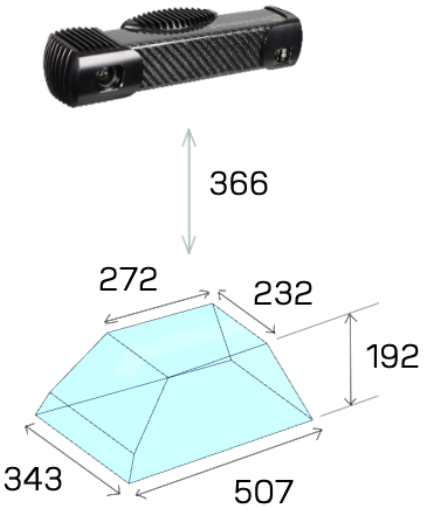


Figure 16: MotionCam-3D S scanning range

MotionCam-3D S+ - Datasheet

Scanning range and performance	
Scanning range	630 - 1574 mm
Depth range	944 mm
Scanning area	481 x 401 mm @ z = 630 mm 1349 x 968 mm @ z = 1574 mm
Camera mode	
Point size (@ z = 900 mm)	0.760 mm
Accuracy	1.000 mm
Temporal noise	0.150 mm
Scanner mode	
Point size (@ z = 900 mm)	0.520 mm
Accuracy	0.500 mm
Temporal noise	0.100 mm
General parameters	
Dimensions	80 x 68 x 307 mm
Weight	1300 g
Baseline	230 mm
Data acquisition time	10 ms

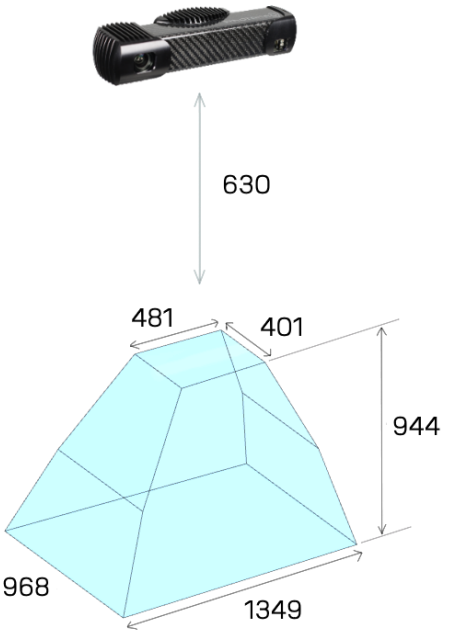


Figure 17: MotionCam-3D S+scanning range

MotionCam-3D M - Datasheet

Scanning range and performance	
Scanning range	497 - 939 mm
Depth range	442 mm
Scanning area	331 x 324 mm @ z = 497 mm 862 x 567 mm @ z = 939 mm
Camera mode	
Point size (@ z = 650 mm)	0.550 mm
Accuracy	0.500 mm
Temporal noise	0.100 mm
Scanner mode	
Point size (@ z = 650 mm)	0.370 mm
Accuracy	0.250 mm
Temporal noise	0.050 mm
General parameters	
Dimensions	80 x 68 x 427 mm
Weight	1400 g
Baseline	350 mm
Data acquisition time	10 ms

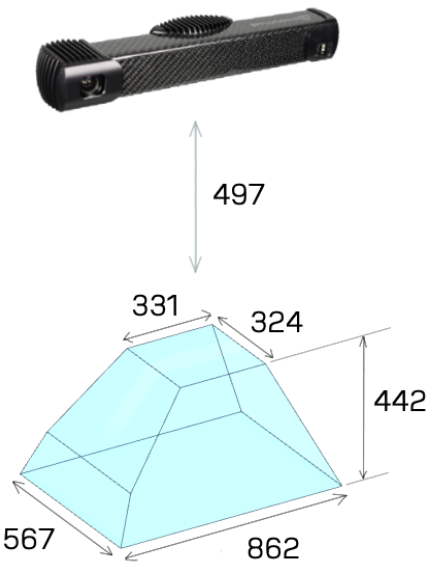


Figure 18: MotionCam-3D M scanning range

MotionCam-3D M+ - Datasheet

Scanning range and performance	
Scanning range	630 - 1574 mm
Depth range	944 mm
Scanning area	451 x 408 mm @ z = 630 mm 1317 x 951 mm @ z = 1574 mm
Camera mode	
Point size (@ z = 900 mm)	0.760 mm
Accuracy	0.600 mm
Temporal noise	0.100 mm
Scanner mode	
Point size (@ z = 900 mm)	0.520 mm
Accuracy	0.300 mm
Temporal noise	0.050 mm
General parameters	
Dimensions	80 x 68 x 427 mm
Weight	1400 g
Baseline	350 mm
Data acquisition time	10 ms

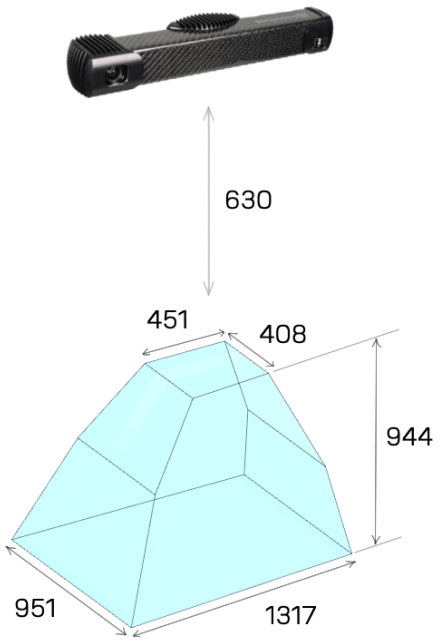


Figure 19: MotionCam-3D M+ scanning range

MotionCam-3D L - Datasheet

Scanning range and performance	
Scanning range	778 - 3034 mm
Depth range	2256 mm
Scanning area	410 x 518 mm @ z = 778 mm 2495 x 1836 mm @ z = 3034 mm
Camera mode	
Point size (@ z = 1239 mm)	1.050 mm
Accuracy	1.250 mm
Temporal noise	0.150 mm
Scanner mode	
Point size (@ z = 1239 mm)	0.720 mm
Accuracy	0.900 mm
Temporal noise	0.10 mm
General parameters	
Dimensions	80 x 68 x 627 mm
Weight	1500 g
Baseline	550 mm
Data acquisition time	20 ms

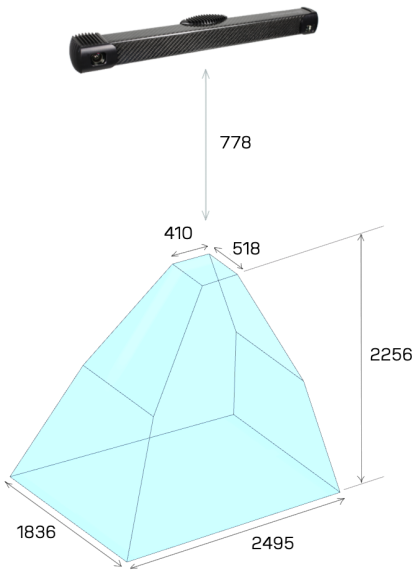


Figure 20: MotionCam-3D L scanning range

Cleaning Instructions

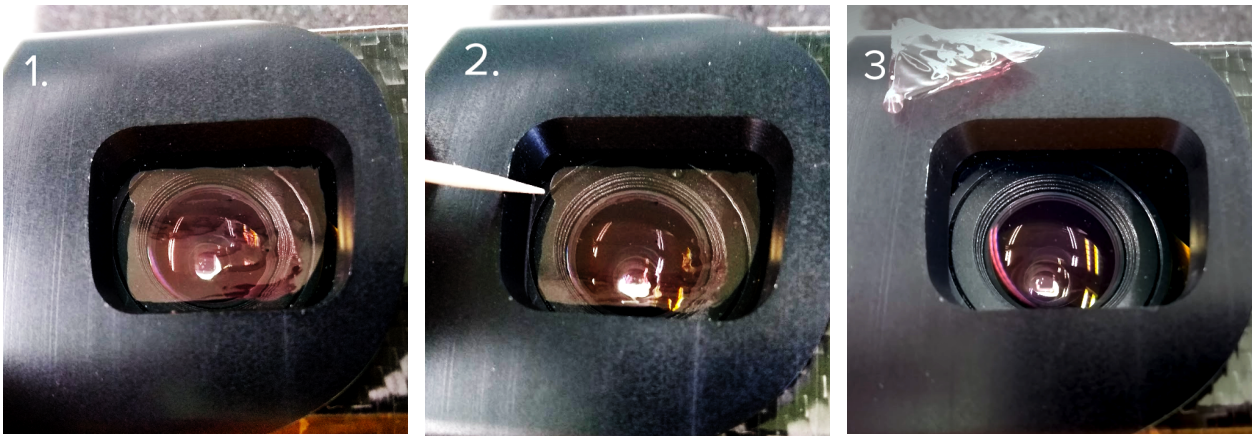
MotionCam-3Ds are generally low maintenance. To preserve their performance and quality of the scans, please check and maintain their outer optical parts regularly.

The glasses covering the camera unit and the projection should not be touched by bare hands to avoid staining of the glass. This could interfere with light passing through them. If the glass was touched or lightly stained by any other mechanism, wipe the glass with lint free wipes intended for optical components.

In cases where the scanner is used in an environment with lots of dust, especially when the dust contains sharp or hard particles that could potentially damage the glass, clean the glasses with specialized cleaning solution for optical components, eg: First Contact™ Cleaning Solution[2].

To clean the glasses:

1. Coat the glass with the solution using the applicator. Make sure not to spread it to the edges. The solution immediately dries and creates a film over the glass.
2. Remove the film from the glass using peel tabs with wooden or plastic tips.
3. The film removes any dirt or particles from the glass.



[2] www.photoniccleaning.com/product-p/rfcr.htm

Compliance with Standards

MotionCam-3D conforms with the following standards and test specifications. Please note that the certification status may change without notification. Consult your local Photoneo representative if you need additional information related to the latest listing of exact approvals.

CE

MotionCam-3D satisfies requirements and safety related objectives according to the EC directives listed below. This CE mark is supported by tests conducted by the manufacturer.

Laser Classification

Laser class of the scanner is determined according to EN 60825-1:2014 Equipment classification and requirements standard.

MotionCam-3D are laser class 3R devices. The laser class was tested by an independent certification body Lasermet Limited which has issued certification reports No. 1830 and1997b.

All devices are labeled according to their respective class following rules given by the harmonized standard.

Details about the laser device used can be found in the section Projection Unit.

If necessary, please contact Photoneo for a written Declaration of Class 3R Laser Product for specific devices.

Degree of Protection

According to standard EN 60529 MotionCam-3Ds have the following mechanical protection:

IP65 Mechanical Protection

Completely protected against ingress of dust (dust-tight). Protected against low pressure jets of water from any direction.

Warranty

Warranty conditions are stated in General Terms and Conditions on Photoneo website:

www.photoneo.com/kb/terms-conditions

Dimensions and Illustrations

Bottom View: Mounting Plate

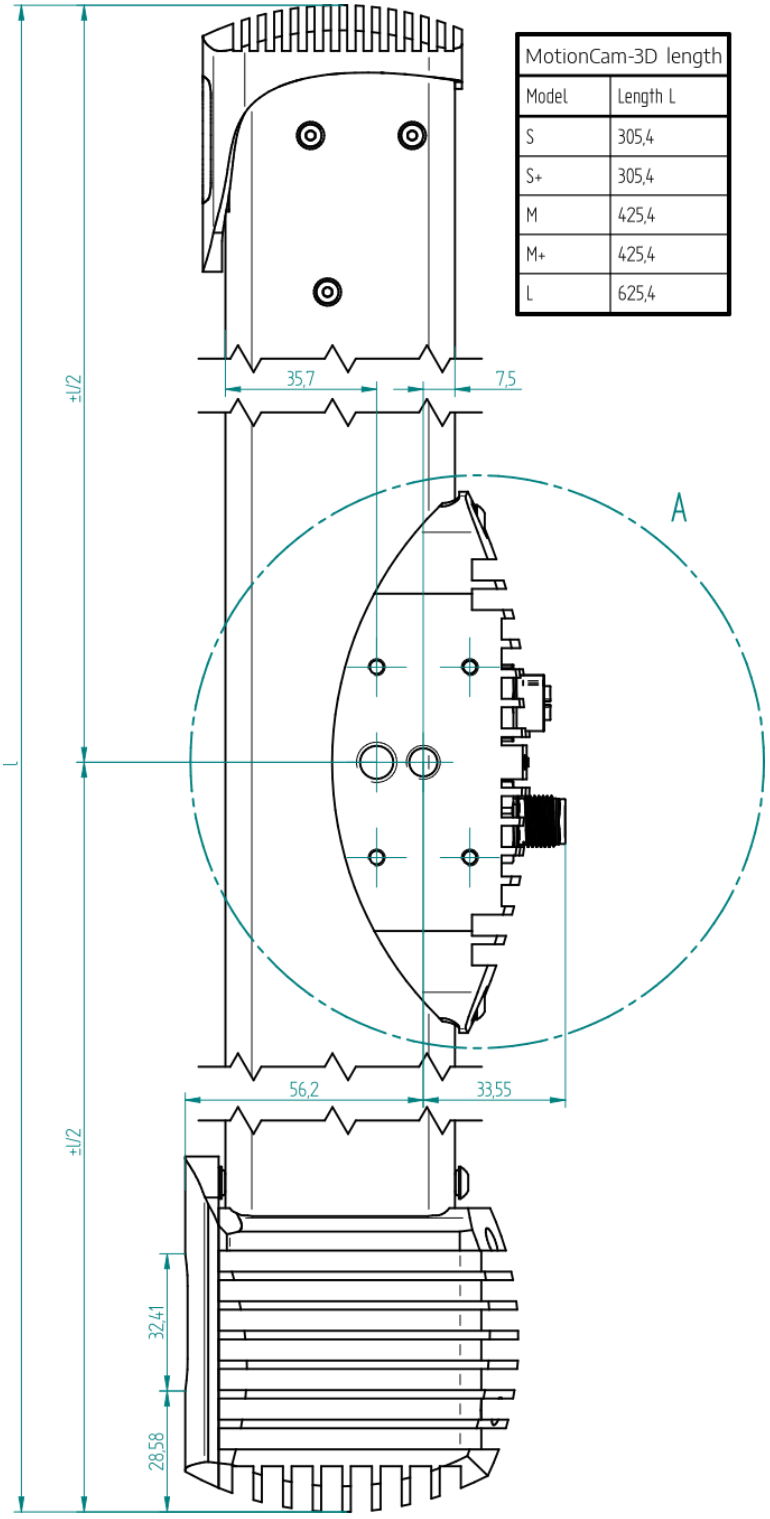


Figure 22: Bottom view of MotionCam-3D

Bottom View: Detail A

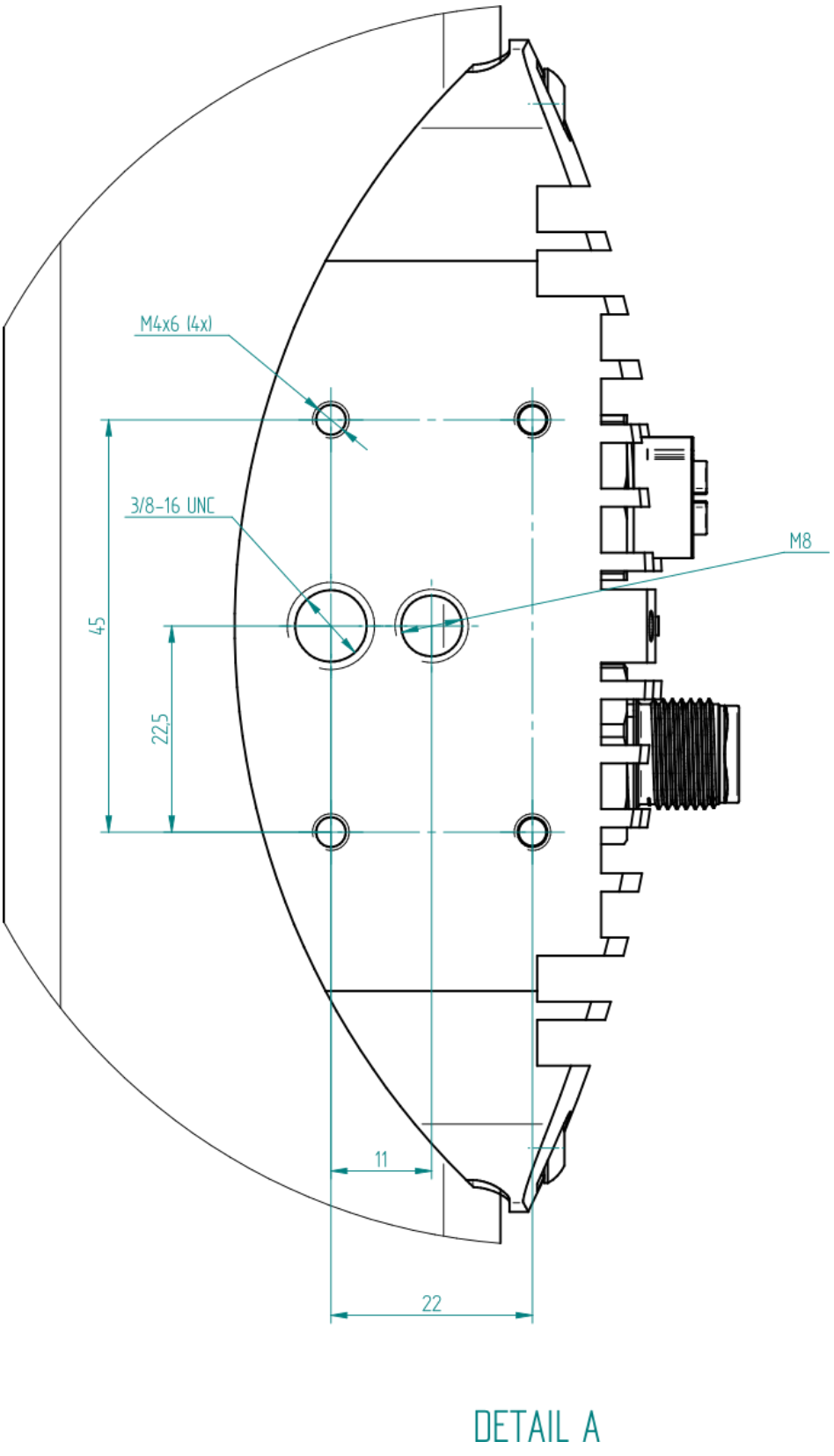


Figure 23: MotionCam-3D - Detail A

Front View: Projection Unit and Camera Unit

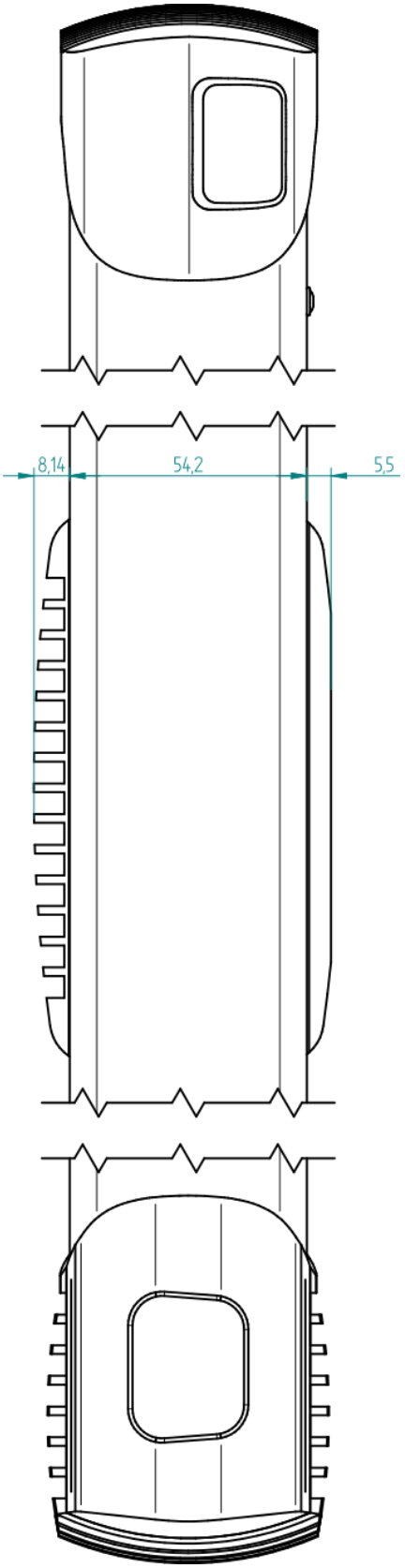


Figure 24: Projection unit and camera of MotionCam-3D

Changelog

List of changes between MotionCam-3D User Manual 08/2021 and MotionCam-3D User Manual 03/2021:

Page	Changes
20	Section 24 V Power Connector: ■ Added section about Hardware Trigger Characteristics

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