



Operating instructions

3D camera

O3X120

O3X130

O3X16x

O3X18x

GB



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1 Preliminary note

You will find instructions, technical data, approvals and further information using the QR code on the unit / packaging or at documentation.ifm.com.

1.1 Symbols used

- ✓ Requirement
- ▶ Instructions
- ▷ Reaction, result
- [...] Designation of keys, buttons or indications
- Cross-reference
-  Important note
Non-compliance may result in malfunction or interference.
-  Information
Supplementary note

1.2 Warnings

Warnings indicate the possibility of personal injury and damage to property. This enables safe product handling. Warnings are graded as follows:



WARNING

Warning of serious personal injury

- ▷ If the warning is not observed, fatal and serious injuries are possible.



CAUTION

Warning of minor to moderate personal injury

- ▷ If the warning is not observed, minor to moderate injuries are possible.

ATTENTION

Warning of damage to property

- ▷ If the warning is not observed, damage to property is possible.

1.3 Legal and copyright information

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All product names, pictures, companies or other brands used on our pages are the property of the respective rights owners.

1.4 Open source information



For more open source information see: documentation.ifm.com.

2 Safety instructions

- The unit described is a subcomponent for integration into a system.
 - The system architect is responsible for the safety of the system.
 - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Intended use).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.

2.1 Safety symbols on the unit

The following symbols are used on the device. Observe the subsequent sections in order to avoid hazards:

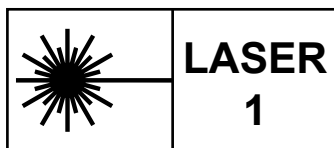


Electric supply must correspond to IEC 61010-1, chapter 9.4 - Limited-energy circuit. (→ [Electrical connection](#) □ 9)
Laser safety. (→ [Laser safety](#) □ 4)



Device of protection class III. Only for operation in PELV circuits. (→ [Electrical connection](#) □ 9)

2.2 Laser safety



Marking on the device:
CLASS 1 LASER PRODUCT
IEC 60825-1:2014
21 CFR 1040.10

The device emits invisible laser radiation ($\lambda=850 \text{ nm} \pm 10 \text{ nm}$) of laser class 1 according to

- IEC 60825-1:2014 and
- EN 60825-1:2014 + AC:2017 + A11:2021 + A11:2021/AC:2022.

USA

Complies with 21 CFR 1040.10 except for conformance with IEC 60825-1 Ed. 3, as described in Laser Notice No. 56, dated May 8, 2019.

Warning against opening the device or damaging it



WARNING

If the device has been opened or damaged, laser safety is no longer guaranteed.

- ▷ Skin or eye damage may occur.
- ▶ The device may only be opened by the manufacturer.
- ▶ If the device is damaged, stop using it and disconnect it from the power supply.

2.3 Cyber security

ATTENTION

Unprotected network environment:

The unit does not include IT security measures according to IEC 62443.

- ▷ Unauthorised read or write access to data is possible.
- ▷ Unauthorised manipulation of the device function is possible.
- ▶ Check and restrict access options to the device.

3 Intended use

The O3X1xx 3D camera is an optical camera (referred to as unit in the following) which measures the distance between the unit and the nearest surface point by point using the time-of-flight principle. The unit illuminates the scene with an infrared light source and calculates the distance by means of the light reflected from the surface.

The unit supplies data which describes the captured scene three-dimensionally. This data is output via Ethernet and evaluated by the user. Parameter setting of the unit is also done via Ethernet.

The unit may only be operated when firmly mounted and not as a portable or hand-held device.

3.1 Application area

The device safety is rated for use under the following operating conditions according to EN IEC 61010-2-201:

- indoor use
- altitudes up to 2000 m
- relative air humidity up to max. 90 %, non condensing
- pollution degree 3



Electromagnetic compatibility (EMC):

The unit is designed for use in industrial environments.

This product may cause radio interference in domestic areas.

- ▶ If required, take appropriate EMC screening measures.

4 Installation

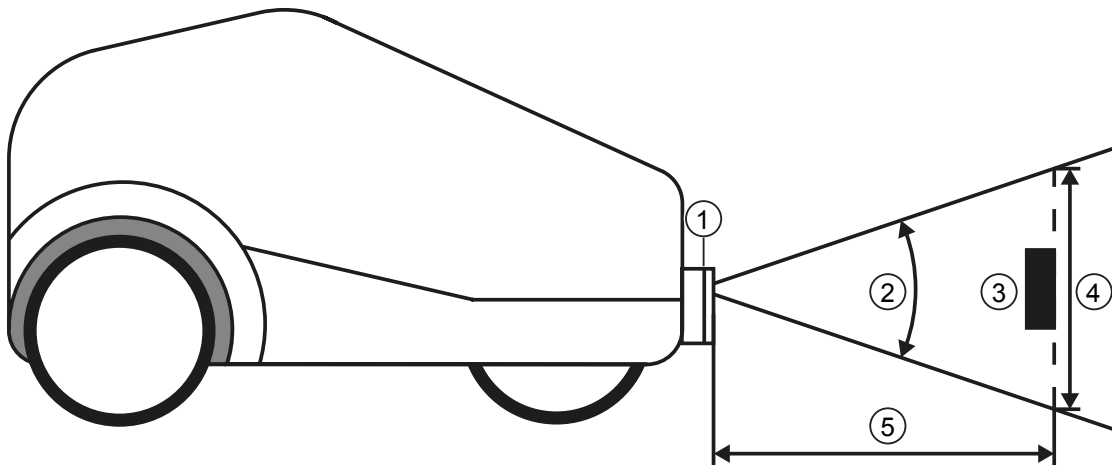


Fig. 1: Installation

- 1 Horizontally mounted unit
- 3 Object
- 5 Distance between unit and object

- 2 Angle of aperture
- 4 Field of view

4.1 Installation instructions

Observe the following instructions when installing the unit.



Measurement errors may occur if the instructions are not observed.

- ▶ Position the object (3) in the **field of view** (4).
 - ▷ The size of the field of view is indicated in the data sheet. The size of the field of view depends on the distance (5) of the unit to the object: With increasing distance the field of view becomes larger.
- ▶ Avoid direct reflections from the floor.
- ▶ Take tolerances into account when positioning the object.
- ▶ Take the measuring range of the unit into account when selecting the distance (5) between the unit and the object.
 - ▷ The measuring range is indicated in the data sheet of the sensor.
- ▶ Keep the distance (5) between the unit and the object as small as possible.
- ▶ If the distance is as small as possible, the object is detected with the maximum resolution.
- ▶ Avoid any strong ambient light and sunlight at the installation location.
 - ▷ An extraneous light level of over 8 klx (with solar spectrum) causes measurement errors. In fact, only the infrared component between 800 and 900 nm is of concern.
- ▶ Avoid transparent panes between the unit (1) and the object (3).
 - ▷ Transparent panes reflect part of the light even if a very clean glass pane is used.

4.2 Prepare the set-up

ATTENTION

The unit can heat up depending on the operating mode, the set parameters and the heat dissipation to the environment.

The difference between the unit's surface temperature and the ambient temperature must not exceed 25 degrees (according to IEC61010-2-201).

- ▶ Reduce the surface temperature.
- ▶ Adjust the operating mode and the parameters.



Reduce the surface temperature

Reduce the surface temperature with the following measures:

- ▶ Install the unit on heat-conductive metal parts.
 - ▷ A large-surface contact of the unit with metal parts increases heat dissipation (e.g. conventional aluminium heat sinks or profiles).
- ▶ Reduce obstructions around the unit. Reduce the density of objects mounted near the unit.
 - ▷ Obstructions around the unit and a high installation density may have a negative impact on **convection**.
- ▶ Reduce exposure time, frame rate or max. background distance.
 - ▷ The surface temperature decreases if the parameters are reduced.

4.3 Install the unit

Observe the following instructions when installing the unit:

- ▶ Install the unit using three M3 screws.
 - ▷ The hole dimensions are indicated in the scale drawing of the unit: documentation.ifm.com
- ▶ Use strain reliefs for all cables connected to the unit.
-  ▶ The unit may only be operated when firmly mounted and not as a portable or hand-held device.
-  ▷ Information about the accessories: documentation.ifm.com

5 Electrical connection

The device must be connected by a qualified electrician.

► Disconnect power before connecting the device.



Protection class III device (IEC 61010-2-201 chap. 6.5.2.101.4).

The electrical supply must

- be provided only by PELV circuits (IEC 61010-2-201 chap. 3.111),
- not exceed 35 V DC during operation,
- not exceed 60 V DC in the event of a single fault and
- not exceed the permitted operating voltage of the device (see data sheet).

The separation of external circuits must comply with IEC 61010-2-201, Figure 102.



WARNING

Unsuitable power supply

- ▷ Electric shock may cause serious injury or death.
- Use a PELV power supply within the specified voltage range.

Use energy-limited circuits for the electrical supply (IEC 61010-1 chap. 9.4). The energy of the circuit can be limited at an operating voltage of 24 V by an overcurrent protection device. The overcurrent protection device must switch off a current of 8.3 A in maximum 120 s. Observe the specific tripping characteristic. Possible overcurrent protection devices:

- fuse or
- non-adjustable and non-self-reclosing electromechanical device.

Separate the circuit from other, non-energy-limited circuits by at least basic insulation.

ATTENTION

No suitable energy limitation of the circuit

- ▷ Fire hazard in case of a malfunction.
- Use energy-limited circuit according to IEC 61010-1 chap. 9.4.

ATTENTION

Long connection cables

- ▷ Surge voltages may damage the device.
- For cable lengths > 30 m inside a building or for cables leaving the building, use additional surge protection according to IEC 61000-4-5.

5.1 Wiring

O3X120 / O3X130

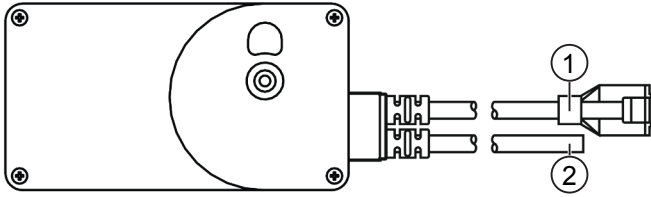


Fig. 2: Wiring of O3X120 and O3X130

1 Ethernet

2 Power supply

(1) Ethernet		
RJ45 Ethernet connector		
	1	TD+
	2	TD-
	3	RD+
	4	not connected
	5	not connected
	6	RD-
	7	not connected
	8	not connected

(2) Power supply	
2 wires, open ends	
Red	U+ (24 V)
Black	GND

5.2 Use of several devices

Observe the following when using multiple devices.



The active lighting of the unit may interfere with the following devices:

- other devices of the same type
- optical measuring systems
- laser scanners
- etc.

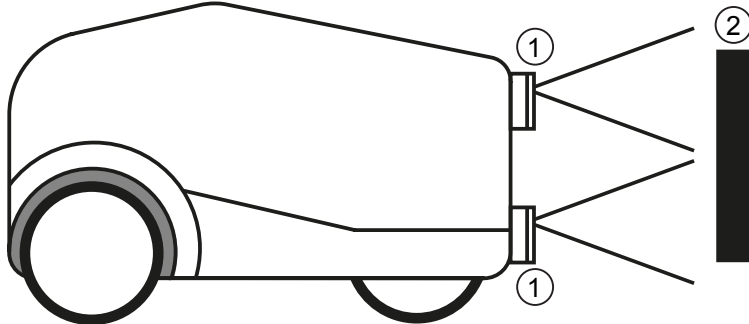


Fig. 3: Two devices installed on a robot

1 Device

2 Object

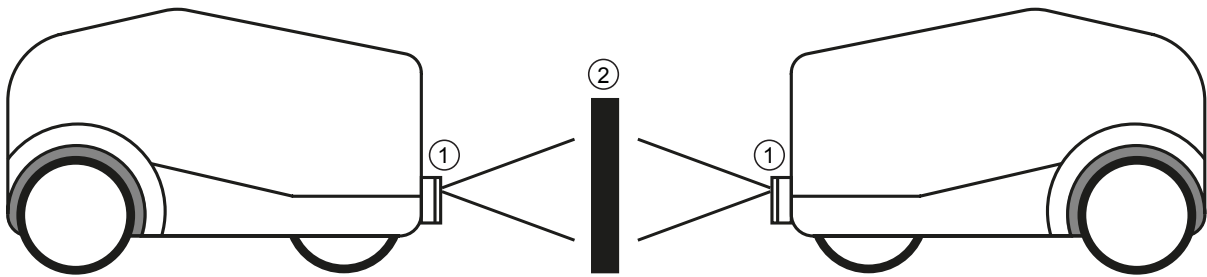


Fig. 4: Two robots with one device each

1 Device

2 Object

Reduce measurement errors by taking the following measures:

- ▶ Optically separate the devices from each other.
- ▶ Trigger the devices one after the other via the process interface using a software trigger.



An internal process considerably reduces possible interference. Nevertheless measurement errors and minor tolerances may occur.

6 Set-up

After power on, the unit is put into operation.

After approx. 25 seconds, the unit is in the evaluation mode where saved applications are executed.

6.1 Set the parameters of the unit

The parameters of the unit can be set in two ways:

- Software ifmVisionAssistant (www.visionassistant.ifm.com)
- ifm3Dlib (<https://github.com/ifm/ifm3d>)
 - Programming example for ifm3Dlib (→ [Programming example](#) 12)
- ROS (<https://github.com/ifm/ifm3d-ros>)



The software ifmVisionAssistant and detailed information about the measuring principle of the unit are described in the software manual.

The software manual is available on our website: documentation.ifm.com



The library ifm3Dlib and the wrapper ROS are available for Linux under Apache License Version 2.0.

6.1.1 Programming example

Preferably use ifm3Dlib for access to the unit under Linux. The library has been tested and is the reference implementation for C++. The Apache-2 licence allows commercial use.

The short C++ example below shows how to address the unit with ifm3Dlib.

```
auto cam = ifm3d::Camera::MakeShared();
auto fg = std::make_shared<ifm3d::FrameGrabber>
  (cam, (ifm3d::IMG_AMP|ifm3d::IMG_RDIS|ifm3d::IMG_CART));
auto img = std::make_shared<ifm3d::ImageBuffer>();
if (! fg->WaitForFrame(img.get(), 1000))
{
  std::cerr << "Timeout waiting for camera!" << std::endl;
  return -1;
}
pcl::io::savePCDFileASCII("point_cloud.pcd", *(img->Cloud()));
imwrite("amplitude.png", img->AmplitudeImage());
imwrite("radial_distance.png", img->DistanceImage());
```

In the example, a data set is retrieved from the unit. The amplitude image and the radial distance from the data set are saved as a PNG file. The Cartesian coordinates are saved as a PCL file.



Detailed examples are available online at: <https://github.com/ifm/ifm3d-examples>

6.2 Optimum object detection

The following conditions increase the detection rate of objects. Large bright objects with good infrared reflectivity allow optimum detection compared to small dark objects.

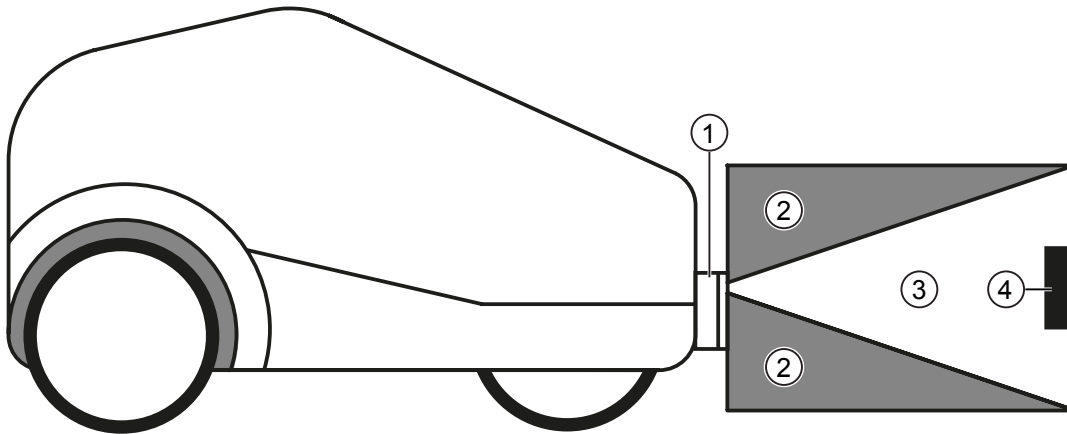


Fig. 5: Optimum object detection

1 Horizontally mounted unit
3 Field of view

2 Area directly next to the field of view
4 Object

Optimum detection of an object (4):

- ▶ Position the object in the **field of view** (3).
- ▶ Viewed from the unit (1), place the object (4) as the nearest visible object.
- ▶ Keep the area (2) free of objects (obstructions etc.).
 - ▷ Especially bright objects in the area (2) right next to the field of view (3) are problematic.
- ▶ Keep the front lens of the unit free from soiling.



Measurement errors may occur if the instructions are not observed.

6.3 Update the firmware

The software manual describes how to update the firmware.



The current software manual can be downloaded at: documentation.ifm.com

7 Troubleshooting

If the unit behaves unexpectedly or incorrectly:

- ▶ Download and install the latest firmware and ifmVisionAssistant versions. Download at documentation.ifm.com.

If the problems persist:

- ▶ Contact the ifm support. Contact at www.ifm.com.

8 Maintenance, repair and disposal

Soiling reduces the contrast and the recognition performance.

- ▶ Keep the front pane free from soiling.
- ▶ Use a clean and lint-free cloth for cleaning.
 - ▷ The device is not protected against the ingress of liquids.
- ▶ Do not open the device.
 - ▷ The device does not contain any components which can be maintained by the user. The device must only be repaired by the manufacturer.
- ▶ After use, dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.



WARNING

If the device has been opened or damaged, laser safety is no longer guaranteed.

- ▷ Skin or eye damage may occur.
- ▶ The device may only be opened by the manufacturer.
- ▶ If the device is damaged, stop using it and disconnect it from the power supply.

Glossary

Angle of aperture

The angle of aperture of the unit is the angle a point on the optical axis forms with the diameter of the entrance or exit pupil. The angle of aperture is specified in the technical data of the unit.

Convection

Convection is the air movement around the unit. Sufficient air movement is necessary to prevent the unit from overheating.

Field of view

The field of view is the angular aperture range of the unit in which objects can be observed. The angle of aperture is indicated in the technical data of the unit.