



Operating instructions
Multicode Reader
O2I5xx

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 instructions in order to avoid hazards:

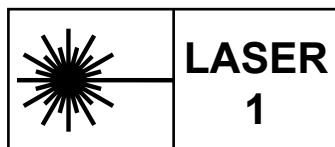


- Electric supply must correspond to IEC 61010-1, chapter 9.4 - Limited-energy circuit. (→ [Electrical connection](#) □ 14)
- Laser safety. (→ [Laser safety](#) □ 4)



- Device of protection class III. Only for operation in PELV circuits. (→ [Electrical connection](#) □ 14)

2.2 Laser safety



Marking on the device:
 CLASS 1 LASER PRODUCT
 IEC 60825-1:2014
 21 CFR PART 1040

The device emits invisible laser radiation ($\lambda=655 \text{ nm} \pm 10 \text{ nm}$) of laser class 1 according to

- EN60825-1:2007 and IEC60825-1:2007
- EN 60825-1:2014 + AC:2017 + A11:2021 + A11:2021/AC:2022 and IEC 60825-1:2014

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 Photobiological safety

The unit has four illumination LEDs that can be switched on independently of each other.

- O2I5x0, O2I5x2 and O2I5x4:
The illumination LEDs emit visible light with a wavelength of 617 nm. The unit complies with the free group according to EN 62471:2008.
- O2I5x1, O2I5x3 and O2I5x5:
The illumination LEDs emit invisible infrared light with a wavelength of 850 nm. The unit complies with the free group according to EN 62471:2008.

2.4 Cyber security

ATTENTION

Unprotected network environment.

The device 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 device decodes labelled and directly marked 2D codes and 1D bar codes and detects fonts (OCR).

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 4000 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.



The IP rating has not been evaluated by UL® Underwriters Laboratories®.



The focus setting is designed for a life cycle of 200,000 changes.



The teach button has a calculated operation of over 100,000 button pushes.

4 Function

The device checks and monitors code content, code properties and code quality and detects fonts (OCR). To do this, it creates image captures with set applications.

The device outputs the results via an Ethernet-based interface (process interface).

In addition, the device has 2 switching outputs for controlling external devices.

4.1 Overview of device functions

- Integrated, configurable code evaluation and detection of fonts (OCR)
- read different code types with one application
- Process interfaces:
 - O2I50x: Ethernet TCP/IP and EtherNet/IP
 - O2I51x: Ethernet TCP/IP and PROFINET
- Parameter setting interface: Ethernet TCP/IP
- Control of the switching outputs via the active application or externally via process interface
- Automatic setting of focus, illumination and code parameters during the configuration
- Internal illumination
- Control of external illumination units
- Internal and external triggering of image captures
- Data processing with function blocks and logical links in the device
- Integrated ifm mass storage device saves current configuration for easy device replacement. Optional storage of error images.

4.2 Web front end

The device has a web front end via which the following information can be retrieved:

- Licences
- Device configuration (the ifm mass storage device is required for saving)
- Error images (the ifm mass storage device is required for saving)



The ifm mass storage device is planned as an accessory: ifm.com, article no.: E2D504

Calling up the web front end

- Enter the IP address of the device in a web browser. Example: <http://192.168.0.69>

4.3 Triggering image captures

1...5 parameter sets can be defined for image captures.

Image captures for code recognition are triggered by an internal or external trigger signal. Depending on the selected trigger mode, the images are then captured accordingly.

- Internal triggering
 - Images are captured continuously with a fixed frame rate.
 - The settings are made via the ifm Vision Assistant software.
- External triggering

- Image capture activated by external trigger source (switching signal of a connected sensor) via the trigger input.
- Image capture activated by process interface command (PLC) via Ethernet.



If an internal or external illumination unit is used, it will be switched on with each triggering.

4.3.1 External triggering

For external triggering of image captures, different trigger modes can be used (→ software manual at documentation.ifm.com):

- Negative edge
- Positive edge
- Negative and positive edge
- Gated trigger
- Burst trigger



During an active trigger process, no new trigger can be activated. A trigger signal that occurs too early will be discarded and treated as a “Trigger overrun” error. The ready signal “Ready for trigger” can be output to a switching output.

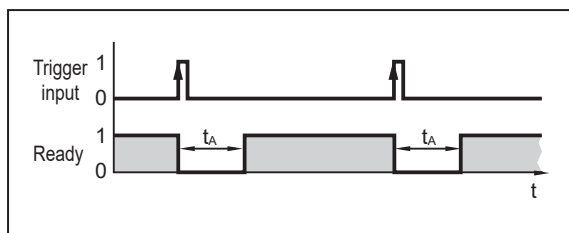


Fig. 1: Ready signal (“Ready for trigger”)

Example: A diffuse reflection sensor as an external trigger source triggers the unit on a positive edge (t_A = evaluation time).

4.3.2 Internal debouncing

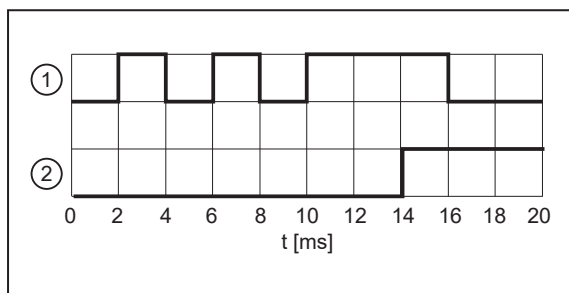


Fig. 2: Internal debouncing

1: trigger input

2: image capture

The trigger input can be debounced internally (preset: internal debouncing deactivated). Internal debouncing prevents several short pulses from triggering. The pulse must be at least 4 ms long to be recognised as a trigger.

Depending on the electrical installation, debouncing is not necessary.



A trigger delay can be set.

4.4 Switching outputs

Switching outputs OUT1 and OUT2 are configurable. If an external illumination is connected, only OUT1 is still available for the application.

The configuration can be set individually for each application using ifm Vision Assistant. The table below shows the standard configuration.

Output	Standard	External illumination	Process interface
OUT1	For applications via ifm Vision Assistant: Ready signal ("Ready for trigger") 0: unit busy 1: unit ready for trigger signal	Trigger output	Selectable via command
	When using the teach button: evaluation successful (pass/fail)		
OUT2	For applications via ifm Vision Assistant: code evaluation 0: code evaluation not successful 1: code evaluation successful When using the teach button: OUT2 not used		

Tab. 1: Standard configuration of the switching outputs

The switching output switches as soon as one of the following device states has occurred:

- "Ready for trigger"
The unit signals that a new image can be captured. Only with this device status are trigger operations processed. For the continuous image capture the status "Ready for trigger" is not output.
- "Image capture finished"
The unit signals that the image capture is finished. The device status can be used for cascading devices in order to prevent mutual interference during image capture.
- "Error"
The unit signals an internal error. Detailed information about errors can be requested via Ethernet.
- "Controlled via process interface" (e.g. by PLC)
The device is controlled via the command "O" (→ Programmer's Guide).
- "User-defined states"
The user-defined states are changed with the processing of codes (e.g. code found, code matches the reference, code quality outside the threshold level, etc.).

4.5 Internal illumination

The activated internal illumination can improve object recognition. The 4 illumination LEDs can be activated separately.

The internal illumination is set via the ifm Vision Assistant software.

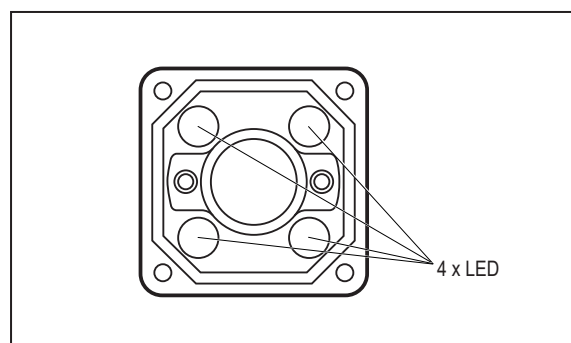


Fig. 3: Illumination LEDs

- O2I5x0, O2I5x2, O2I5x4: red light (617 nm) and integrated polarisation filter
- O2I5x1, O2I5x3, O2I5x5: infrared light (850 nm)

5 Mounting

Depending on the application and surface of the object to be monitored, the unit can be installed in front of or above the object.

- ▶ Fasten the unit to a bracket via the two threaded holes present on the unit. Tightening torque max. 2.1 Nm.
- ▶ Use the laser markings to align the unit (→ [Aligning the unit and object](#) □ 12).



Information about available accessories at www.ifm.com

5.1 Installation instructions

Storage at high humidity can lead to fogging of the front glass after switch-on, which can affect the functioning of the unit.

- ▶ Do not exceed the following limits:

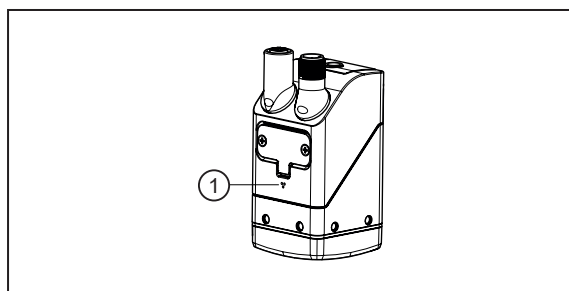
Temperature	Maximum recommended relative humidity
25 °C	75%
30 °C	72%
35 °C	70%
40 °C	67%

- ▶ Avoid back light, scattered light and changing light conditions. Sunlight hitting the lens or the scene to be monitored may cause interference.
- ▶ Ensure mechanical decoupling when installing the device to prevent the sensor from vibrating.
- ▶ Avoid installation in heavily polluting areas of the machine.



Units mounted side by side can interfere with each other when exposed to active lighting simultaneously.

- ▶ Ensure constant external illumination or trigger the units one after the other.
- ▶ Make sure that the pressure compensation element on the bottom side of the unit is not covered.



1: pressure compensation element

Fig. 4: pressure compensation element

ATTENTION

Laser beams can destroy the image sensor

- ▶ High-energy lasers (class 3 and above) could destroy the image sensor if they impinge on the lens.
- ▶ Do not position the device in the immediate vicinity of high-energy lasers (e.g. laser labelling systems).

5.2 Mounting with clamp

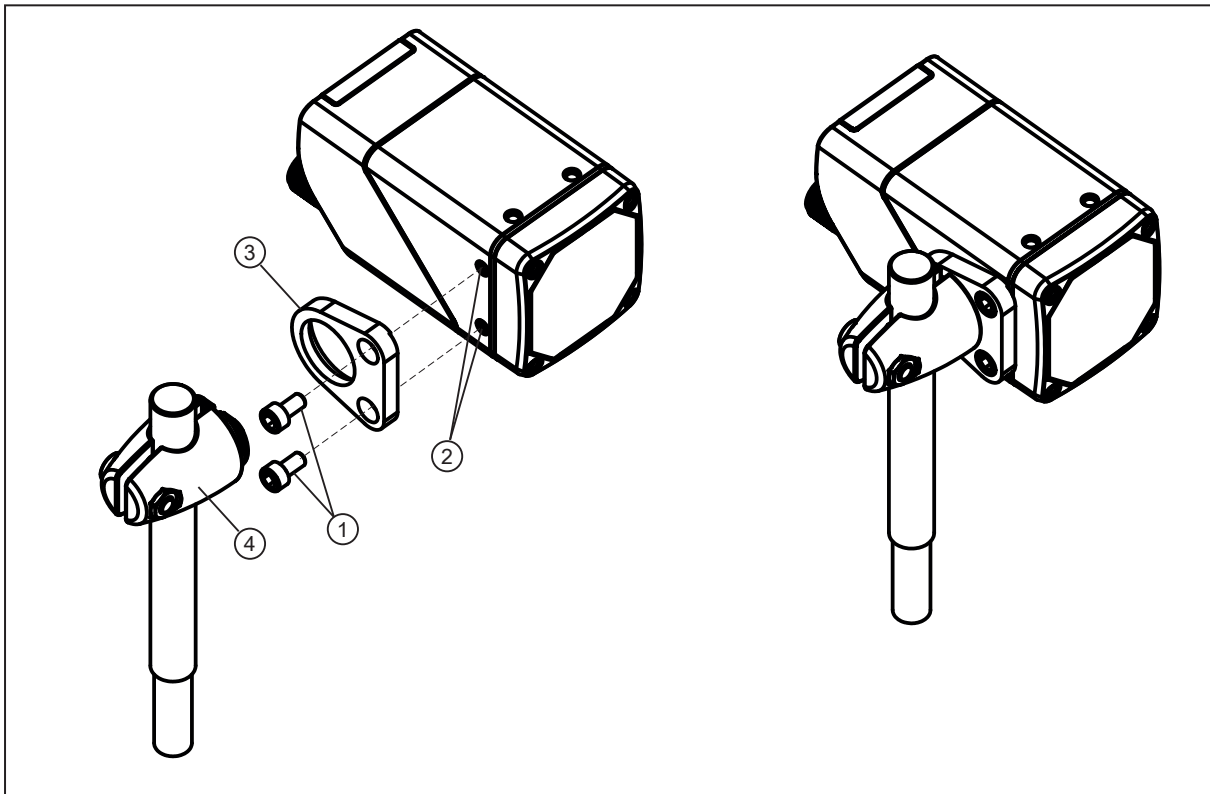


Fig. 5: Installation using the mounting set E2D500

1: M4 screws
3: bracket

2: threaded M4 holes (depth 7 mm)
4: clamp

- Fasten the bracket to the threaded M4 holes of the unit using two M4 screws. Tightening torque max. 2.1 Nm.
- Fix the clamp to the bracket.

5.3 Mounting with dome illumination

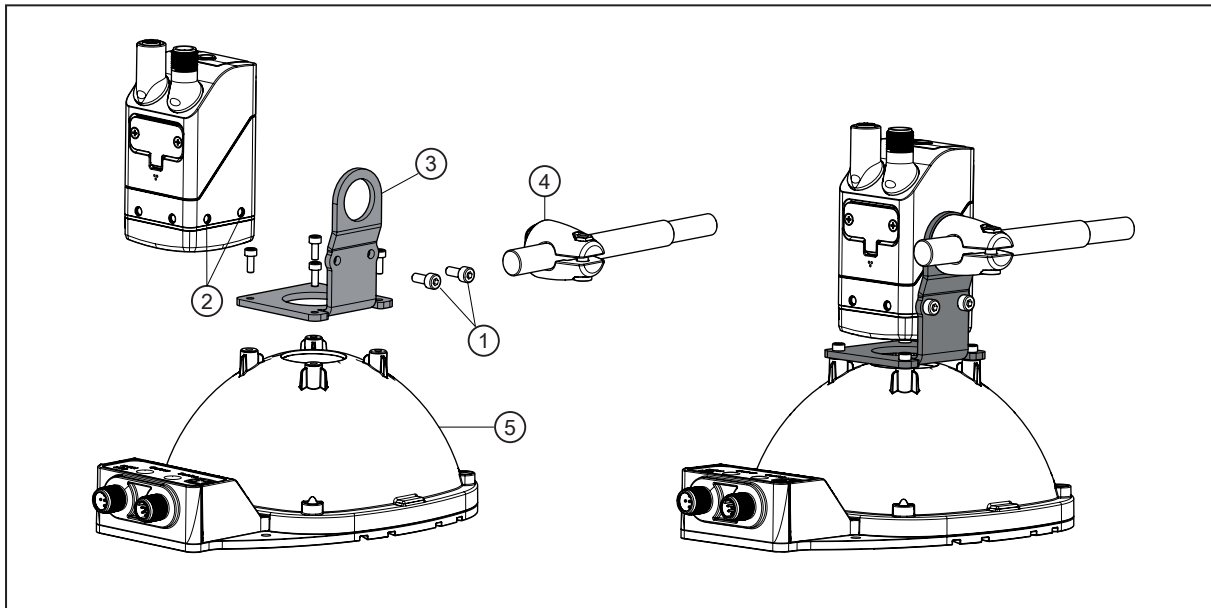


Fig. 6: Installation using the mounting set E2D501

- | | |
|----------------------|-----------------------------------|
| 1: M4 screws | 2: threaded M4 holes (depth 7 mm) |
| 3: bracket | 4: clamp |
| 5: dome illumination | |

- Fasten the bracket to the threaded M4 holes of the unit using two M4 screws. Tightening torque max. 2.1 Nm.
- Fasten the bracket to the dome illumination using four screws.
- Fix the clamp to the bracket.

5.4 Aligning the unit and object

The unit is aligned with 2 laser markings. The laser markings mark an area on the surface. The unit detects an object in the area.

Aligning the unit:

- Press the teach button for 3 seconds.
 - ▷ The 2 laser markings light up.
- Place the unit to the centre of the object.

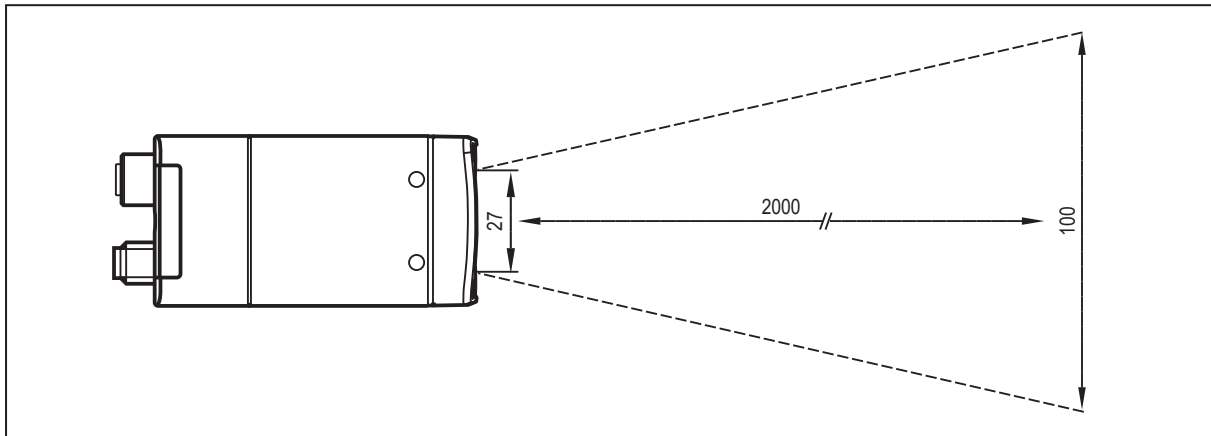


Fig. 7: Side view of the unit



The service life of the laser markings is approx. 10,000 hours.

- ▶ Activate the laser markings only briefly for alignment.

6 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.



The device may only be connected to internal Ethernet networks that do not leave the building. It must not be connected to TNV circuits.

ATTENTION

Use an additional protection against surge voltages according to IEC 61000-4-5 if the connection cable is longer than 30 m.

ATTENTION

The unit can be damaged by insufficiently tightened M12 connectors.

- ▷ The IP rating indicated in the data sheet is only guaranteed if the M12 connectors are firmly screwed.
- Firmly screw the M12 connectors to the unit.
- Cover the unused sockets with protective caps (E73004). Tightening torque: 0.6...0.8 Nm.
- Use strain reliefs for cables connected to the unit.



If the device is permanently used in wet areas, the nut of the M12 industrial Ethernet connection cable (e.g. E11898) may corrode.

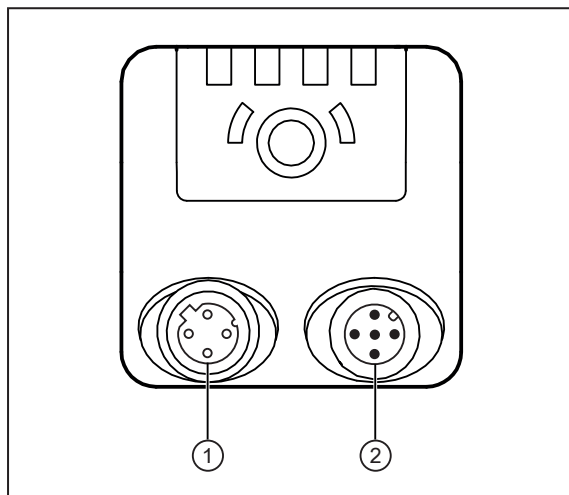
► Use a connection cable with a high-grade stainless steel nut.



For the scope of validity cULus:

Minimum temperature rating of the cable to be connected to the field wiring terminals: 70 °C.

6.1 Wiring



① Ethernet (parameter setting interface, process interface) M12 socket, D-coded, 4 poles	
	1: TD+ 2: RD+ 3: TD- 4: RD- S: screen
② Power supply and process outputs M12 connector, A-coded, 5 poles	
	1: U+ 2: trigger input 3: GND 4: switching output OUT1 – ready 5: switching output OUT2

6.1.1 PNP/NPN selection

Pins 2, 4 and 5 can be switched between PNP and NPN logic.

The setting cannot be made for individual pins, but applies to all pins.

6.2 Maximum current consumption

The maximum current consumption of the device is specified in the data sheet in accordance with IEC 61010-2-201:

The maximum current consumption corresponds to the average current consumption for the most unfavourable supply voltage and the maximum device load (exposure time, frame rate, internal lighting, storage device switched on, maximum load on the switching outputs, etc.).

The application-dependent average current consumption can be significantly lower.



The maximum current consumption is increased during exposure of the image with the internal lighting: max. 15 ms by approx. 150-200 mA above the average current consumption.

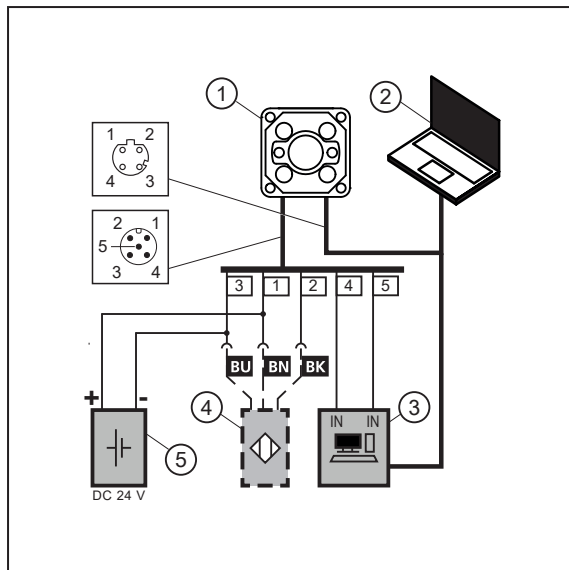
► Select the power supply of the device taking into account the maximum current consumption.

6.3 Wiring example

External triggering of the unit is possible via:

- Ethernet
- external switching signal via trigger input

In the wiring example, the image capture is triggered with a proximity switch via the trigger input.



- 1: Unit
- 2: Notebook for parameter setting
- 3: Industrial PC for evaluation and triggering
- 4: Proximity switch
- 5: Voltage source

Fig. 8: Wiring example of a trigger circuit



An adapter cable (Y cable) is available for external trigger sensors: → Accessories at www.ifm.com.

6.4 External illumination

An external illumination can be connected to facilitate object recognition. For example, the O2D9xx illumination unit is suitable.

The illumination unit is connected to switching output OUT2 of the unit. The illumination unit is active as long as OUT2 is in the state "high".



An adapter cable (Y cable) is available for external illuminations: → Accessories at www.ifm.com.

7 Installation

To be able to make full use of the unit's functions, the ifm Vision Assistant software is required for parameter setting.

- ▶ Download the software ifm Vision Assistant via the download area of the unit:
documentation.ifm.com



The operation of the ifm Vision Assistant software is described in the software manual. →
Software manual at documentation.ifm.com

7.1 Update firmware

- ▶ Download the software ifm Vision Assistant via the download area of the unit:
documentation.ifm.com
- ▶ Connect the device to the ifm Vision Assistant software.
- ▶ Update the firmware of the device.
 - ▷ Updating the firmware deletes the configuration stored on the device. The configuration of the device can be backed up before updating and then restored.

8 Operating and display elements

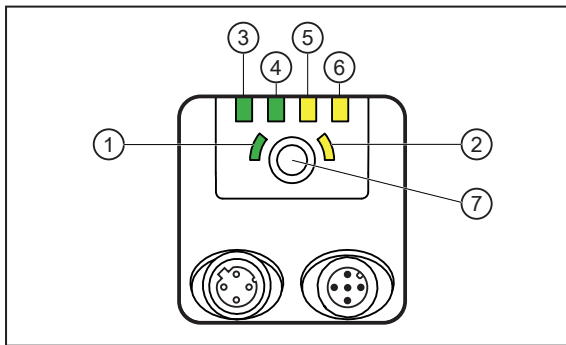


Fig. 9: LEDs and button

- 1: teach LED (green)
- 2: teach LED (yellow)
- 3: Ethernet LED (green)
- 4: power LED (green)
- 5: OUT1 LED (yellow)
- 6: OUT2 LED (yellow)
- 7: teach button

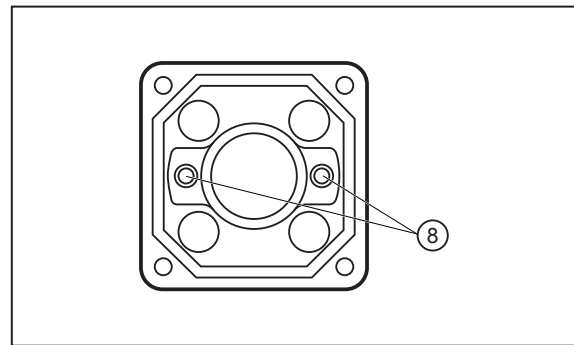


Fig. 10: Laser markings

- 8: red laser markings (655 nm)

8.1 Signal indications

Green teach LED	Yellow teach LED	Laser markings	Description
on	---	on	Alignment mode active
on	flashes at 1 Hz	flash at 1 Hz	Set-up mode active
flashes at 2 Hz	---	---	Configuration is saved
on for 2 s	---	---	Configuration successfully saved
flashes at 8 Hz	flashes at 8 Hz	---	Active mode for configuration transfer from ifm storage device via teach button
---	flashes at 8 Hz	---	Error: lock button is active
---	flashes at 8 Hz	flash at 8 Hz	Error: configuration failed
flashes at 2 Hz	flashes at 2 Hz	---	Visual localisation is active (→ Visual localisation ▢ 21)

Tab. 2: Teach LEDs (green, yellow), laser markings

Ethernet LED	Power LED	OUT1 LED	OUT2 LED	Description
---	on	---	---	Unit is ready for operation.
---	flashes at 0.5 Hz	---	---	No parameters set or parameter setting was not loaded into the unit. On Off 
---	flashes 2x at 0.5 Hz	---	---	Unit is in parameter setting mode. On Off 
---	on	on	---	OUT1 is switched.
---	on	flashes at 8 Hz	---	OUT1 has a short circuit.
---	on	---	on	OUT2 is switched.
---	on	---	flashes at 8 Hz	OUT2 has a short circuit.
on	on	---	---	Unit is ready for operation, Ethernet is connected.
flashes	on	---	---	Ethernet transmitting data.

Ethernet LED	Power LED	OUT1 LED	OUT2 LED	Description
Off	---	---	---	Ethernet not connected.
---	---	flashes at 8 Hz	flashes at 8 Hz	Unit signals internal error.
---	---	flashes at 2 Hz	flashes at 2 Hz	Unit signals correctable error. The error information can be read via Ethernet.
---	running light ⇒			Unit booting.
---	running light ⇐			Unit carrying out firmware update.

Tab. 3: Ethernet LED, power LED, OUT1 LED, OUT2 LED

9 Set-up



Error during set-up

- ▷ The unit may cause errors if it is put into operation below 0 °C.
- ▶ Put the unit into operation above 0 °C.
 - ▷ After being put into operation, the unit can be used below 0 °C. The possible ambient temperatures are specified in the data sheet.

After power on, the unit is put into operation.

After approx. 30 seconds, the unit is in the evaluation mode where saved applications are executed.

The indicators signal the current operating status.

On delivery, no applications are set up and the unit does not perform any function.

▶ Set the device using one of the following methods:

- Configure the device via the ifm Vision Assistant.
- Teach the code using the teach button on the device.



PLC modules and Python sample code are available on the web for programming the device:
documentation.ifm.com

10 Parameter setting

The device parameters can be set in two ways:

- ifm Vision Assistant software (→ see software manual at www.ifm.com):
 - parameter setting of up to 32 applications with multiple codes and image captures.
 - configure process interface and switching outputs.
- Code teaching via the teach button.
 - automatic teaching of a simple application with a code in an image.
 - preconfigured process interface and switching outputs.
- Transfer the configuration from the ifm storage device (→ [Replacing the unit](#) □ 24).



The focus setting is designed for a life cycle of 200,000 changes.



The ifm Vision Assistant software and the software manual are available on the Internet: www.ifm.com

10.1 Teach code with teach button



The code must be of high quality and of high contrast. The unit focusses the code better if the background looks uninteresting. Several codes in the marked zone make the teaching process of a certain code more difficult.

- ▶ Observe the notes on how to install the unit (→ [Mounting](#) □ 10).
- ▶ [Aligning the unit and object](#) (→ □ 12).
- ▶ Press the teach button for 3 seconds.
 - ▷ The green teach LED is permanently on.
 - ▷ 2 red laser markings can be seen on the surface.
- ▶ Place a code in the zone marked by the red laser markings
- ▶ Press the teach button for 1 second within 2 minutes (timeout).
 - ▷ The yellow teach LED flashes while the unit automatically sets exposure time and focus and then teaches the code.
- ▷ The code is taught if the green the led teach flashes briefly and is then on for 2 seconds (→ [Signal indications](#) □ 18).
- ▷ The code is not taught if the yellow teach led flashes briefly (→ [Signal indications](#) □ 18).



The teach button has a calculated operation of over 100,000 button pushes.

10.2 Visual localisation

The device can be located remotely in the system via PROFINET.

The green and yellow multi-function LEDs flash when using the command. (→ [Signal indications](#) □ 18)

11 Operation

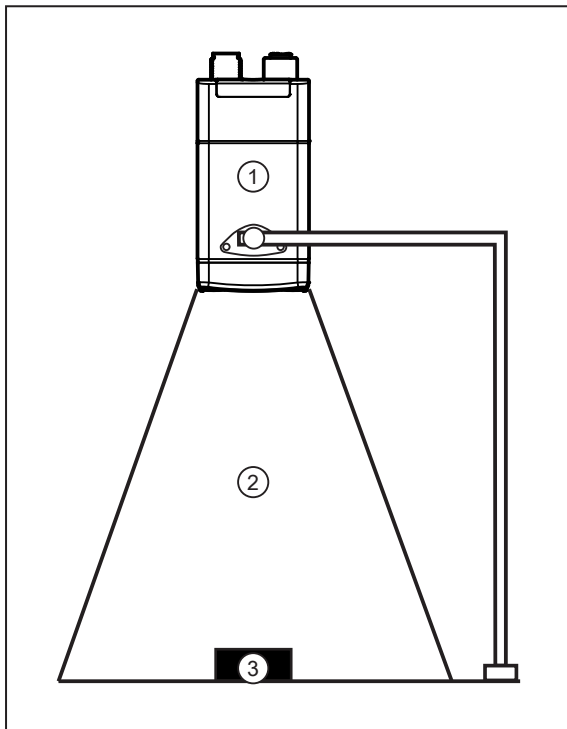


Fig. 11: Detect object

The following recommendations increase the recognition rate:

- ▶ Place the object (3) in the field of view (2).
- ▶ Remove other objects from the field of view.
- ▶ For objects with shiny surface:
 - slightly tilt the device (1) or
 - use the polarisation filter (only available in O2I5x0, O2I5x2 and O2I5x4).
- ▶ Clean the front lens of the unit (1).
- ▶ Observe the notes on installation (→ [Mounting](#)  10).

11.1 Over temperature protection

To protect the hardware, the device is equipped with over temperature protection.

This may become active in the case of:

- a high ambient temperature
- a high frame rate
- a long exposure time

If the over temperature protection is active, no images will be captured. The over temperature protection will be deactivated as soon as the internal temperature of the device has decreased.



The laser markings are deactivated at the following internal temperatures of the device:

<5°C

>70°C

12 Troubleshooting

If the unit behaves unexpectedly or incorrectly:

- Download and install the latest firmware and ifm Vision Assistant versions. Download at documentation.ifm.com.

If the problems persist:

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

13 Maintenance, repair and disposal

If used correctly, the unit is maintenance-free.

Soiling reduces the contrast and the recognition performance.

- ▶ Keep the front lens free from soiling.
- ▶ Use glass cleaner as cleaning agent. Cleaning agents containing solvents can damage the front glass.

Only the manufacturer is allowed to repair the unit.



Only the manufacturer is allowed to open the unit. To replace the unit, the service lid may be opened by the user.

- ▶ After use dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.

13.1 Replacing the unit

When the unit is replaced, the saved configuration can be transferred to the new unit. The internal ifm mass storage device of the old unit is inserted in the new unit.



The integrated ifm storage device has a data retention time of 3 years at a maximum storage temperature of 55 °C. If this time is exceeded, data loss is possible. During operation, the stored data is refreshed periodically.



The service lid may only be opened for the transfer of the configuration.

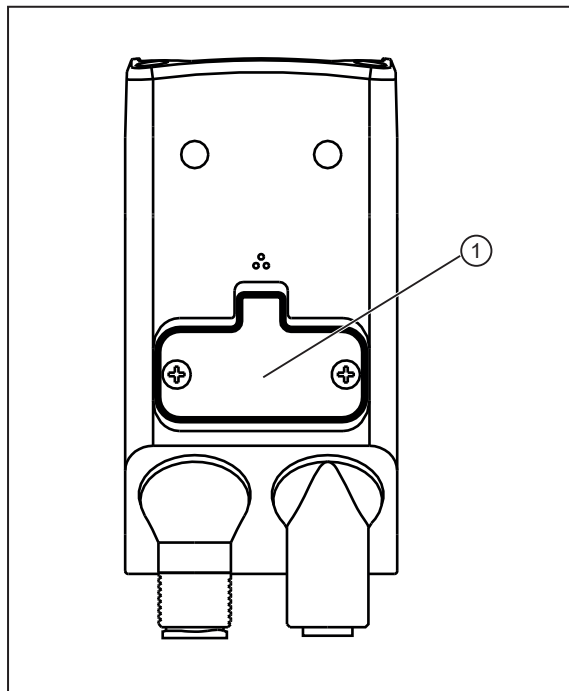
- ▶ Only open the service lid in a clean and dry environment (degree of soiling 2).



The ifm mass storage device may only be used for the O2x5xx devices.

- ▶ Do not use the ifm memory stick with a PC, notebook, etc.

To replace the ifm mass storage device:



- ▶ Remove the cables connected to the unit.
- ▶ Disconnect the unit from the power supply.
- ▶ Loosen the screws of the service lid.
- ▶ Remove the service lid from the unit.



The sealing rubber on the inside of the service lid must not be damaged.

- ▶ Insert the ifm mass storage device from the old unit in the new unit.
- ▶ Reattach the service lid. Tighten the screws applying max. 0.2 Nm.

Activate the configuration in the new unit:

- ▶ Connect the new unit to the voltage supply.
- ▶ Press the teach button while the green and yellow teach LEDs are flashing.
- ▶ The configuration is transferred from the ifm mass storage device to the new unit.

Fig. 12: Replace the unit.

1: service lid