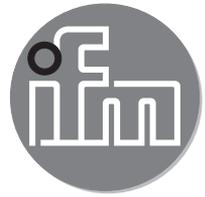


ifm electronic

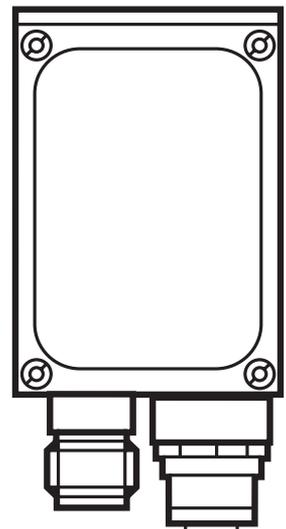


Operating instructions  
Object recognition sensor

**efector250<sup>®</sup>**

**O2D22x**

UK



## Contents

1	Preliminary note	4
1.1	Symbols used	4
2	Safety instructions	4
3	Items supplied	4
3.1	Accessories	4
4	Functions and features	4
5	Installation	5
5.1	Mounting accessory	5
5.2	Mounting dimensions	6
5.3	Installation location	6
6	Electrical connection	7
6.1	Wiring	7
6.2	Wiring	8
6.3	External illumination	8
6.4	External trigger source	9
6.5	Timing diagrams	10
6.5.1	Inputs/outputs	10
6.5.2	Static selection of the application	12
6.5.3	Pulse-controlled selection of the application	13
7	Operating and display elements	14
7.1	LED display	14
7.2	Display	15
7.2.1	Operating indicators	15
7.2.2	Connection via the operating program	16
7.2.3	Error messages	16
7.3	Pushbuttons	16
8	Set-up	17
8.1	Parameter setting on the unit	17
8.2	Verify and set the IP address on the unit	17
8.3	Adjustable parameters	18
8.3.1	Parameter structure	19
8.4	Lock / unlock sensor	20
8.4.1	Reset device to factory settings	20
8.5	Parameter setting via PC operating program	20
9	Operation	21
9.1	Evaluation mode (normal operating mode)	21
10	Scale drawing	21
11	Technical data	22
11.1	Operating distance L	22
11.2	Factory settings	22

12	Process data protocol . . . . .	24
12.1	Configuring the process interface . . . . .	24
12.2	Communication basics . . . . .	24
12.2.1	Abbreviations and terms . . . . .	24
12.2.2	Commands for the device . . . . .	24
12.2.3	Replies from the device . . . . .	24
12.3	Protocol versions . . . . .	25
12.4	Command types . . . . .	25
12.5	Release trigger . . . . .	26
12.6	Select protocol version . . . . .	26
12.7	Select the application . . . . .	26
12.8	Activate/deactivate result output . . . . .	27
12.9	Transmit the image to the device for evaluation . . . . .	27
12.10	Transmit the application data set to the device . . . . .	28
12.11	Request the assignment of the application data from the device . . . . .	28
12.12	Request the statistics from the device . . . . .	29
12.13	Request the error code from the device . . . . .	29
12.14	Request the last image from the device . . . . .	29
12.15	Request the last result from the device . . . . .	30
12.16	Release trigger, evaluate captured image and result output via process interface . . . . .	30
12.17	Request the protocol version . . . . .	30
12.18	Request the device information . . . . .	31
12.19	Request the last "bad" image from the device . . . . .	31
12.20	Result message . . . . .	32
12.21	Error codes from the device . . . . .	35
13	Maintenance, repair and disposal . . . . .	37
14	Approvals/standards . . . . .	37
15	Note on the software . . . . .	37

# 1 Preliminary note

## 1.1 Symbols used

▶ Instruction

> Reaction, result

[...] Designation of pushbuttons, buttons or indications

→ Cross-reference



Important note

Non-compliance can result in malfunction or interference



Information

Supplementary note

## 2 Safety instructions

These instructions are part of the device. They contain information and illustrations about the correct handling of the device and must be read before installation or use.

Observe the operating instructions.

Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or incorrect handling can affect the safety of operators and machinery.

The installation and connection must comply with the applicable national and international standards. Responsibility lies with the person installing the unit.

Only the signals indicated in the technical data or on the device label may be supplied to the connections or wires.

## 3 Items supplied

1 Object recognition sensor O2D22x

1 Operating instructions "Object recognition sensor O2D22x", Ident no.: 706225

The device is supplied without installation/connection accessories and software.

### 3.1 Accessories

[www.ifm.com](http://www.ifm.com) → Data sheet search → e.g. O2D220 → Accessories

## 4 Functions and features

The sensor uses incident light or backlight to detect the contours of an object and compares them with the contours of one or several models in a reference image. Depending on the degree of conformity the output can indicate if a model was found or which one was found.

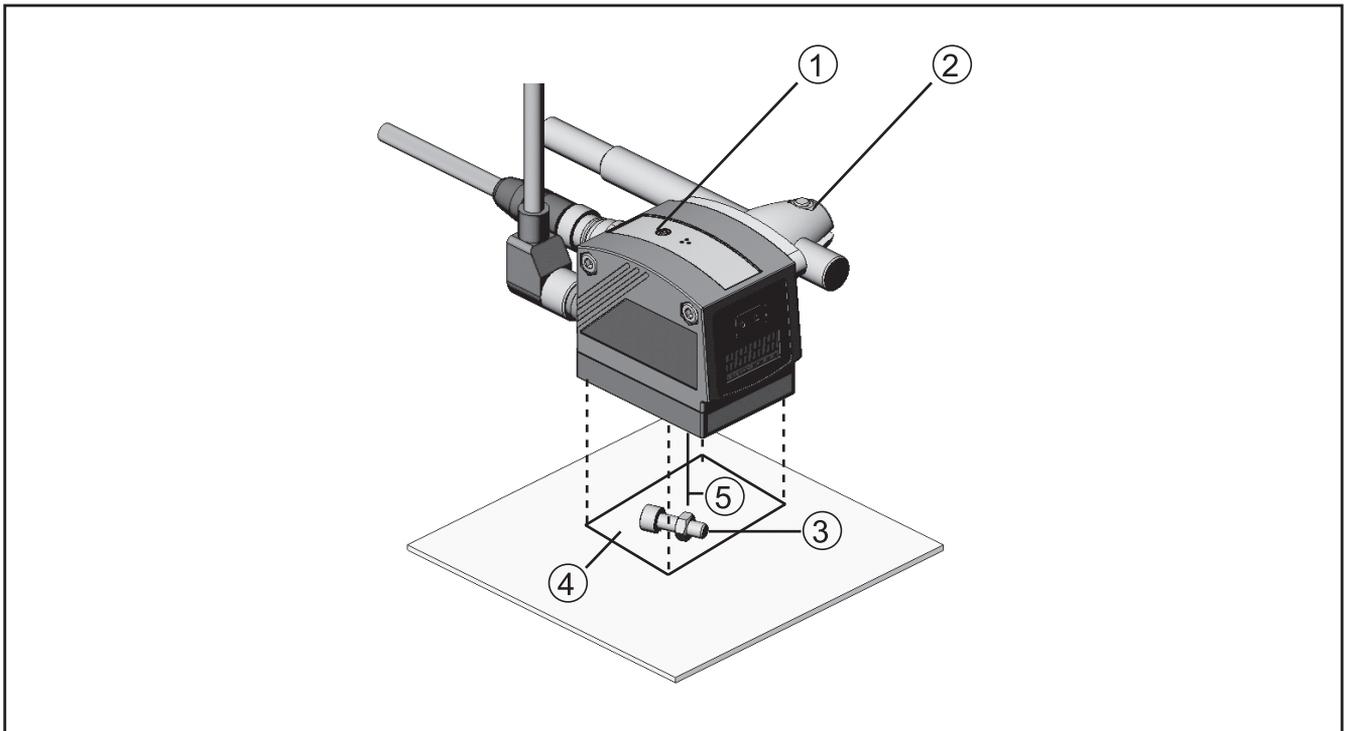
## 5 Installation

### 5.1 Mounting accessory

The device is compatible with the mounting accessories of ifm's photoelectric sensors for the O2lxxx (multicode reader), O2Mxxx (EthernetCamera) series etc.

Example mounting with clamp and bracket

- Use the mounting accessory E2D101.



UK

1. Focal setter
2. Mounting accessory
3. Object to be recognised
4. Field of view size W X H
5. Operating distance L

Depending on the intended location and type of mounting the following mounting accessories are available:

Description	Art. no.
Mounting set for shaft $\varnothing$ 12 mm (clamp and bracket for types O2Dxxx, O2Mxxx, O2lxxx)	E2D110
Shaft, straight $\varnothing$ 12 mm, length 130 mm, M10	E20938
Shaft, angled $\varnothing$ 12 mm, length 200 mm, M10	E20940
Mounting set for shaft $\varnothing$ 14 mm (clamp and bracket for types O2Dxxx, O2Mxxx, O2lxxx)	E2D112

Description	Art. no.
Shaft, straight Ø 14 mm, length 130 mm, M12	E20939
Shaft, angled Ø 14 mm, length 200 mm, M12	E20941

You can find more information about the available accessories at:

[www.ifm.com](http://www.ifm.com) → Data sheet search → e.g. O2D220 → Accessories  
or directly

[www.ifm.com](http://www.ifm.com) → Data sheet search → e.g. E2D110

## 5.2 Mounting dimensions

The device is mounted using the mounting accessories or 2 M4 screws and nuts.  
Hole dimensions → Chapter 10 Scale drawing.

## 5.3 Installation location

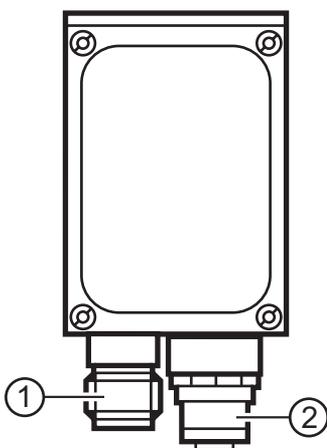
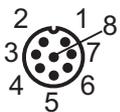
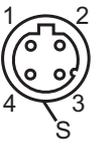
- ▶ Mount the sensor in front of or above the area to be monitored. The detectable field of view size depends on the operating distance → Chapter 11 Technical Data.
- ▶ Back light or scattered light situations and continuously changing light conditions are to be avoided.
- ▶ Do not position room lights directly facing the camera lens.
- ▶ Position the optional external illumination (e.g. O2D909) opposite the camera lens.
- ▶ To avoid adverse effects on the image detection, avoid installation in heavily polluting areas of the machine.
- ▶ The connected cables must be provided with a strain relief.

## 6 Electrical connection

### NOTE

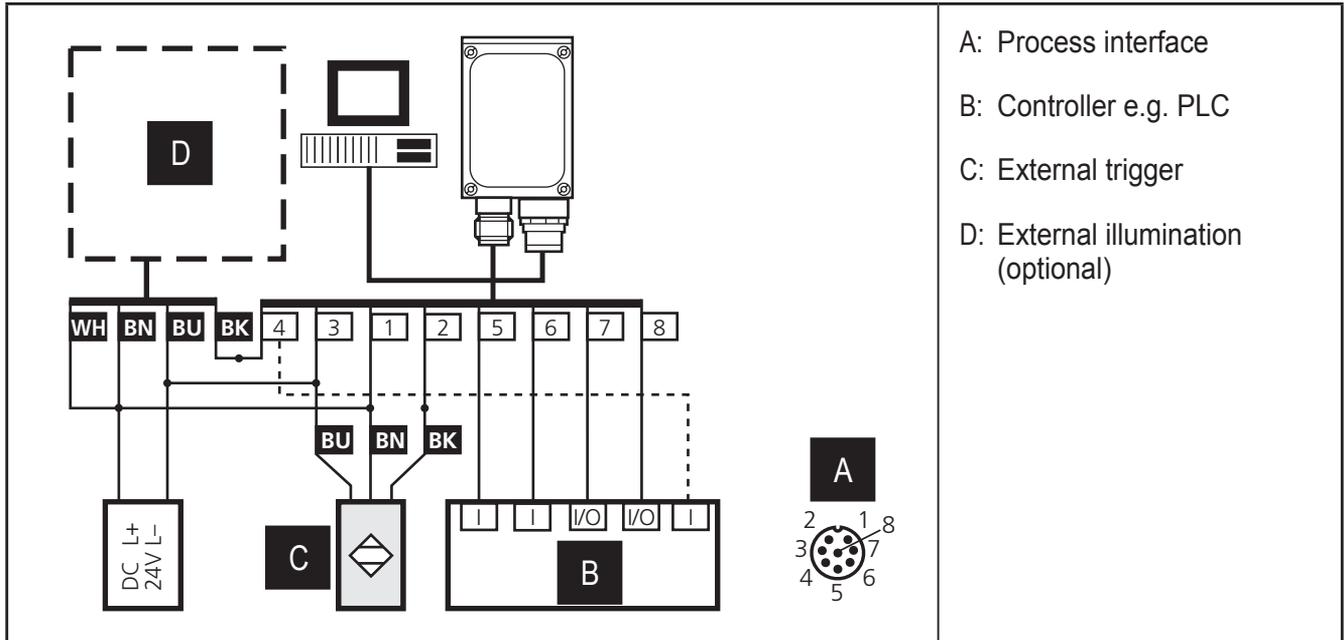
The unit must be connected by a qualified electrician. Disconnect power before connecting the unit.

### 6.1 Wiring

	<b>Process interface (1)</b>	
	M12 plug, A-coded, 8 poles (view on the unit)	
		<ul style="list-style-type: none"> <li>1 U+</li> <li>2 Trigger input</li> <li>3 0V</li> <li>4 Switching output / trigger output</li> <li>5 Switching output (ready)</li> <li>6 Switching output (OUT)</li> <li>7 Switching output / input 1</li> <li>8 Switching output / input 2</li> </ul>
	<b>Parameter/process interface (2)</b>	
M12 socket, D-coded, 4 poles (view on the unit)		
	<ul style="list-style-type: none"> <li>1 Ethernet TD +</li> <li>2 Ethernet RD +</li> <li>3 Ethernet TD -</li> <li>4 Ethernet RD -</li> <li>S Shield</li> </ul>	

UK

## 6.2 Wiring



Pin	Use (factory setting)
5	Output signal "READY" provides the status of the sensor: "1" after the evaluation has been carried out. "0" as long as the evaluation is being carried out, a different application is being selected or in case of an internal error (trigger signals are ignored).
6	Output signal "OUT" provides the result of the evaluation: "0" no matching model "1" matching model

- ▶ For PNP units (e.g. O2D220) use trigger sensors, illumination units and controllers with PNP inputs and outputs.
- ▶ For NPN units (e.g. O2D227) use trigger sensors, illumination units and controllers with NPN inputs and outputs.

## 6.3 External illumination

- ▶ Connect external illumination to the trigger output of the device.

Example	Art. no.
Illumination unit, transmitter red light 630 nm	O2D909

For information about the a.-m. example see:

[www.ifm.com](http://www.ifm.com) → Data sheet search → O2D909

## 6.4 External trigger source

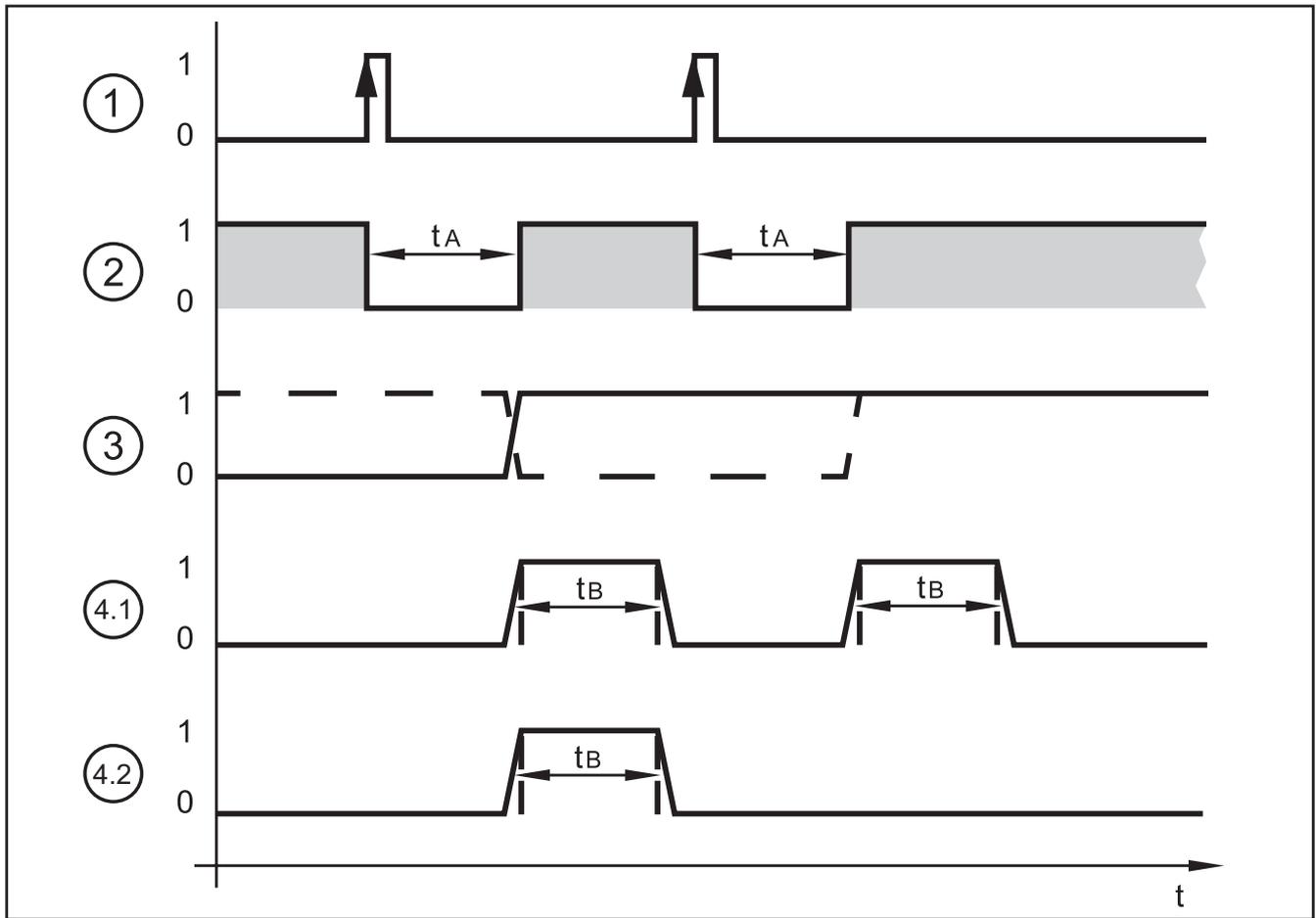
- ▶ Connect an external trigger source (e.g. a diffuse reflection sensor) to the trigger input of the device.



If you use an external trigger source (e.g. a diffuse reflection sensor), connect the trigger signal to the trigger input of the sensor. If you use external illumination, it must be controlled via the trigger output of the sensor. Depending on the device setting, one of four configuration files saved in the sensor can be selected via two switching inputs. Information about the test result is provided via switching outputs.

## 6.5 Timing diagrams

### 6.5.1 Inputs/outputs



Example: Triggering positive edge

1:	Trigger input	Trigger signal 0: no action 1: triggering on positive edge	
2:	READY output	Ready signal 0: unit busy, OUT output not valid 1: unit ready for trigger signal, OUT output valid	
3:	OUT output, static	Object evaluation 0: object evaluation not successful 1: object evaluation successful	
		Example 1 (dashed line): last object OK, OUT = 1 next object faulty, OUT 1 → 0 next object OK, OUT 0 → 1	Example 2 (solid line): last object faulty, OUT = 0 next object OK, OUT 0 → 1 next object OK, OUT 1
4	OUT output, pulsed	Object evaluation 0: object evaluation not successful or timeout of pulse length 1: object evaluation successful	
		Example 4.1: both objects OK, OUT = 1 after expiration of $t_B$ , OUT = 0	Example 4.2: first object OK, OUT = 1 after expiration of $t_B$ , OUT = 0 second object faulty, OUT = 0

The evaluation time  $t_A$  depends on

- the size of the field of view selected
- the model size
- the smoothing degree
- the sensitivity
- the orientation
- the number of models

Typical evaluation times are between 50 and 800 ms.

The pulse length  $t_B$  can be set between 100 ms and 2000 ms via the PC user program. For more detailed information about the configuration of the switching outputs we refer you to the programming manual of the sensor.

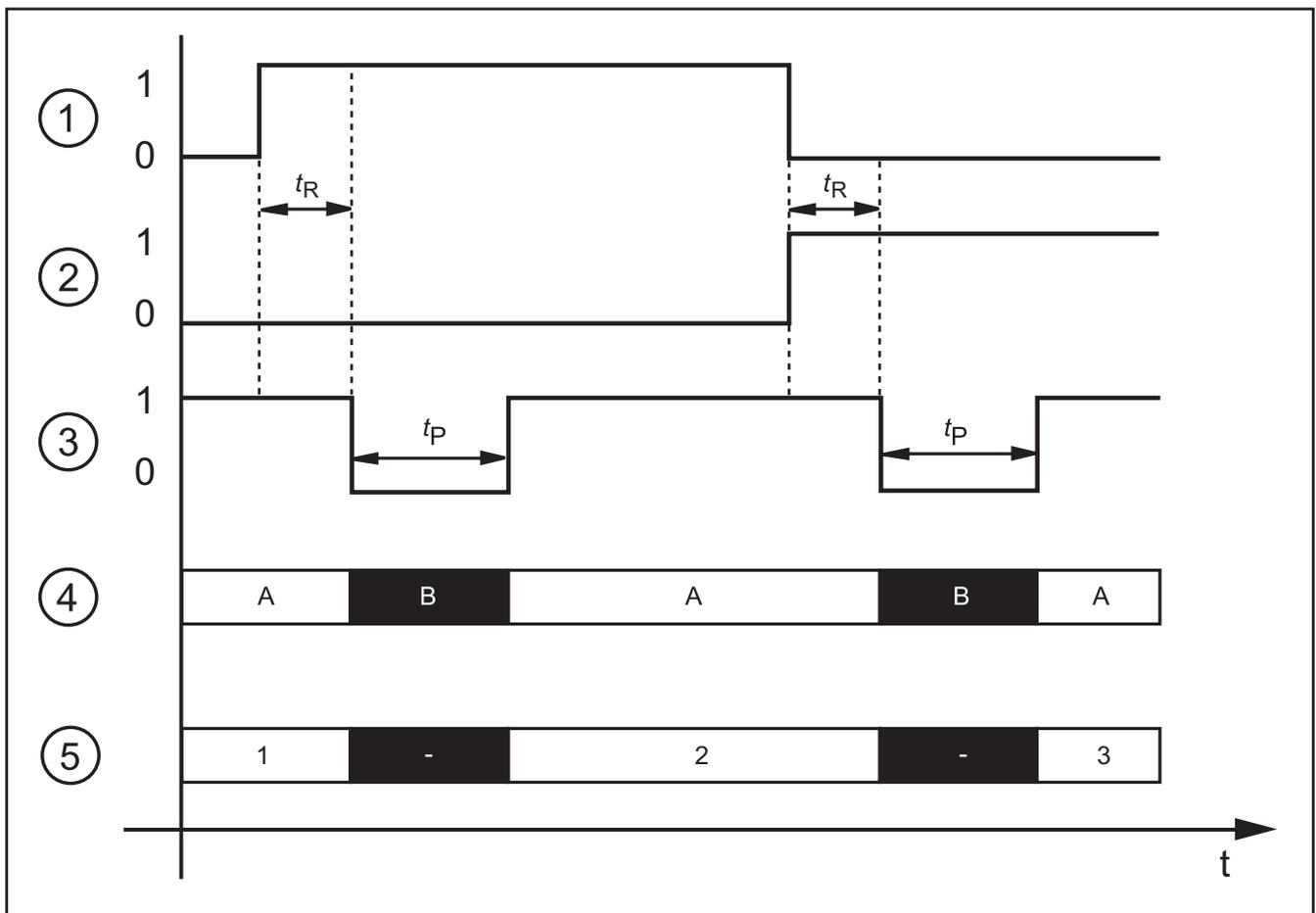
[www.ifm.com](http://www.ifm.com) → Data sheet search → O2D220 → Operating instructions

**UK**

### 6.5.2 Static selection of the application

Up to 32 different inspection tasks can be stored in the sensor. With the corresponding unit configuration the first four applications can be selected via the two switching inputs.

Input 2	Input 1	Application no.
0	0	1
0	1	2
1	0	3
1	1	4



Example: Selection application 1 → application 2 → application 3

1:	Switching input 1 = 0 → 1 → 0
2:	Switching input 2 = 0 → 0 → 1
3:	READY output
4:	Trigger input
	A: trigger enabled
	B: trigger disabled
5:	ID number of the active application

For the selection of the applications the monitoring time  $t_R$  and the trigger disable time  $t_P$  have to be taken into consideration.

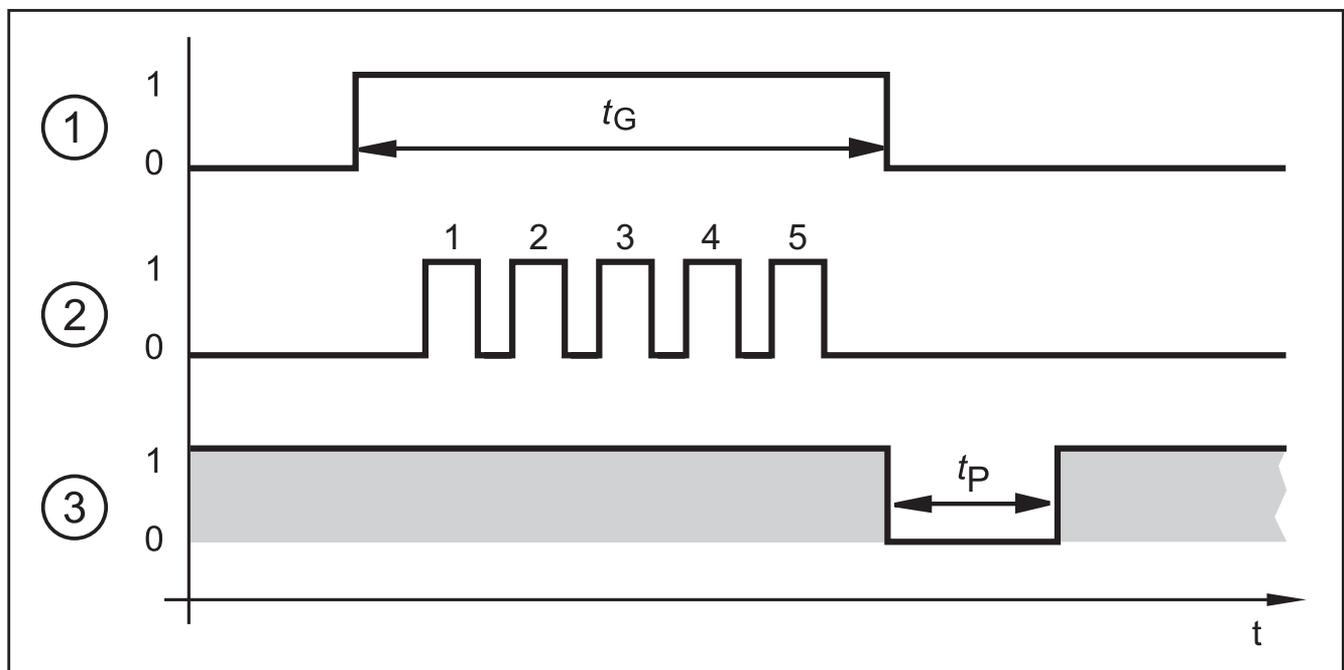
Monitoring time  $t_R$ : After a change in edges the external selection of the application does not start before the state of both switching inputs remains stable for 20 ms.

Trigger disable time  $t_P$ : The trigger input is disabled during the selection of the application. The disable time depends on:

- the number of applications on the sensor
- the number of models in the application to be activated

### 6.5.3 Pulse-controlled selection of the application

As an alternative to the static selection the selection of the application can also be pulse-controlled.



1:	Gate signal, switching input 1 = 0 → 1 → 0 ( $t_G$ = signal active)
2:	Pulse signal, switching input 2 or trigger input = 0 → 5 pulses → 0
3:	READY output

While there is an active signal on switching input 1 (gate signal), the sensor counts incoming pulses and activates the respective application.

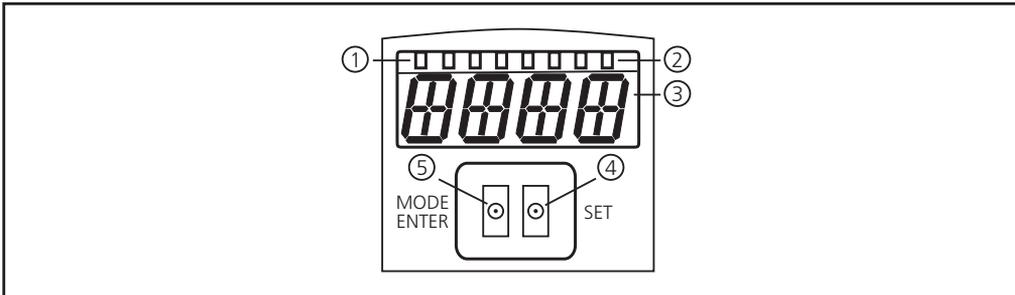
Number of pulses = ID number of the application

Either the 2nd switching input or the trigger input of the sensor can be used as pulse input.

For more detailed information about the configuration of the selection of the application we refer you to the programming manual of the sensor.

[www.ifm.com](http://www.ifm.com) → Data sheet search → O2D220 → Operating instructions

## 7 Operating and display elements



1	3 x LED green	Active LED Power (ready for operation display) Eth (Ethernet connection status) Con (connection status to the operating program (software))
2	4 x LED yellow	Indication of the switching status; lights when the corresponding input or output is switched. LED 1 status indication switching output 1 / switching input 1 LED 2 status indication switching output 2 / switching input 2 LED 3 status indication switching output 3 LED 4 status indication switching output 4
3	4-digit alphanumeric display	Indication of the evaluation results, parameters, parameter values, warnings and error messages.
4	Programming button "Set"	Setting of the parameter values (scrolling by holding pressed; incremental by pressing briefly).
5	Programming button Mode / Enter	Selection of the parameters and acknowledgement of the parameter values.

### 7.1 LED display

- LED green Power: ready for operation display
  - lights: ready for operation
  - flashes (20 Hz): device fault
  - flashes (2 Hz): no application on the device
- LED green Eth: Ethernet connection status
  - lights: connection available
  - flashes: data traffic
- LED green Con: connection status to operating program
  - lights: connection available
- LED yellow 1: switching status indication
  - off: switching input 1 / switching output 1 not switched
  - on: switching input 1 / switching output 1 switched
  - flashes (20 Hz): short circuit switching output 1
- LED yellow 2: switching status indication

- off: switching input 2 / switching output 2 not switched
- on: switching input 2 / switching output 2 switched
- flashes (20 Hz): short circuit switching output 2
- LED yellow 3: switching status indication
  - off: switching output 3 not switched
  - on: switching output 3 switched
  - flashes (20 Hz): short circuit switching output 3
- LED yellow 4: switching status indication
  - off: switching output 4 not switched
  - on: switching output 4 switched
  - flashes (20 Hz): short circuit switching output 4

## 7.2 Display

### 7.2.1 Operating indicators

Display	Description
vNNN	Version number of the IO controller software (1st indication after power on, e. g. v041)
Init	Device initialisation after power on (2nd indication after power on)
nnnn	Firmware version, e.g. 1031 (3rd indication after power on)
rEdY	Device ready for trigger (4th indication after power-on if one configuration is active with external triggering. Device waiting for triggering.)
WAIT	Device is busy
nr28	Application successful (number of the application)
run	Device waiting for connection, no application active (factory setting)
LOAd	Loading an application
donE	Loading of application completed
uLoc	Keys unlocked Parameter values can be displayed and changed
Lock	Locking the pushbuttons
Lok1	Pushbuttons locked
FWUP	Firmware update running

## 7.2.2 Connection via the operating program

Display	Description
OnLI	Connection with the operating program
Parm	Parameter setting via operating program
Moni	Monitor mode
SerP	Connection with the operating program, service report mode

## 7.2.3 Error messages

Display	Description
FAIL	Application not successful
ErrD	Critical hardware error
ErrP	Selection of a non-existing application via switching inputs
SC	Short circuit of a switching output
DHCP_noIP	No DHCP server found. Both character strings are displayed alternately.

## 7.3 Pushbuttons

Button	Function
MODE/ENTER	Change into the parameter setting mode Selection of the parameters Acknowledgement of the parameter values
SET	Selecting the subparameters Setting/changing/selecting the parameter values - incremental by pressing briefly - hold down to scroll

## 8 Set-up

Set-up is carried out via a menu-guided PC operating program. The device stores up to 32 applications.

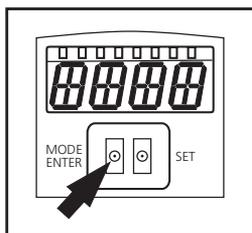
### 8.1 Parameter setting on the unit

Set the parameter values via pushbuttons and display on the device.

The sensor is programmed using the two buttons [Mode/Enter] and [Set].

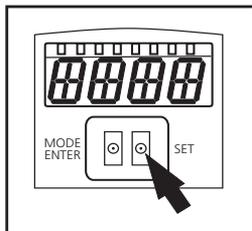
First activate a parameter with the [Mode/Enter] button, select the required value with the [Set] button and confirm it pressing again the [Mode/Enter] button.

UK



The unit changes to the parameter setting mode when you

- ▶ press [MODE/ENTER] for more than 1 s.
- > The first menu item is displayed.
- ▶ Press [MODE/ENTER] several times until the required parameter is displayed.
- ▶ Press [SET].



- ▶ The menu item is activated and the current setting is displayed.
- ▶ Keep [SET] pressed.
- > The display flashes, after 5 s with pressed SET button the display stops flashing.
- ▶ Press [SET] and change setting.
- ▶ Press [Mode/Enter].
- > The change is acknowledged and the previous menu item is shown again.

If no button is pressed for longer than 15 s, you will get to the next higher menu item or the evaluation mode.



The device does not operate during use of the pushbuttons.

### 8.2 Verify and set the IP address on the unit

- ▶ Select the parameter "IP" (IP address) with [MODE/ENTER] and [SET].
- > The IP address is processed automatically and shown in 4 groups (A, B, C, D).
- ▶ Verify the IP address and set with [SET], if necessary.

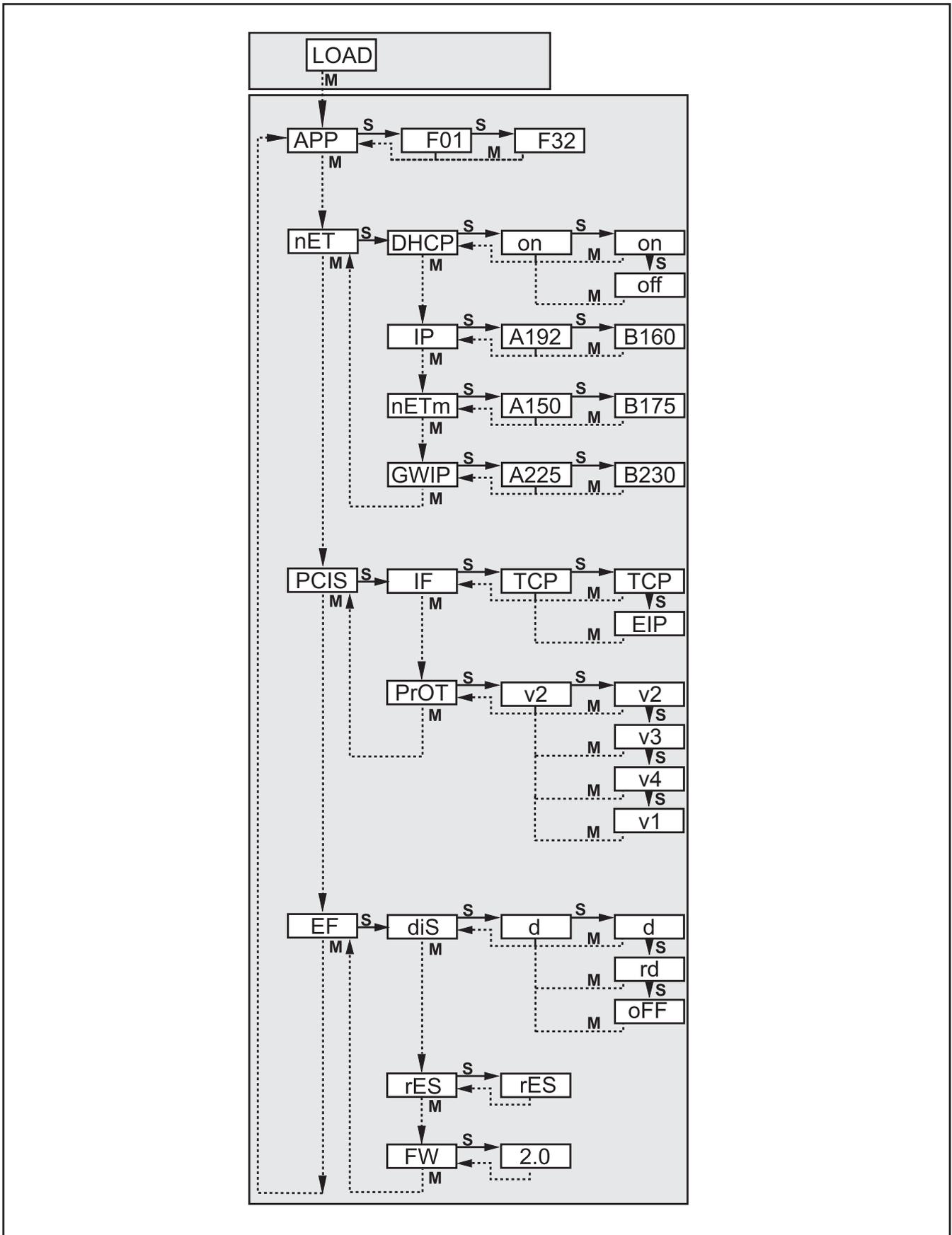


Changes only become effective after a restart of the unit (power off, power on).

### 8.3 Adjustable parameters

<i>APP</i>	<p><b>Memory location</b></p> <p>Select an application. The device can save up to 32 applications. By pressing the SET button the memory location number is incremented in the display. The current state of the memory location is visualised in the first digit of the display:</p> <p>F = memory location available  I = memory location used by an inactive application  A = memory location used by an active application  E = memory location (selected by external selection of the application)</p>
<i>NET</i>	<p><b>Network operation</b></p> <p>Here you set the parameters for network operation.</p>
<i>DHCP</i>	<p><b>Network settings via DHCP</b></p> <p>If the sensor is to get its network settings via DHCP, select the setting "on" in this menu item. With the setting "off" the fixed network settings (see next menu items) are used. In the DHCP mode the sensor must be operated in a network with DHCP server. Otherwise it is not accessible via the operating program E2D200.</p>
<i>IP</i>	<p><b>Set IP address</b></p> <p>Here the IP address of the sensor is set. This setting is used when the sensor does not work in the DHCP mode. The input is made in the "dotted decimal notation", e.g. 192.168.0.3. Using the SET button you can select the four groups of the address. The respective group is visualised by a letter in the first digit of the display.</p>
<i>NETm</i>	<p><b>Set subnet mask</b></p> <p>Here the subnet mask of the sensor is set. This setting is used when the sensor does not work in the DHCP mode. The subnet mask must match the IP address. It is input in the same way as the IP address.</p>
<i>GWIP</i>	<p><b>Set gateway address</b></p> <p>Here the gateway address used by the sensor is set. This setting is used when the sensor does not work in the DHCP mode. It is input in the same way as the IP address.</p>
<i>PCIS</i>	<p><b>Set the Ethernet process interface</b></p> <p>Here the Ethernet process interface and the version of the process data protocol are selected.</p>
<i>IF</i>	<p><b>Select the Ethernet process interface</b></p> <p>Here you choose between the two settings TCP/IP (TCP) and EtherNet/IP (EIP).</p>
<i>PrOT</i>	<p><b>Select the process data protocol version</b></p> <p>Here you choose between the four possible versions of the process data protocol (v1, v2, v3, v4). → Chapter 12.3 Protocol versions.</p>
<i>EF</i>	<p><b>Access extended functions</b></p> <p>Here the extended functions of the sensor are accessed.</p>
<i>di S</i>	<p><b>Rotate / switch off display</b></p> <p>Here you set whether a text is displayed normally (d) or rotated by 180° (rd). You also set whether the display is to be switched off (oFF) in the evaluation mode.</p>
<i>rES</i>	<p><b>Reset sensor</b></p> <p>Here you reset the sensor to the factory setting.</p>
<i>FW</i>	<p><b>Firmware version</b></p> <p>In this menu item you can enquire about the firmware version of the sensor.</p>

## 8.3.1 Parameter structure



UK

## 8.4 Lock / unlock sensor

Lock sensor

- ▶ Keep [Mode/Enter] and [Set] pressed simultaneously for 10 s.
- > Display changes to uLok.
- ▶ Press [Set].
- ▶ Display changes to Lock.
- ▶ Confirm with [Mode/Enter].
- > The sensor is locked.

Unlock the sensor

- ▶ Keep [Mode/Enter] and [Set] pressed simultaneously for 10 s.
- > Display shows Lok1, changes to Lock after 10 s.
- ▶ Press [Set].
- > Display changes to uLok.
- ▶ Confirm with [Mode/Enter].

The sensor is unlocked, display changes to "run".

### 8.4.1 Reset device to factory settings

- ▶ Activate the parameter "rES".
- ▶ Press [SET] > 5 s.

## 8.5 Parameter setting via PC operating program

The PC operating program is described in a separate document → Programming manual E2D200.

[www.ifm.com](http://www.ifm.com) → Data sheet search → Additional data

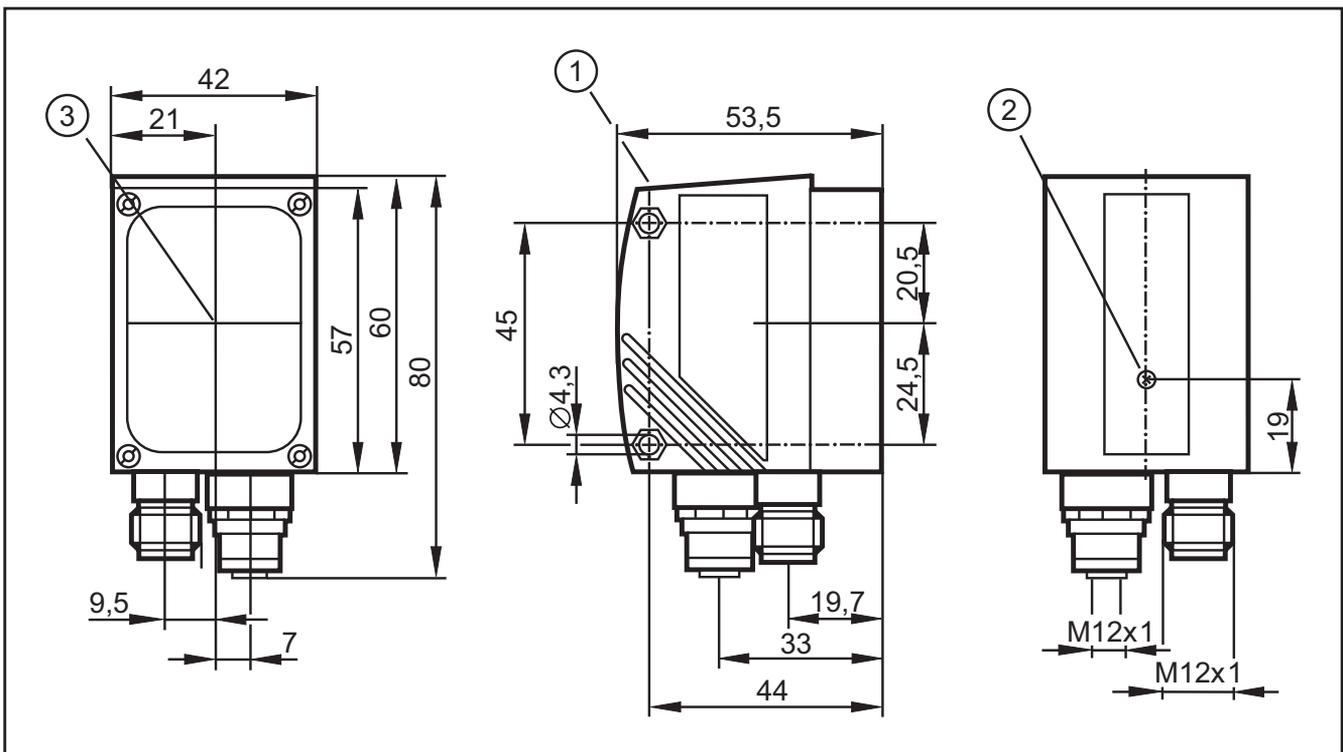
## 9 Operation

### 9.1 Evaluation mode (normal operating mode)

After power-on the device is in the evaluation mode. If an active application is saved on the device, it carries out its monitoring function and generates output signals according to the set parameters. The display indicates the current evaluation result, the yellow LEDs signal the switching status of the outputs or inputs.

## 10 Scale drawing

UK



1. Operating and display elements
2. Focal setter
3. Middle of the optical axis

## 11 Technical data

### 11.1 Operating distance L

When selecting the operating distance it has to be taken into account that contour detection becomes less reliable with decreasing size of the objects. The objects to be detected should cover at least 5% of the field of view. For the operating distance L depending on the applications please see the following table.

Types O2D220 / O2D227 (normal lens)							
Operating distance L [mm]	50	75	100	200	400	1000	2000
Field of view size WxH [mm]	16x12	24x18	32x24	64x48	128x96	320x240	640x480
Resolution [mm]	0.1	0.2	0.3	0.4	0.8	2.0	4.0

Types O2D222 / O2D229 (wide-angle lens)							
Operating distance L [mm]	50	75	100	200	400	1000	2000
Field of view size WxH [mm]	33x24	50x36	66x47	132x94	264x189	660x472	1320x945
Resolution [mm]	0.3	0.4	0.5	0.9	1.7	4.0	8.0

Types O2D224 / O2D225 (telephoto lens)							
Operating distance L [mm]	50	75	100	200	400	1000	2000
Field of view size WxH [mm]	-	15x11	20x15	40x30	80x60	200x150	400x300
Resolution [mm]	-	0.08	0.12	0.25	0.52	1.25	2.52

### 11.2 Factory settings

#### Device settings

Parameters	Factory setting
Device name	New sensor
Device location	New location
DHCP	not active
IP address	192.168.0.49
Subnet mask	255.255.255.0
Gateway	192.168.000.201
XML-RPC port	8080
Video port	50002
Application selection via switching inputs	not active
Trigger debouncing	not active
Process interface mode	TCP/IP
Process interface version	2
Process interface TCP/IP port	50010

**Application settings**

Parameters	Factory setting
Models	none
Minimum match	80%
Contour tolerance width	4
Number of models	1
Orientation	-10°... +10° (operating program)
Device connection 4	Trigger output (with external illumination)
Device connection 5	Switching output, function ready for trigger (Ready)
Device connection 6	Switching output, function all models detected
Device connection 7	-
Device connection 8	-
Illumination	Internal
Trigger mode	Continuous

UK

## 12 Process data protocol

The process interface ensures communication between the process PC (e.g. PLC) and the device. A command from the process PC can for example activate trigger pulses, select applications or provide application results.

### 12.1 Configuring the process interface

When the Ethernet interface is used, two protocols are available: TCP/IP and EtherNet/IP. The protocol is selected and configured in the PC operating program.

For more detailed information about the configuration of the process interface we refer you to the programming manual of the sensor.

[www.ifm.com](http://www.ifm.com) → data sheet search → O2D220 → Operating instructions

### 12.2 Communication basics

#### 12.2.1 Abbreviations and terms

Abbreviation	Description	ASCII code (dec)
CR	Carriage Return	13
LF	Linefeed	10
< >	Marking of a placeholder (e.g. <code> is a placeholder for code)	
[ ]	Optional argument (possible but not required)	

#### 12.2.2 Commands for the device

- 8-bit ASCII characters are allowed.
- All commands to the device are terminated with an LF character. The device ignores all received CR characters.
- A command to the unit has to be transmitted within 5 s. Otherwise the unit will cancel command recognition.

#### 12.2.3 Replies from the device

- All replies by the device are terminated with an CR and an LF character.
- As a reply to a valid command the device provides the character string \* CR LF (ASCII 42 dec + 13 dec + 10 dec).
- As a reply to an invalid command the device provides the character string ? CR LF (ASCII 63 dec + 13 dec + 10 dec).
- If the device is busy, it provides the character string ! CR LF (ASCII 33 dec + 13 dec + 10 dec) as a reply.

## 12.3 Protocol versions

The device supports 4 different protocol versions with different message format.

Version	Format
V1	<contents>CR LF
V2	<ticket><contents>CR LF
V3	<ticket><length>CR LF<ticket><contents>CR LF
V4	<length>CR LF<contents>CR LF The replies by the device are preceded by length information; however, not the commands to the device.

UK

<contents> is the command to the device or the reply by the device (e.g. evaluation results).

<ticket> is a character string of 4 digits 0-9, to be interpreted as decimal number. If a message with a specific ticket is sent to the device, its reply will contain the same ticket. Ticket 0000 is reserved for messages sent by the device independently.

<length> is a character string beginning with the letter 'L' followed by 9 digits to be interpreted as decimal number. This figure indicates the length of the following data (<ticket><contents>CR LF) in bytes.

Factory setting and reset condition are V2.

## 12.4 Command types

There are two different types of command to the device: actions and queries. Actions have the device do something, e.g. take an image and evaluate it.

Requests are used to retrieve information from the device.

The replies by the device are either status information, reply messages or results.

Results are transmitted by the device without a request being sent to the device before.

The device transmits status information and reply messages as direct reply to action commands or request commands.

## 12.5 Release trigger

<b>Command</b>	t	
<b>Type</b>	Action	
<b>Reply</b>	*	Trigger was released, the device captures the image and evaluates it.
	!	<ul style="list-style-type: none"> <li>• Currently no application active.</li> <li>• The device is busy with evaluation.</li> <li>• The device is in an invalid state, e.g. administer applications.</li> <li>• Currently set trigger mode not possible via TCP/IP; EtherNet/IP</li> <li>• Too high a trigger rate</li> </ul>
<b>Note</b>	Result output via the process interface if the output is activated. Activation of the output → 12.8 Activate / deactivate result output.	

## 12.6 Select protocol version

<b>Command</b>	v <digit><digit>	
<b>Type</b>	Action	
<b>Reply</b>	*	Normal case
	!	The device does not support the protocol version indicated.
<b>Note</b>	<digit><digit>: to be interpreted as two-digit decimal number for the protocol version. The protocol version is not changed before the reply by the device.	

## 12.7 Select the application

<b>Command</b>	c <group><number>	
<b>Type</b>	Action	
<b>Reply</b>	*	Successful change
	!	<ul style="list-style-type: none"> <li>• The device is in an invalid state, e.g. administering applications.</li> <li>• Invalid or not existing group or application number.</li> </ul>
<b>Note</b>	<group>: digit for the application group (always 0 for O2D22X). <number>: two-digit character string, to be interpreted as decimal number for the application number.	

## 12.8 Activate/deactivate result output

Command	p <digit>	
Type	Action	
Reply	*	Successful execution
	!	<ul style="list-style-type: none"> <li>• No active application.</li> <li>• &lt;digit&gt; contains incorrect value.</li> <li>• The device is in an invalid state.</li> </ul>
Note	<digit> is either 0 or 1. 1 enables the result output. 0 disables the result output.	

UK

## 12.9 Transmit the image to the device for evaluation

Command	i <length><image data>	
Type	Action	
Reply	*	Normal case
	?	Invalid length
	!	<ul style="list-style-type: none"> <li>• No application at present.</li> <li>• Application is being edited.</li> <li>• The image format (BMP, RAW, etc.) does not meet the specifications.</li> <li>• Invalid image contents (image size, internal image head data).</li> </ul>
Note	<length>: character string with exactly 9 digits, interpreted as decimal number it indicates the length of the following image data in bytes. Image data format according to setting in the operating program. The image must be available with a resolution of 640x480. With the Raw image format, each pixel is coded with an 8 bit value, the bmp must be available in 8 bit format.	

## 12.10 Transmit the application data set to the device

<b>Command</b>	u <length><group><number><application data set>	
<b>Type</b>	Action	
<b>Reply</b>	*	Normal case
	?	Invalid length
	!	<ul style="list-style-type: none"> <li>• The device is in teach mode or in administrative mode.</li> <li>• &lt;application data set&gt; is no valid application.</li> <li>• The group/application number is invalid.</li> <li>• "Selection of the application" via digital switching inputs is activated.</li> </ul>
<b>Note</b>	<p>&lt;length&gt;: character string with exactly 9 digits, interpreted as decimal number it indicates the length of the following image data in bytes (file length + 3 for group and number).</p> <p>&lt;group&gt;: digit for the application group (always 0 for O2D22X).</p> <p>&lt;number&gt;: two-digit character string, to be interpreted as decimal number for the application number.</p>	

## 12.11 Request the assignment of the application data from the device

<b>Command</b>	a?	
<b>Type</b>	Request	
<b>Reply</b>	<number><blank><group><number><blank><group><number><blank>...<group><number>	Normal case
	!	No application active on the device.
<b>Note</b>	<p>&lt;number&gt;: character string with 3 digits for the number of applications on the device as decimal number.</p> <p>&lt;group&gt;: digit for the application group (always 0 for O2D22X).</p> <p>&lt;number&gt;: two-digit character string, to be interpreted as decimal number for the application number.</p> <p>At first the number of the active configuration is output.</p> <p>&lt;blank&gt;: individual blank.</p>	

## 12.12 Request the statistics from the device

<b>Command</b>	s?	
Type	Request	
Reply	<total><blank><good><blank><bad>	Normal case
	!	No application active on the device.
Note	<p>&lt;total&gt;: total number of evaluations.          &lt;good&gt;: number of "good" evaluations.          &lt;bad&gt;: number of "bad" evaluations.          &lt;blank&gt;: individual blank.          &lt;total&gt;, &lt;good&gt; and &lt;bad&gt; are always character strings with 10 digits, to be interpreted as decimal number.</p>	

UK

## 12.13 Request the error code from the device

<b>Command</b>	E?	
Type	Request	
Reply	<code>	
Note	<p>&lt;code&gt; is the error code, character string with 4 digits, to be interpreted as decimal number.          Chapter Error codes 12.21</p>	

## 12.14 Request the last image from the device

<b>Command</b>	I?	
Type	Request	
Reply	<length><image data>	Normal case
	!	<ul style="list-style-type: none"> <li>• Currently no application active.</li> <li>• No evaluation carried out.</li> <li>• Sensor is working.</li> </ul>
Note	<p>&lt;length&gt;: character string with exactly 9 digits, interpreted as decimal number it indicates the length of the following image data in bytes.           Image data format according to setting in the operating program.</p>	

## 12.15 Request the last result from the device

Command	R?	
Type	Request	
Reply	Message in result format → Chapter result message 12.20.	Normal case
	!	<ul style="list-style-type: none"> <li>• Currently no application active.</li> <li>• Application is being edited.</li> <li>• No results available yet.</li> </ul>
Note	none	

## 12.16 Release trigger, evaluate captured image and result output via process interface

Command	T?	
Type	Request	
Reply	Message in result format → Chapter result message 12.20.	Normal case.
	!	<ul style="list-style-type: none"> <li>• Currently no application active.</li> <li>• The device is busy with evaluation.</li> <li>• The device is in an invalid state, e.g. administer applications.</li> <li>• Currently set trigger mode not possible via TCP/IP; EtherNet/IP</li> <li>• too high a trigger rate</li> </ul>
Note	The result is always provided via the process interface; with activated and also non-activated output via the process interface.	

## 12.17 Request the protocol version

Command	V?
Type	Request
Reply	<p>&lt;current&gt;&lt;blank&gt;&lt;min&gt;&lt;blank&gt;&lt;max&gt;</p> <p>&lt;current&gt; two-digit decimal number with current version</p> <p>&lt;blank&gt; space character</p> <p>&lt;min&gt; two-digit decimal number with minimum version</p> <p>&lt;max&gt; two-digit decimal number with maximum version</p>
Note	none

## 12.18 Request the device information

Command	D?
Type	Request
Reply	<pre>&lt;manufacturer&gt;&lt;t&gt;&lt;article number&gt;&lt;t&gt;&lt;name&gt;&lt;t&gt;&lt;location&gt;&lt;t&gt;&lt;ip&gt; &lt;subnet mask&gt;&lt;t&gt;&lt;gateway&gt;&lt;t&gt;&lt;MAC&gt;&lt;t&gt;&lt;DHCP&gt;&lt;t&gt;&lt;port number&gt; &lt;manufacturer&gt; IFM ELECTRONIC &lt;article number&gt; article designation and status, e.g. O2D220AC &lt;name&gt;          sensor name as entered in the operating program &lt;location&gt;     sensor location as entered in the operating program &lt;ip&gt;           IP address of the device &lt;subnet&gt;       subnet mask of the device &lt;gateway&gt;      gateway address of the device &lt;MAC&gt;          MAC address of the device &lt;DHCP&gt;         0 if DHCP is disabled, 1 if DHCP is enabled &lt;t&gt;            tabulator character &lt;port&gt;         XML-RPC port number</pre>
Note	none

UK

## 12.19 Request the last "bad" image from the device

Command	F?				
Type	Request				
Reply	<table border="1"> <tr> <td>&lt;length&gt;&lt;image data&gt;</td> <td>Normal case</td> </tr> <tr> <td>!</td> <td> <ul style="list-style-type: none"> <li>• Currently no application active.</li> <li>• No evaluation carried out or no error occurred.</li> <li>• Sensor is working.</li> </ul> </td> </tr> </table>	<length><image data>	Normal case	!	<ul style="list-style-type: none"> <li>• Currently no application active.</li> <li>• No evaluation carried out or no error occurred.</li> <li>• Sensor is working.</li> </ul>
<length><image data>	Normal case				
!	<ul style="list-style-type: none"> <li>• Currently no application active.</li> <li>• No evaluation carried out or no error occurred.</li> <li>• Sensor is working.</li> </ul>				
Note	<p>&lt;length&gt;: character string with exactly 9 digits, interpreted as decimal number it indicates the length of the following image data in bytes.</p> <p>Image data format according to setting in the operating program.</p>				

## 12.20 Result message

The evaluation result can be provided in ASCII or binary format. The output format is set via the PC operating program.

### ASCII format

In the ASCII mode the evaluation result is transmitted in the following format:

```
<start><result><sc><match><sc><instances>[<sc><model info>][<sc><image info>]<stop>
```

Component	Description
<start>	Start string according to setting in operating program.
<sc>	Separator according to setting in the operating program.
<stop>	Stop string according to setting in operating program.
<result>	Total result, either 'PASS' or 'FAIL' string.
<match>	Overall match quality, in the format <digit><digit><digit>.<digit>, for example '089.5' for 89.5% match. The "overall match quality" corresponds to the object with the worst match.
<instances>	Character string with 3 digits (decimal number) for the number of objects found (instances).
[<model info>]	Optional detailed information, only if object detail output has been enabled in the operating program. Format: <model_index><sc><x><sc><y><sc><rot><sc><match_quality>
<model_index>	Two-digit model number
<x>	Character string with 4 digits, decimal number for X position of the object (in pixels); zero point left
<y>	Character string with 4 digits, decimal number for Y position of the object (in pixels); zero point top
<rot>	Character string with six characters for the orientation of the object e.g. +179.0 or -001.3
<match_quality>	Match quality, in the format <digit><digit><digit>.<digit>, for example '089.5' for an 89.5% match.
[<image info>]	Optional image information only if image output in the operating program has been enabled. Format: <format><sc><length><sc><image data>
<format>	'RAW' or 'BMP' according to the setting of the image format in the operating program.
<length>	9-digit decimal number for the quantity of image data in bytes
<image data>	Image data in the given format

## Binary format

In the binary mode the evaluation result is transmitted in the following format:  
 <start byte>< switching outputs><match><instances>[<model info>]

Component	Description
<start byte>	Start byte: 0x00 (1 byte)
<switching outputs>	Status of the switching outputs (SA) after the evaluation binary value (2 bytes, unsigned short) Format: Byte n = 0xXX bit 7 = 0 bit 6 = 0 bit 5 = 0 bit 4 = SA1 bit 3 = SA2 bit 2 = SA3 bit 1 = SA4 bit 0 = SA5 byte n+1 = 0x00
<match>	Overall match quality (in "percent" x 10) binary value (2 bytes, unsigned short) The "overall match quality" corresponds to the object with the worst match.
<instances>	Total number of the objects found binary value (2 bytes, unsigned short)
[<model info>]	Detailed information about the object found. Format: <modell_index><x><y><rot><match_quality>
<modell_index>	Model number binary value (2 bytes, unsigned short)
<x>	X position of the object (in pixels); zero point left binary value (2 bytes, unsigned short)
<y>	Y position of the object (in pixels); zero point top binary value (2 bytes, unsigned short)
<rot>	Orientation of the object (in "degrees" x 10) binary value (2 bytes, signed short, two's complement)
<match_quality>	Match quality (in "percent" x 10) binary value (2 bytes, unsigned short)



All binary information is to be interpreted as integer numbers in little-endian format.

**Example binary output:**

- Number of models: 2
- Number of objects searched for per model: {2}
- Object detail output active: yes
- Number of objects found per model: {2}

Output length: 27 bytes

Output:

**0x00 0x02 0x00 0xE0 0x03 0x02 0x00 0x01 0x00 0xF4 0x00 0x38 0x01 0x17  
0x00 0xE0 0x03 0x01 0x00 0xF4 0x00 0x10 0x00 0x00 0x00 0xE7 0x03**

Component	Description
0x00	Start byte
0x02 0x00	Switching outputs (SA) In this example the default assignment of the switching outputs is used: bit 7 0 bit 6 0 bit 5 0 SA1: 0 (not used) SA2: 0 (not used) SA3: 0 (READY signal, during evaluation always 0) SA4: 1 (all models found: 1, not all models found: 0) SA5: 0 (not used) 00000010 → 0x02
0xE0 0x03	Overall Match Quality: 99,2 % x 10 = 992 (x03E0)
0x02 0x00	Total number of the objects found: 2
0x01 0x00	Model number: 1
0xF4 0x00	X position of the object: 244 (x00F4)
0x38 0x01	Y position of the object: 312 (x0138)
0x17 0x00	Orientation of the object: 2,3 ° x 10 = 23 (x0017)
0xE0 0x03	Match Quality: 99,2 % x 10 = 992 (x03E0)
0x01 0x00	Model number: 1
0xF4 0x00	X position of the object: 244 (x00F4)
0x10 0x00	Y position of the object: 16 (x0010)
0x00 0x00	Orientation of the object: 0° x 10 = 0 (x0000)
0xE7 0x03	Match Quality: 99,9 % x 10 = 999 (x03E7)

## 12.21 Error codes from the device

<b>Definition</b>	<b>SENSOR_NO_ERRORS</b>
Numeric value	0
Description	No errors
Solution/Workaround	–

<b>Definition</b>	<b>SENSOR_NO_ACTIVE_CONFIG</b>
Numeric value	0100
Description	No application is currently loaded in the sensor.
Solution/Workaround	Some commands need a current application. If this is not the case, an error occurs.

<b>Definition</b>	<b>SENSOR_INVALID_PARM</b>
Numeric value	0105
Description	Invalid input parameter
Solution/Workaround	Read the command documentation to send the required information to the sensor.

<b>Definition</b>	<b>SENSOR_INVALID_STATE</b>
Numeric value	0108
Description	The sensor is in an operation mode which does not permit the execution of commands.
Solution/Workaround	Check the command documentation to see when the command can be executed.

<b>Definition</b>	<b>SENSOR_ERR_NO_MEM</b>
Numeric value	0110
Description	Fatal internal error.
Solution/Workaround	Reboot the sensor.

<b>Definition</b>	<b>SENSOR_CONFIG_NOT_FOUND</b>
Numeric value	0902
Description	Application to be activated not found.
Solution/Workaround	Check whether the application number is correct. Check also if the application can be edited using the PC Software.

<b>Definition</b>	<b>SENSOR_INVALID_TRIGGER_MODE</b>
Numeric value	1000
Description	It is not possible to trigger the sensor because the trigger function via TCP/IP; EtherNet/IP is not activated.
Solution/Workaround	Review the sensor configuration to change the sensor trigger mode.

UK

<b>Definition</b>	<b>SENSOR_OBJECT_IMAGE_INVALID</b>
Numeric value	1300
Description	Internal fault during the image transmission from/to the sensor.
Solution/Workaround	Check which is the required image format and if all parameters for the results via TCP/IP are correct. In case of a problem during the transmission of information, check whether the information to be sent is correct.

<b>Definition</b>	<b>SENSOR_RESULT_ID_NOT_AVAILABLE</b>
Numeric value	1600
Description	The user tries to obtain a result although no results are available in the sensor.
Solution/Workaround	–

<b>Definition</b>	<b>SENSOR_CURRENTLY_DECODING</b>
Numeric value	1601
Description	The command cannot be executed because the sensor is currently decoding.
Solution/Workaround	Try to execute the command again.

<b>Definition</b>	<b>SENSOR_IMAGE_FORMAT_MISMATCH</b>
Numeric value	1602
Description	An image is uploaded to the sensor for evaluation. The format detected does not match that of the currently activated application.
Solution/Workaround	Edit the running application to check which is the required image format.

<b>Definition</b>	<b>SENSOR_CONFIG_SWITCHING_ACTIVE</b>
Numeric value	1603
Description	It is not possible to upload an application to the sensor if the external selection of the application is activated.
Solution/Workaround	Use the PC Software to deactivate the external selection of the application.

<b>Definition</b>	<b>SENSOR_TRIGGER_NOT_AVAILABLE</b>
Numeric value	1604
Description	The user sends a trigger via TCP/IP; EtherNet/IP to the device. Due to an internal fault the sensor cannot process the trigger.
Solution/Workaround	This error code shows a sensor failure. Normally the sensor tries to remedy the failure itself. If this error occurs again, reboot the sensor. When the trigger is reduced, this fault may be prevented.

## 13 Maintenance, repair and disposal

- ▶ Keep the lens window free from soiling.  
Soiling may considerably affect the reading result!
- ▶ To clean the lens window, do not use any detergents or solvents which might damage the front glass.
- ▶ Do not open the housing as the device does not contain any components which can be repaired by the user. The device must only be repaired by the manufacturer.
- ▶ Dispose of the device in accordance with the national environmental regulations.

UK

## 14 Approvals/standards

The CE Declaration of Conformity is available at:

[www.ifm.com](http://www.ifm.com) → Data sheet search → e.g. O2D220 → Approvals

## 15 Note on the software

This unit contains (maybe modified) Open Source software, which is subject to special licensing terms.

For copyright information and licensing terms please refer to:  
[www.ifm.com/int/GNU](http://www.ifm.com/int/GNU)

For software subject to the GNU General Public License or the GNU Lesser General Public License the source code can be requested against payment of the copying and shipping costs.



The software E2D200 version 3.0 is required as of firmware version 1030.

The software is available at:

[www.ifm.com](http://www.ifm.com) → Data sheet search → e.g. O2D220 → Download/Software.