ifm electronic

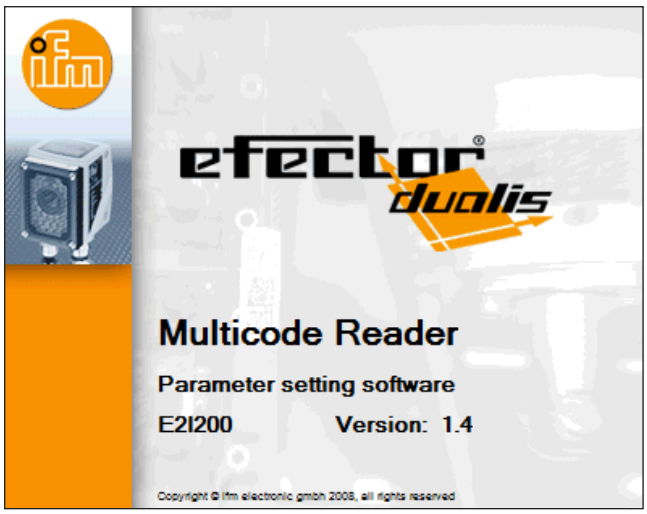
Programming guide

Configuration software for dualis Multicode Reader O2I1xx O2I3xx

UK

efector190®

E2I200
Version 1.4



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Content

UK

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1 Preliminary note

1.1 Symbols used

► Instructions

> Reaction, result

[…] Designation of keys, buttons or indications

→ Cross-reference

Important note
Non-compliance may result in malfunction or interference.

Information
Supplementary note

2 System requirements

2.1 PC hardware

– PC with Pentium III processor or higher, clock frequency min. 500 MHz
– min. 128 MB RAM
– min. 35 MB freely available hard disc memory
– CD-ROM drive
– XGA compatible graphic card with min. 1024 x 768 pixel resolution
– Ethernet network card for 10Base-T/100Base-TX, TCP/IP protocol

2.2 PC software

– Operating system Microsoft Windows 2000, XP, Vista or Windows 7.

2.3 Required accessories

– Crossover cable for parameter setting connection (Ethernet), M12 connector/RJ45 connector, 4 poles, e.g. art. no.: E11898 (2 m)
– Connection cable for supply voltage and process connection, M12 socket, 8 poles, e.g. art. no. E11231 (2 m, wirable cable end)

You can find more information about the available accessories at:
www.ifm.com → Data sheet search → e.g. O2I102 → Accessories

2.4 Compatibility of configuration software and device firmware

	Published firmware versions (as in 06/2015)							
	3025	**3026**	**3027**	**3028**	**3029**	**3031**	**3051**	**3052**
PC operating program V1.0	●	●	●	–	–	–	–	–
PC operating program V1.1	–	–	–	●	●	●	–	–
PC operating program V1.2	–	–	–	–	–	–	●	●
PC operating program V1.3	–	–	–	–	–	–	–	–
PC operating program V1.4	–	–	–	–	–	–	–	–

● = compatible / − = not compatible, i.e. update the device firmware or use compatible configuration software version

	Published firmware versions (as in 06/2015)							
	3072	**3074**	**3075**	**3076**	**3078**	**3080**	**80xx (O2I30x)**	**81xx (O2I35x)**
PC operating program V1.0	–	–	–	–	–	–	–	–
PC operating program V1.1	–	–	–	–	–	–	–	–
PC operating program V1.2	–	–	–	–	–	–	–	–
PC operating program V1.3	●	●	●	●	●	●	–	–
PC operating program V1.4	●	●	●	●	●	●	●	●

● = compatible / – = not compatible, i.e. update the device firmware or use compatible configuration software version

Directly after power-on the firmware version of the device is shown third in the display.

Device with firmware version 3080 and older cannot be upgraded to the newer firmware versions as from 8002. A downgrade as from firmware version 8002 to an older version is not possible, either. The current firmware versions differ from older versions with new functionalities; they are compatible with the functionalities of the older firmware.

2.5 Download configuration software and device firmware

The latest configuration software and device firmware can be downloaded from:
www.ifm.com

► Note the hints in the download area concerning the current versions.
(→ 6.8 Update device firmware)

3 Functions and features

In conjunction with an O2I multicode reader the In conjuction with efector pmd2d the PC operating program provides the following: provides the following options:

- Create, administer, name and/or group application-specific configurations
- Real-time monitor mode for set-up and service purposes
- Save service reports for statistical evaluations.

4 Installation

Installation and setting for operation with a fixed assigned IP address are described below (= direct connection to the PC).
This is the factory-preset operating mode of the multicode reader.

The figures and texts show the installation process under Windows 7.

4.1 Hardware

► Connect the device to the Ethernet interface of the PC using a crossover cable.

► Select the type of process data transfer to the PC:
  – TCP/IP:
    Ethernet connection is used. No other connection is required.
  – Serial:
    Connect the RS-232 interface of the reader with the RS-232 interface of the PC.

► Supply the device via the process connection.
  Wiring → type label, O2I data sheet or operating instructions

4.2 Software

► Insert the CD in the drive.
> The start menu opens.

► Select the menu item "Start efector dualis".
> The program starts.

If the autostart function for CD drives is deactivated and the start menu does not open automatically:

► Start the "O2IStart.exe" file in the main directory of the CD with a double click.
> The start menu opens.

► Select the menu item "Start efector dualis".
> The program starts.

4.3 Network settings

The IP address range of the device and the PC have to match.

	IP address range	Factory setting
O2I multicode reader	192.168.0	79
	=	≠
PC	192.168.0	xx

4.3.1 Factory setting multicode reader

O2I multicode reader Parameters	Description	Factory setting
DHCP	Dynamic Host Configuration Protocol	Off
IP	IP address	192.168.0.79
nETm	Subnet mask	255.255.255.0
GWIP	Gateway address	192.168.0.201

4.3.2 Verify and set the IP address of the PC

► Activate menu "Internet Protocol Properties Version 4 (TCP/IPv4)".The Windows menu "Internet Protocol (TCP/IP) Properties" is accessible for example via:Start → Control Panel → Network and Sharing Center → Change adapter settings → Local Area Connection → Properties.

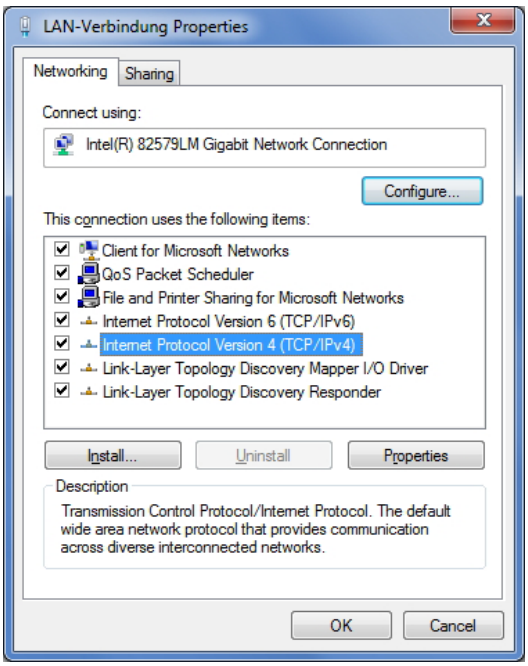
► Select the menu item "Use the following IP address".

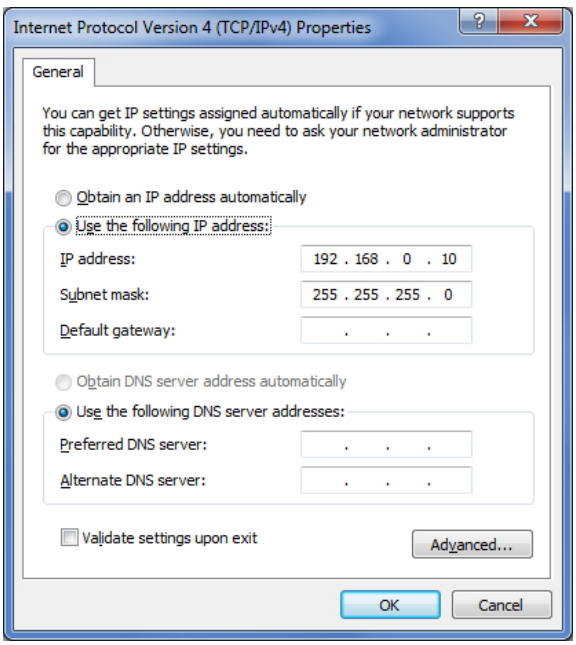
► Verify and set the IP address, if necessary (here e.g. 192.168.0.10).

► Enter the subnet mask (255.255.255.0).

► Leave default gateway blank.

► Confirm the settings with [OK].



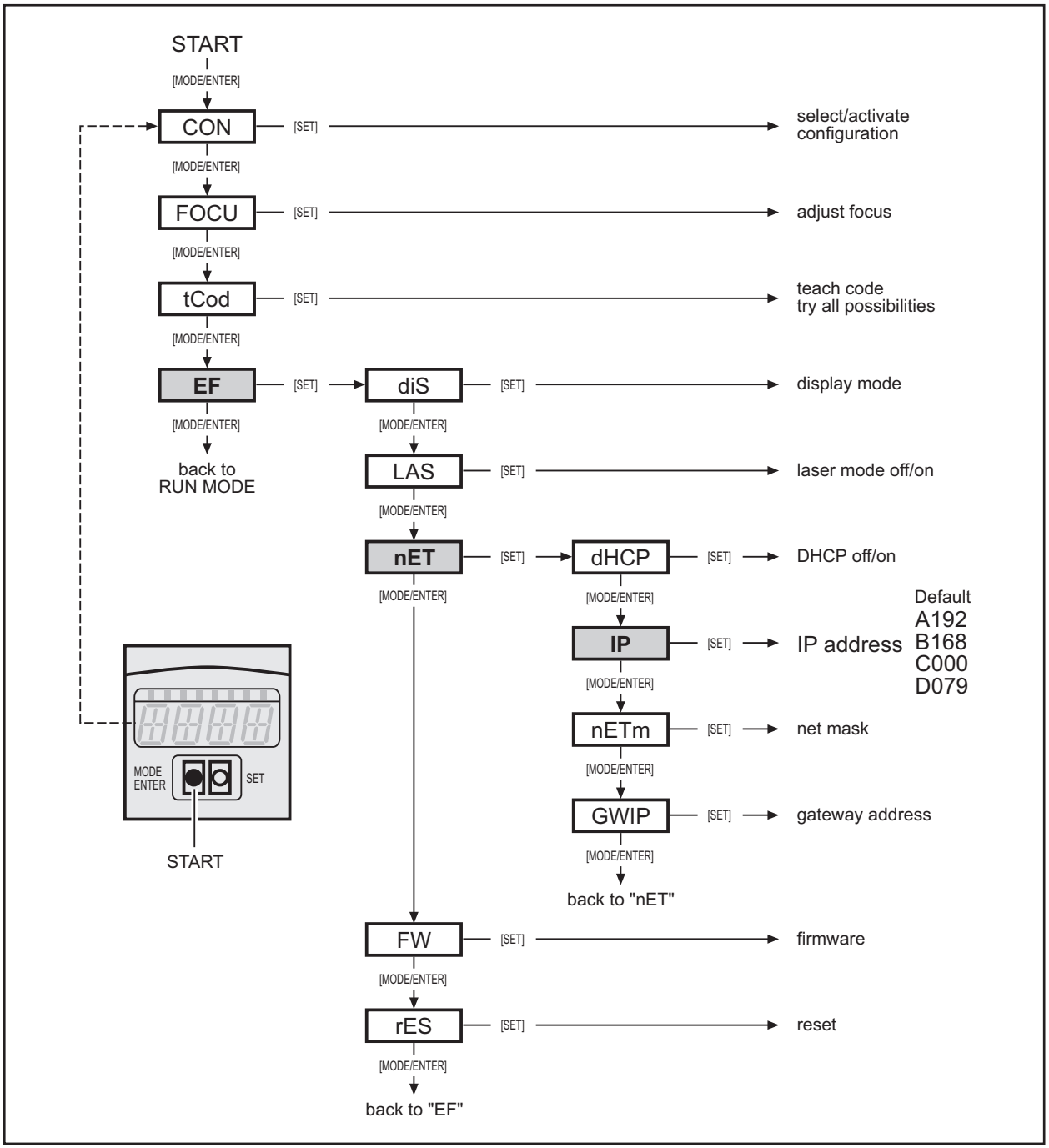


Changes in the network settings of the PC require extended user rights.
Contact your system administrator.

4.3.3 Verify and set the IP address of the multicode reader

► 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.



Parameter description → "dualis Multicode Reader O2I" operating instructions

4.4 Establish the transmission of the process data

The process interface ensures communication between the process PC (e.g. PLC) and the device. A command from the processor can, for example, activate trigger pulses, request read results or activate configurations/groups.

The process data can be displayed via a terminal program, below described using the example "HyperTerminal".

4.4.1 Factory setting multicode reader

O2I multicode reader	Factory setting
Process data transmission	RS-232 (serial)
Baud rate	9,600 baud
Data bits	8
Parity	none
Stop bits	1
Flow control	none

RS-232 or TCP/IP can be selected in the PC operating program at "Global device settings" (→ 6.5 Global device settings).

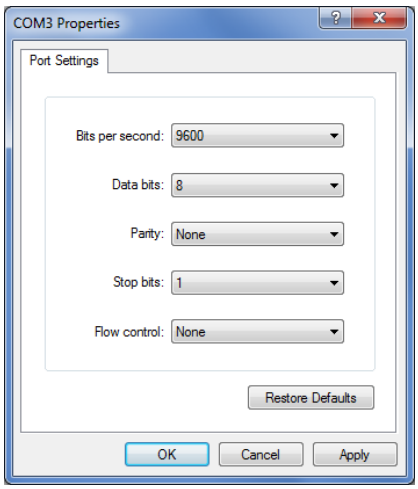
4.4.2 Establish the RS-232 connection

► Start HyperTerminal.
The program can be accessed for example via: Start → All programs → Accessories → Communication.

► Assign a symbol and a name for the connection (here e.g. multicode reader RS-232).

► Select connection "COM" (here for example COM1).

► Apply the parameters of the device (→ 4.4.1 Factory setting multicode reader).



► Click on [Apply] and close window with [OK].
> Connection is established and the terminal window opens.

4.4.3 Establish the TCP/IP connection

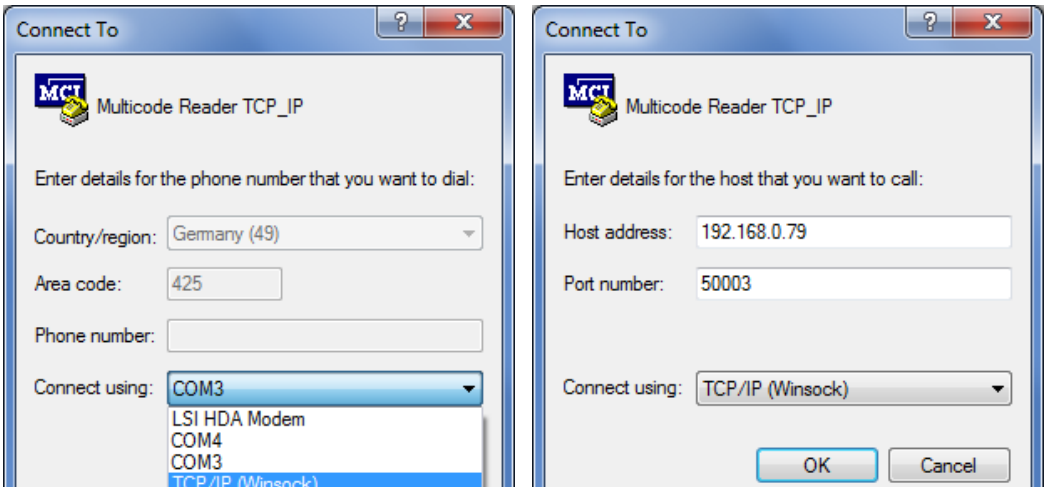
► Start HyperTerminal.
The program can be accessed for example via: Start → All programs → Accessories → Communication.

► Assign a symbol and a name for the connection (here e.g. Multicode Reader TCP/IP).

► Select connection TCP/IP.

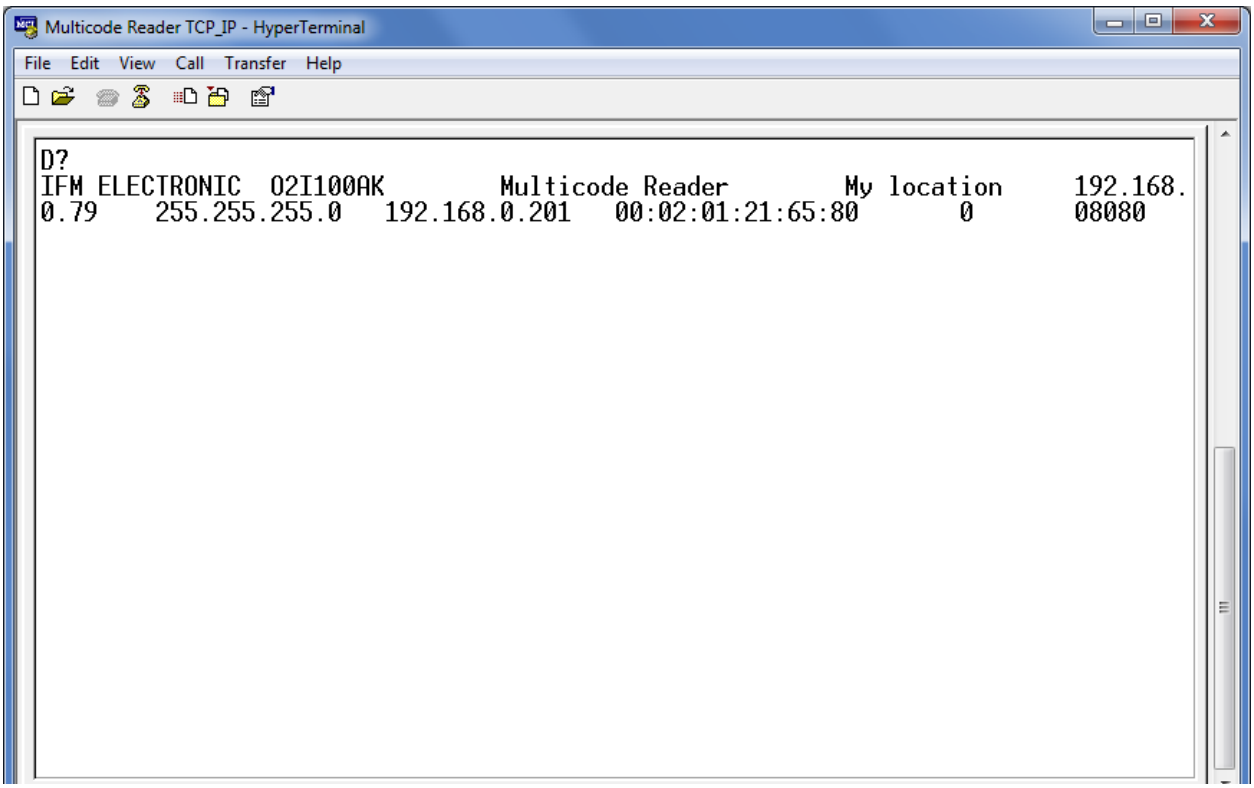
► Enter the host address.
(Corresponds to the IP address of the device, here the factory setting 192.168.0.79)

► Enter the connection number.
(Corresponds to the TCP/IP port number of the device, here the factory setting 50003)



► Close window with [OK].
> Connection is established and the terminal window opens.

Example:



Process data protocol (→ 14)

4.4.4 Establish the EtherNet/IP connection

General information about EtherNet/IP

The Ethernet Industrial Protocol (EtherNet/IP) is an open standard for industrial networks. EtherNet/IP serves for the transmission of cyclic I/O data as well as acyclic parameter data. EtherNet/IP provides a broad basis for effective data communication in the industry. EtherNet/IP extends Ethernet by a modern industrial protocol (CIP, Common Industrial Protocol) as an application layer for applications in automation.

Settings

The multicode reader is an Ethernet/IP adapter device and supports the communication with a device configured as an EtherNet IP scanner. This is usually the processor (e.g. PLC).

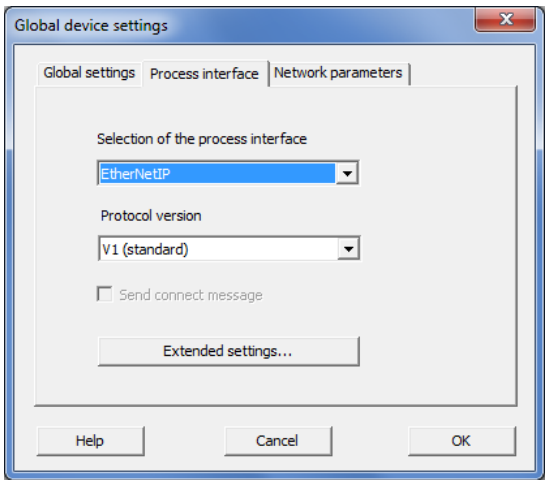
Communication can be effected with explicit messages class3 via TCP/IP or implicit messages class1 via UDP/IP.

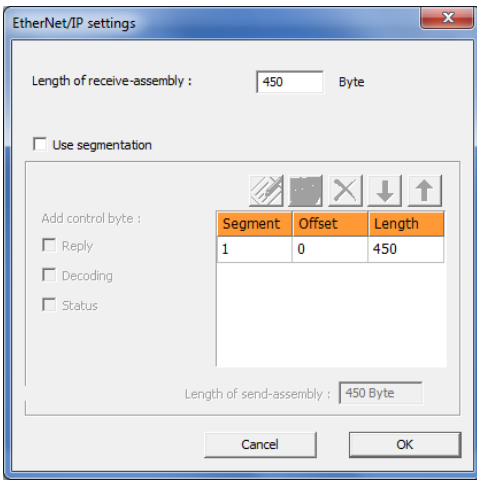
Communication is carried out using 2 EtherNet/IP assemblies; one for data transport from the controller to the sensor ("output assembly instance", ID address 100 / 0x64) and one for data transport from the sensor to the controller ("input assembly instance", ID address 101 / 0x65). The same lengths of the assemblies must be set in the sensor and the controller.

► Click on [Global device settings ...] (→ 6.5 Global device settings).

► Select [Process interface], then "EtherNet/IP" in the pulldown menu.

► Click on [Extended settings...] and enter the parameters for EtherNet/IP.





- "Length of the receive-assembly" defines the length of the "output assembly instance" (ID 100)
- "Use segmentation" activates the definition of the different "input assembly instance" (ID 101) parameters.

Structure of the assembly in case of deactivated segmentation

The "input assembly instance" (101) is 450 bytes long and consists of 3 segments:

Segment	Offset	Length	Contents
Segment 1	0	215 bytes	Reply to the incoming messages
Segment 2	215	215 bytes	Result of the code evaluations
Segment 3	430	20 bytes	Fixed device and result information

The last byte of each segment serves as control byte which is incremented during processing by the multicode reader. With identical code content these control bytes are used for distinguishing the input data.

Test	Offset	Length	Selection field
Control byte segment 1	214	1 byte	Reply
Control byte segment 2	429	1 byte	Decode
Control byte segment 3	449	1 byte	Status

Segmentation

The "input assembly instance" can be segmented in order to save memory space. This way, only the data which is actually required for the application is transmitted. For each segment, an "Offset" and the required "Length" can be selected from the segment selection list.

The predefined "input assembly instance" segmentation can be reconfigured using the segmentation table. The segmentation table provides a new order of the bytes for the "input assembly instance". A segment is defined by its index, a number of bytes (segment length) and a byte address from the predefined "input assembly instance" (segment offset).

The "input assembly instance" is restructured on this basis. The segment index defines the order of assignment. The number of assigned bytes is defined by the segment length and the segment offset points to the address from the predefined "input assembly instance" from which the bytes are extracted.

The last byte of each segment can be activated as control byte. It is incremented during processing by the multicode reader. With identical code content these control bytes are used for distinguishing the input data. The control byte can be activated or deactivated by clicking onto the respective field.

Segmentation example 1:

Index	Offset	Length
1	0	450 bytes

Explanation:
Default segmentation table. Takes 450 bytes (all!) from the predefined "input assembly instance" and positions these on the address 0. Therefore, this segmentation table has no actual influence on the "input assembly instance".

Segmentation example 2:

Index	Offset	Length
1	215	215 bytes
2	0	215 bytes
3	430	20 bytes

Explanation:
Segments 1 and 2 from the predefined "input assembly instance" are swapped: First, 215 bytes starting with byte address 215 from the predefined "input assembly instance" are repositioned. Then, 215 bytes starting with byte address 0 and then 20 bytes starting with byte address 430 from the predefined "input assembly instance".

In the "output assembly instance" messages are always written as from address 0; only the length can be determined. It must correspond to at least the length of the longest possible message (max. 450 bytes).

Data exchange via EtherNet/IP

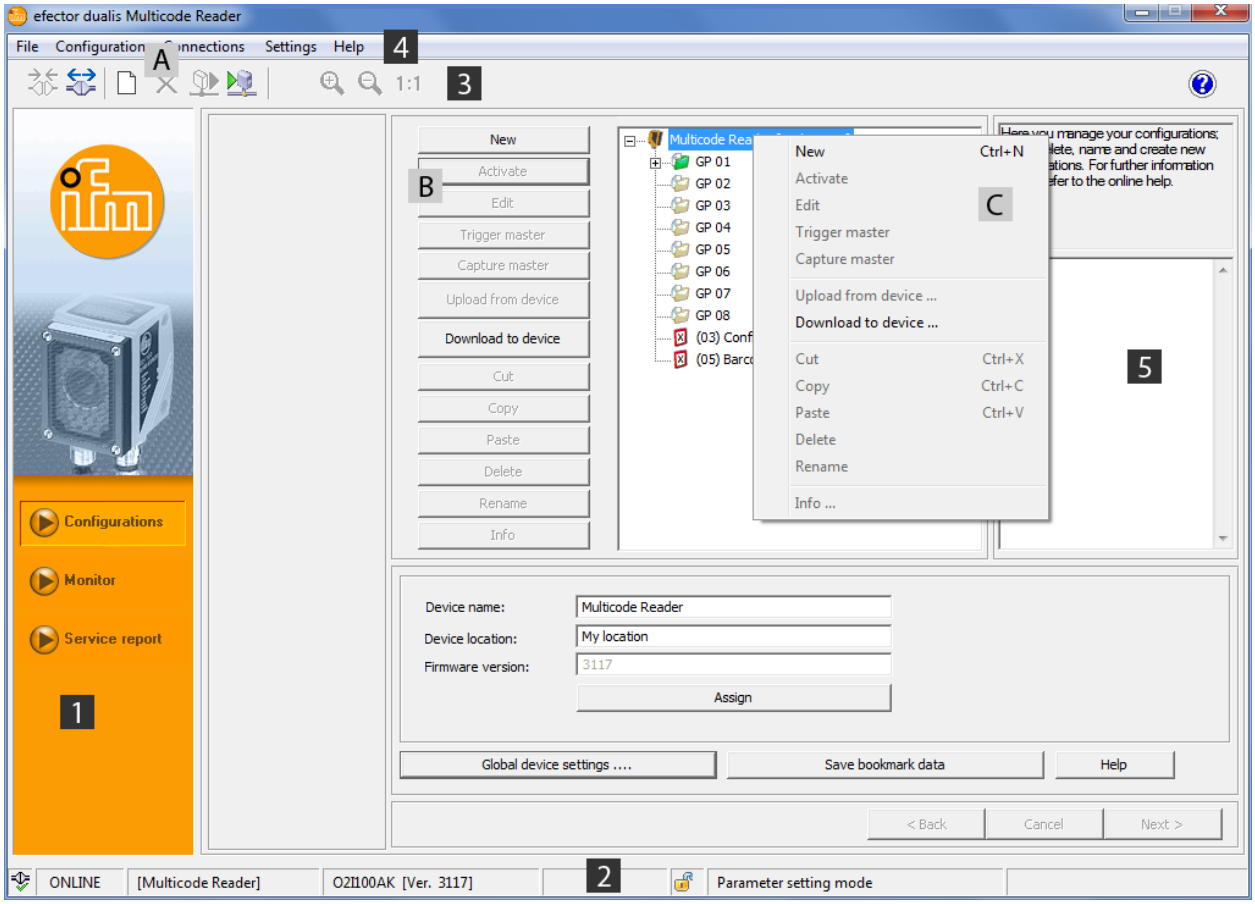
The data exchange between a sensor with EtherNet/IP capacity and a PLC is carried out cyclically. This means that the data stored in the sensor in the output assembly segment (ID 100) is retrieved from the connected PLC in each cycle and stored in the data area defined in the PLC.

If the data in the sensor changes, it will be adopted in the defined data area in the next cycle of the PLC and will be available until the sensor overwrites its output assembly area.

► Observe the current information in the ifm internet download area at
www.ifm.com

5 Basic functions of the program

5.1 Basics on the user interface

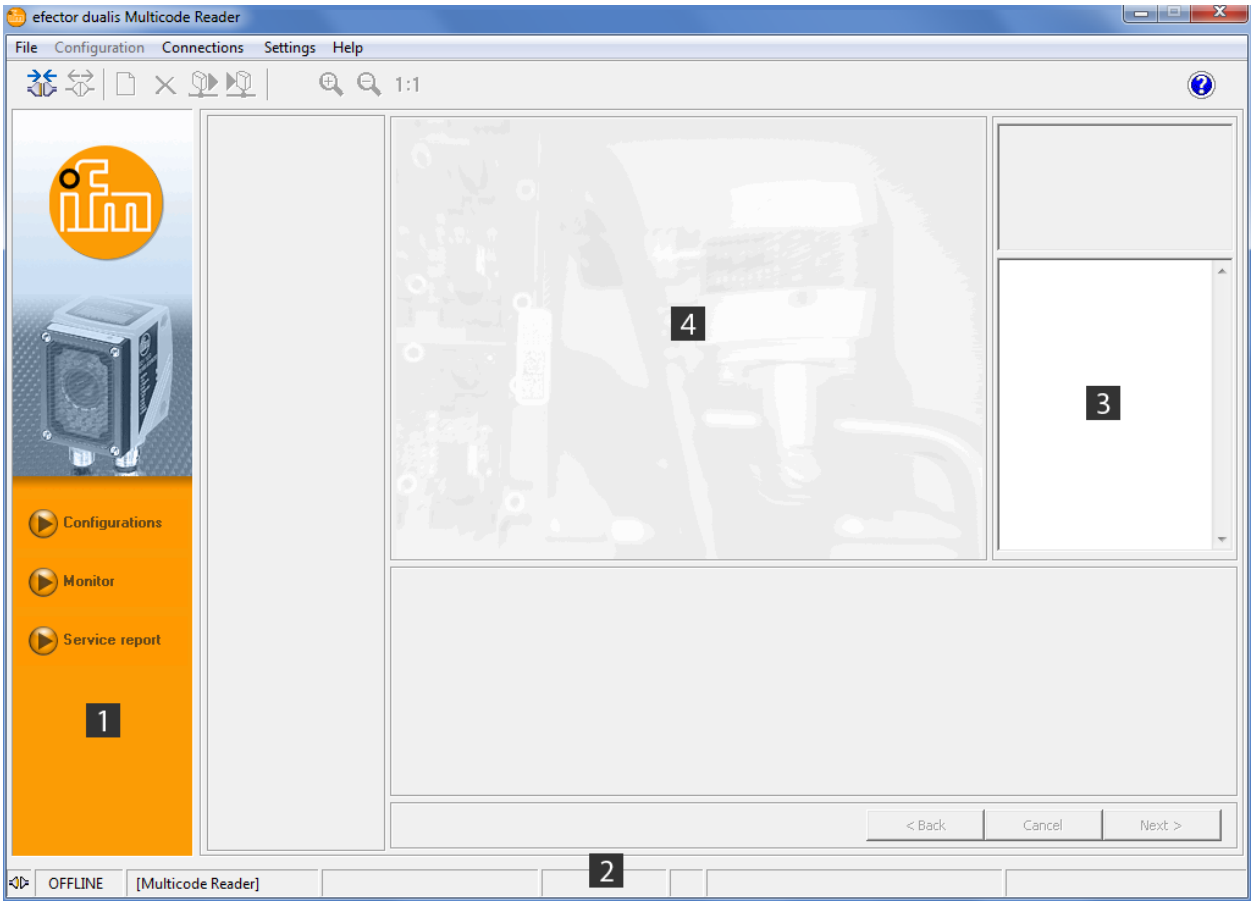


Pos.	Display / operating elements	Contents
1	Mode	• Configuration Create, manage or group configurations. By changing into this mode, the device will stop the read mode. • Monitor Device will run independently with saved and activated group or configuration. The read operation can be observed. • Service report By changing into this mode, the device will stop the read mode. The results, statistics and captured images can be activated and/or saved.
2	Status bar	• Network status of the device (OFFLINE/ONLINE) • Device name • Article number/production status/firmware of the connected device • Password protection on/off (lock symbol) • Program status (current program function)
3	Toolbar	Buttons (e.g. "connect" or "disconnect") Commands that cannot be selected are displayed in grey.
4	Menu strip	Pull-down menus with program functions.
5	Result field	• Reading result e.g. number of found codes, code content, read time, total decoding time
A/B/C	Selection variants	Identical commands can be selected in different ways. (depending on the program function). A = selection via pulldown menu in the menu bar B = selection via button C = selection via context menu (click with right mouse button)

5.2 Program start

► Start configuration software "Dualis Multicode.exe".

> The start screen displays the article number, program designation and version number for approx. 5 s.
> The neutral user interface opens.

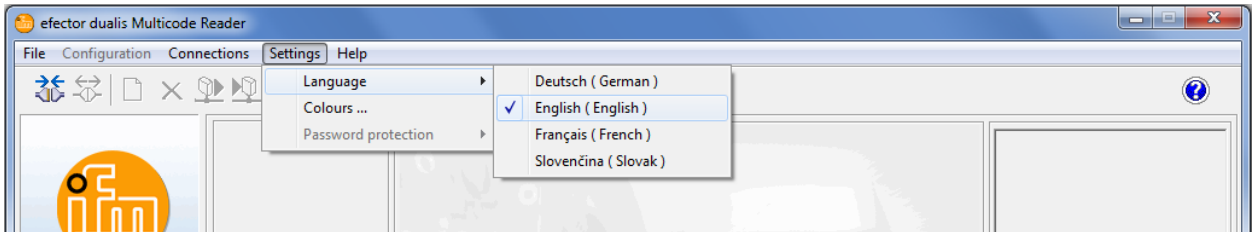


Pos.	Display / operating elements	Contents
1	Mode	No button activated
2	Status bar	Status: OFFLINE
3	Result field	Blank
4	Monitor field	Blank

5.3 General settings

5.3.1 Languages

► Select [Settings] → [Language] in the menu bar.

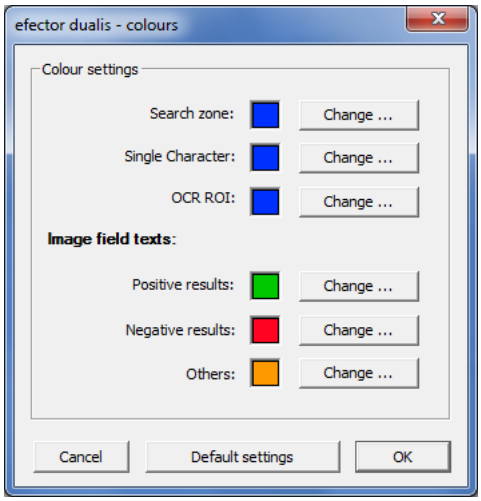


The selection of a language is possible in any mode. A restart of the program is not required.

5.3.2 Colours

The colours for the search zone and the image field texts can be set.
The colour settings are used for the illustration and storage of the evaluation and service images (→ 12 Service report mode)

► Select [Settings] → [Colours...] in the menu bar.
► Change the colour settings in the sub-menu and confirm with [OK].

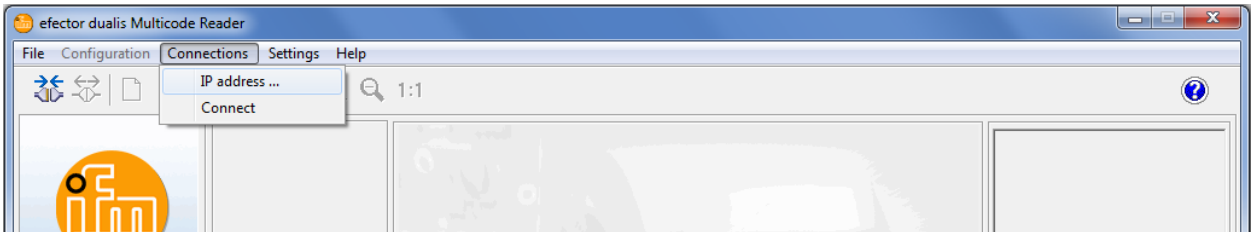


Colour settings to be made in the configuration step "Define code" (→ 8).
In this configuration step the changes can be seen at once.

5.4 Connect device to the configuration software

5.4.1 Alternative 1: Bookmark entry

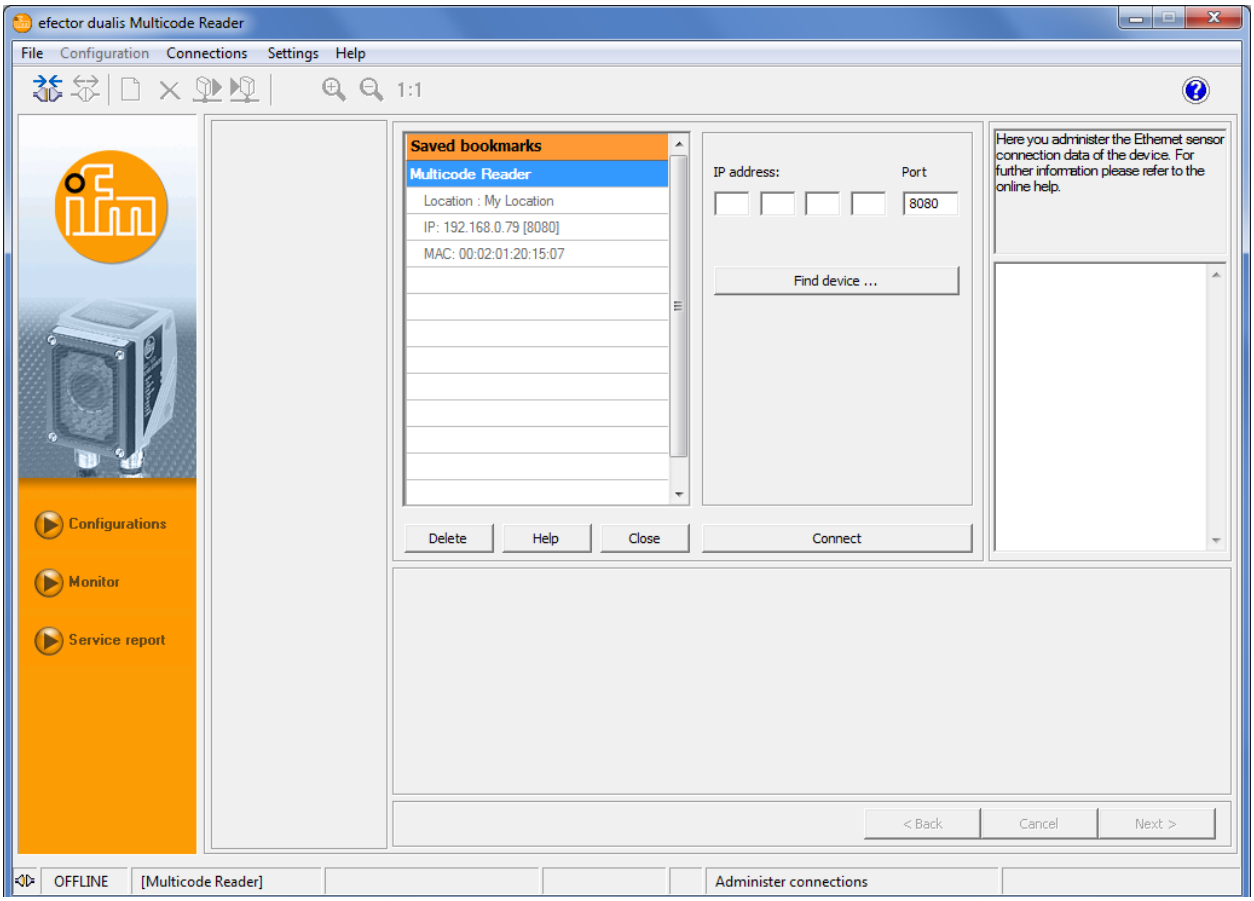
► Select [Connections] → [IP address ...] in the menu bar.



> User interface changes to the connection settings.

> "Saved bookmarks" contains a bookmark entry with the factory settings of the device.
(If this is not the case, continue with 5.4.2 or 5.4.3)

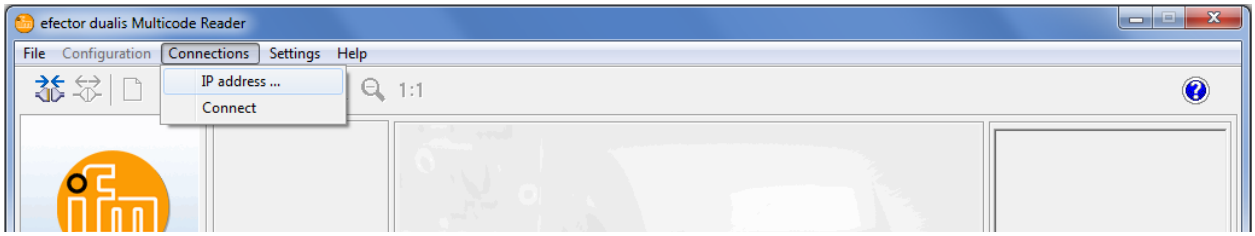
► Activate the bookmark entry by clicking once and then click on [Connect].
Alternatively: Double-click on the entry.



> Change of status: OFFLINE → ONLINE
(→ 5.4.4 The device is connected to configuration software)

5.4.2 Alternative 2: Enter the reader IP address.

► Select [Connections] → [IP address ...] in the menu bar.

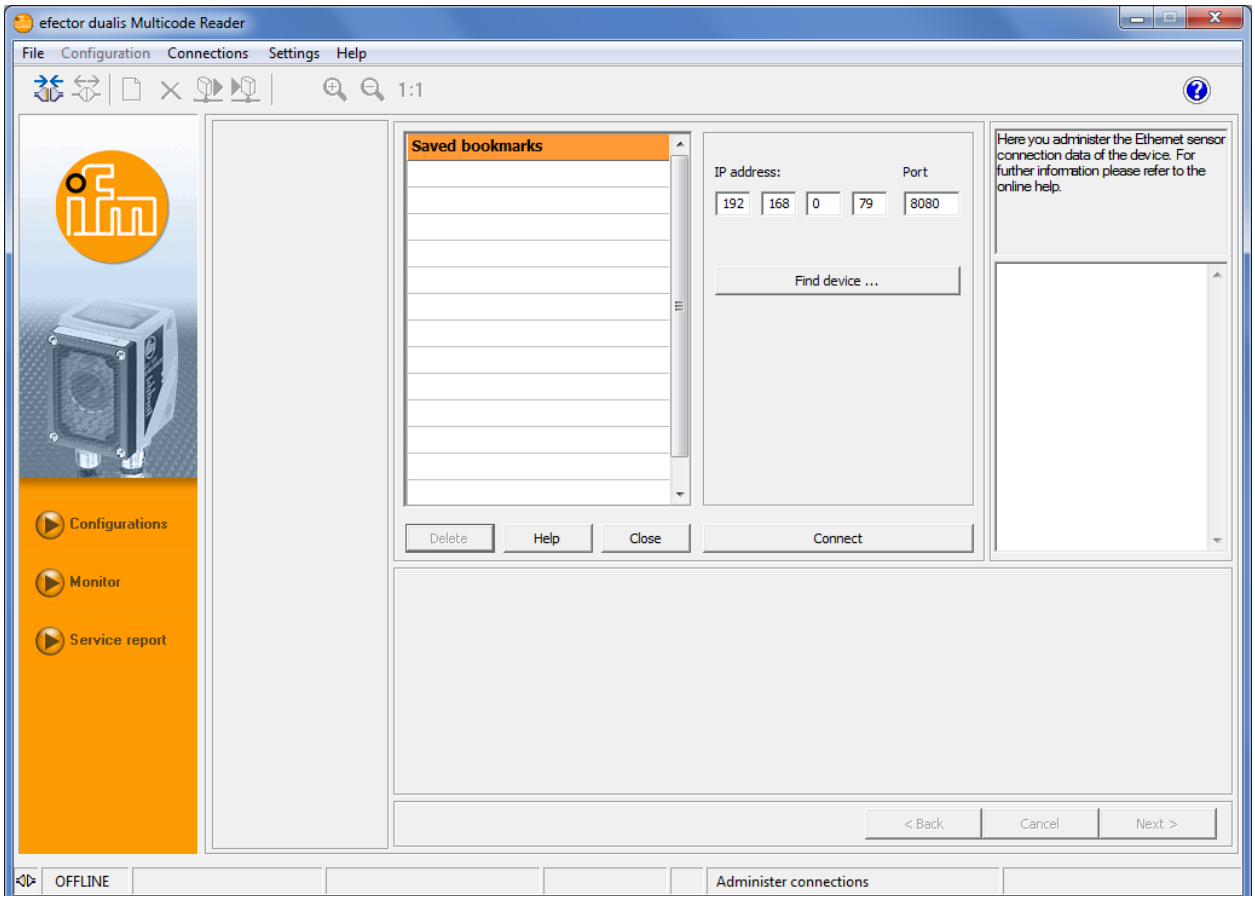


► Enter the IP address of the device in the input mask "IP address".

► Apply preset port number 8080.

If a firewall is active on the PC, ensure that this port and the port number 50002 have been enabled for image transmission.

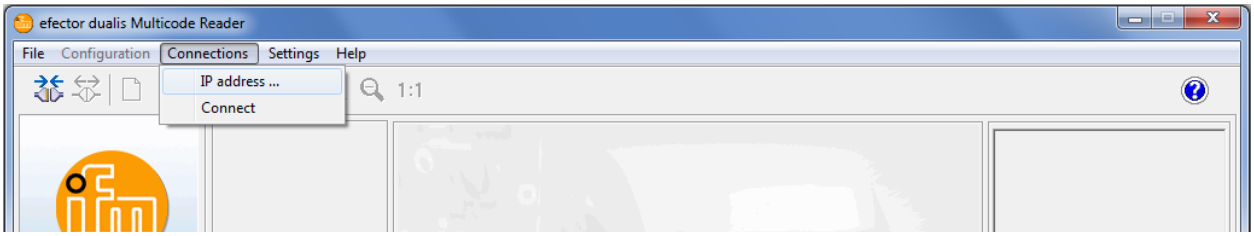
► Click on [Connect].



> Change of status: OFFLINE → ONLINE
(→ 5.4.4 The device is connected to configuration software)

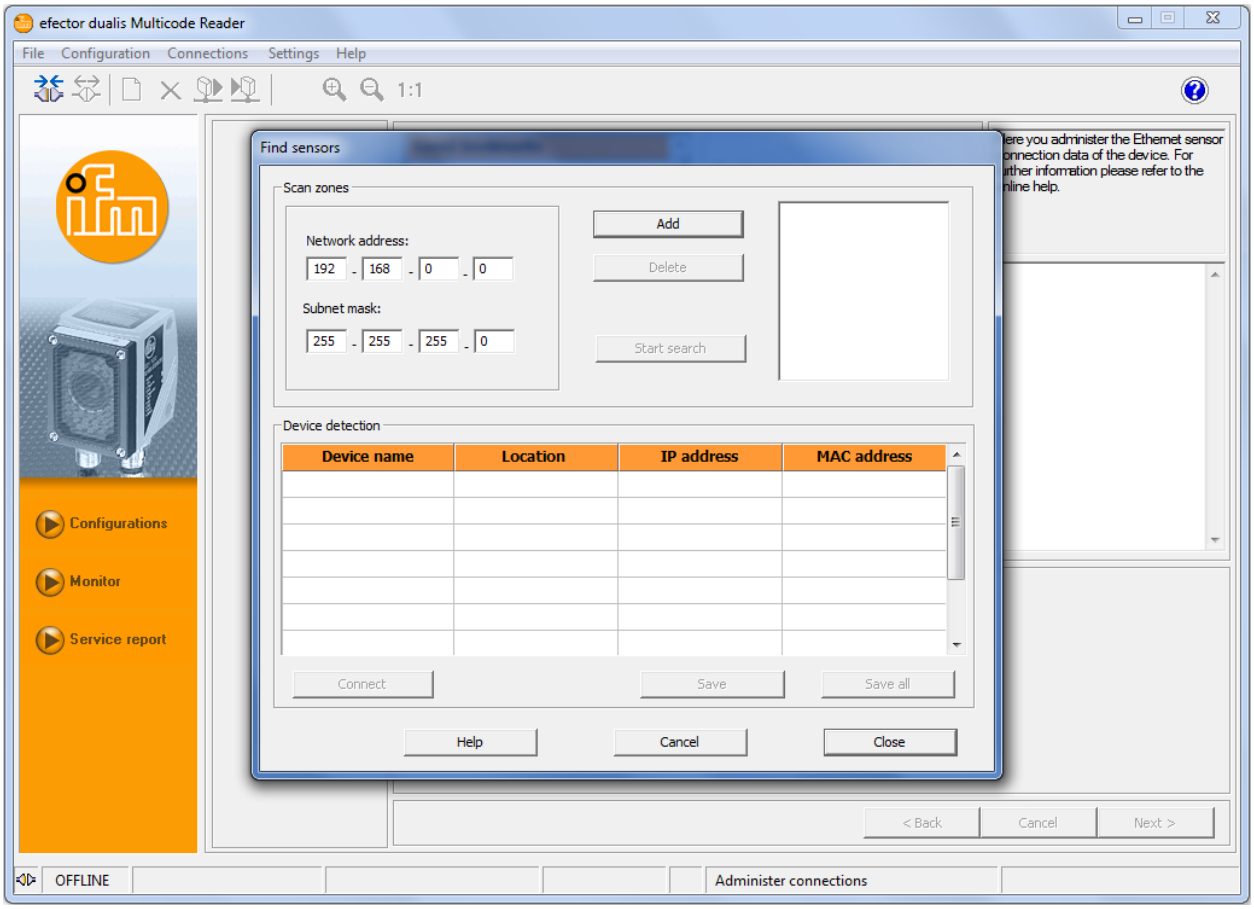
5.4.3 Alternative 3: Find the reader IP address.

► Select [Connections] → [IP address ...] in the menu bar.



► Click on [Find device ...].

> The window "Find sensors" opens.

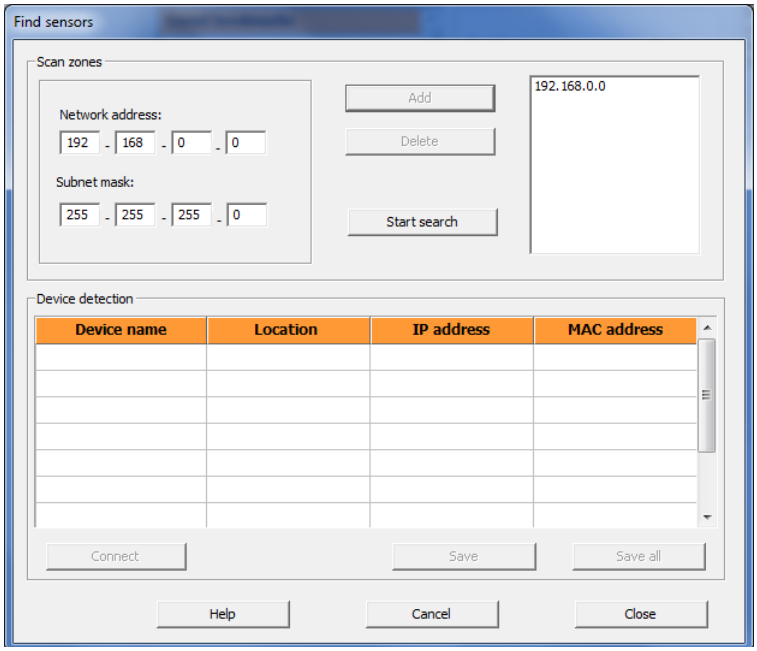


► Enter the IP address range at "Network address", here e.g. 192.168.0.0.

► Enter the "Subnet mask", here e.g. 255.255.255.0.

► Click on [Add].

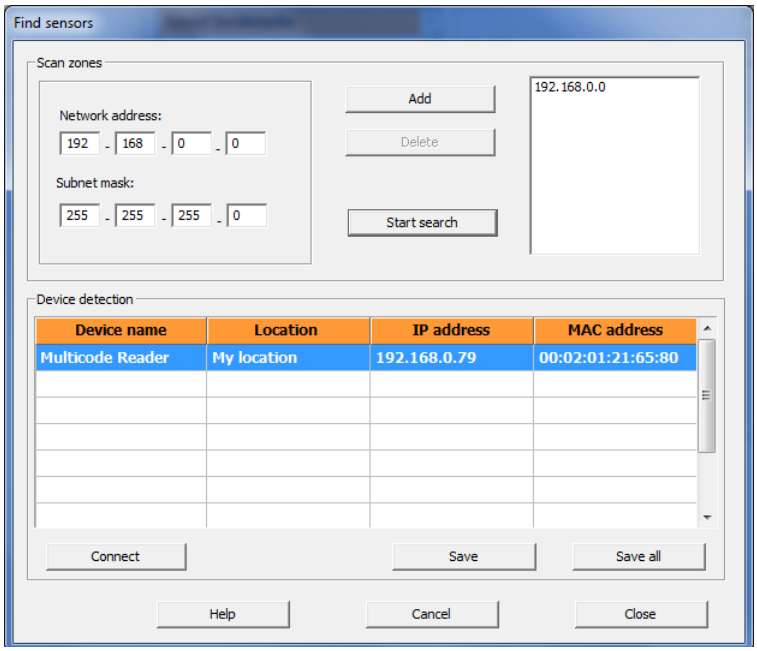
> The network address is added to the search list.
Input fields for the network address and subnet mask are blank so that other entries can be made in the search list.



► Click on [Start search].

> The devices found are listed in the "Device detection" box.

> All network data necessary for the connection to the device is saved locally on the PC in a bookmark entry with the indicated device name and its location.



► Single-click on the entry in the search list and then on [Connect].
Alternatively: Double-click on the entry in the search list.

> Change of status: OFFLINE → ONLINE
(→ 5.4.4 The device is connected to configuration software)

5.4.4 The device is connected to configuration software

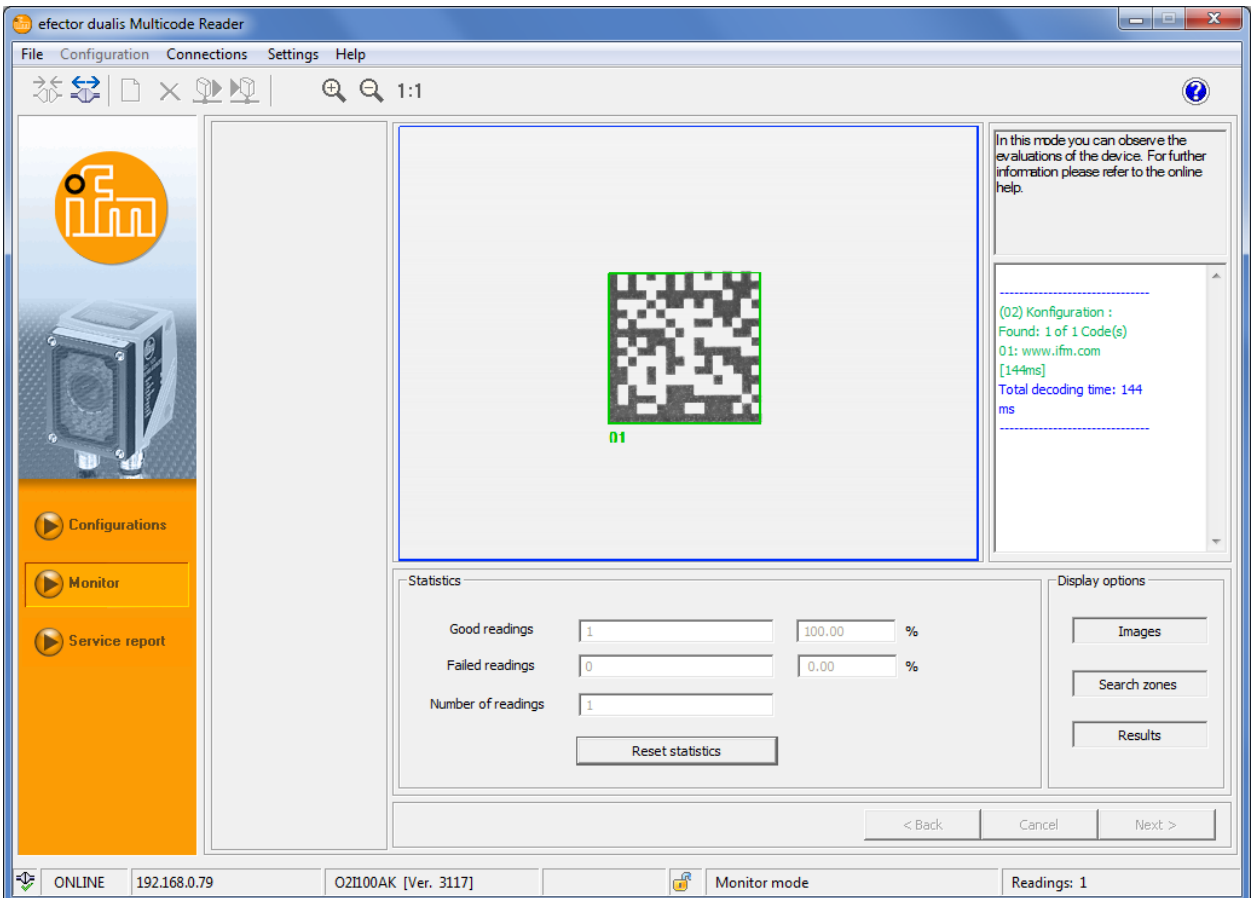
Once the sensor is connected, 2 cases have to be distinguished.

1. Device as supplied:
   No configuration file saved on the device.

> The user interface changes to the configuration mode (→ 6).
> [Configurations] button is activated.
> Configurations can be created and managed.
> Global device settings are possible.

2. Device has already been configured:
   Active configuration file saved on the device:

> The user interface changes to the monitor mode (→ 11)
> The [Monitor] button is activated.After a trigger pulse the monitor window displays the current image captured by the device.
> The result field on the right displays the current results.



Establishing the connection may take several seconds.

6 Configuration mode

6.1 General

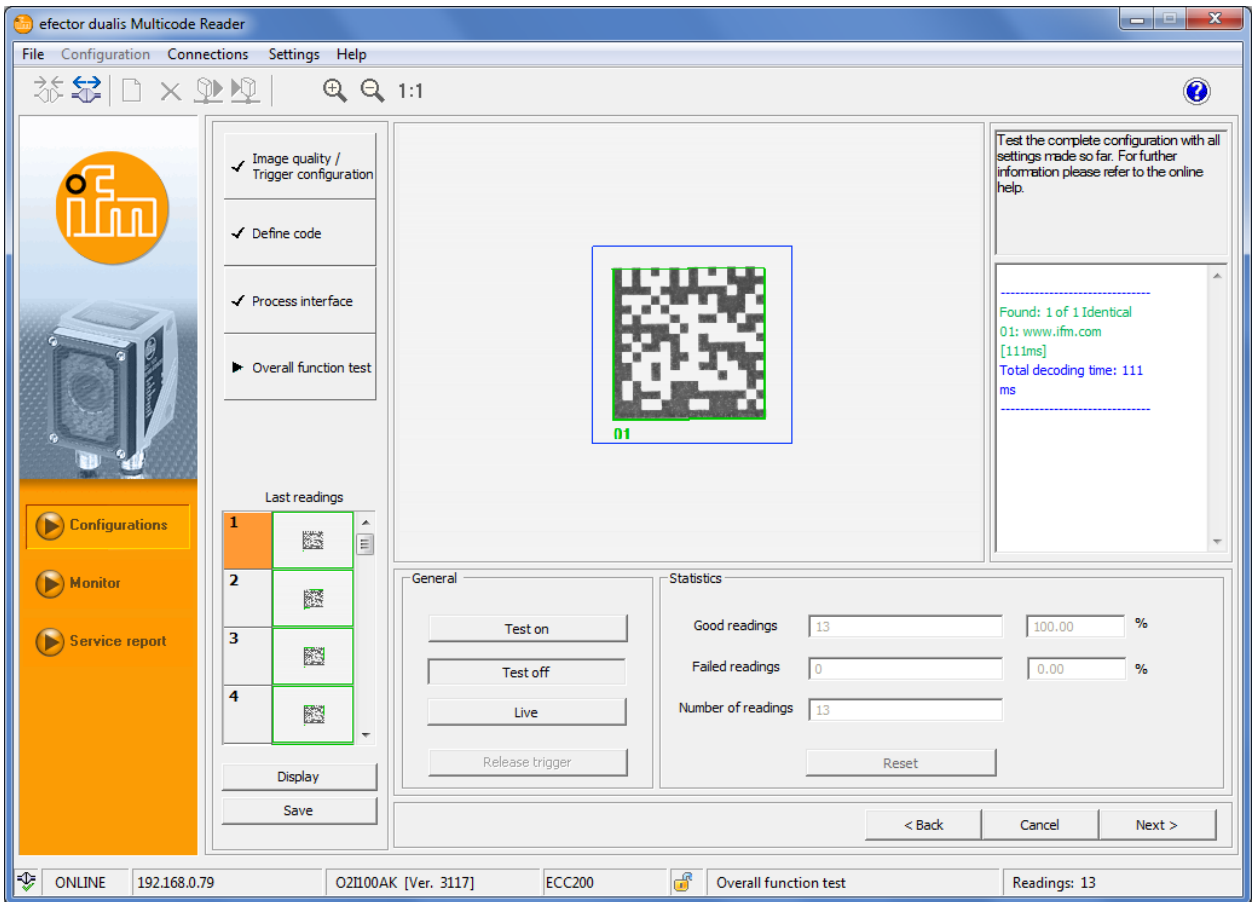
The device can store up to 32 configuration files (= parameter sets).
A configuration contains all application-relevant parameters allowing the device to execute the read mode independently.

For creating a configuration the user is guided via a predefined navigation. The following settings and parameters are defined step by step:

1. Image quality / Trigger configuration
   Internal/external illumination
   Exposure time, parameters for the image quality, trigger type, trigger window, etc.
2. Define code and text

Code	Text (only O2I35x)
Code definitions, code recognition criteria, filter functions for the image pre-processing, code-specific optimisation parameters, etc.	Code and text definitions, text parameters, filter functions for image preprocessing, etc.

3. Process interface
   Information about the process data, distinction between read operation/comparison/pattern recognition, character strings, etc.
4. Overall function test
   Final function test with the defined specifications

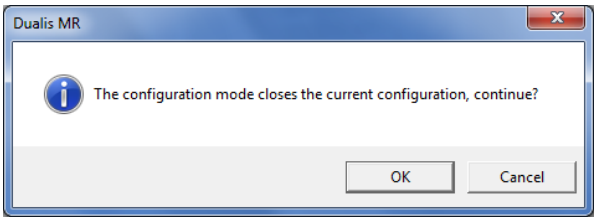


When a configuration is newly created, the next step can only be selected with [Next], if the parameters of the current step have been defined.
When an existing configuration is edited, any sequence of the steps is possible.

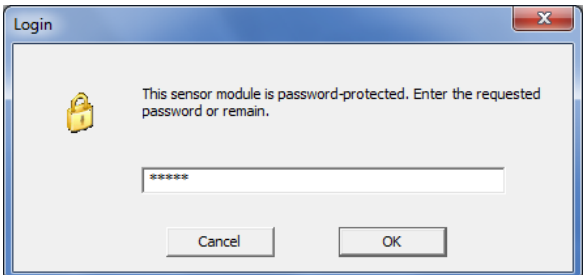
Access to this mode can be locked by means of a password.
(→ 6.7 Password protection)

6.2 Activate configuration mode

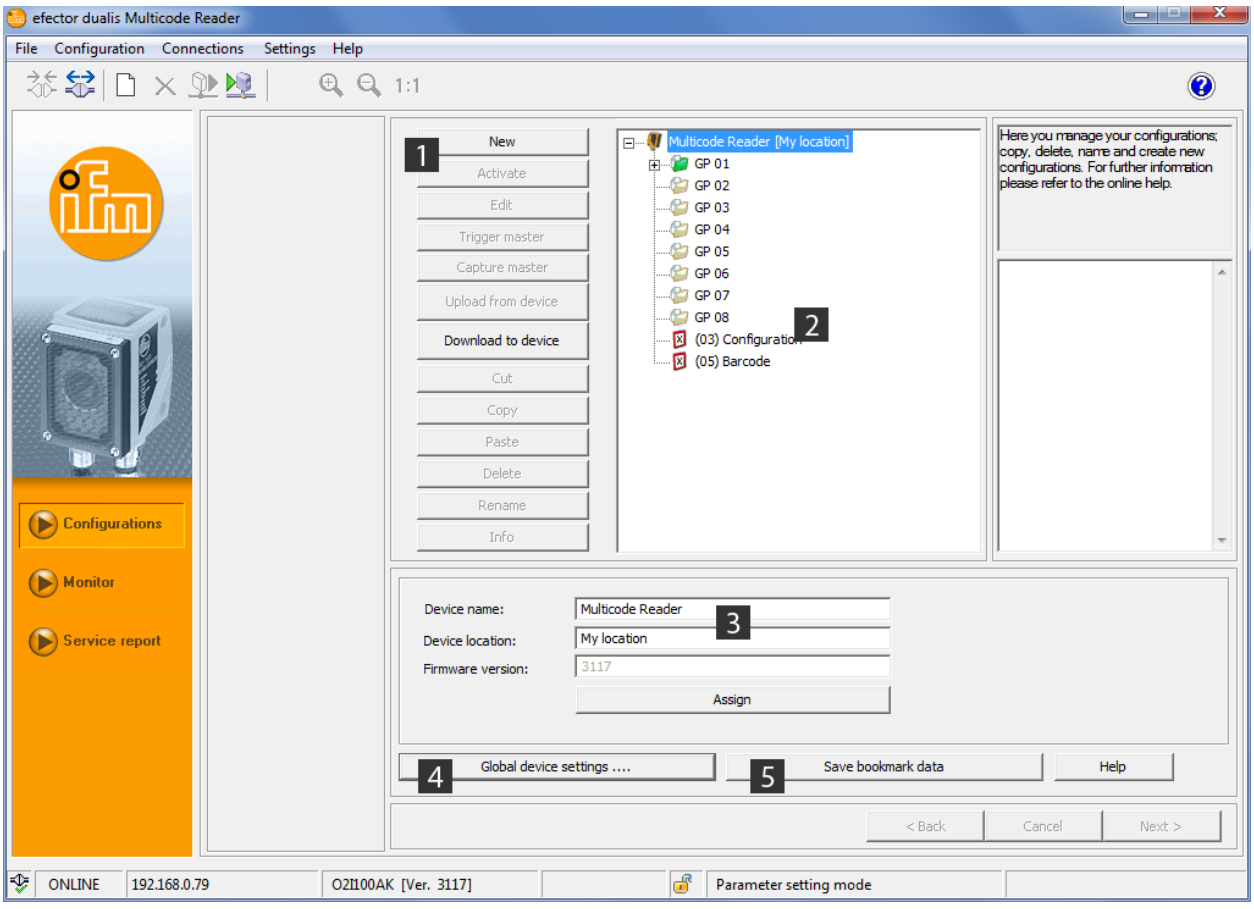
► Click on [Configurations].
► Acknowledge warning with [OK].



► If the device is password protected, enter the password and confirm it with [OK].
Password protection (→ 6.7)



> The user interface changes to the Configurations mode.



UK

Pos.	Display / operating elements	Function	
1	Management of the configurations and groups	New	Creates a new configuration (→ 6.9)
		Activate	Activates a group
		Edit	Settings of a configuration can be changed or verified. ● Image quality / Trigger configuration ● Define code ● Process interface ● Overall function test
		Trigger master	Configuration becomes specification for triggering in a group (→ 6.3.2)
		Capture master	Configuration becomes specification for image captures in a group (→ 6.3.2)
		Upload from device	Save configuration on the hard disk (→ 6.6.2)
		Download to device	Save configuration from the hard disk to the device (→ 6.6.1)
		Cut	Copy configuration to clipboard and delete it from the directory structure
		Copy	Copy configuration to clipboard
		Paste	Paste the configuration from the clipboard to a group or append it to the directory structure
		Delete	Delete the configuration
		Rename	Rename configuration
		Info	Call configuration information (→ 6.3.3)
2	Directory of the configurations and groups	Overview, structure and selection of the configurations and groups	
3	General device management	Device-specific information	
4	Global device settings....	Possible basic settings of the performance and network parameters of the device. ● Trigger input debouncing (on/off) ● Laser marking (on/off) ● Process interface (RS-232, TCP/IP or EtherNet/IP) ● Network parameters (DHCP on/off, IP address etc.)	
5	Save bookmark data	Saves the entered "Global connection data" (item 4) to the device	

6.3 Handling the configurations and groups

Handling and selection of Groups or Configurations is identical to the file management used by Windows explorer.

A single click with the left mouse button activates a configuration or a group; a single click with the right mouse button opens the context menu.

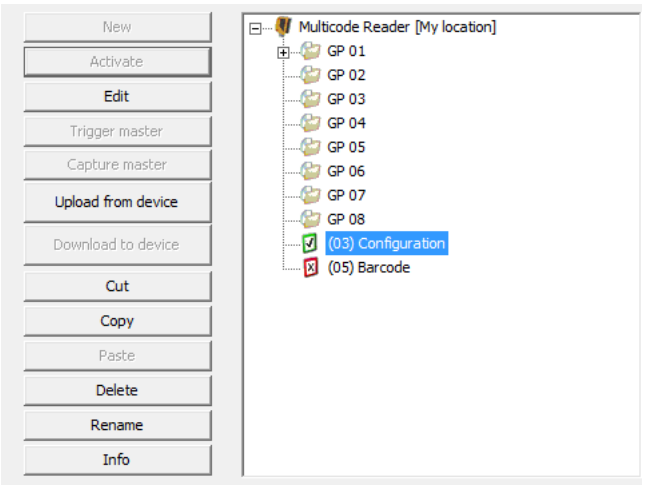
The configuration symbols can be moved into one of the 8 defined groups via drag and drop. The abbreviation "GP" for a group and the group numbers 01...08 are preset and cannot be changed.

A total of 32 configurations can be saved in one device.

UK

Symbol	Function
	Device symbol Can be compared with a main directory in the directory structure of the Windows Explorer.
	Group Can be compared with a subdirectory in the directory structure of the Windows Explorer.
	Active group The device executes the configurations in this group in the read operation. With a trigger signal all configurations of the group are tried one after the other until there is a good reading. If there is no good reading for any of the contained configurations, the result is a bad reading. (Note → 6.3.2 Configuration within in a group)
	Configuration (general) Can be compared with a file in the directory structure of the Windows Explorer. In the configuration all parameters of the respective setting are saved.

6.3.1 Configuration outside a group



Symbol	Function
	Active configuration, not assigned to any group The device performs these configurations during the read operation.
	Inactive configuration

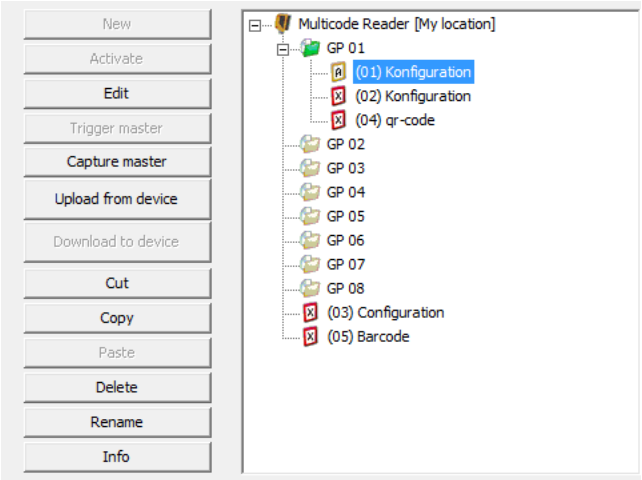
6.3.2 Configuration within in a group

When a reading process starts, all configurations within the group are executed consecutively until there is a good reading. If there is no good reading for any of the contained configurations, the result is a bad reading.

During the next reading process the configuration that delivered the last good reading is started.

This function can, for example, be used if different code types are to be recognised with the same code reader or if different image settings are necessary for different readings.

The group function ensures operation with different configurations without having to change the active configuration manually.



A configuration defining the trigger settings has to be within a group (either trigger specification "T" or combination trigger/image capture specification "A").

In addition, another or the same configuration can include the specifications for the image capture (image capture specification "C" or combination trigger/image capture specification "A").

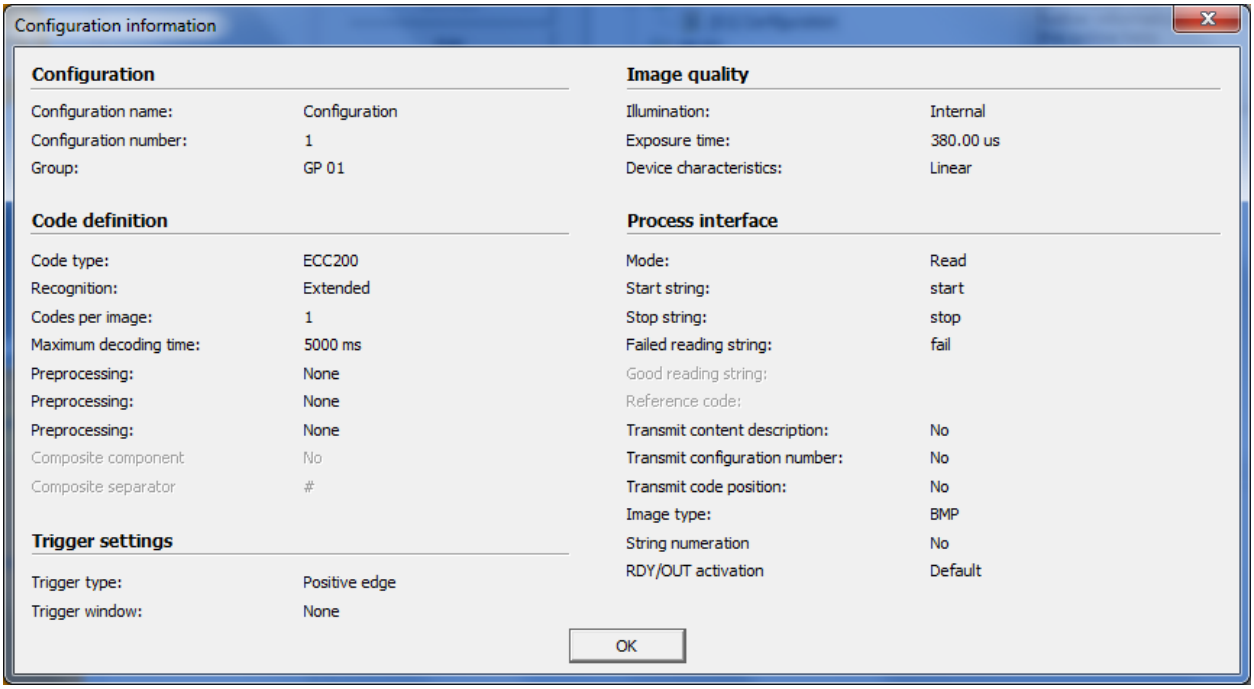
Symbol	Function
T	Trigger specification in a group This configuration defines the trigger settings for the group (trigger type, trigger window, number of tried reads, time window)
C	Image capture specification in a group This configuration defines the settings for the image quality for a group (type of lighting, number of lighting segments, exposure time, etc.)
A	Trigger/image capture specification for the group combined in one configuration.
	Configuration without trigger/image capture specification

- Operation group without image capture specification (groups only with T):
  As each configuration is tried, a new image is taken with the respective settings.
- Operation group with image capture specification (groups with C or A):
  Only one image is taken with the settings of the image capture specification.

6.3.3 Call configuration information

► Select a configuration with the right mouse button.
> The context menu opens.

► Select [Info].



6.4 General device management

► Enter the name and the location according to the application.
► Transfer the entries to the device with [Assign].

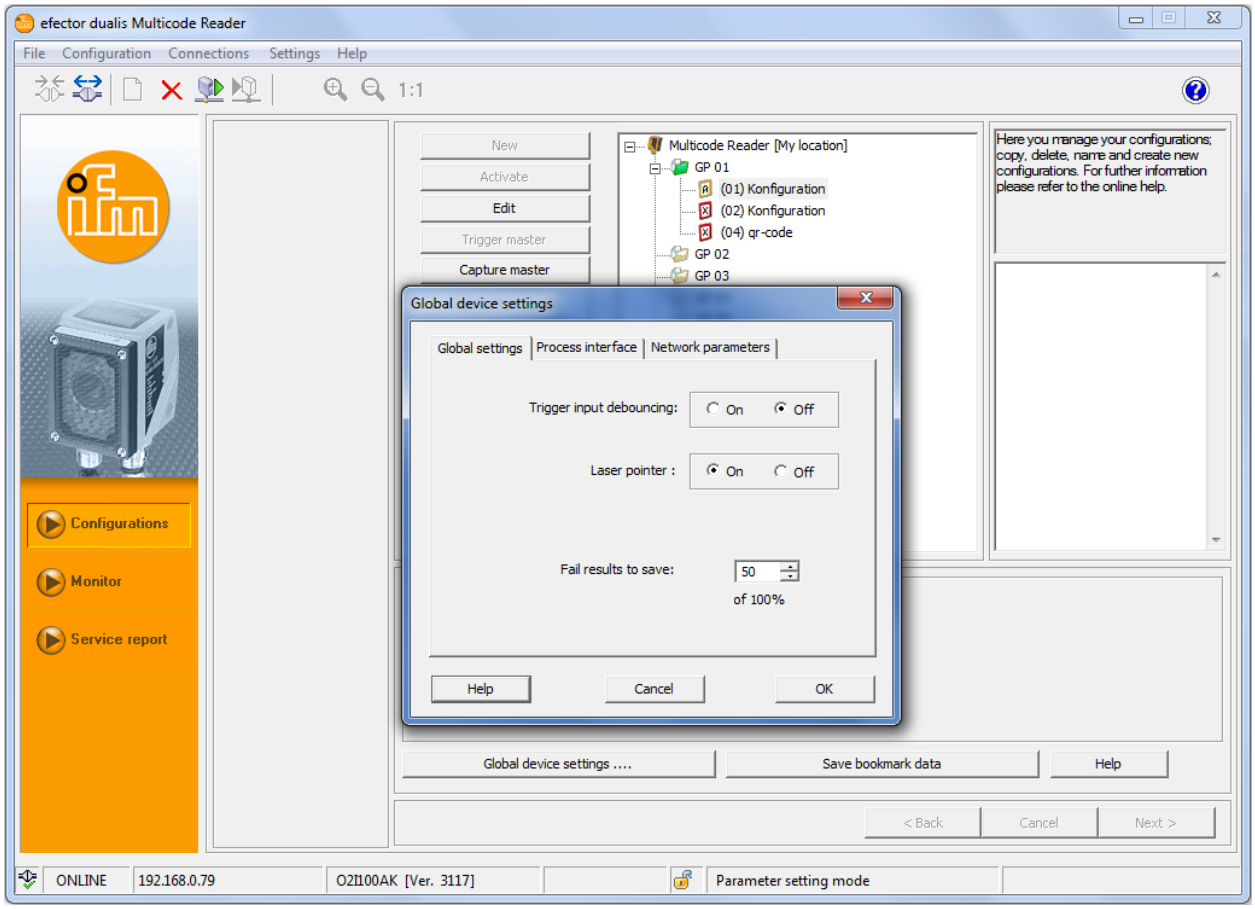
Field	Function
Device name	Any application-specific device name
Device location	Location description (e.g. conveyor belt 12)
Firmware version	Firmware version of the device (cannot be changed)

6.5 Global device settings

► Click on [Global device settings …].

6.5.1 Global settings

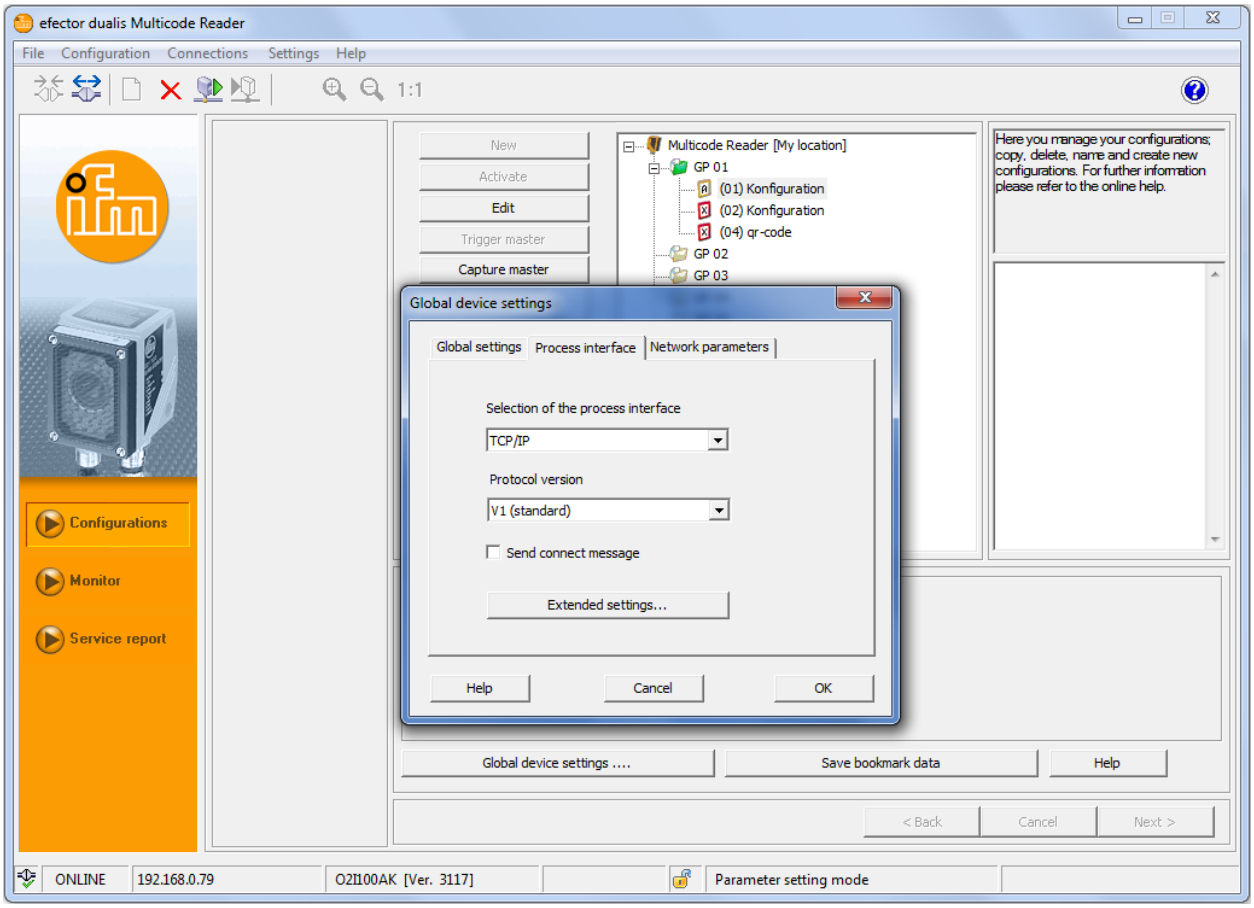
► Check the entries in the dialogue window "Global device settings" and change them, if necessary.



Field	Function
Trigger input debouncing	Prevents that several pulses occurring shortly after each other cause a trigger process on the device. With "On" a stable pulse has to be on the input for at least 3 ms so that it is recognised as a trigger pulse. Shorter pulses are ignored.
Laser pointer	Laser marking (laser pointer) on/off The laser marking serves as alignment aid and is parallel to the optical axis. It is located approx. 2 cm above the middle of the field of view.
Fail results to save	Ratio of stored error images and total number of images

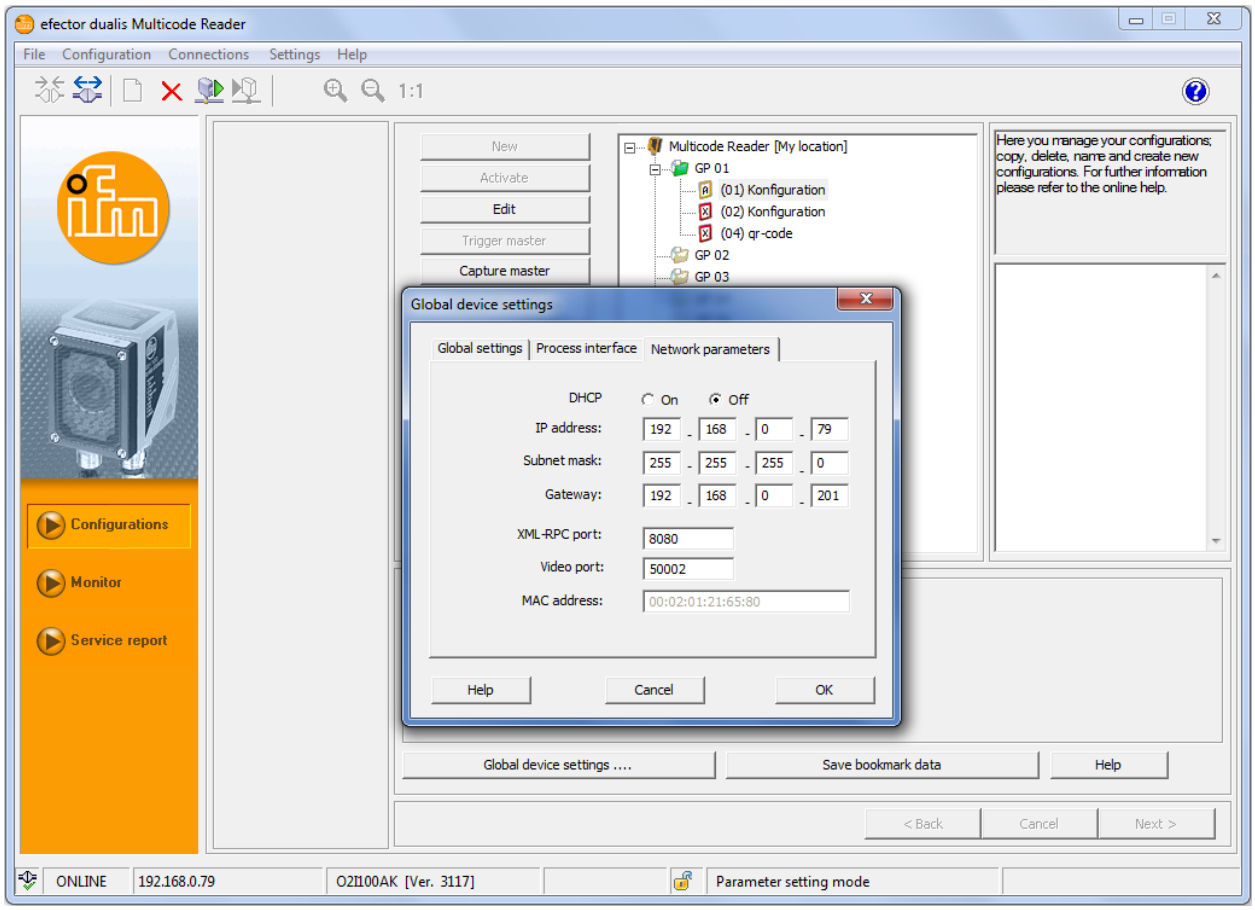
6.5.2 Process interface

► Check the entries in the dialogue window "Process interface" and change them, if necessary.



Field	Function
Selection of the process interface	Defined transmission standard • TCP/IP • Serial • EtherNet/IP
Protocol version	Defines the characteristics of the process data transmission • V1 (standard) Messages/replies without ticket and without message length • V2 (with ticket) The messages to the device are preceded by a 4-digit decimal number as ticket. The reply by the device starts with the same number. Messages and replies are then linked. • V3 (with ticket and message length) The messages to the device and the replies by the device are preceded by length information and a ticket. • V4 (with message length) The replies by the device are preceded by length information, the messages to the device, however, are not. Process data protocol (→ 14)
Send connect message	If this field is activated, the device will automatically output a message when the connection is established again. Contents: IFM ELECTRONIC, article, device name, device location, IP address, subnet mask, gateway, MAC address, XML-RPC port Process data protocol (→ 14)
Extended settings...	Interface-specific settings e.g. TCP/IP port number, baud rate, stop bits, etc.

6.5.3 Network parameters



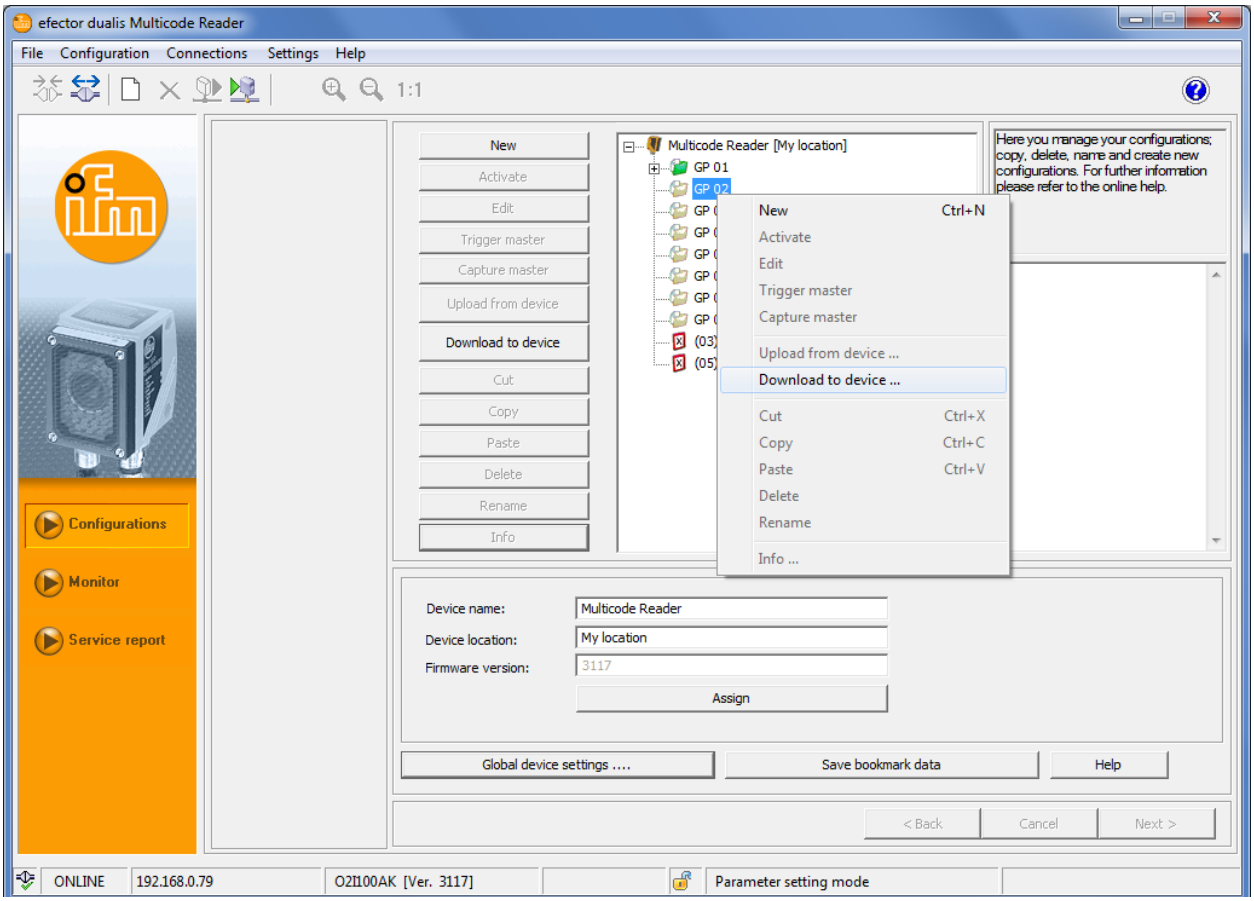
Field	Function
DHCP	In the DHCP mode the input fields for the IP address, the subnet mask and the standard gateway are blocked. The reader is assigned an address in the network by a DHCP server. **Please note the warning when you switch to "On"!**
IP address	Currently assigned IP address of the device
Subnet mask	Currently assigned subnet mask of the device
Gateway	Default gateway address
XML-RPC port	Port number for the communication via the XML-RPC protocol (Remote Procedure Call)
Video port	Port number for the transmission of images
MAC address	The MAC address of the device (cannot be changed)

6.6 Uploading/downloading an available configuration

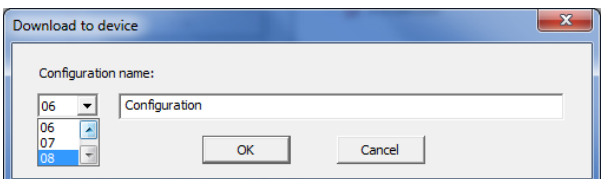
6.6.1 Copying the configuration from the hard disk to the multicode reader

► Select the name/location of the device in the directory structure by clicking on it once.
If the configuration is to be assigned to a group, click on this group once.

► Click on [Download to device].
Alternatively: Selection via the context menu (right mouse button) or via the tool bar →  .



► Assign a number and a name to the new configuration.
Required information:
Length of the name 1..32 characters
Umlauts allowed (Ä, ä etc.)No blank or tabulator characters before and after an entry
No special characters (&, $, -, _, etc.)



The selection list only shows the free numbers to be assigned.
The number is required for activating and enquiring about a configuration via the process interface.
Process data protocol, e.g. permanently activate configuration/group (→ 14.4.4)

► Acknowledge with [OK].

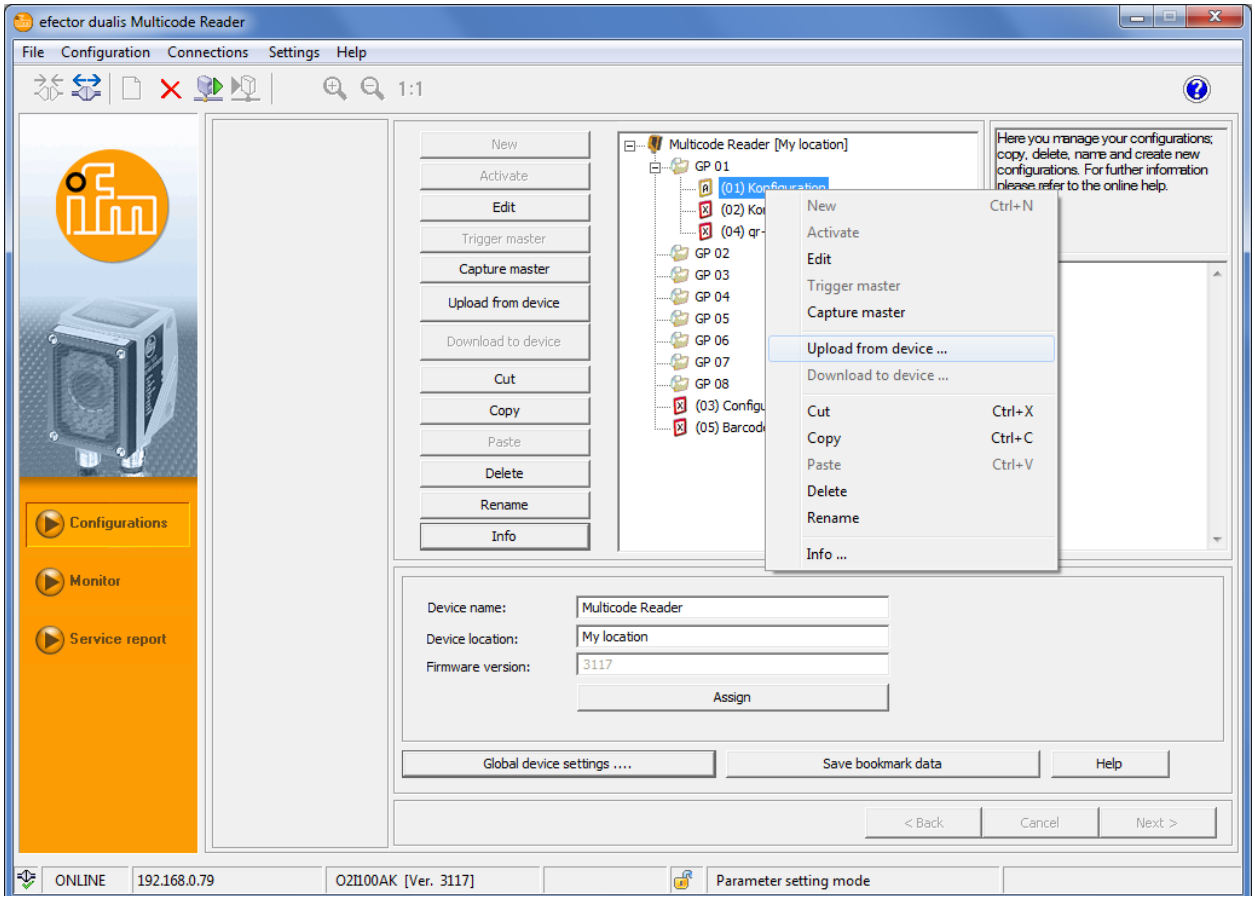
► Define the memory location on the hard disk and select the file.

> The configuration is downloaded to the device and can be seen in the directory structure.

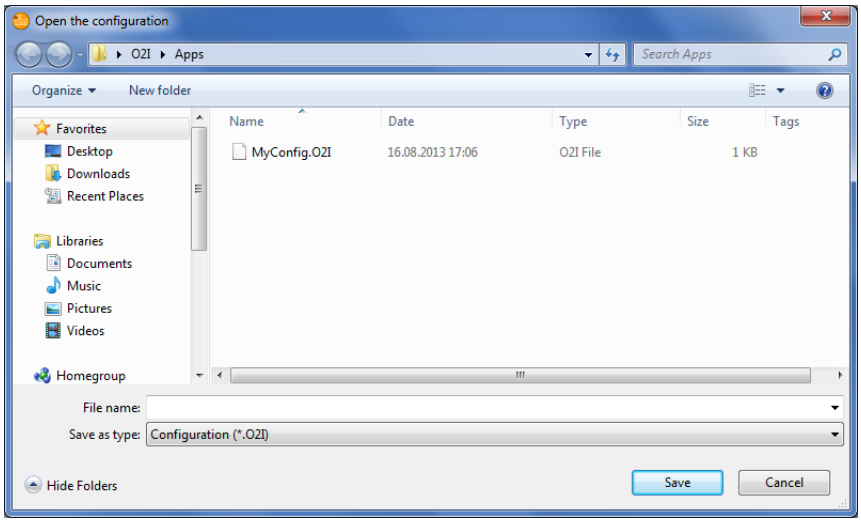
6.6.2 Copying the configuration from the multicode reader to the hard disk

► Select the configuration in the directory structure by clicking once.

► Click on [Upload from device].
Alternatively: Selection via the context menu (right mouse button) or via the tool bar →  .



► Define the memory location on the hard disk and assign a file name.



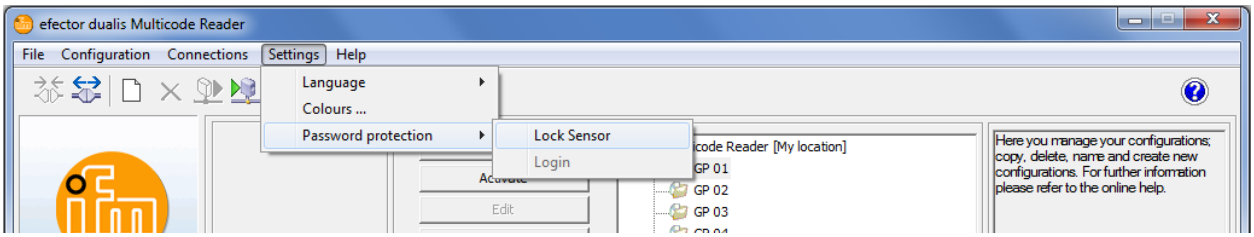
► Acknowledge with [OK].

> The configuration is uploaded on the hard disk and can be copied to other devices, if required.

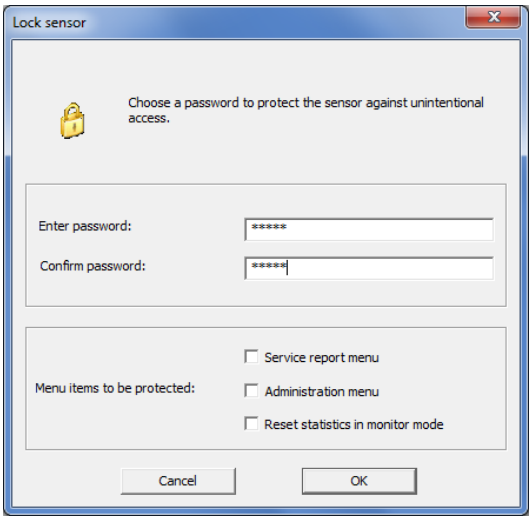
6.7 Password protection

Devices can be protected against manipulation using a password.
To do so, the device has to be connected with the operating program (→ 5.4).

► In the menu bar, select [Settings] → [Password protection] → [Lock sensor].

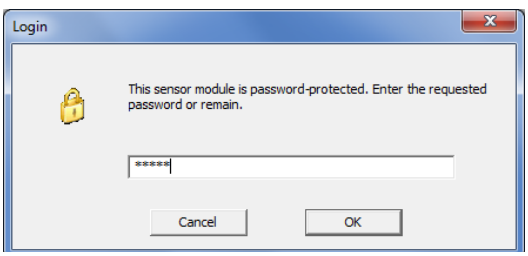


► Enter the password and confirm it by entering it again.
► Select [Menu items to be protected] as required.



Field	Function
Service report menu	Access to the "Service report" mode is password protected. No read results (evaluations) stored in the device can be called and looked at, externally stored or deleted.
Administration menu	Access to the "Configurations" mode is password protected. No device settings and configurations can be newly created or changed.
Reset statistics to monitor mode	In the "Monitor" mode the read results (evaluations) stored in the device cannot be deleted.

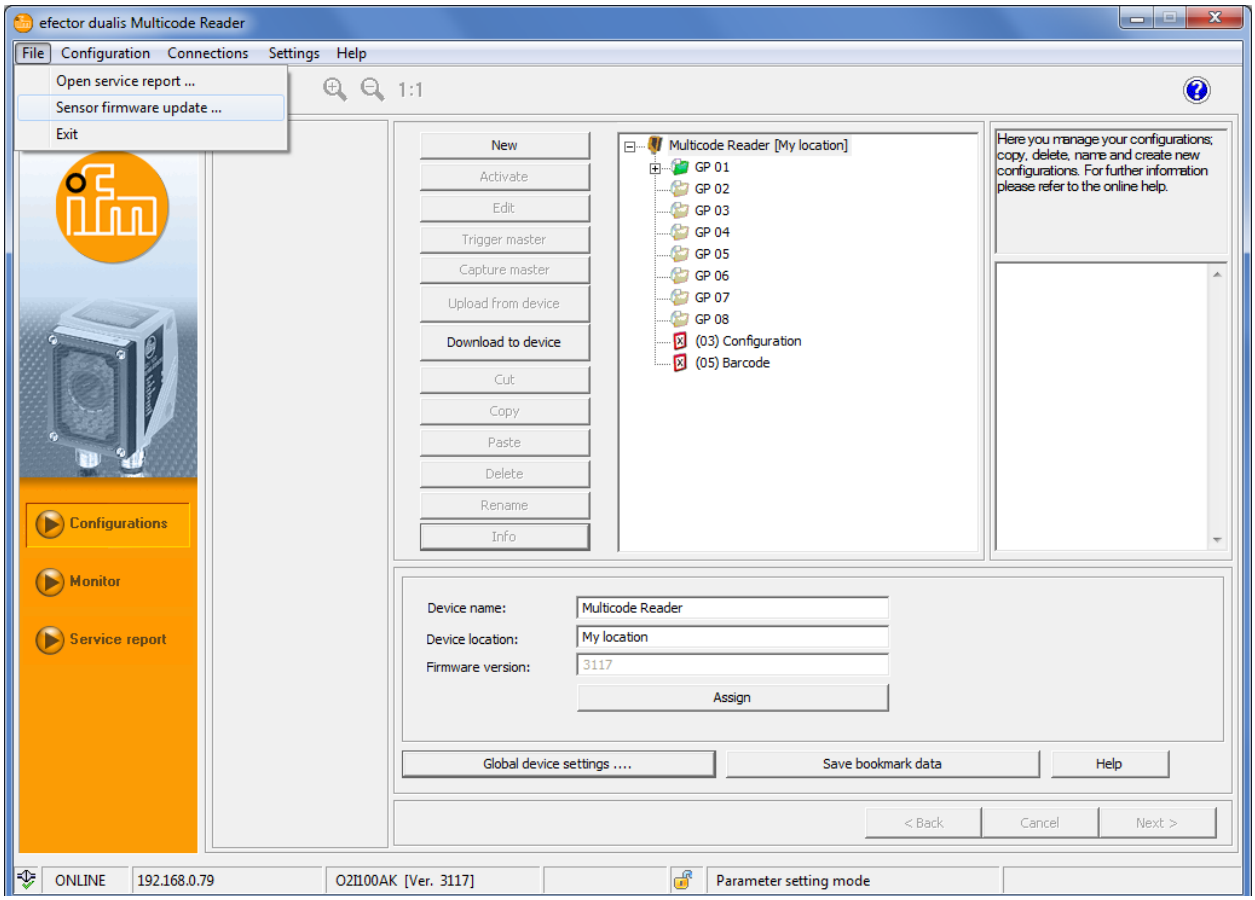
> If the device is then connected with the operating program again, the password will be asked for when a protected menu item has been selected.



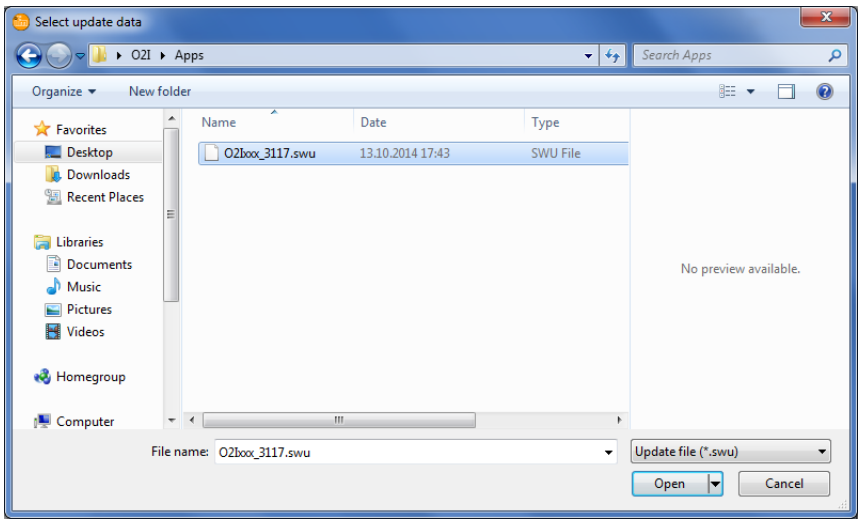
Irrespective of which menu items are protected, the password protection locks the operating keys of the device. Parameter values cannot be displayed and changed. "Lok1" is displayed on the device.

6.8 Update device firmware

► Select [File] → [Sensor firmware update ...] in the menu bar.



► Determine the storage location of the update file (.swu) and select it with [Open].



> The update process starts.

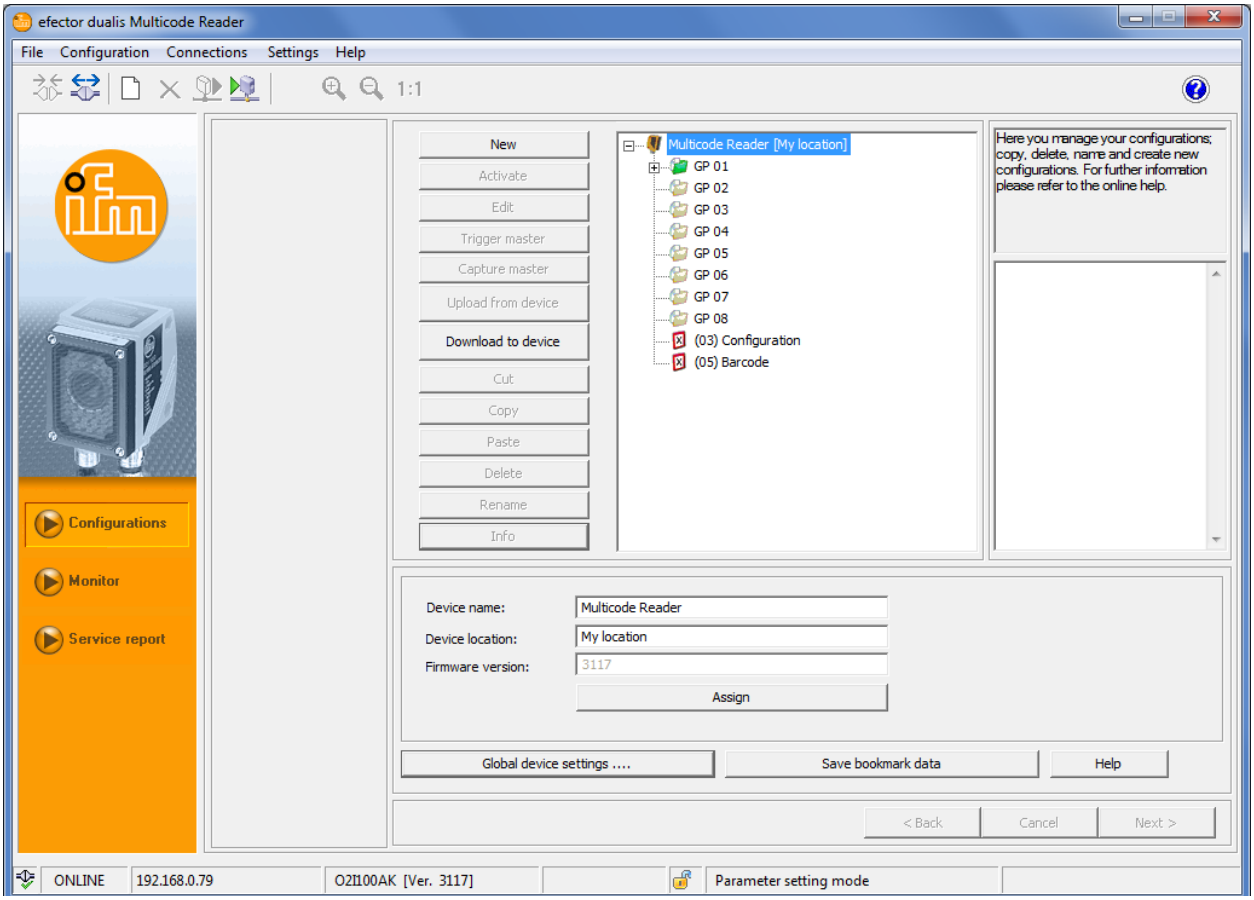
The update takes some time.
Do not disconnect the device (power supply or coms) during the update.

The device firmware can be downloaded from:
www.ifm.com
Note the remarks concerning the respective firmware versions.

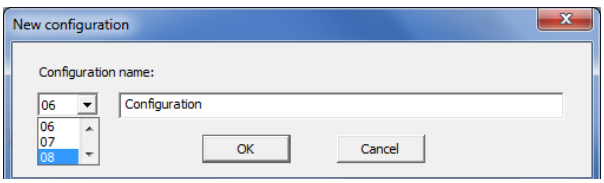
6.9 Create a new configuration

► Click on [New].

If the name/location of the device has been selected in the directory structure (= shown in blue), the new configuration is not assigned to any group and added at the end of the data structure.
If the new configuration is already to be assigned to a group, select this group with a single click.
Then click on [New].



► Assign a number and a name to the new configuration.
Required information:
Length of the name 1..32 characters
Umlauts allowed (Ä, ä etc.)No blank or tabulator characters before and after an entry
No special characters (&, $, -, _, etc.)



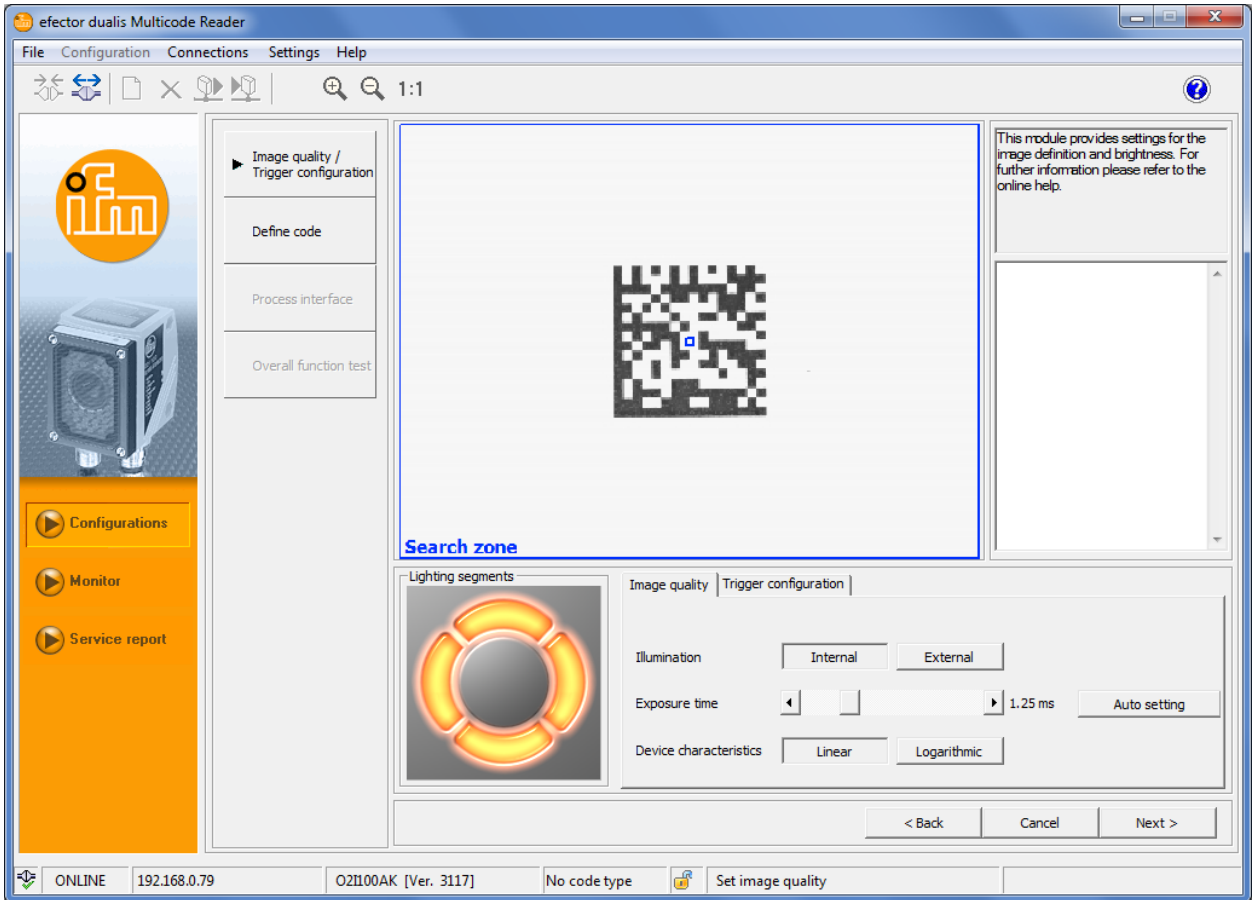
The selection list only shows the free numbers to be assigned.
The number is required for activating and enquiring about a configuration via the process interface.
Process data protocol, e.g. permanently activate configuration/group (→ 14.4.4)

► Acknowledge with [OK].

> The new configuration is created.
> The user interface changes to the first configuration step "Image quality/Trigger configuration" (→ 7).

7 Image quality / Trigger configuration

7.1 Image quality



► To ensure reliable code recognition adjust and set the reader so that the following criteria are met:

- The code has to be set to be sharp and should be of the highest possible contrast (ideal = black/white or white/black).
- The code has to be displayed within the search zone.
- The size of the code in the image should be no larger than approx. 2/3 of the image.
- The minimum module size of the code has to be taken into account for selecting the operating distance.
  (Operating instructions "dualis Multicode Reader O2I" or www.ifm.com → Data sheet search → e.g. O2I102 → More information).
- Any code position is possible.

If there is any interfering reflectance in the image, install the device transversely to the code plane, if necessary. Depending on the code size the resulting trapezoidal distortion can be tolerated within certain limits.

► Optimise the image definition (focus) via the setting screw on the back of the device.

► To maximise the read reliability and rate, adjust the blue search zone.

- In the running process the code has to be seen within the search zone.
- Only image data from that search zone will be used for reading.
- The read rate largely depends on the size of the search zone. Therefore do not leave the search zone unnecessarily in its maximum size in time-critical applications.

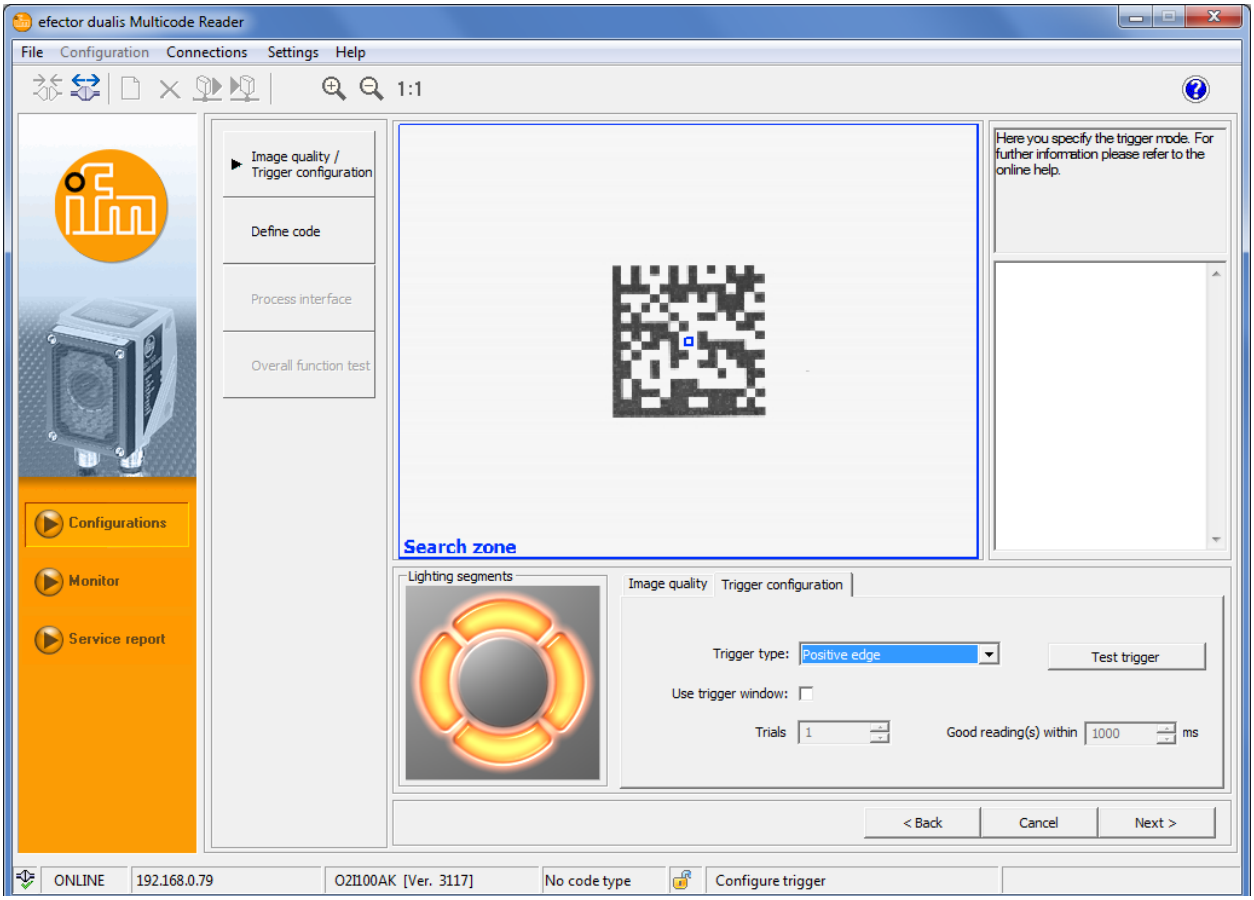
The fine adjustment and optimisation of the search zone is made in the following configuration step "Define code". The effect of the search zone size on the read rate can be read in the result field.

► Switch the lighting segments on and off according to the application and the light conditions.
The code should be equally illuminated.
The 4 segments of the internal illumination can be activated independently with a mouse click on the segments (factory setting = internal illumination, 4 segments "on").

► Define the exposure time with [Auto setting].
Readjust the exposure time manually for difficult light or surface conditions.

► Select the tab [Trigger configuration] (→ 7.2).

7.2 Trigger configuration



► Select the trigger type in the pulldown menu.

- Positive edge (external triggering)
- Negative edge (external triggering)
- Positive and negative edge (external triggering; this operating mode activates a trigger if a positive **or** negative edge is detected on the switching input).
- Serial, TCP/IP or EtherNet/IP (triggering via the selected process interface → 6.5.2)
- Continuous (internal triggering)

With activated function "Use trigger window" the reader tries to read a defined number of codes within a certain period of time after a trigger pulse. Reading is stopped when the number of "trials" has been reached or the time "Good reading(s) within" has elapsed.

Trials (1...100):

Number of codes that are expected within the time window.
Each change of status designates a trial:
If the same code is detected in two consecutive good readings, this is considered to be 1 trial.
If there is a bad reading between two identical good readings, they are considered to be 2 trials.
If two different codes are detected in two consecutive good readings, they are also considered to be 2 trials.

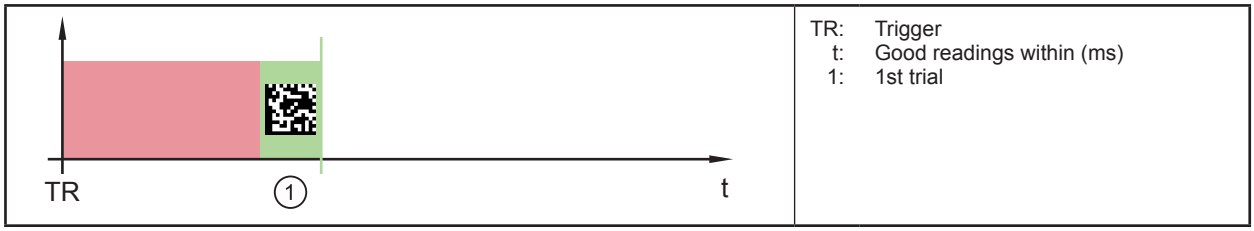
Good readings within (100...10000 ms, step increment 100 ms):

Time span during which the "trials" can be made.

Example 1:

Trials = 1; Good readings within = 5000 ms

The reading result is provided after 2000 ms since the first trial was reached after this time.

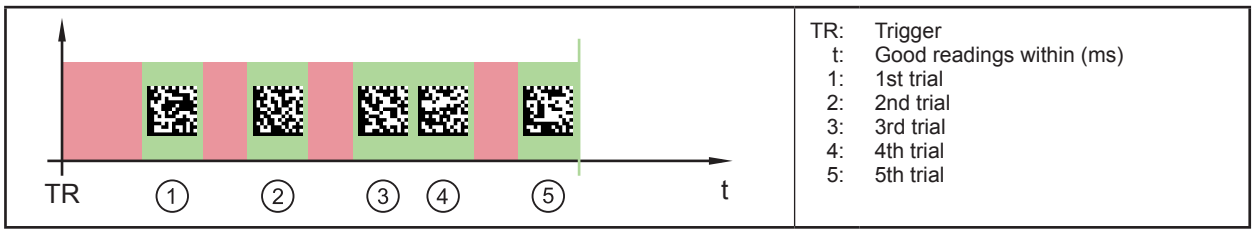


Result output: start**CODE1**stop

Example 2:

Trials = 5; Good readings within = 5000ms

The reading result is provided after 4000 ms since the 5 trials were reached after this time.

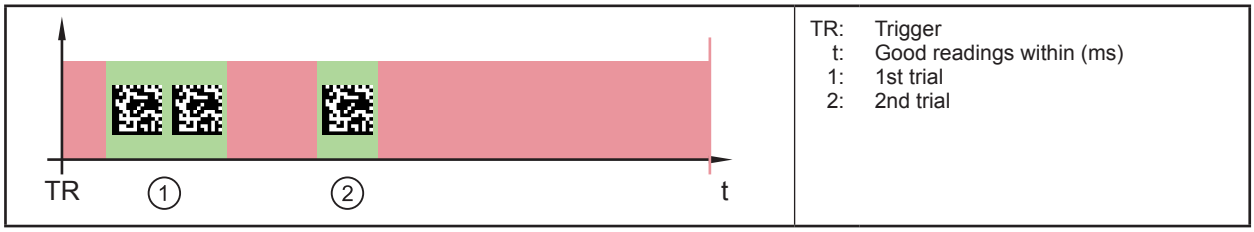


Result output: start**CODE1**stopstart**CODE2**stopstart**CODE3**stopstart**CODE4**stopstart**CODE5**stop

Example 3:

Trials = 5; Good readings within = 5000ms

The reading result is provided after 5000 ms since the 5 trials were reached after this time.

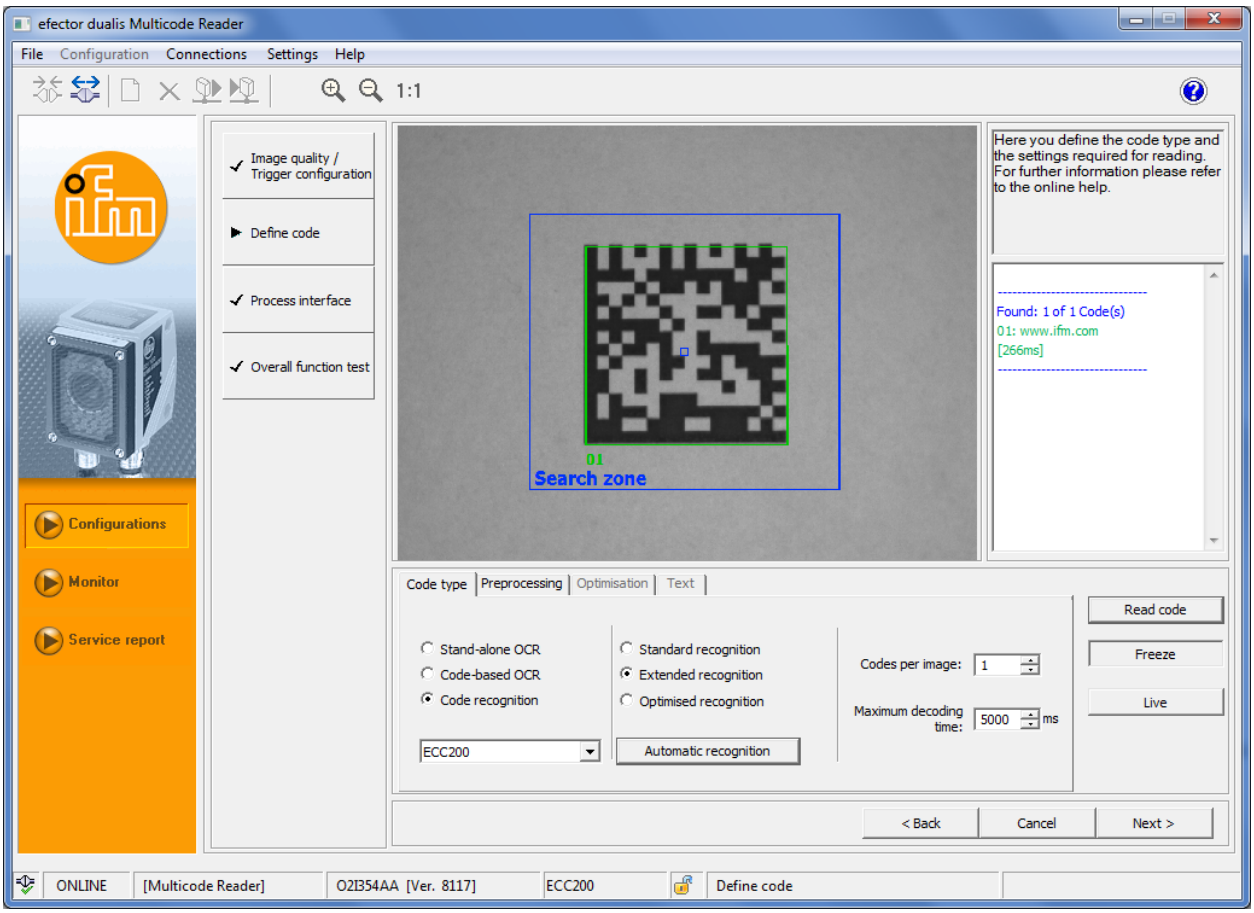


Result output: start**CODE1**stopstart**CODE1**stopstart**FAIL**stopstart**FAIL**stopstart**FAIL**stop

► Change to the next configuration step "Define code" with [Next] (→ 8).

8 Configuration step "Define code"

When a new configuration is created, the program automatically performs a code recognition process after the change from "Image quality / Trigger configuration" → "Define code". This may take several seconds.



8.1 Code recognition

► Select [Code recognition] in the tab "Code type".

8.1.1 Standard recognition and Extended recognition

Preferred for code applications with good contrast, surface and light conditions.
No filter functions are necessary for the standard recognition.

► Select or leave [Extended recognition].

Parameter		Extended recognition (Default setting)	Standard recognition
Module colour		Dark symbols on light background and light symbols on dark background	Dark symbols on light background
Contrast		≥ 10 %	≥ 30 %
Module size	ECC200 QR	≥ 4 pixels (for high-contrast images ≥ 2 pixels)	6...20 pixels
	PDF417	≥ 3 pixels (for high-contrast images ≥ 2 pixels)	3...15 pixels
Column and line spacing		Greater distances possible (≤ 50 % of the module size)	No or small distance between adjoining modules (≤ 10 % of the module size)
Inclination	ECC200	≤ 30°	≤ 10°

► Enter the number of the codes to be recognised in [Codes per image].
(Codes of the same type!)

If "OCR" is selected, the number is limited to 1.

► Enter [Maximum decoding time].
If the code is not read during this time, the evaluation will stop and the reading is a bad reading.

► Select the code type in the pulldown menu.

Supported 2D codes

O2I1xx and O2I3xx
ECC200 PDF417 QR
In addition O2I3xx
Micro-QR Aztec Code GS1 ECC200 GS1 QR Code GS1 Aztec Code

Supported 1D bar codes

O2I1xx and O2I3xx	
Interleaved 2-of-5 Industrial 2-of-5 Code 39 Code 93 Code 128 Pharma code Codabar EAN8 EAN8 Add-On 2 EAN8 Add-On 5 EAN13 EAN13 Add-On 2 EAN13 Add-On 5 UPC-A UPC-A Add-On 2 UPC-A Add-On 5 UPC-E UPC-E Add-On 2 UPC-E Add-On 5 GS1 DataBar Omnidirectional GS1 DataBar Truncated GS1 DataBar Stacked GS1 DataBar Stacked Omnidirectional GS1 DataBar Limited GS1 DataBar Expanded GS1 DataBar Expanded Stacked	
In addition O2I3xx	**Composite*)**
GS1 DataBar Omnidirectional	●
GS1 DataBar Truncated	●
GS1 DataBar Stacked	●
GS1 DataBar Stacked Omnidirectional	●
GS1 DataBar Limited	●
GS1 DataBar Expanded	●
GS1 DataBar Expanded Stacked	●
GS1 - 128	–
MSI Barcode	–

*) Composite is an extension of a 1D bar code by an additional 2D code. The 2D code can contain extended information about the product.

► If the code type to be recognised is not known, select [Automatic recognition].

Pharma code and MSI code are not supported by the automatic recognition.
These code types can only be set manually.

Depending on the volume of the image information to be processed, automatic code recognition may take several seconds.

> The result field shows the code type and the number of codes recognised.

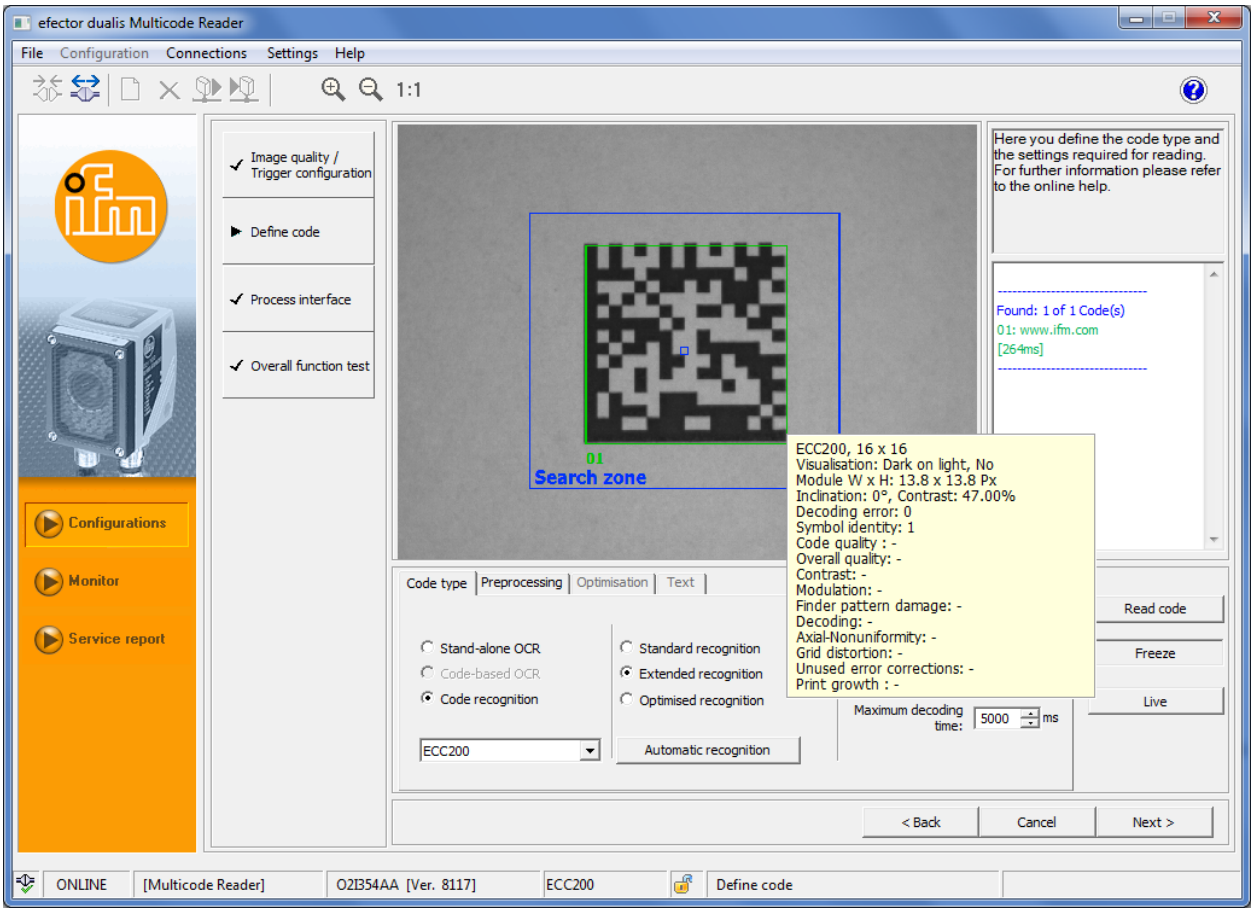
► Select [Read code].

> The result field shows:
Number of codes found (figure)
Number of codes searched (figure)
Code string (content)
Read time (ms)
Total time (ms)

► Optimising the search zone by reducing or shifting it.
Verify the effects on the read time in the result field with [Read code].

> The recognised codes are displayed in a green, numbered code field.

> When the mouse pointer is moved above the green code field, a tool tip will open giving specific code information (here e.g. code type, status of code recognition, polarity, code size, etc.).



► Continue to the next step "Process interface" with [Next].

If code recognition and the read process were not successful, repeat the process with the filter functions of "Preprocessing" (→ 8.3).

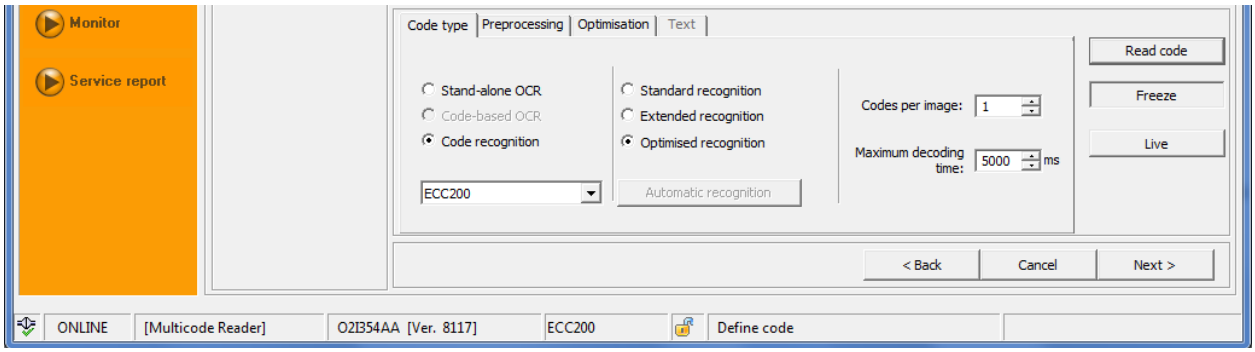
If this setting is not successful, either, repeat the process with the setting "Optimised recognition" (→ 8.1.2).

8.1.2 Optimisation (e. g. ECC200)

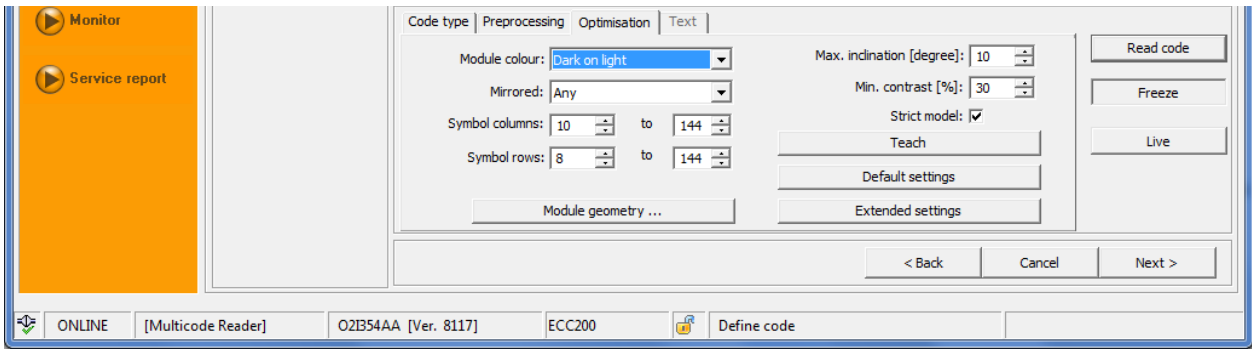
Code-specific read parameters are available for optimising the evaluation time.

► Select [Optimised recognition].

> The "Optimisation" tab is displayed
(change: grey → black).



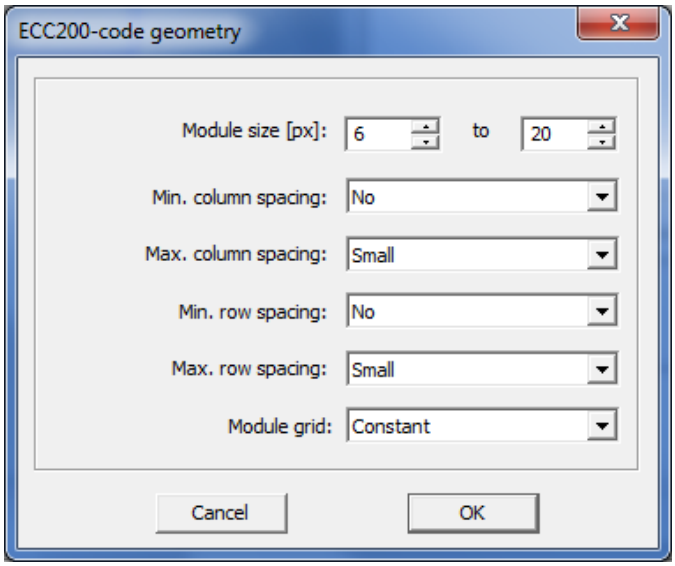
► Click on [Optimisation].
> Adjustable code-specific parameters are activated (here e.g. ECC200).



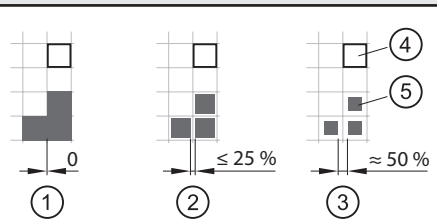
► Set code-specific parameters.

► Activate [Strict model] if the device should use only the set code parameters for read. This feature can be used for finding codes with certain characteristics in the image while differing codes are ignored. If this menu item is deactivated, the device will first try to perform reading with the set parameters. If this is not successful, all possible code parameters will be processed automatically.

[Teach] adopts the recognised module geometry (module colour, symbol columns etc.).
[Default settings] and [Extended settings] reset the parameters.



The min/max indications for column and row spacing are to be interpreted with regard to the cell size.

Column/row spacing	Meaning		
No	No spacing between two neighbouring printed modules.	1	
Small	The spacing between two neighbouring printed modules is max. approx. 25% of the cell width/height.	2	
Large	The spacing between two neighbouring printed modules is max. approx. 50% of the cell width/height.	3	

1: no column/row spacing
2: small column/row spacing
3: large column/row spacing
4: cell (is ideal module width/height)
5: printed module

► Check the reading results and times in the result field with [Read code].

► Continue to the next step "Process interface" with [Next)] (→ 9).

8.2 Text recognition (only O2I35x)

In addition, the devices of the O2I35x series support the reading of texts (OCR).

The text recognition supports the following functions:

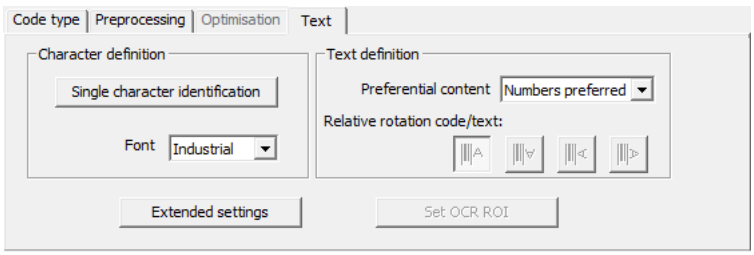
– Read free-standing texts (Stand-alone OCR)

– Read texts by means of a reference object (Code-based OCR)

8.2.1 Stand-alone OCR

► Select [Stand-alone OCR] in the tab "Code type".

> The tab "Text" is activated and displayed.

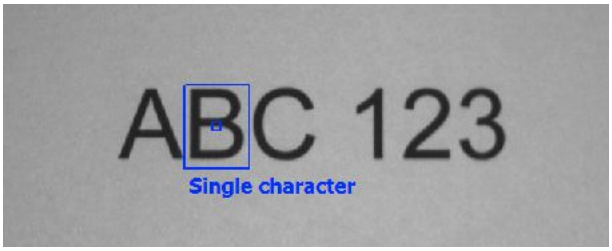


Teach text parameters

The configuration software supports the automatic recognition of the required read parameters.

► Click on [Single character identification] in the section "Character definition".

► Drag an"individual character" bounding box around an individual character of the text to be recognised.



Select a character with a typical height and width of the selected font. "2" or "B" obtain a better result than "1" or "I", since they are too narrow.

For optimum results the text to be recognised should be min. 70 pixels high. Move the multicode reader closer to the target text if the characters appear to be too small.

► Click on [Finish character identification].

> The read parameters are set and the image rotation is aligned to the text.

Select the font

► Select the required font.

Font	Description
Industrial (default setting)	Recognises characters in Arial, OCR-B or other sans-serif fonts.These fonts are usually used on signs or the like. Available special characters: - / + . $ % * e £ ¥
DotPrint	Recognises characters that were printed by dot matrix printers. Lower case characters are not recognised.
Document	Recognises characters in Arial, Courier or Times New Roman These fonts are usually used in documents or letters. Please note that the characters "I" and "1" cannot be distinguished in the Arial font. "I" may be recognised as "1" and vice versa. Available special characters: - = + < > . # $ % & ( ) @ * e £ ¥

Select the text content

► Select the preferential content in the section "Text definition".

Preferential content	Permitted characters
Numbers preferred	0-9 (i.e. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9)
Capital letters preferred	Capital letters of the English alphabet
Letters preferred (default setting)	Capital and small letters of the English alphabet
Letters and numbers	All characters of "Numbers preferred" and "Letters preferred"
Anything	All characters
Regular expression...	Opens the "Extended..." dialogue to create a regular expression

Test the settings

► Click on [Read char] to check if the text is correctly recognised.

> The recognised text is displayed in a green, numbered text field.

► If necessary, adapt the search zone by reducing or shifting.By clicking on [Read Char] again check the effect on the read time in the result window.

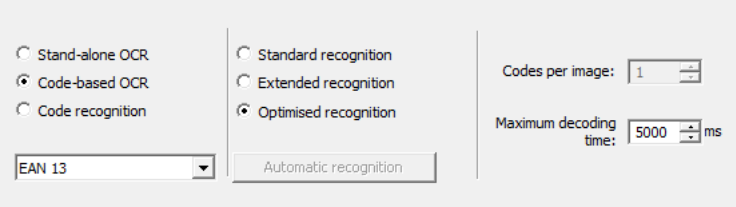
If the text is not correctly recognised, the read settings can be further refined in the extended settings (→ 8.2.3)

8.2.2 Code-based OCR

The function "Code-based OCR" permits reading of texts within a region that is determined by the bounding box of a reference code and its relative position to the text. By evaluating this position information the size of the text search zone can be decreased so as to improve the recognition time.

Supported 1D bar codes:
Interleaved 2-of-5 Industrial 2-of-5 Code 39 Code 93 Code 128 Pharma code Codabar EAN8 EAN8 Add-On 2 EAN8 Add-On 5 EAN13 EAN13 Add-On 2 EAN13 Add-On 5 UPC-A UPC-A Add-On 2 UPC-A Add-On 5 UPC-E UPC-E Add-On 2 UPC-E Add-On 5 GS1 DataBar Omnidirectional GS1 DataBar Truncated GS1 DataBar Stacked GS1 DataBar Stacked Omnidirectional GS1 DataBar Limited GS1 DataBar Expanded GS1 DataBar Expanded Stacked GS1 - 128 MSI bar code

► In the tab "Code type" select the reference code in the pulldown menu.



► Select [Code-based OCR].

Code-based OCR can only be selected if a reference code is found in the image.

> The tab "Text" is displayed.

► Follow the steps "Teach text parameters", "Select the font" and " Select the text content" in (→ 8.2.1 Stand-alone OCR).

Set text rotation depending on the reference code

In the section "Text definition" the text orientation can be set relative to the reference code in steps of 90°.

► Select the required orientation via the buttons.

Setting	Example
Default 	TEXT 
Rotated by 180° 	 ƚXƎƚ

Setting	Example
Rotated by -90° 	TEXT 
Rotated by +90° 	 TEXT

Create OCR regions

► Click on [Set OCR ROI].

> The bounding box of the reference code is detected and the image is automatically aligned.

► Drag the bounding box of the "Search zone OCR" around the text to be detected.

► Click on [Set OCR ROI] again.

> The OCR region has been created.

Test the settings

► Click on [Read Char] to test if the text is correctly recognised.

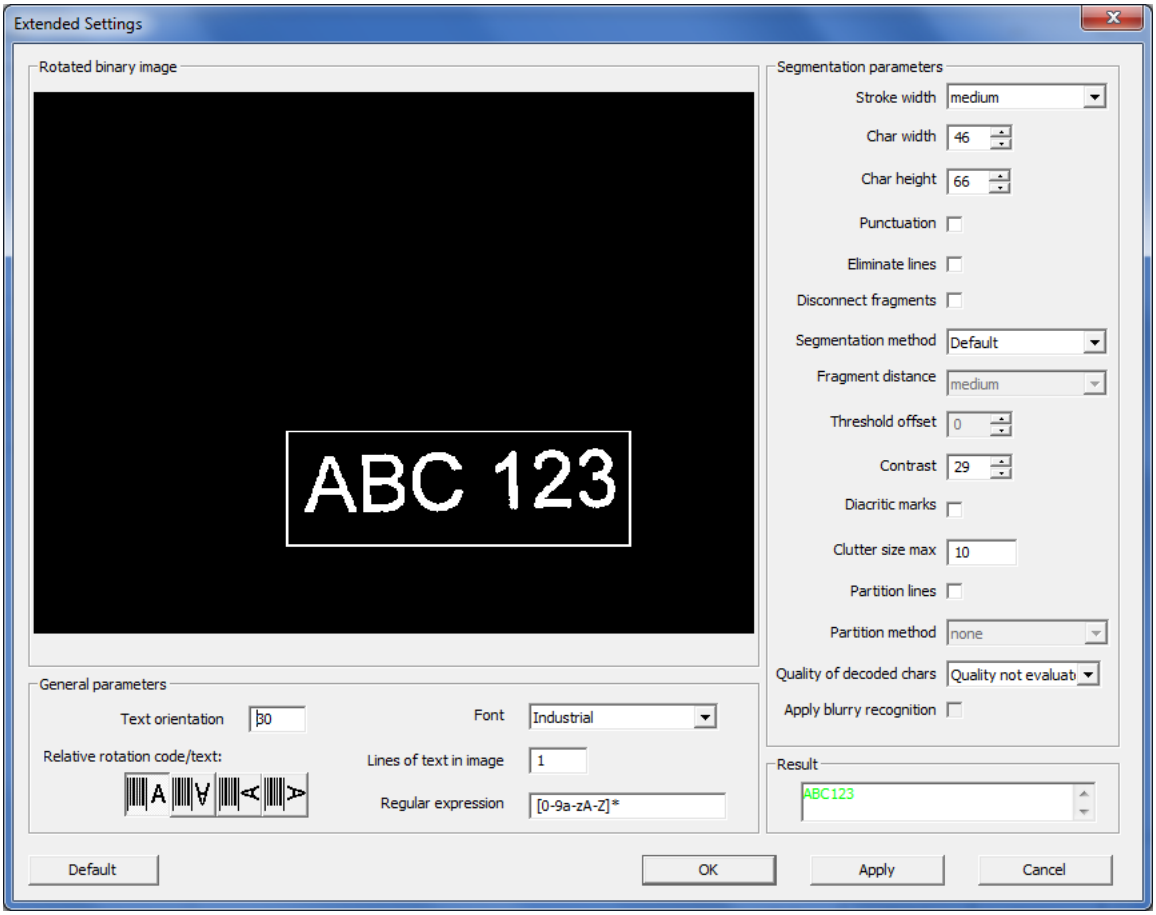
> The code and the recognised text are displayed in a green, numbered text field as result 1 and result 2.

► If necessary, adapt the search zone by reducing or shifting.By clicking on [Read Char] again check the effect on the read time in the result window.

If the text is not correctly recognised, the read settings can be further refined in the extended settings (→ 8.2.3)

8.2.3 Extended settings

In the dialogue "Extended settings" the parameters for text recognition can be further refined.



General parameters

Parameter	Description
Text orientation	Determines the orientation of an individual text line or a paragraph relative to the horizontal image axis. Range: 0...45 degrees (default setting: 30)
Lines of text in image	Defines the max. number of text lines. Range: 0...10 (default setting: 1)
Regular expression	Defines a regular expression as recognition criterion (→ 9.1.2 Regular expression)
Font	Defines the font of the text to be detected.

Only text with an orientation between +45° and -45° can be recognised.

Segmentation parameters

Parameter	Description
Stroke width	Stroke width of a character. Possible values: bold, light, medium, ultra light (default setting: medium)
Char width	Average width of a character. Range: 10...640 pixels (default setting: 130)

Parameter	Description
Char height	Approximate height of the text lines in the defined region. Range: 10...640 pixels (default setting: 130)
Punctuation	This parameter permits the recognition of punctuation marks (e.g. .,:´”!?/()[]-). If the parameter is deactivated, punctuation marks are ignored. Default setting: deactivated
Eliminate lines	This parameter should be activated if the character recognition is disturbed by horizontal and vertical lines. Default setting: deactivated
Disconnect fragments	This parameter should be activated if the characters to be recognised are fragmented, i.e. a character is not coherent but separated into several parts. Example: If instead of a small "i" a small "l" is recognised, this check box should be activated. Default setting: deactivated
Segmentation method	This parameter controls the segmentation, i.e. the differentiation between text and background in the defined region of the image (ROI). The segmentation methods assume that the text is darker than the background. Possible values: – Default setting: This method detects text that deviates locally from the background. This is the preferred method for highly textured backgrounds. – Noise reduction: The minimum contrast is set automatically to reduce the number of the very small regions. This method is particularly suited for very noisy images. Default setting: default
Fragment distance	This parameter influences the connection of character fragments. If too many fragments are connected, the parameter should be set to "narrow" or "medium". If too few fragments are connected, the parameter should be set to "medium" or "wide". This parameter can only be configured if the parameter "Disconnect fragments" is activated. Default setting: medium
Threshold offset	Value to adapt segmentation. This parameter can only be configured if the parameter "Segmentation method" is set to "Noise reduction". Range: 0...45 (default setting: 0)
Contrast	Minimum difference of the grey-scale value between text and background. This parameter can only be configured if the parameter "Segmentation method" is set to "Default". Range: 1...255 (default setting: 10)
Diacritic marks	This parameter permits the recognition of diacritic marks (e.g. pronunciation or stress marks such as é, á). If the parameter is deactivated, the diacritic marks are ignored. Default setting: deactivated
Clutter size max	This value should be increased if the closer environment of the character to be detected contains clutters (small regions). Range: 1...100 (default setting: 10)

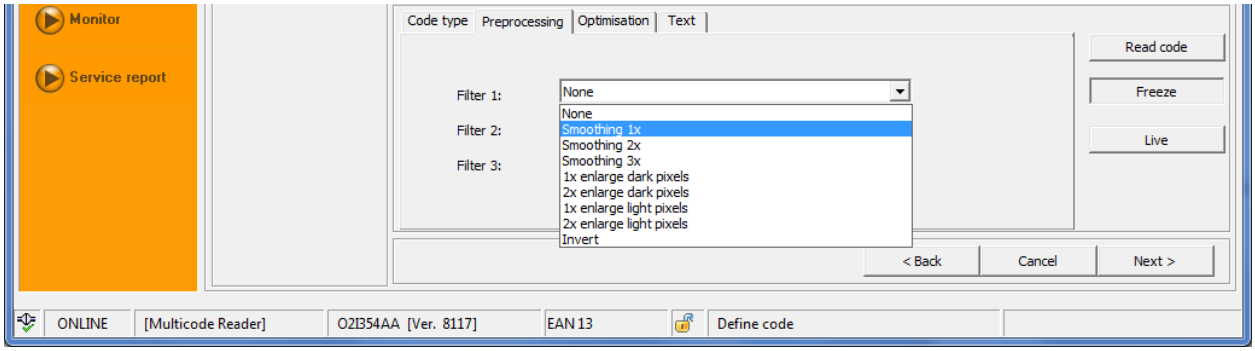
Parameter	Description
Partition lines	This parameter should be activated if neighbouring characters or characters from different text lines are connected with each other. Default setting: deactivated
Partition method	This parameter controls the partition of neighbouring, interconnected characters. This parameter can only be configured if the parameter "Partition lines" is activated. Possible values: – none: A partition is not carried out. – fixed_width: A constant character width is assumed for the partition. The partition begins with the left edge of the region. – variable_width: The characters are separated at the point of the thinnest connection. This method should be used for fonts with variable character length or for several consecutive, interconnected characters. Default setting: none
Quality of decoded chars	Via this parameter it is possible to exclude characters that were only insufficiently recognised from further processing. The character quality is a percentage value that reflects the difference between the detected character and an ideal reference character. The higher the value, the better the quality of the detected character. Possible values: – Quality not evaluated: There is no evaluation. – Characters of minor quality: Characters of a quality of less than 90 % are rejected during text recognition. – Characters of medium quality: Characters of a quality of less than 95 % are rejected during text recognition. Default setting: Quality not evaluated.
Apply blurry recognition	This parameter permits the replacement of low-quality characters with a placeholder "?" instead of rejecting them. This parameter can only be configured if the parameter "Quality of decoded chars" is set to "Characters of minor quality" or "Characters of medium quality". Default setting: deactivated

8.3 Preprocessing (filter functions)

In difficult applications that cannot be read with the standard or extended recognition, filter functions can be used.
This may, for example, be the case for codes on curved, reflective surfaces or for codes with heavy soiling or for inversely printed codes.

► Select the tab [Preprocessing].

► Select the filter function(s).
> The effect of a filter function can be seen directly in the image field.



Filter functions	Description
Smoothing	Smoothing filter Removes/suppresses noise and noise pixels (filter intensity divided into 1x, 2x, 3x)
Enlarge dark pixels	Correction of modules that are too small Enlarges/combines dark pixel groups Decreases/removes light pixel gaps (filter intensity divided in 1x, 2x)
Enlarge light pixels	Correction of modules that are too large Enlarges/combines light pixel groups Decreases/removes dark pixel groups (filter intensity divided in 1x, 2x)
Invert	Inversion of the brightness values (black/white → white/black)

A combination of up to 3 filters ensures optimisation for special cases. The individual filter functions are applied to the field of view one after the other.

Each filter function requires some calculation time and decreases the obtainable read rate in the process.

► Return to the initial menu by clicking on the tab [Code type].

► Define the number of codes in the search zone [Codes per image].
(Codes of the same type!)

► Select the code type in the pulldown menu.
If the code type to be recognised is not known, select [Automatic recognition].
> The image in the reading range changes from "Live" to "Freeze".
> The recognised code type is displayed in the result field.

► Select [Read code].
> The result field shows:
Number of codes found (figure)
Number of codes searched (figure)
Code string (content)
Read time (ms)
Total time (ms)

► Continue to the next step "Process interface" with [Next] (→ 9).

If code recognition and the reading process were not successful, repeat the process with other filter functions.

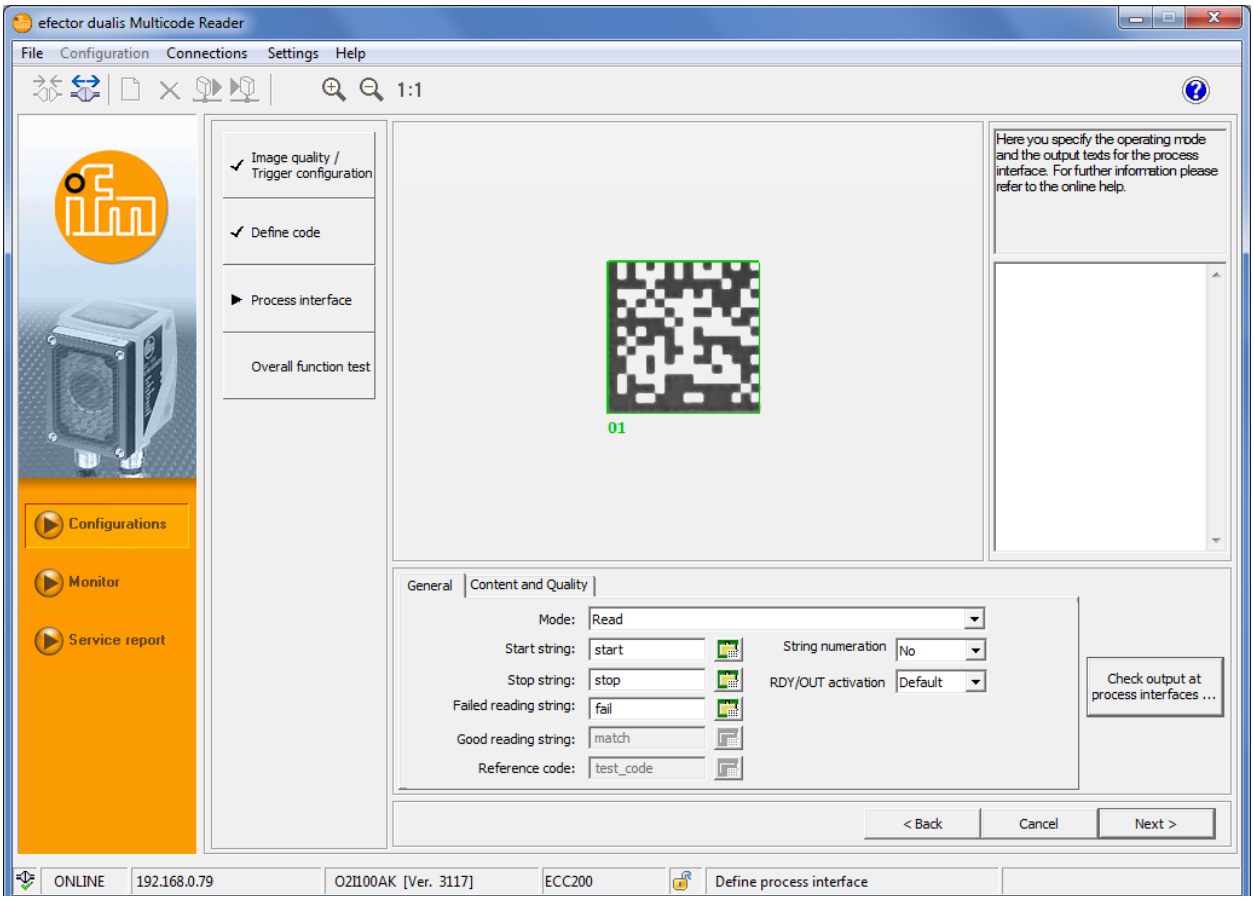
► Select [Optimisation...] if the read process and the evaluation time are to be further optimised (→ 8.1.2).

UK

9 Configuration step "Process interface"

9.1 Mode (process performance)

► Select the process performance of the device at [Mode].



Mode	Performance
Read	Code content is read and transmitted.
Compare	Code content is compared with a reference code. (no 1:1 match = failed reading) If the stand-alone OCR is used, only the text contents are compared. **Note:** The comparing function only considers the first result found.
Compare (ignore case)	
Pattern recognition	Code content is compared with a reference code. This reference code may contain placeholders (→ 9.1.1) (no match = failed reading).
Pattern recognition (ignore upper / lower case)	
Regular expression	Code content is compared with a regular expression. This reference code may contain placeholders (→ 9.1.2) (no match = failed reading).
Regular expression (ignore upper / lower case)	

► Activate function "String numeration" to add a consecutive number to start and stop characters.

Example:

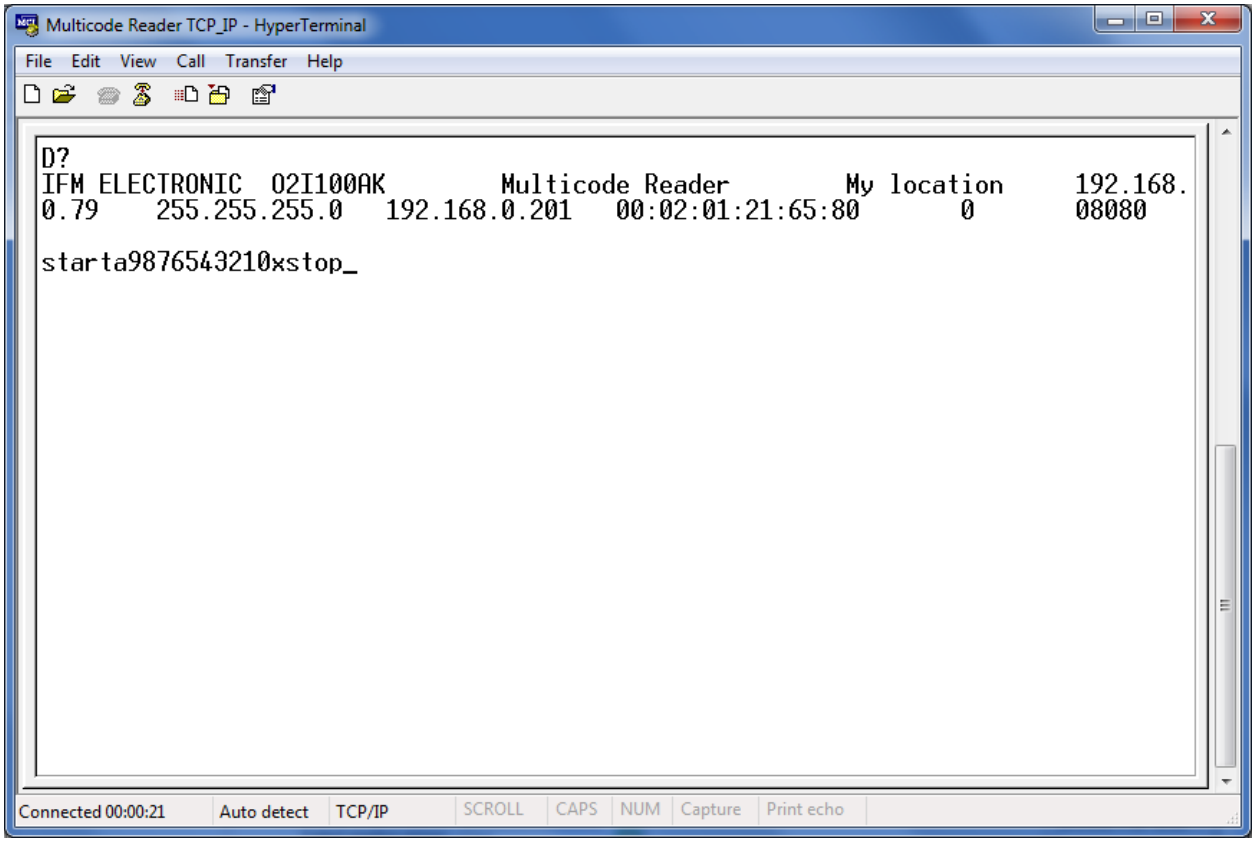
String of characters without numeration: **startMATCHstopstartMATCHstopstartMATCHstop**
String of characters with numeration: **start01MATCHstop01start02MATCHstop02start03MATCHstop03**

With the function "RDY/OUT activation" the status of the two switching outputs can be defined via the process interface (only O2I3xx).

– Default: Switching output "OUT" = code evaluation, switching output "RDY" = ready signal
– External: Set RDY/OUT via the process interface (→ 14.4.16)

► Test the entered character strings with [Check data transmission].

> In the area [Check process interface output] the entered character strings can be transferred to the processor as a test.



Process data protocol (→ 14)

If you use the text recognition function (OCR), a text string is displayed instead of "Multicode Reader" & "My Location".

Code-based OCR provides two results each. The first result contains the code content, the second the recognised text.

9.1.1 Pattern recognition

The code content is compared with a pattern in the reference code.
In the reference code, ? stands for any character, * for any character string.

Examples

Reference code	Code content	Result	Output
31-03-2009*	31-03-2009-ABCD	Good reading	Good reading string
	31-03-2008-ABCD	Bad reading	Bad reading string
31-0?-2009	31-03-2009	Good reading	Good reading string
	31-04-2009	Good reading	Good reading string
	31-10-2009	Bad reading	Bad reading string
31-0?-20*	31-03-2010	Good reading	Good reading string
31-0?-20*	31-10-2010	Bad reading	Bad reading string

The case can be ignored if set accordingly.

9.1.2 Regular expression

Regular expressions are a kind of filter criterion for texts. They ensure that character strings are verified for a certain composition.

Example 1
Specification of a range of numbers as good reading, without having to explicitly indicate all numbers.

Reference code	Code content	Result	Output
31-03-200[7-9] i.e. characters 7, 8 and 9 allowed	31-03-2009	Good reading	Good reading string
	31-03-2008	Good reading	Good reading string
	31-03-2006	Bad reading	Bad reading string
31-[0-3]{0.1}[0-9]-2009 i.e. characters 0 to 3 may exist 0 times or once, followed by characters 0 - 9	31-03-2009	Good reading	Good reading string
	31-3-2009	Good reading	Good reading string
	31-43-2009	Bad reading	Bad reading string

Example 2
Access to parts of a code

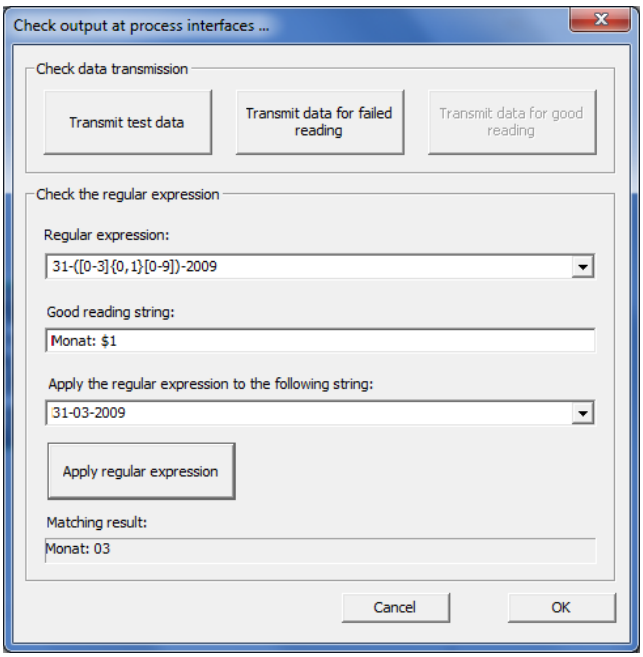
Required information:
Reference code: 31-([0-3]{0,1}[0-9])-2009
Good reading string: : month: $1 ($1 stands for the 1st expression in round brackets)
Bad reading string: fail

Reference code	Code content	Result	Output	
31-([0-3]{0.1}[0-9])-2009	31-03-2009	Good reading	Good reading string	month: 03
	31-3-2009	Good reading	Good reading string	month: 3
	31-43-2009	Bad reading	Bad reading string	fail
	31-143-2009	Bad reading	Bad reading string	fail

The case can be ignored if set accordingly.

For a syntax description and more information e.g. on the internet see en.wikipedia.org/wiki/Regular_expression

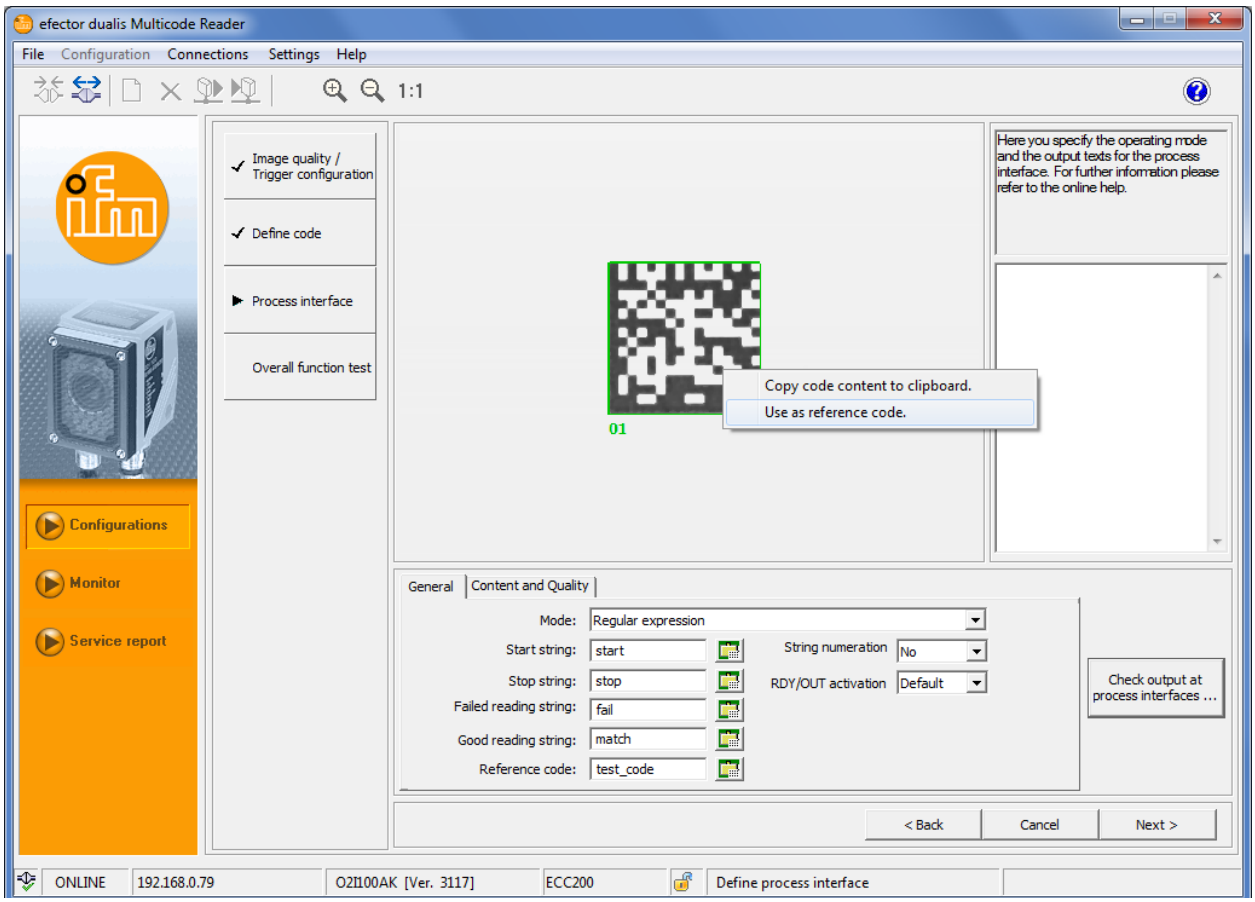
► Test a regular expression with [Check data transmission].
Any character string or a code content already read (→ 9.1.3) can be checked with a regular expression.



9.1.3 Use code content as reference code

► Click into the code field with the right mouse button.
> The context menu opens.

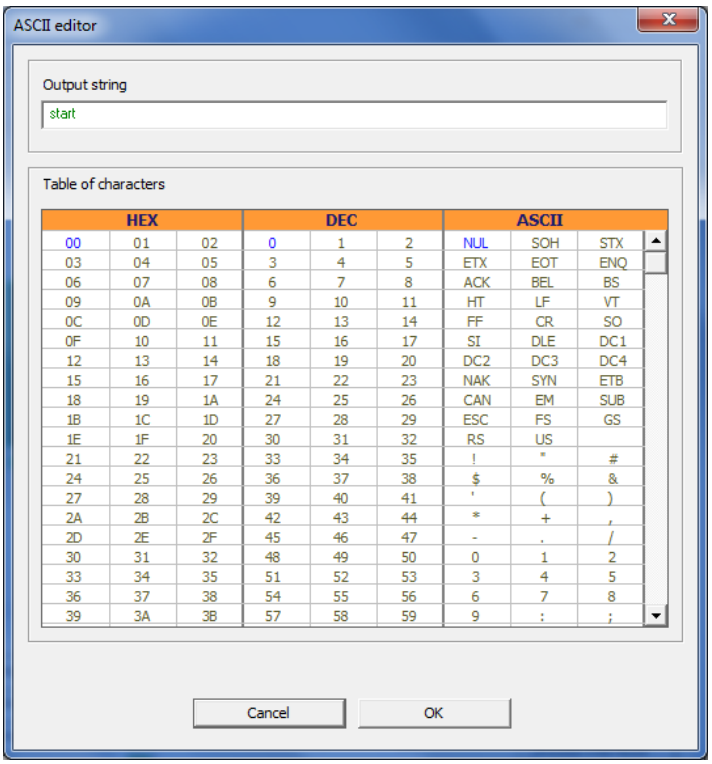
► Select [Use as reference code].



This function is available in the Compare, Pattern recognition and Regular expression modes.

9.1.4 Define character strings

► Define character strings (data strings).
An ASCII editor can be activated as an input assistant for each field → .



9.2 Process data content

In the tab "Content and Quality" you define which contents are to be transferred together with the process data.

► Activate "Transmit content description" to prepend a unique marking to each element of the result message (→ 14.7 Result output with description).

► Define with "Append configuration number" if the configuration number with which reading was successful, is automatically appended to the process data.

You can find information about more settings in the respective sub-chapters:

– Code position (→ 9.3)

– Image output (→ 9.4)

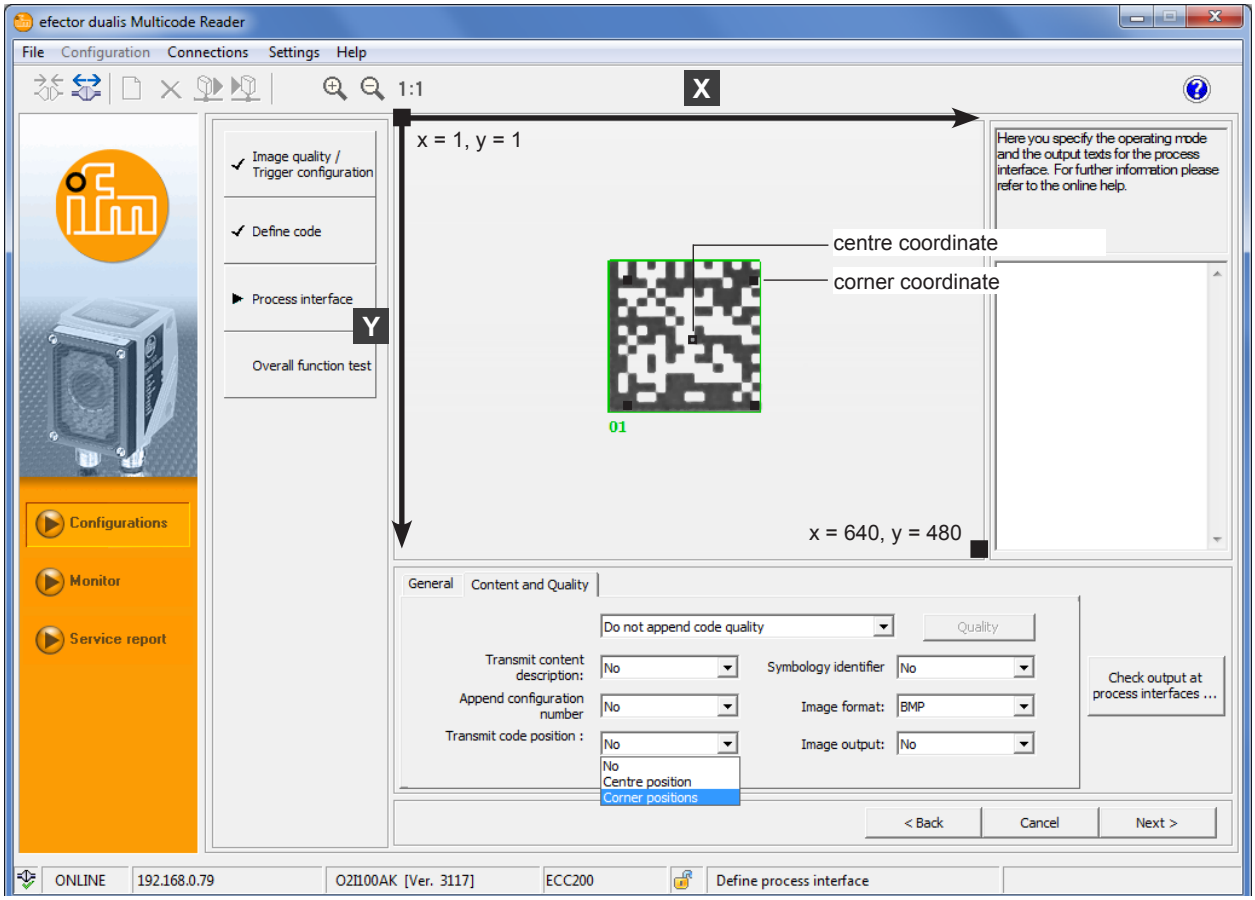
– Code quality (→ 9.5)

9.3 Code position

Irrespective of the set search zone the reference point of the code position is always the top left corner of the image (pixel coordinates: x=1, y=1).

The codes are output in the order top to bottom, left to right.

► Define the "centre coordinates" (= 1 pair of coordinates per code) or "corner coordinates" (= 4 coordinate pairs per code).



Example output format for 4 codes with corner coordinates

```
startc22220509;0181;0333;0185;0331;0110;0506;0105;stop
startc11110247;0188;0071;0189;0072;0112;0246;0113;stop
startc44440518;0416;0337;0419;0336;0338;0515;0334;stop
startc33330248;0421;0069;0424;0069;0344;0248;0342;stop
```

Result output see process data protocol (→ 14.6 und → 14.7)

9.4 Transmit image

► Activate [Image output] if the image captured is to be output via the process interface.

► Define the file format of the images via [Image format] (Windows BMP or JPEG).

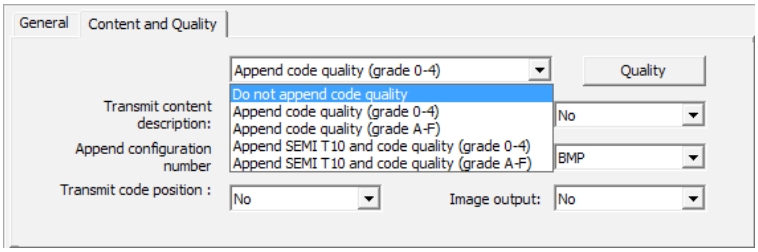
9.5 Code quality

There is an assessment of the code quality for the 2D code types ECC200, QR, PDF417, Micro QR and Aztec. For other code types the tab field [Quality] is suppressed.

Units of the O2I3xx series additionally support the evaluation of the code quality of 1D bar codes, see chapter (→ 9.5.2).

The SEMI T10 test method is only available for unit O2I300 to O2I305 in combination with the 2D code type ECC200 (→ 9.5.3).

► Select [Content and Quality].
► Select [Quality] (here e.g. ECC200 quality).
> The selection menu with quality features is displayed.



9.5.1 Evaluation of the code quality

The ISO/IEC15415 and ISO/IEC16022 standards define various features to assess the quality of an ECC200, QR, PDF417, Micro QR or Aztec code.

These quality features are analysed independently and rated in 5 steps.

Comparison ISO/IEC 15415 and ISO/IEC 16022:

Quality characteristic (acc. to standard)	Meaning (selection field)	ISO/IEC 15415	ISO/IEC 16022
Decoding		●	●
Symbol Contrast		●	●
Print Growth		–	●
Axial Nonuniformity		●	●
Unused Error Correction		●	●
Grid Nonuniformity		●	–
Fixed Pattern Damage		●	–
Modulation		●	–
Overall Quality		●	●

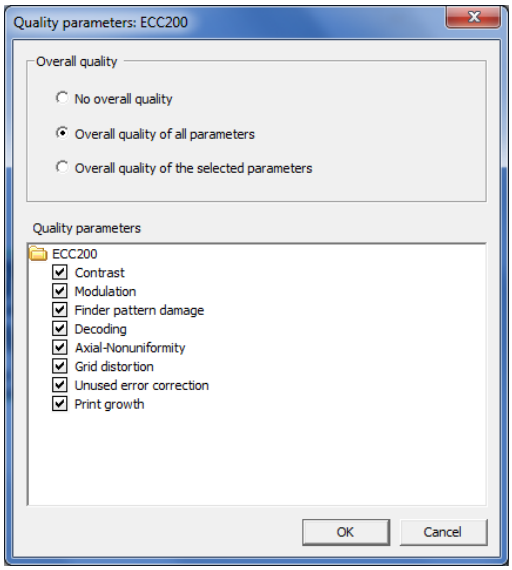
● = defined in standard / – not defined in standard

► Click on [Append code quality] if the selected quality features should be transferred with the process data.
Define if the assessment is to be effected in the steps 0...4 to ISO/IEC 15415 or in the steps A...F to ISO/IEC 16022.

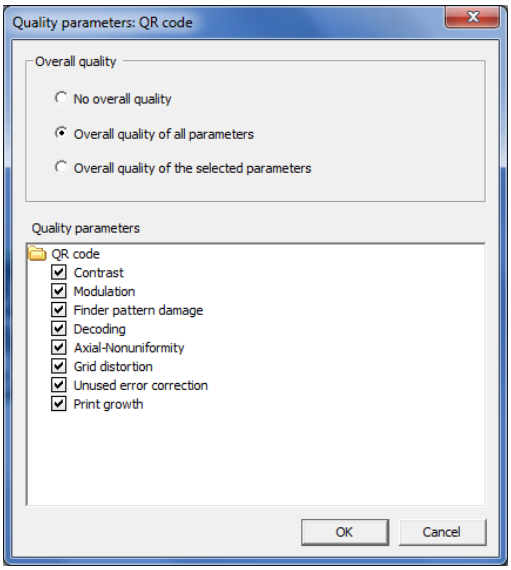
ISO/IEC 15415	ISO/IEC 16022	Description
4	A	passed, very good, highest quality level
3	B	passed ↓
2	C	passed ↓
1	D	passed ↓
0	F	not passed, lowest quality level

► Click on the desired quality features.
(Overall quality, Contrast etc.)

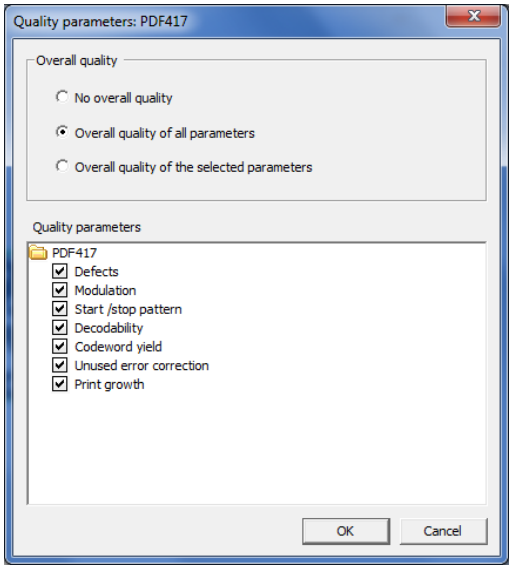
ECC200 quality features



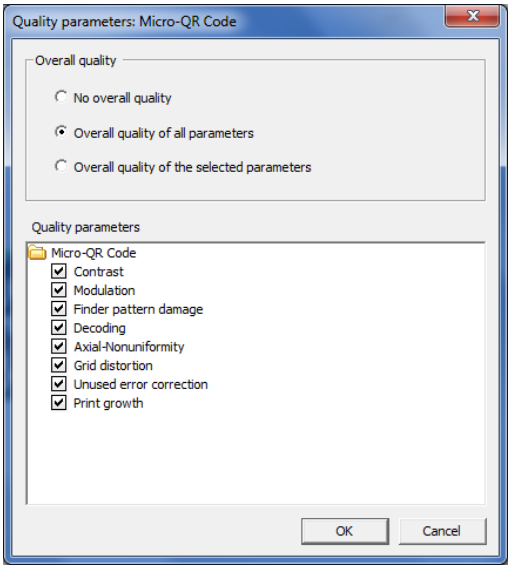
QR quality features



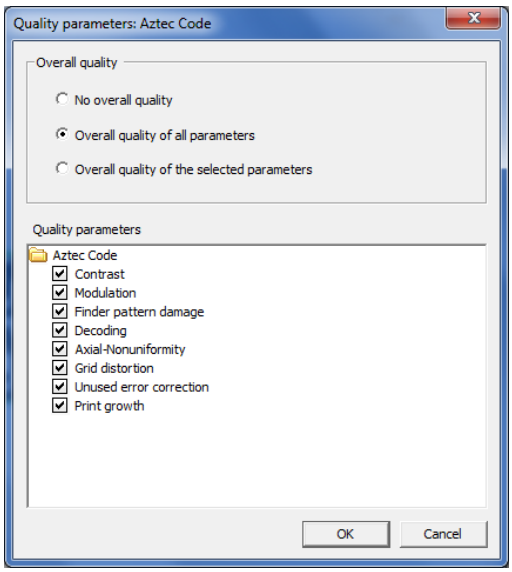
PDF417 quality features



Micro QR quality features



Aztec quality features



Overview and description:

Feature	Selectable								Description
	ECC200	QR	PDF417	Micro QR	Aztec	GS1 ECC200	GS1 QR	GS1 PDF417	
Symbol identifier	●	●	●	●	●	●	●	●	Used coding → 14.6 and → 14.7) Marking if the code contains FNCI and/or ECI characters.
Overall	●	●	●	●	●	●	●	●	Overall quality of the code. Corresponds to the individual feature with the worst rating.
Contrast	●	●	–	●	●	●	●	–	Contrast of the modules to the background.
Modulation	●	●	●	●	●	●	●	●	Homogeneity of the light and dark modules.
Finder pattern damage	●	●	–	●	●	●	●	–	Error rate in the 3 basic elements of the code (finder pattern, alternating pattern and quiet zone).
Decode	●	●	●	●	●	●	●	●	Rating 4 (A) if the code can be decoded, otherwise 0 (F).
Axial-Nonuniformity	●	●	–	●	●	●	●	–	Ratio of the module size in horizontal and vertical direction.
Grid distortion	●	●	–	●	●	●	●	–	A measure for how far the module corresponds to the symbol grid.
Unused error correction	●	●	●	●	●	●	●	●	A measure for the degree of distortion of the code and what part of the existing error correction mechanisms was necessary to nevertheless decode the code successfully.
Print growth	●	●	●	●	●	●	●	●	Ratio dark/light modules in alternating pattern
Defects	–	–	●	–	–	–	–	–	Assessment of the bar/gap representation of the code.
Start / stop pattern	–	–	●	–	–	–	–	–	Assessment of the start/ stop pattern.
Codeword yield	–	–	●	–	–	–	–	–	Assessment of the relative number of correctly decoded words.

● = feature relevant / – = feature not relevant

► Change to the next configuration step "Overall function test" with [Next] (→ 10).

9.5.2 Code quality of 1D bar codes

Units of the O2I3xx series support the evaluation of the code quality of the following 1D bar codes:

- Interleaved 2-of-5, Industrial 2-of-5
- Code 39, Code 93, Code 128
- EAN8, EAN8-Add-On 2, EAN8-Add-On 5
- EAN13, EAN13-Add-On 2, EAN13-Add-On 5
- UPC-A, UPC-A Add-On 2, UPC-A Add-On 5
- UPC-E, UPC-E Add-On 2, UPC-E Add-On 5
- GS1 - 128
- MSI bar code
- Codabar
- Pharma code
- GS1 Databar

Overview of the quality parameters (except GS1 Databar)

Element	Quality parameter
0	Overall quality
1	Decode
2	Symbol contrast
3	Minimum reflection value
4	Minimal Edge contrast
5	Modulation
6	Defects
7	Decodability
8	Further requirements

The quality parameters for GS1 Databar bar codes are divided into three groups:

- Overall
- Linear
- Composite incl. subgroup composite RAP

The composite quality parameters are only available if the composite component is activated in "Define code" → "Optimisation" in the operating program (setting "Optional" or "Mandatory").

Overall quality

Element	Quality parameter
0	Overall quality
1	Overall quality linear
2	Overall quality composite

Linear

Element	Quality parameter
3	Decoding
4	Symbol contrast
5	Minimum reflection value
6	Minimal edge contrast
7	Modulation
8	Defects
9	Decodability
10	Further requirements

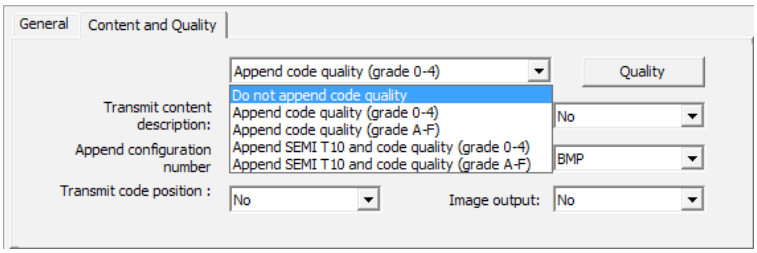
Composite

<table>
<tr><th>Element</th><th colspan="2">Quality parameter</th></tr>
<tr><td>11</td><td colspan="2">Decoding</td></tr>
<tr><td>12</td><td colspan="2">Overall quality RAP pattern</td></tr>
<tr><td rowspan="8"></td><td colspan="2">Composite RAP</td></tr>
<tr><td>Element</td><td>Quality parameter</td></tr>
<tr><td>13</td><td>Contrast</td></tr>
<tr><td>14</td><td>Minimum reflection value</td></tr>
<tr><td>15</td><td>Minimal Edge contrast</td></tr>
<tr><td>16</td><td>Modulation</td></tr>
<tr><td>17</td><td>Defects</td></tr>
<tr><td>18</td><td>Decodability</td></tr>
<tr><td>19</td><td colspan="2">Codeword yield</td></tr>
<tr><td>20</td><td colspan="2">Unused error correction</td></tr>
<tr><td>21</td><td colspan="2">Modulation</td></tr>
<tr><td>22</td><td colspan="2">Decodability</td></tr>
<tr><td>23</td><td colspan="2">Defects</td></tr>
</table>

9.5.3 Evaluation of the code quality to SEMI T10

The SEMI T10 test method can be used in addition to the ISO/IEC 15415 and ISO/IEC 16022 quality parameters.

The SEMI T10 test method is only available for unit O2I300 to O2I305 in combination with the 2D code type ECC200.



► Select [Content and Quality].

► Select the top dropdown menu.

> In the dropdown menu "Do not append code quality" is preset.

► Select [Append SEMI T10 and code quality (grade 0-4 / A-F)].

To assess the quality of an ECC200 code SEMI T10 provides various quality values The quality values are associated with defined quality parameters.

Overview of the quality parameters

Element	Quality parameter (meaning)	Quality parameter (group, acc. to standard)	Quality parameter (name, acc. to standard)	Quality parameter (details)
1	Location and orientation of the Data Matrix Symbol	Location and orientation of the Data Matrix Symbol	Data Matrix Location Descriptors	Coordinate of the image's corner points along with number of rows M and columns N.
			Data Matrix Grid	Divide the image into small grids M x N.
2	Symbol contrast	Symbol contrast	Symbol contrast	The value for symbol contrast reports the contrast between light and dark classified symbol pixels with respect to the full grey-value range (255 for by images) in percent.
3	Ratio symbol contrast / signal noise	Symbol contrast to SNR	Symbol Contrast Signal To Noise Ratio	Relative measure of the symbol contrast to the noise or maximum deviation in the light or dark grayscale level in the symbol.
4	Growth of the Data Matrix cells	Mark Growth	Horizontal Mark Growth	This parameter gives an idea of the actual size of the cell vs the observed size - horizontal difference in the cell size.
			Vertical Mark Growth	This parameter gives an idea of the actual size of the cell vs the observed size - vertical difference in the cell size.
5	Data Matrix Cell Size	Data Matrix Cell Size	Data Matrix Cell Height	Height of each cell in the grid.
			Data Matrix Cell Width	Width of each cell in the grid.
6	Data Matrix Mark Misplacement	Data Matrix Mark Misplacement	Horizontal Mark Misplacement	Displacement of the alternating pattern marks' center in horizontal direction in percent respect the cell width.
			Vertical Mark Misplacement	Displacement of the alternating pattern marks' center in vertical direction in percent respect the cell height.
7	Defects	Defects	Cell Defects	Percentage of identified image pixels with incorrect binary values.
			Finder Pattern Defects	Within the L pattern - percentage of identified image with incorrect binary values.
8	Unused Error Correction	Unused Error Correction	Unused Error Correction Value	Unused error correction values blockwise while decoding the 2D bar code.

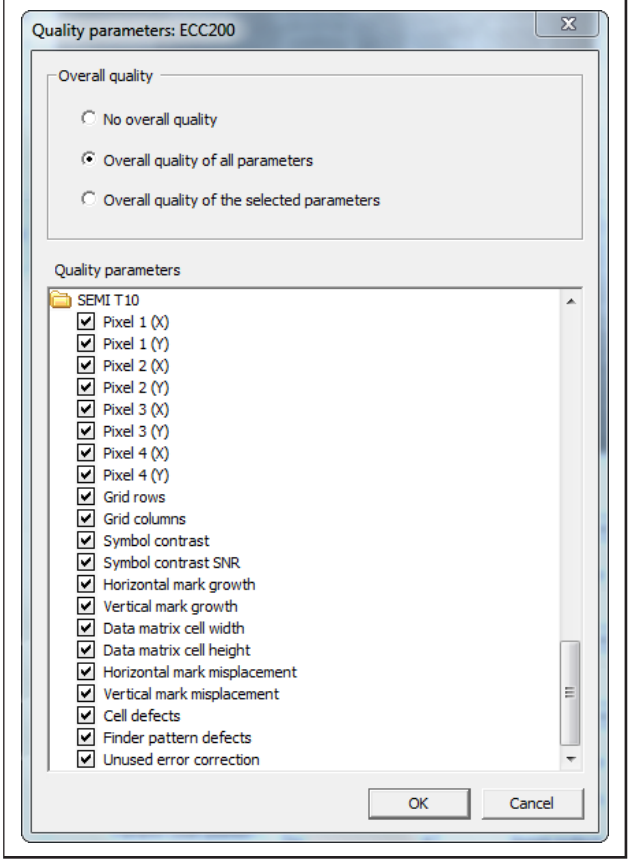
► Click on [Append code quality] if the selected quality parameters should be transferred with the process data.

Format of the quality values

Element	Quality parameter (name, acc. to standard)	Description of value	Value length	Example	Description of example
1	Data Matrix Location Descriptors	Corner 1 positions X and Y coordinates	4 Byte x 2	01250136	X=125, Y=136
		Corner 2 positions X and Y coordinates	4 Byte x 2	00440612	X=44, Y=612
		Corner 3 positions X and Y coordinates	4 Byte x 2	01230125	X=123, Y=125
		Corner 4 positions X and Y coordinates	4 Byte x 2	00030065	X=3, Y=65
	Data Matrix Grid	ECC200 N (rows)	4 Byte	0010	ECC200 rows=10
		ECC200 M (columns)	4 Byte	0010	ECC200 columns=10
2	Symbol contrast	Contrast between light and dark, in procent	4 Byte	0089	Contrast: 8,9 %
3	Symbol Contrast Signal To Noise Ratio	Ratio of contrast between light and dark modules	4 Byte	0311	Ratio of 3,11
4	Horizontal Mark Growth	Width of module respect module+space, in procent	4 Byte	0415	Value of 41,5 %
	Vertical Mark Growth	Height of module respect module+space, in procent	4 Byte	0325	Value of 32,5 %
5	Data Matrix Cell Height	Average module height	4 Byte	0020	Cell height avg = 20
	Data Matrix Cell Width	Average module width	4 Byte	0019	Cell width avg = 19
6	Horizontal Mark Misplacement	Misplacement respect the horizontal direction, in procent	4 Byte	0152	Value of 15,2 %
	Vertical Mark Misplacement	Misplacement in procent respect the vertical direction	4 Byte	0178	Value of 17,8 %
7	Cell Defects	procentage of incorrect clasified symbol pixels	4 Byte	0485	Value of 4,5 %
	Finder Pattern Defects	procentage of finder pattern pixels incorrectly clasified	4 Byte	0237	Value of 23,7 %
8	Unused Error Correction Value	Error correction capatibilies not used, in procent	4 Byte	0666	Value of 66,6 %

► Click on the required quality parameters (overall quality, contrast etc.).

SEMI T10 Quality parameters



► Change to the next configuration step "Overall function test" with [Next] (→ 10).

10 Configuration step "Overall function test"

This final step tests all settings of the new configuration.

► Click on [Test on].

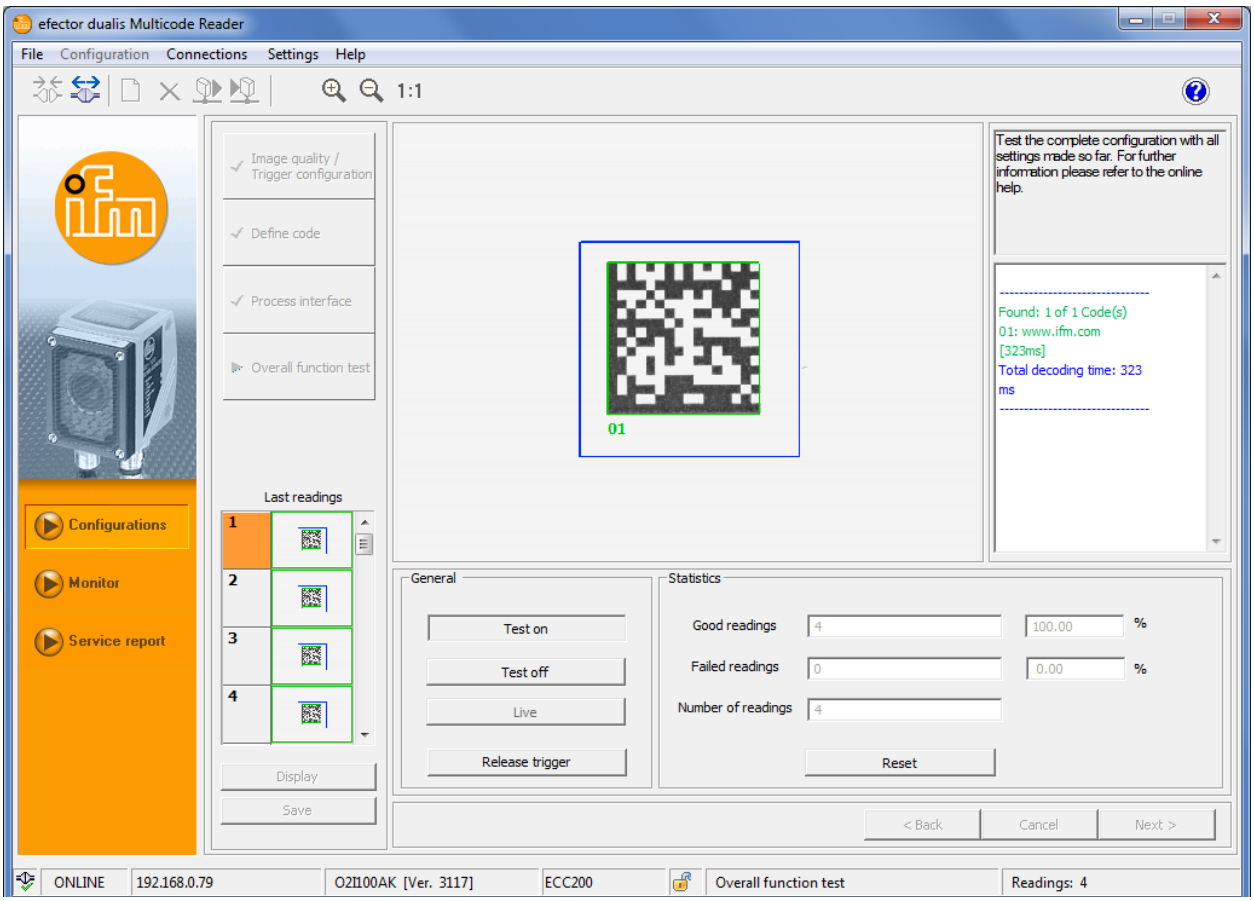
► Click on [Release trigger].

> The device performs reading on the basis of the previous settings.

> The result field shows:
Number of codes found (figure)
Number of codes searched (figure)
Code string (content)
Read time (ms)
Total time (ms)

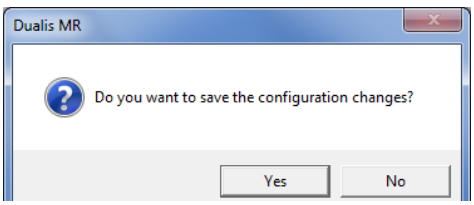
With internal triggering [Release trigger] is deactivated. Here the read process is continuous as soon as [Test on] is clicked on.

► To terminate click on [Test off].



► To confirm the configuration, click on [Next].

► Acknowledge the note with [Yes].



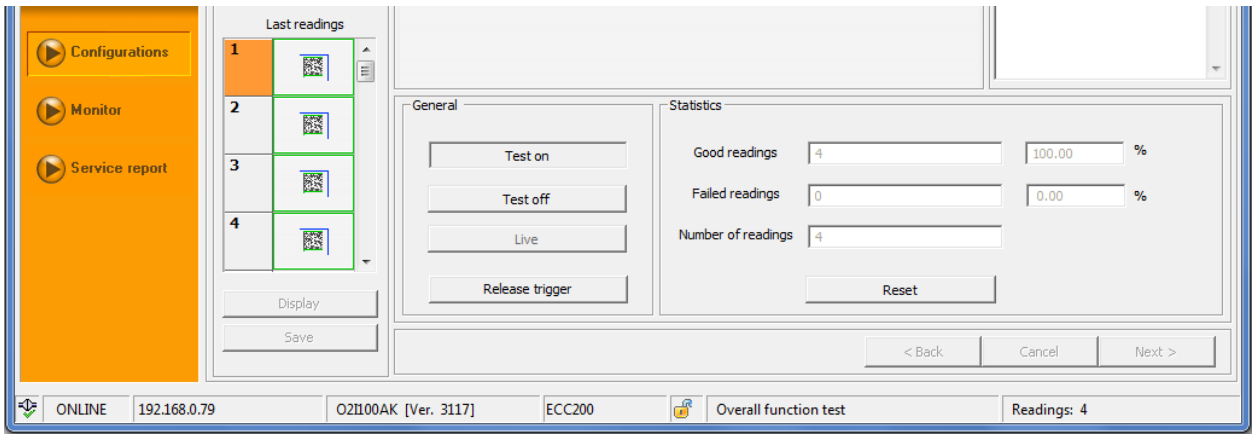
> The configuration is saved.
The program returns to the directory structure.
The newly created configuration is active.

10.1 Save the read result

The last 32 readings are recorded to the first-in-first-out principle. They can be selected individually and saved for evaluation purposes.

Visualisation (default setting): good reading = green, error = red (→ 5.3.2 Colours)

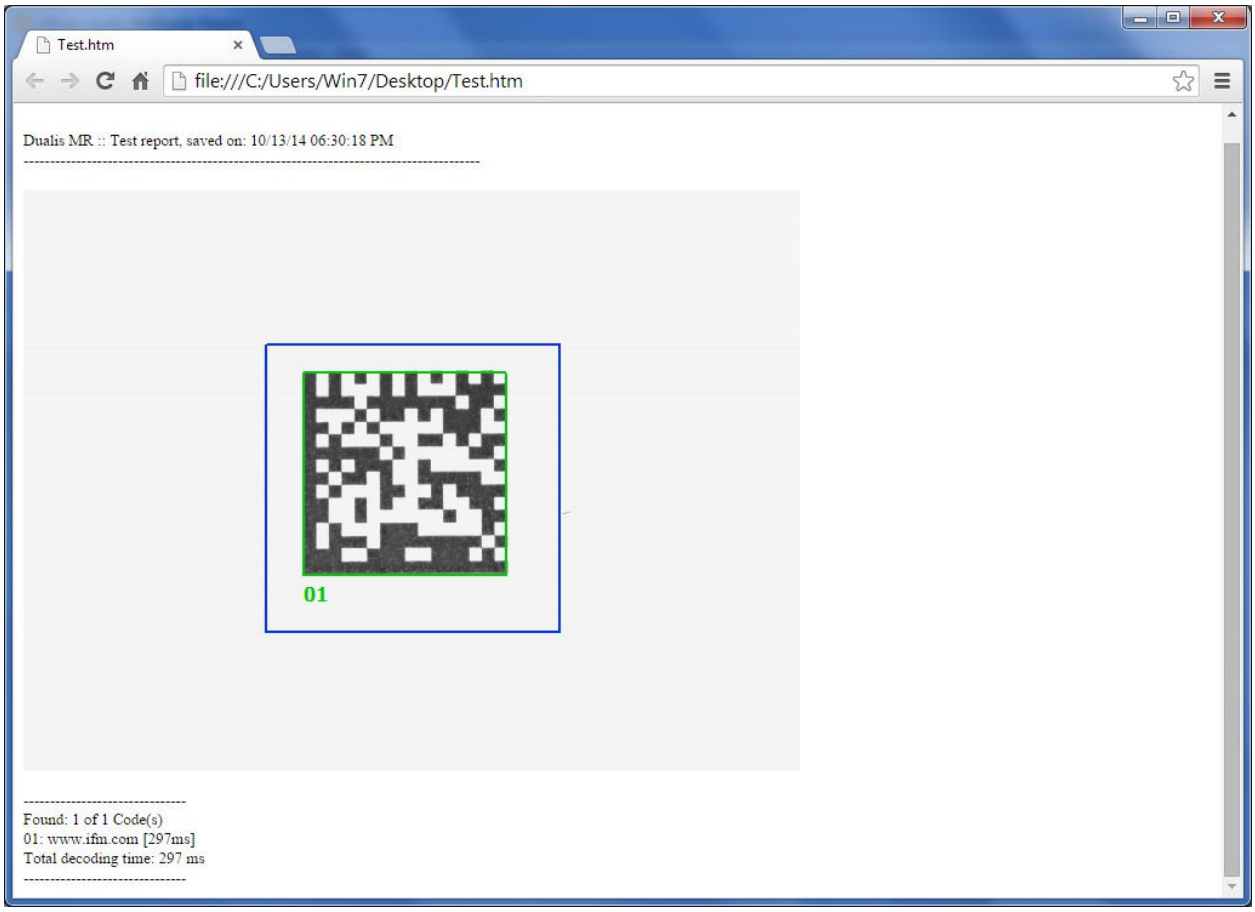
► Select required reading in the window "Last readings".



► Click on [Save].

► Define the memory location, assign a file name.

> The read result and the image are saved as HTML/XML or BMP file.
Display via any internet browser.



10.2 Delete the read results

► Click [Reset].

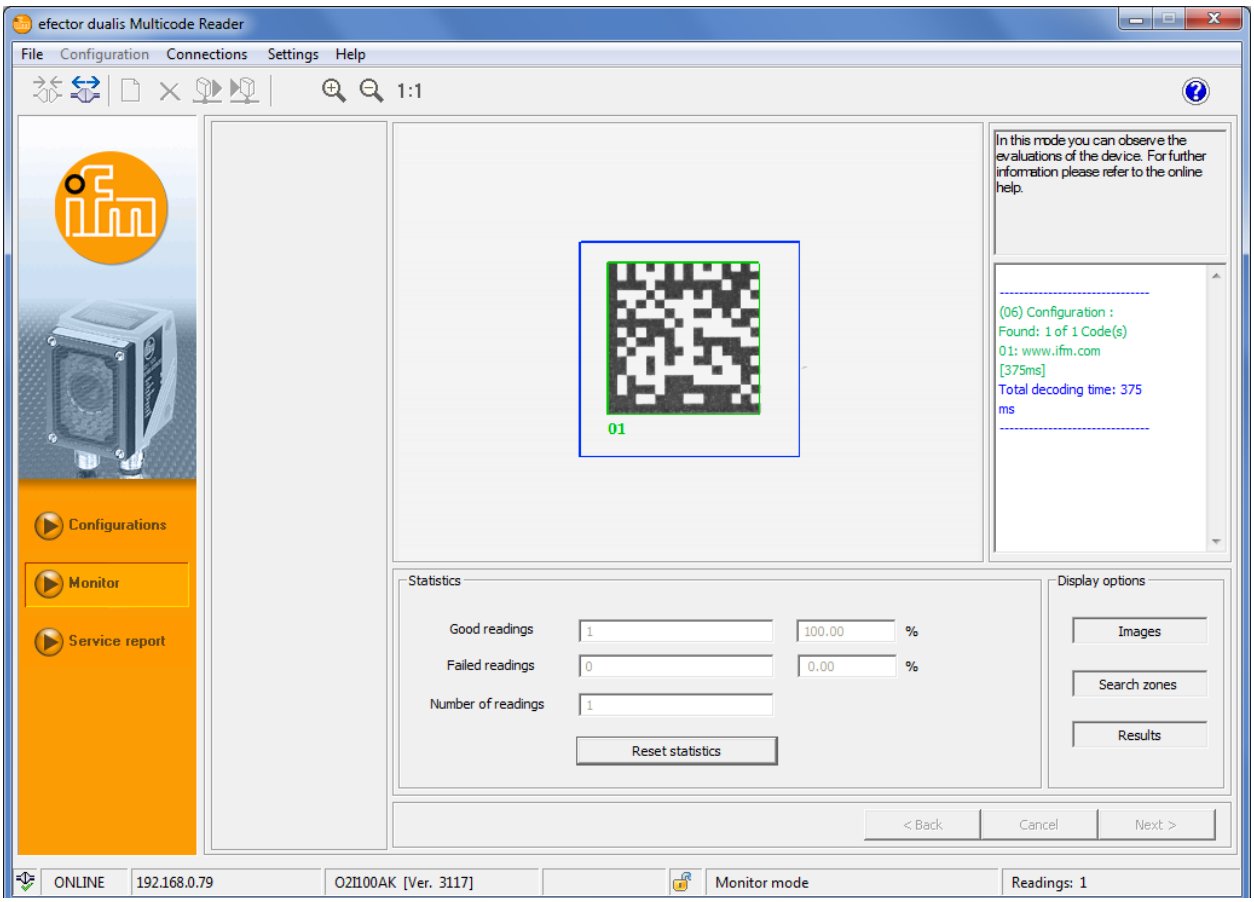
> The statistics are reset.
The read results and the image tank are deleted.
The window "Last readings" is blank.

11 Monitor mode

UK

In this mode the operation of the device is observed.

With each triggering the image captured is transferred to the operating program, displayed and evaluated. The respective read result is displayed in the result field.



The image transmission to the operating program reduces the read rate.

► Should the read results be saved or assessed, continue with a click on [Service report].

> The device stops the read process.
The monitor mode is exited.

12 Service report mode

Access to this mode can be locked by means of a password.
(→ 6.7 Password protection)

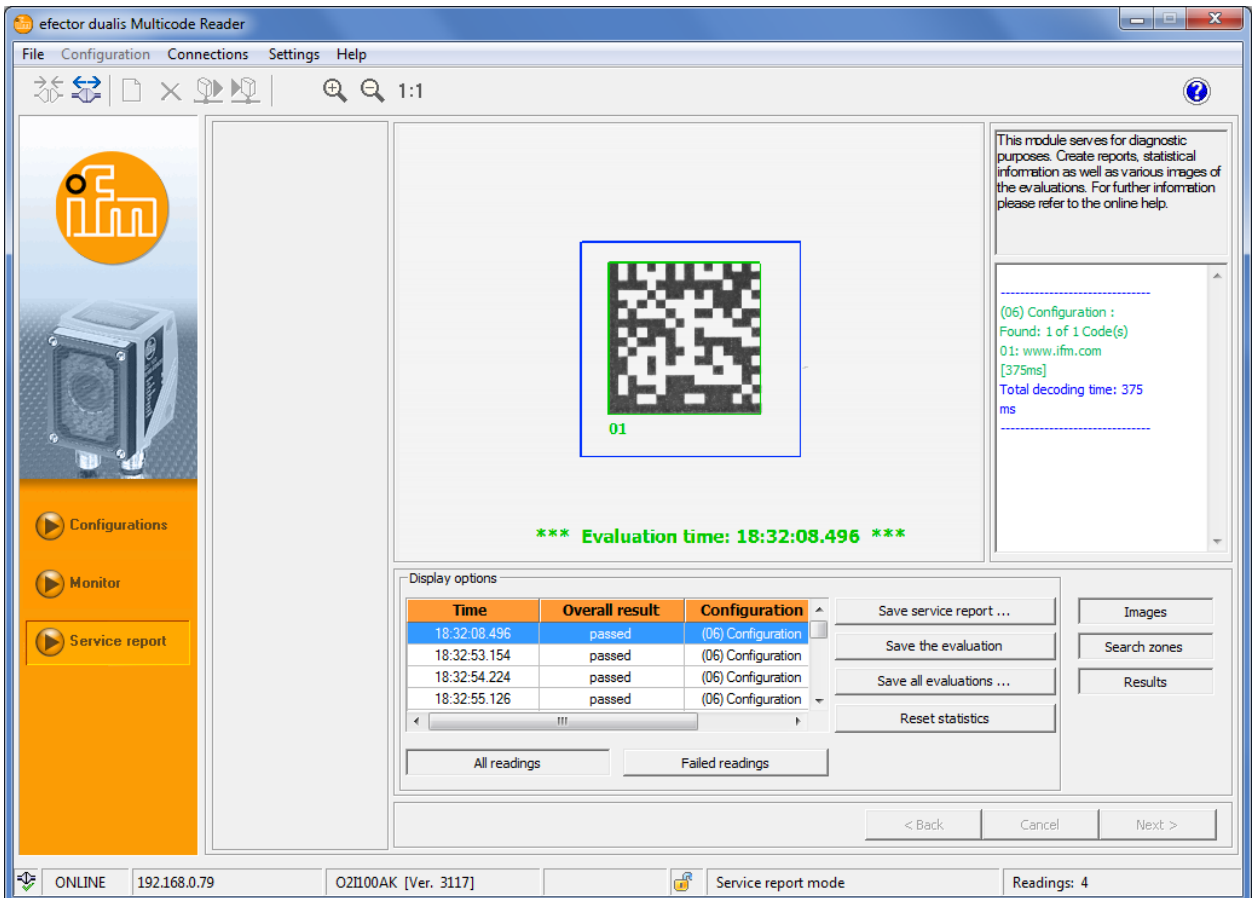
12.1 Evaluations

The read results obtained in the monitor mode can be saved locally as evaluation protocol.

12.1.1 Individual evaluations

► Define which evaluations are to be displayed in the protocol window with [All readings] or [Failed readings].

► Select the required evaluation in the protocol window.
> The selected evaluation is displayed in the monitor window and in the result field.



► Click on [Save the evaluation].

► Define the memory location and assign a file name.
> The evaluation and the image are saved.

12.1.2 All evaluations

► Click on [Save all evaluations …].

► Define the memory location and assign a file name.
> All evaluations and all images are saved.

12.2 Save service report

The service report saves the configuration of the device, the evaluation statistics (good/bad readings) and the last read results with image.

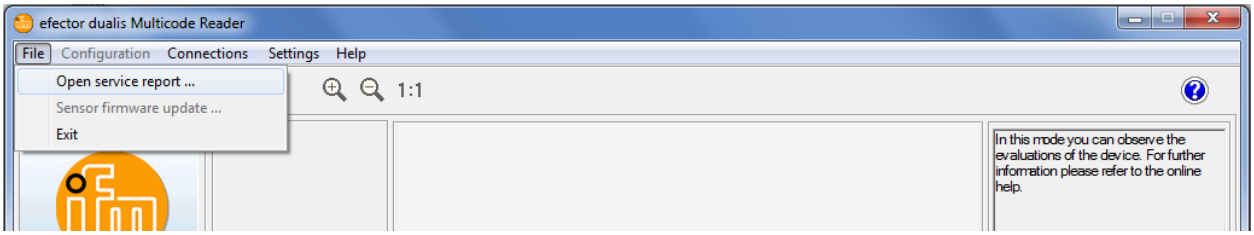
► Click on [Save service report …].

► Define the memory location and assign a file name.
> The service report (HTML/XML file and BMP files) is saved.

Display of the evaluations or service reports via any internet browser (here e.g. Microsoft Internet Explorer)

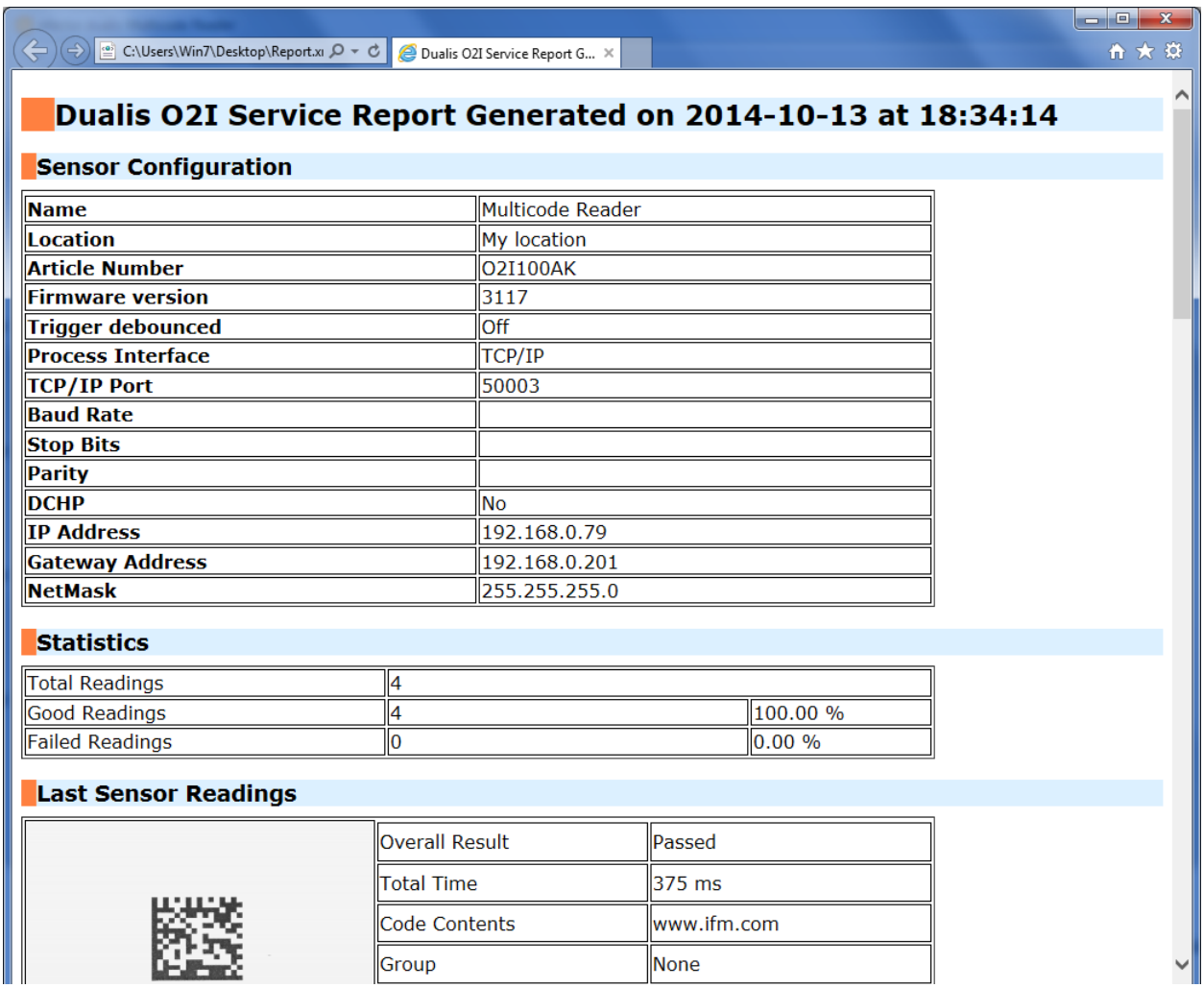
12.3 Open service report

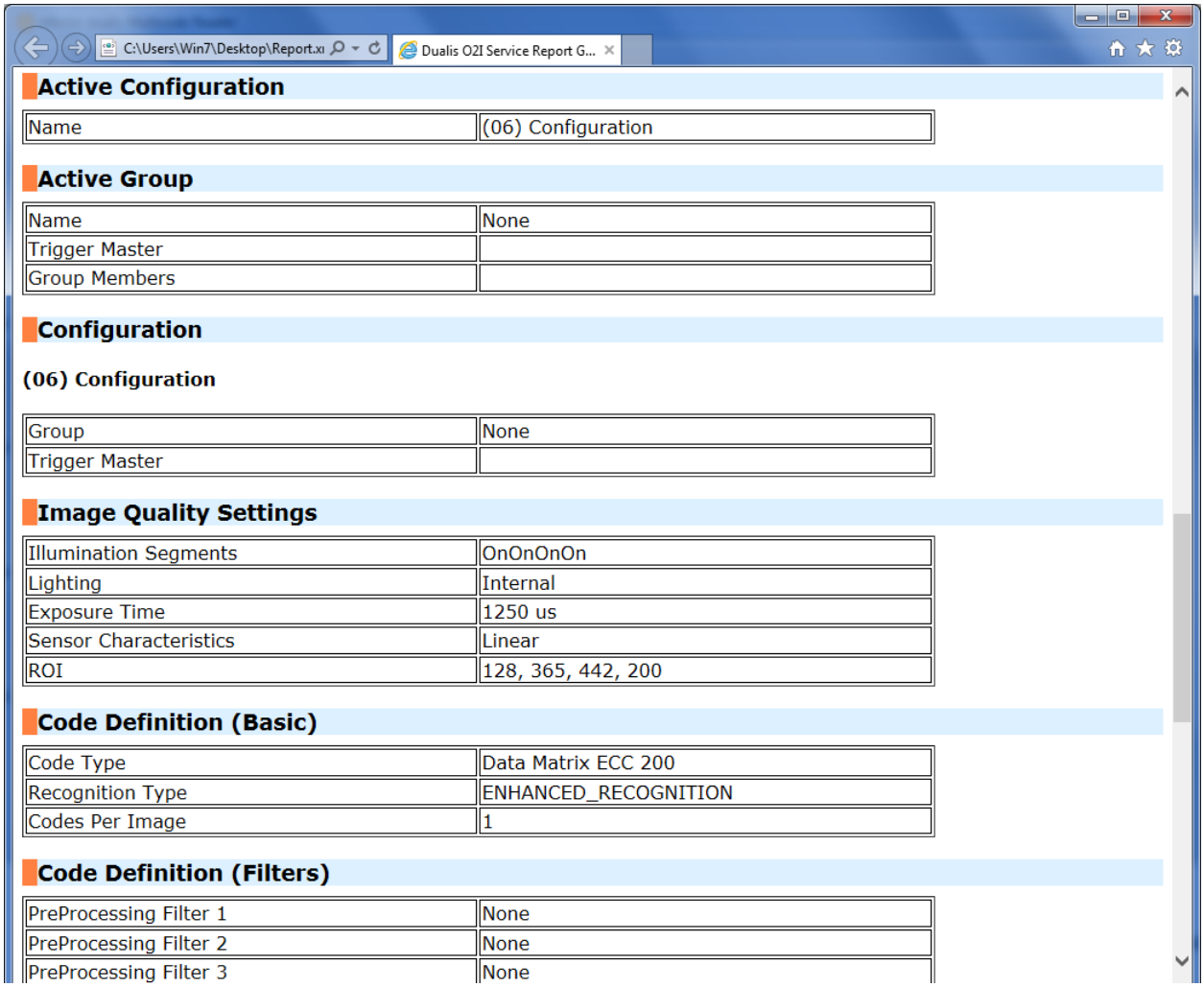
► Select [File] → [Open service report ...] in the menu bar.



► Define the memory location and open the file (.htm/.xml).

> The internet browser defined as standard in Windows opens (here e.g. Microsoft Internet Explorer).
> The service report is displayed.





Active Configuration

Name	(06) Configuration

Active Group

Name	None
Trigger Master	
Group Members	

Configuration

(06) Configuration

Group	None
Trigger Master	

Image Quality Settings

Illumination Segments	OnOnOnOn
Lighting	Internal
Exposure Time	1250 us
Sensor Characteristics	Linear
ROI	128, 365, 442, 200

Code Definition (Basic)

Code Type	Data Matrix ECC 200
Recognition Type	ENHANCED_RECOGNITION
Codes Per Image	1

Code Definition (Filters)

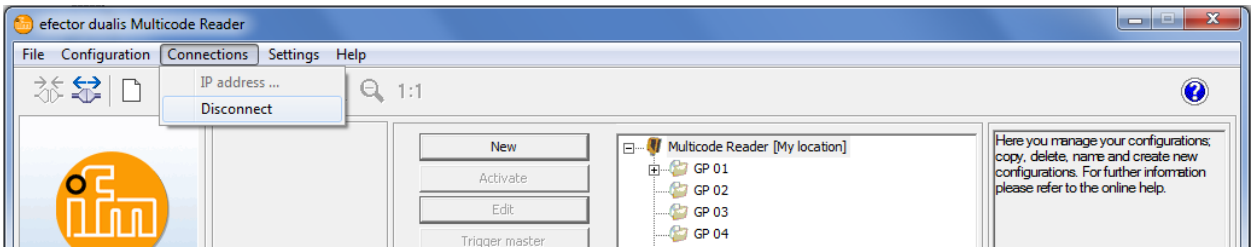
PreProcessing Filter 1	None
PreProcessing Filter 2	None
PreProcessing Filter 3	None

Service reports or evaluations can also be opened in the Configurations or Monitor program modes.

13 Exit the program

13.1 Disconnect

► Select [Connections] → [Disconnect] in the menu bar.Alternatively: Click on the disconnect symbol in the tool bar →  .

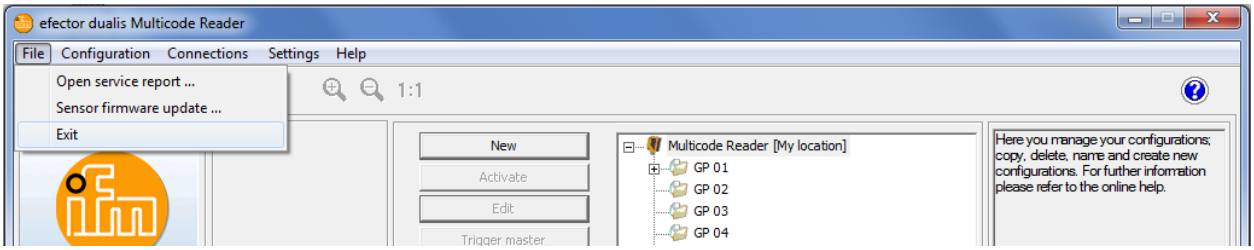


► Acknowledge warning with [OK].

> The device is disconnected from the program.
The device is waiting for the trigger pulse and executes the group or configuration activated last.

13.2 Close program

► Select [File] → [Exit] in the menu bar.



14 Process data protocol

14.1 Quick reference guide of the commands

Command	ASCII characters	Chapter
Release trigger	T	→ 14.4.1
Release trigger and output result	t	→ 14.4.2
Request trigger mode	g?	→ 14.4.3
Permanently activate configuration/group	a<group><number>	→ 14.4.4
Activate configuration/group	c<group><number>	→ 14.4.5
Request configuration/group	a?	→ 14.4.6
Set reference code	r<number><refcode>	→ 14.4.7
Request reference code	r?	→ 14.4.8
Request statistics	s?	→ 14.4.9
Request last image	I?	→ 14.4.10
Request last error image	F?	→ 14.4.11
Request device information	D?	→ 14.4.12
Select protocol version	v<digit><digit>	→ 14.4.13
Request protocol version	V?	→ 14.4.14
Request the error code from the device	E?	→ 14.4.15
External selection of the RDY/OUT outputs	o<digline><digstatus>	→ 14.4.16

14.2 Validity and area of application

The described features are implemented as of the firmware version 3070.
The respective version of the operating program is 1.3.006.

14.3 Basics

14.3.1 Abbreviations and terms

Abbreviation	Meaning		ASCII code (dec)
CR	Carriage Return		13
LF	Line Feed		10
CAN	Cancel		24
»	Tabulator		9
< >	Marking of a placeholder (e.g. <code> is a placeholder for code)		
[ ]	Optional argument (possible but not required)		

14.3.2 Commands to 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.
- A sequence of 16 consecutive CAN characters reinitialises the command recognition.

14.3.3 Replies from the device

- All replies by the device are terminated with a CR and an LF character.
- As a reply to a valid command the device provides the character string * CR LF.
- As a reply to an invalid command the device provides the character string? CR LF.
- If the device is busy, it provides as a reply the character string! CR LF.

The CR and LF characters are not indicated in the following protocol description.

14.4 Commands to the device

14.4.1 Release trigger

Command	T
Possible reply	
The trigger was released	*
Device is busy with evaluation or another trigger source is configured	!
Note	The read result is output when decoding is terminated.

14.4.2 Release trigger and output result

Command	t
Possible reply	
Result	Standard result output (→ 14.6) Result output with description (→ 14.7)
Device is busy with evaluation	!
Another trigger source has been configured	?
Note	The standard result output does not end with a CR and LF character.

14.4.3 Request trigger mode

Command	g?
Possible reply	
Trigger input positive edge	T0
Trigger input negative edge	T1
Process interface	T2
Free-running trigger (continuous)	T3
Device is busy with evaluation or at present no application active	!

14.4.4 Permanently activate configuration/group

Command	a<group><number>
	<group> is a 1-digit number and designates the group. Group 0 designates "no group". <number> is a 2-digit number, possibly with leading zero to designate the configuration. <number> is ignored if the group is not equal to zero.
Possible reply	
Configuration/group activated	*
Device is busy with evaluation	!
Group is empty or configuration not available	?
Example	
Activating group 3	a300

Activating configuration 12, not assigned to any group	a012
Note	The configuration/group is permanently activated, i.e. it is automatically active after the next power-on. By activating a configuration/group this configuration/group is selected automatically.

14.4.5 Activate configuration/group

Command	c<group><number>
	<group> is a 1-digit number and designates the group. Group 0 designates "no group". <number> is a 2-digit number, possibly with leading zero to designate the configuration. <number> is ignored if the group is not equal to zero.
Possible reply	
Configuration/group activated	*
Device is busy with evaluation	!
Group is empty or configuration not available	?
Example	
Activating group 3	c300
Activating configuration 12, not assigned to any group	c012
Note	The configuration/group is not permanently activated, i.e. it is not automatically active after the next power-on. By activating a configuration/group this configuration/group is selected automatically.

14.4.6 Request configuration/group

Command	a?
Possible reply	
List of all configurations	<number> <G><NN> <G><NN> <G><NN> ...
	<number> is a 3-digit number and designates the number of configurations <G> designates the group. <NN> designates the configuration number. At first the number of the active configuration is output. The 3-digit numbers are separated by a blank.
Device is busy with evaluation	!

14.4.7 Set reference code

Command	r<number><refcode>
	<number> is a 3-digit number, possibly with leading zeros to designate the code length.
Possible reply	
Reference code has been set	*
Device is busy with evaluation	!
Error in the command (e.g. length 0)	?
Example	
Set reference code with 13 characters (e.g. 4711081547110)	r0134711081547110
Note	Setting the reference code only has an effect if the device is in the comparing or pattern recognition mode. The submitted reference code is not stored permanently.

14.4.8 Request reference code

Command	r?
Possible reply	
Normal case	<length><reference code>
Device is busy with evaluation or at present no application active	!
Note	<length> is a character string with exactly 3 digits which indicates the number of characters of the following reference code if interpreted as a decimal number.

14.4.9 Request statistics

Command	s?
Possible reply	
Total number of readings (number$_1$) Number of good readings (number$_2$) Number of bad readings (number$_3$)	<number$_1$> <number$_2$> <number$_3$>
	The 10-digit numbers are separated by a blank.
Device is busy with evaluation	!

14.4.10 Request last image

Command	I?
Possible reply	
Normal case	<length><image data>
Device is busy with evaluation or no evaluation performed or at present no application active	!
Note	<length> is a character string with exactly 9 digits, interpreted as decimal number indicating the length of the following image data in bytes. Image format according to setting in the operating program.

14.4.11 Request last error image

Command	F?
Possible reply	
Normal case	<length><image data>
Device is busy with evaluation or no evaluation performed or at present no application active	!
Note	<length> is a character string with exactly 9 digits, interpreted as decimal number indicating the length of the following image data in bytes. Image format according to setting in the operating program.

14.4.12 Request device information

Command	D?
Possible reply	
Normal case	IFM ELECTRONIC » Article » Device name » Device location » IP address » Subnet mask » Gateway » MAC address » XML-RPC port

14.4.13 Select protocol version

Command	v<digit><digit>
Possible reply	
Normal case	*
The device does not support the protocol version indicated.	!
Note	<digit><digit> is to be interpreted as a 2-digit decimal number for the protocol version. The protocol version is not changed before the reply by the device.

14.4.14 Request protocol version

Command	V?
Possible reply	
Normal case	<current><blank><min><blank><max>
Note	<current> is a 2-digit decimal number with current version. <blank> is a space character. <min> is a 2-digit decimal number with minimum version. <max> is a 2-digit decimal number with maximum version.

14.4.15 Request the error code from the device

Command	E?
Possible reply	
Normal case	<code>
Note	<code> is the error code, character string with 4 digits, to be interpreted as decimal number. Error codes (→ 14.8)

14.4.16 External selection of the RDY/OUT outputs (only O2I3xx)

Command	o<digline><digstatus>
	<digline> is a 1-digit number characterising the output that is to be selected. 1 = OUT 2 = RDY <digstatus> is a 1-digit number characterising the switching status. 0 = LOW 1 = HIGH
Possible reply	
Switching status was set	*
Device is busy with evaluation or command cannot be executed	!
Error in the command (e.g. length 0)	?
Example	
Change switching status from output OUT to HIGH	o11
Note	The switching status of OUT cannot be changed if an external illumination is active. The command can therefore only be executed if the function "RDY/OUT activation" is set to "External" in the active configuration (→ 9.1) Within a group the external selection in the configuration that is used as image capture specification has to be activated (→ 6.3.2)

14.5 Global device settings

14.5.1 Send connect message

If the field [Send connection message] at [Global device settings] is not activated, the device will not output a message when the connection is established.

Format of that message:

IFM ELECTRONIC » Article » Device name » Device location » IP address » Subnet mask » Gateway » MAC address » XML-RPC port

14.5.2 Protocol version V1 (standard)

Command (example)	s?
Possible reply	
Statistics	0000000012 0000000011 0000000001

14.5.3 Protocol version V2 (with ticket)

The messages to the device are preceded by a 4-digit decimal number as ticket.
The reply by the device starts with the same number.
Messages and replies are then linked.

Command (example)	<digit>s?
Possible reply	
Ticket and statistics	<digit>0000000012 0000000011 0000000001
Note	<digit> is a 4-digit decimal number as ticket. Tickets are allowed in the range 0000...9999. Replies that the device sends without preceding command (e.g. output of a read result with free-running trigger) have the ticket 0000.

14.5.4 Protocol version V3 (with ticket and length of message)

The messages to the device and the replies by the device are preceded by length information and a ticket. The length information is a 9-digit decimal number and refers to the following characters.

Command (example)	<figure>L000000008 <figure>s?
Possible reply	
Ticket and message length Statistics	<figure>L000000038 <figure>0000000012 0000000011 0000000001
Note	<digit> is a 4-digit decimal number as ticket. Tickets are allowed in the range 0000...9999. L000000008 is the length indication of the following command (here e.g. 8 digits “<digit>s?CRLF”).

14.5.5 Protocol version V4 (with length of message)

The replies by the device are preceded by length information; however, not the commands to the device.

Command (example)	s?
Possible reply	
Length of message Statistics	L000000034 0000000012 0000000011 0000000001
Note	L000000034 is the length indication of the following message (here e.g. 34 characters).

14.6 Standard result output

Output:
Reading result [[reading result] ...] [Image type Image length Image data]

Reading result :
Start string decoding result
[Symbol identity] [Code quality] [Configuration number] [Code position]
Stop string

- Decoding result
  Failed_reading_string
  or Code content
  or Good_reading_string
- Image type
  According to the setting "Image format" in the operating program, either the character string "BMP" for Windows Bitmap Format or “JPEG” for the JPEG format.
- Image length
  9 digits, interpreted as decimal numbers, indicating the number of bytes in the image data
- Image data
  Image content
- Start string
  According to the setting "Start string" in the operating program
- Stop string
  According to the setting "Stop string" in the operating program
- Symbol identity
  Character "0" or "1" as identification mark if the code contains FNC1 and/or ECI characters.
  Is transferred if "Symbol identity" is activated in the operating program.
- Code quality
  The code quality parameters correspond to the setting and sequence in the operating program.
- SEMI T10 code quality
  The code quality parameters correspond to the setting and sequence in the operating program.

  SEMI T10 is only available for unit O2I300 to O2I305.

- Configuration number
  3 digits. The first stands for the group, the last two for the number of the configuration by means of which decoding was effected.
- Code position
  Position of the found codes (pixel coordination).
  With the setting "Transmit code position: centre coordinates" the centre coordinates of each code are provided in the format “xxxx; yyyy;"
  xxxx and yyyy are 4-digit decimal numbers for the X or Y centre coordinates.
  With the setting "Transmit code position: corner coordinates", the coordinates of the four corner points are provided in the format “xxx1;yyy1;xxx2;yyy2;xxx3;yyy3;xxx4;yyy4;”.
- Failed reading string
  According to the setting "Failed reading string" in the operating program
- Good reading string
  According to the setting "Good reading string" in the operating program. Replacements can be made in the "Regular expression" mode.

Legend:

[ ] = optional
... = repetition

14.7 Result output with description

With result output with description, describing markings, by means of which the output can be interpreted without any additional information, are added to the output.

A tag consists of the identifier and the length indication.

Identifier:
8-digit hexadecimal number, e.g. “1000f02e”

Length indication:
8-digit hexadecimal number always starts with the character "1”.
The actual length results if this leading "1" is dropped.

Example: “10000015” means a length of 15h = 21d characters.

Output:
Prefix Main tag Read result
[[Reading result] ...] [Image tag Image data]

Reading result :
Result tag Start string Code tag Decoding result
[List tag [Symbol identity] [Code quality]]
[Configuration number]
[Position tag Code position]
Stop string

- Decoding result
  Failed_reading_string
  or Code content
  or Good_reading_string
- Code position
  Point X coord value text tag ; Y coord value text tag
  Point X coord value text tag ; Y coord value text tag ;
  Point X coord value text tag ; Y coord value text tag ;
  Point X coord value text tag ; Y coordinate value text tag ;
  Point X coord value text tag ; Y coord value text tag ;]
- Prefix
  Fixed character string
  “1a45dfa38e428288ifm pcic”
- Main tag
  Identifier “1000001f”
- Result tag
  Identifier “1000002f”
- Code tag
  Identifier “100001ee”
- Start string
  According to the setting "Start string" in the operating program
  Identifier “1000100e”
- Stop string
  According to the setting "Stop string" in the operating program
  Identifier “1000100e”
- List tag
  Identifier “1000003f”
- Symbol identity
  Character "0" or "1" as identification mark if the code contains FNC1 and/or ECI characters.
  Is transferred if "Symbol identity" is activated in the operating program.
  Identifier “1000 030e”

- Code quality
  The code quality parameters correspond to the setting and sequence in the operating program.
  - Identifier "1000 031e"
    Code quality overall (ECC200, PDF417, QR)
  - Identifier "1000 032e"
    Code quality contrast (ECC200, QR), Code quality defects (PDF417)
  - Identifier "1000 033e"
    Code quality modulation (ECC200, PDF417)
  - Identifier "1000 034e"
    Code quality finder pattern damage (ECC200, QR), Start/stop pattern (PDF417)
  - Identifier "1000 035e"
    Code quality decoding (ECC200, PDF417, QR)
  - Identifier "1000 036e"
    Code quality axial non uniformity (ECC200, QR), Code word yield (PDF417)
  - Identifier "1000 037e"
    Code quality grid distortion (ECC200, QR)
  - Identifier "1000 038e"
    Code quality unused error correction (ECC200, PDF417, QR)
  - Identifier "1000 039e"
    Code quality print growth (ECC200, PDF417, QR)
- SEMI T10 code quality
  The code quality parameters correspond to the setting and sequence in the operating program.

  SEMI T10 is only available for unit O2I300 to O2I305.

  - Identifier „1000 0600“
    P1 corner, row value
  - Identifier „1000 0601“
    P1 corner, column value
  - Identifier „1000 0602“
    P2 corner, row value
  - Identifier „1000 0603“
    P2 corner, column value
  - Identifier „1000 0604“
    P3 corner, row value
  - Identifier „1000 0605“
    P3 corner, column value
  - Identifier „1000 0606“
    P4 corner, row value
  - Identifier „1000 0607“
    P4 corner, column value
  - Identifier „1000 0608“
    Data Matrix rows
  - Identifier „1000 0609“
    Data Matrix columns
  - Identifier „1000 060a“
    Symbol Contrast
  - Identifier „1000 060b“
    Symbol Contrast SNR
  - Identifier „1000 060c“
    Horizonal Mark Growth

  - Identifier „1000 060d“
    Vertical Mark Growth
  - Identifier „1000 060e“
    Data Matrix Cell Width
  - Identifier „1000 060f“
    Data Matrix Cell Height
  - Identifier „1000 0610“
    Horizontal Mark Misplacement
  - Identifier „1000 0611“
    Vertical Mark Misplacement
  - Identifier „1000 0612“
    Cell Defects
  - Identifier „1000 0613“
    Finder Pattern Defects
  - Identifier „1000 0614“
    Unused Error Correction
- Configuration number
  Three digits. The first stands for the group, the last two for the number of the configuration by means of which decoding was effected.
  Identifier “1000 105e”
- Position tag
  Identifier “1000 004f”
- Point
  Identifier “1000 020f”
- X coordinate
  Identifier “1000 0210”
- Y coordinate
  Identifier “1000 0220”
- Text tag
  Identifier “1000 100e”
- Value
  Value of the X or Y pixel coordinate as 4-digit decimal number.
  With the setting "Transmit code position: centre coordinates" the centre coordinates of each code are provided.
  With the setting "Transmit code position: corner coordinates" the coordinates of the four corner points are provided.
- Failed_reading_string
  According to the setting "Failed reading string" in the operating program
  Identifier “100001ee”
- Good_reading_string
  According to the setting "Good reading string" in the operating program.
  Replacements can be made in the "Regular expression" mode.
  Identifier “100001ee”
- According to the setting "Image format" in the operating program, either identifier “1000 f02e” for Windows Bitmap format or “1000 f01e” for JPEG format
- Image data
  Image content

14.7.1 Example outputs

Example:

1a45dfa38e428288ifm pcic1000001f100003161000002f100001731000100e10000005start100
001ee10000003IFM1000003f100000aa1000030e1000000111000031e10000001C1000032e100000
01C1000033e10000001C1000034e10000001C1000035e10000001A1000036e10000001A1000037e1
0000001A1000038e10000001A1000039e10000001A1000105010000003001100004f1000005a100
0020f1000004a1000021010000004047010001 00e10000001;1000022010000004008110001 00e10
000001;1000100e10000004stop1000002f100001831000100e10000005start100001ee10000013
30Q324343430794<OQQ1000003f100000aa1000030e1000000111000031e10000001C1000032e100
00001C1000033e10000001B1000034e10000001A1000035e10000001A1000036e10000001A100003
7e10000001A1000038e10000001A1000039e10000001A1000105010000003001100004f1000005a
1000020f1000004a1000021010000004046410001 00e10000001;1000022010000004036210001 00
e10000001;1000100e10000004stop

Meaning:

1a45dfa3 8e
Identifier '1a45dfa3': MAGIC
Length: Eh = 14d
Content: ''

4282 88 ifm pcic
Identifier '4282': DOCTYPE
Length: 8h = 8d
Content: 'ifm pcic'

1000001f 10000316
Identifier '1000001f': MAIN TAG
Length: 316h = 790d
Content: ''

1000002f 10000173
Identifier '1000002f': RESULT TAG
Length: 173h = 371d
Content: ''

1000100e 10000005 start
Identifier '1000100e': TEXT TAG
Length: 5h = 5d
Content: 'start'

100001ee 10000003 IFM
Identifier '100001ee': CODE TAG
Length: 3h = 3d
Content: 'IFM'

1000003f 100000aa
Identifier '1000003f': LIST TAG
Length: AAh = 170d
Content: ''

1000030e 10000001 1
Identifier '1000030e': SYMBOL IDENTITY
Length: 1h = 1d
Content: '1'

1000031e 10000001 C
Identifier '1000031e': CODEQUALITYOVERALL
Length: 1h = 1d
Content: 'C'

1000032e 10000001 C
Identifier '1000032e': CODEQUALITYCONTRAST/DEFECTS
Length: 1h = 1d
Content: 'C'

1000033e 10000001 C
Identifier '1000033e': CODEQUALITYMODULATION
Length: 1h = 1d
Content: 'C'

1000034e 10000001 C
Identifier '1000034e': CODEQUALITYPATTERN
Length: 1h = 1d
Content: 'C'

1000035e 10000001 A
Identifier '1000035e': CODEQUALITYDECODING
Length: 1h = 1d
Content: 'A'

1000036e 10000001 A
Identifier '1000036e': CODEQUALITYAXNONUNIF/YIELD
Length: 1h = 1d
Content: 'A'

1000037e 10000001 A
Identifier '1000037e': CODEQUALITYGRIDDISTO
Length: 1h = 1d
Content: 'A'

1000038e 10000001 A
Identifier '1000038e': CODEQUALITYUEC
Length: 1h = 1d
Content: 'A'

1000039e 10000001 A
Identifier '1000039e': CODEQUALITYPRINTGROWTH
Length: 1h = 1d
Content: 'A'

10001050 10000003 001
Identifier '10001050': CONFIGURATION NUMBER
Length: 3h = 3d
Content: '001'

1000004f 1000005a
Identifier '1000004f': POSITION TAG
Length: 5Ah = 90d
Content: ''

1000020f 1000004a
Identifier '1000020f': POINT
Length: 4Ah = 74d
Content: ''

10000210 10000004 0470
Identifier '10000210': X COORD
Length: 4h = 4d
Content: '0470'

1000100e 10000001 ;
Identifier '1000100e': TEXT TAG
Length: 1h = 1d
Content: ';'

10000220 10000004 0081
Identifier '10000220': Y COORD
Length: 4h = 4d
Content: '0081'

1000100e 10000001 ;
Identifier '1000100e': TEXT TAG
Length: 1h = 1d
Content: ';'

1000100e 10000004 stop
Identifier '1000100e': TEXT TAG
Length: 4h = 4d
Content: 'stop'

1000002f 10000183
Identifier '1000002f': RESULT TAG
Length: 183h = 387d
Content: ''

1000100e 10000005 start
Identifier '1000100e': TEXT TAG
Length: 5h = 5d
Content: 'start'

100001ee 10000013 30Q324343430794<OQQ
Identifier '100001ee': CODE TAG
Length: 13h = 19d
Content: '30Q324343430794<OQQ'

1000003f 100000aa
Identifier '1000003f': LIST TAG
Length: AAh = 170d
Content: ''

1000030e 10000001 1
Identifier '1000030e': SYMBOL IDENTITY
Length: 1h = 1d
Content: '1'

1000031e 10000001 C
Identifier '1000031e': CODEQUALITYOVERALL
Length: 1h = 1d
Content: 'C'

1000032e 10000001 C
Identifier '1000032e': CODEQUALITYCONTRAST/DEFECTS
Length: 1h = 1d
Content: 'C'

1000033e 10000001 B
Identifier '1000033e': CODEQUALITYMODULATION
Length: 1h = 1d
Content: 'B'

1000034e 10000001 A
Identifier '1000034e': CODEQUALITYPATTERN
Length: 1h = 1d
Content: 'A'

1000035e 10000001 A
Identifier '1000035e': CODEQUALITYDECODING
Length: 1h = 1d
Content: 'A'

1000036e 10000001 A
Identifier '1000036e': CODEQUALITYAXNONUNIF/YIELD
Length: 1h = 1d
Content: 'A'

1000037e 10000001 A
Identifier '1000037e': CODEQUALITYGRIDDISTO
Length: 1h = 1d
Content: 'A'

1000038e 10000001 A
Identifier '1000038e': CODEQUALITYUEC
Length: 1h = 1d
Content: 'A'

1000039e 10000001 A
Identifier '1000039e': CODEQUALITYPRINTGROWTH
Length: 1h = 1d
Content: 'A'

10001050 10000003 001
Identifier '10001050': CONFIGURATION NUMBER
Length: 3h = 3d
Content: '001'

1000004f 1000005a
Identifier '1000004f': POSITION TAG
Length: 5Ah = 90d
Content: ''

1000020f 1000004a
Identifier '1000020f': POINT
Length: 4Ah = 74d
Content: ''

10000210 10000004 0464
Identifier '10000210': X COORD
Length: 4h = 4d
Content: '0464'

1000100e 10000001 ;
Identifier '1000100e': TEXT TAG
Length: 1h = 1d
Content: ';'

10000220 10000004 0362
Identifier '10000220': Y COORD
Length: 4h = 4d
Content: '0362'

1000100e 10000001 ;
Identifier '1000100e': TEXT TAG
Length: 1h = 1d
Content: ';'

1000100e 10000004 stop
Identifier '1000100e': TEXT TAG
Length: 4h = 4d
Content: 'stop'

14.8 Error codes

Code	Meaning	Memnonic
103	No configuration active	SENSOR_NOT_INITIALIZED
137	Active configuration does not allow a trigger via PCIC process interface	SENSOR_INVALID_TRIGGER_MODE
138	Invalid command format	SENSOR_INVALID_PARM
139	No image or error image available	SENSOR_NO_IMAGE

15 History

PC operating program	Programming guide		
Version	**Ident number**	**Date**	**Modifications**
1.0	704247 / 00	03.2008	First version
1.1	704247 / 01	10.2008	Supplement → 3 System requirements → 3.4 Device firmware Extension of function Prepend reply length → 7.5 Global device settings
1.3	704743 / 00	04.2010	● Code quality – Overall quality as an option via selected quality features or via all features – Selectable steps 0-4 or A-F – Support for print growth – Selected quality parameters are marked in the tool tip – Quality parameters in the service report ● Output of the code position via process interface – Corner coordinates or centre coordinates – Output sorted from left to right, top to bottom ● Comparison code content with reference code via pattern and regular expression possible ● New settings for improved barcode reading – Min./max. bar width, min./max. number of characters, read direction for pharmacodes ● Password protection ● Process interface – Selectable output current image, request last image, last error image – EtherNet/IP protocol – Optional transmission of one message when the connection is established ● Support for RSS-14, RSS Limited and RSS expanded codes ● One image capture per configuration in group possible ● Miscellaneous – Search zone can now also be changed with code definition – Automatic code recognition in extended mode – Improved service report – Better performance when the supply voltage is switched off during DHCP and IP changes – Teach optimised settings – Adjustable relation saved error images/images – Statistics can be reset in the monitor mode – Process data protocol
1.4	706359 / 00	08.2013	● Readable codes – Support of Micro QR and Aztec codes ● Process interface – New function "string numeration" – New function "RDY/OUT activation"
1.4	706359 / 00	07.2015	Supplement ● Optical character recognition (OCR)
1.4	706359 / 01	12.2015	Supplement ● SEMI T10 code quality