EN

wenglor
the innovative family

# B50
# C50

**Smart Camera / Vision-Sensor / 1D-/2D-Code-Scanner / OCR Reader**

**Operating Instructions**

# EN

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## 1. Use for Intended Purpose

The wenglor weQube is an optoelectronic sensor which is used for contactless inspection of specific objects.

The sensor unites a camera unit, illumination, optics with auto-focus and an analysis module in a single housing. The sensors work with a CMOS color or monochrome image sensor.
Image processing functions including measurement, object counting, checking for the presence of objects, pixel comparison, shape analysis and reference image comparison can be configured by means of a PC or laptop via the integrated Ethernet port. 1D and 2D codes can be read as well.

These image processing functions can be executed in trigger mode operation, as well as during continuous monitoring, and objects can be detected regardless of position thanks to tracking. Six convertible I/O switching outputs are available, which can be used as either inputs or outputs. Beyond this, an external lamp can also be connected to the weQube, and the integrated illumination can be partially or completely switched off.

## 2. Safety Precautions

- These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
- Read the operating instructions carefully before using the product.
- This sensor is not suitable for safety applications.
- Installation, initial start-up and maintenance of the product should only be carried out by qualified personnel.
- Protect the sensor against mechanical influences.
- Tampering with or modifying the product is impermissible.
- Protect the sensor against contamination during initial start-up.
- The mounting screws must have a thread engagement length of 5 to 7 mm.

## 3. Approvals and protection class

# 4. Technical Data

## 4.1. Available weQube Sensor Types

### 4.1.1. Sensors with Monochrome Image Chip

| Sensor type | Connection \ Light | White Light | IR | Red Light |
|---|---|---|---|---|
| **weQube Vision** | Ethernet | B50S002 | B50S003 | - |
| | | B50S005 | B50S006 | - |
| | Industrial Ethernet | B50S101 | B50S102 | - |
| | | B50S104 | B50S105 | - |
| weQube Decode | Ethernet | C50C001 | C50C002 | C50C003 |
| | Industrial Ethernet | C50C100 | C50C101 | C50C102 |
| weQube | Ethernet | B50M002 | B50M003 | B50M004 |
| | Industrial Ethernet | B50M101 | B50M102 | B50M104 |
| weQube OCR | Ethernet | B50R001 | - | - |
| | Industrial Ethernet | B50R100 | - | - |
| | Ethernet | - | B50R002 | - |
| | Industrial Ethernet | - | B50R101 | - |

### 4.1.2. Sensors with monochrome image chip and C-mount

| Sensor type | Connection | Monochrome |
|---|---|---|
| **weQube Vision** | Ethernet | B50S012 |
| | | B50S014 |
| | Industrial Ethernet | B50S111 |
| | | B50S113 |
| **weQube Decode** | Ethernet | C50C011 |
| | Industrial Ethernet | C50C110 |
| **weQube OCR** | Ethernet | B50R011 |
| | Industrial Ethernet | B50R110 |
| **weQube** | Ethernet | B50M012 |
| | Industrial Ethernet | B50M111 |

**4.1.3. Sensors with Color Image Chip and Autofocus**

| Sensor type | Connection / Light | | White light |
|---|---|---|---|
| **weQube Vision** | Ethernet | | B50S001 |
| | | | B50S004 |
| | Industrial Ethernet | | B50S100 |
| | | | B50S103 |
| **weQube** | Ethernet | | B50M001 |
| | Industrial Ethernet | | B50M100 |

**4.1.4. Sensors with color image chip and C mount**

| Sensor type | Connection | Monochrome |
|---|---|---|
| **weQube Vision** | Ethernet | B50S011 |
| | | B50S013 |
| | Industrial Ethernet | B50S110 |
| | | B50S112 |
| **weQube** | Ethernet | B50M011 |
| | Industrial Ethernet | B50M110 |

## 4.2. List of Technical Data

| Optical Characteristics | |
|---|---|
| Working range | ≥ 20 mm (weQube with auto-focus) |
| Resolution | 736 px × 480 px |
| Field of vision | See "Range of Vision Table" |
| Image chip | See section 4.1 on available sensor types |
| Type of light | See section 4.1 on available sensor types |
| Refresh rate (monochrome) | ≤ 25 Hz |
| Refresh rate (color) | ≤ 15 Hz |
| Service life | 100,000 hours |
| Risk group (EN 62471) | Free group |
| **Electrical Characteristics** | |
| Supply power * | 18 to 30 V DC |
| Current consumption (operating voltage = 24 V) | < 200 mA |
| Response time (monochrome) | < 40 ms |
| Response time (color) | < 66 ms |
| Temperature range | −25…55 °C ** |
| Number of digital I/Os | 6 |
| Switching output voltage drop | < 2.5 V |
| Switching output switching current | 100 mA |
| Short-circuit proof | Yes |
| Protected against polarity reversal | Yes |
| Overload-proof | Yes |
| Protection class | III |
| Interfaces | Ethernet 10/100 Base TX; Ethernet or Profinet (see section 4.1 on available sensor types) |
| **Mechanical Characteristics** | |
| Configuration interface | Ethernet port |
| Housing material | Aluminum |
| Protection | IP67 |
| Connector type | M12×1, 12-pin |
| Ethernet connector type | M12×1, 8-pin |
| Configurable as PNP, NPN or push-pull | Yes |
| Can be switched to NC or NO operation | Yes |
| Illumination output | Yes |
| RS-232 interface | Yes *** |
| **General Data** | |
| Webserver | Yes (all Ethernet and Industrial Ethernet Devices, see section "4.1. Available weQube Sensor Types") |

\*    Supply voltage residual ripple may not exceed 10 % (within the specified voltage range).
\*\*  −25 °C: Ambient conditions should not result in condensation; avoid the formation of ice on the front panel!
      55 °C: Continuous illumination at max. 1 % or flash mode at 100 % brightness with an exposure time of ≤ 5 ms: may affect the service life of the product.
\*\*\* Maximum connection length: 30 m
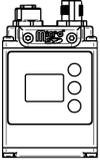
Range of vision table (weQube with auto-focus):

| Working distance | 20 mm | 100 mm | 200 mm | 1000 mm | 5000 mm |
|---|---|---|---|---|---|
| Range of vision | 16×12 mm | 64×48 mm | 120×90 mm | 600×450 mm | 3000×2250 mm |

Range of vision for C mount variant depends on the utilized lens.

## 4.3. Connection Diagrams

Plug No. 1                          Plug No. 2
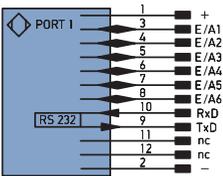
```
1008                                002
PORT 1         1    +               PORT 2
               3    E/A1                    1   Tx+
               4    E/A2                    2   Tx−
               5    E/A3                    5
               6    E/A4                    6
               7    E/A5                    7
               8    E/A6                    8
               10   RxD                     3   Rx+
RS 232         9    TxD                     4   Rx−
               11   nc
               12   nc
               2    −
```
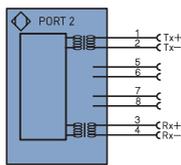
Explanation of Symbols

## Legend

| | |
|---|---|
| + | Supply Voltage + |
| − | Supply Voltage 0 V |
| ~ | Supply Voltage (AC Voltage) |
| A | Switching Output (NO) |
| Ā | Switching Output (NC) |
| V | Contamination/Error Output (NO) |
| V̄ | Contamination/Error Output (NC) |
| E | Input (analog or digital) |
| T | Teach Input |
| Z | Time Delay (activation) |
| S | Shielding |
| RxD | Interface Receive Path |
| TxD | Interface Send Path |
| RDY | Ready |
| GND | Ground |
| CL | Clock |
| E/A | Output/Input programmable |
| ⬡ IO-Link | IO-Link |
| PoE | Power over Ethernet |
| IN | Safety Input |
| OSSD | Safety Output |
| Signal | Signal Output |
| BI_D+/− | Ethernet Gigabit bidirect. data line (A-D) |
| EN₀RS422 | Encoder 0-pulse 0-0̄ (TTL) |

| | |
|---|---|
| PT | Platinum measuring resistor |
| nc | not connected |
| U | Test Input |
| Ü | Test Input inverted |
| W | Trigger Input |
| O | Analog Output |
| O− | Ground for the Analog Output |
| BZ | Block Discharge |
| AₘW | Valve Output |
| a | Valve Control Output + |
| b | Valve Control Output 0 V |
| SY | Synchronization |
| E+ | Receiver-Line |
| S+ | Emitter-Line |
| ⏚ | Grounding |
| SnR | Switching Distance Reduction |
| Rx+/− | Ethernet Receive Path |
| Tx+/− | Ethernet Send Path |
| Bus | Interfaces-Bus A(+)/B(−) |
| La | Emitted Light disengageable |
| Mag | Magnet activation |
| RES | Input confirmation |
| EDM | Contactor Monitoring |
| ENₐRS422 | Encoder A/Ā (TTL) |
| ENᵦRS422 | Encoder B/B̄ (TTL) |

| | |
|---|---|
| ENₐ | Encoder A |
| ENᵦ | Encoder B |
| AₘIN | Digital output MIN |
| AₘAX | Digital output MAX |
| AₒK | Digital output OK |
| SY In | Synchronization In |
| SY OUT | Synchronization OUT |
| Oₗₜ | Brightness output |
| M | Maintenance |
| rsv | reserved |

Wire Colors according to DIN IEC 757

| | |
|---|---|
| BK | Black |
| BN | Brown |
| RD | Red |
| OG | Orange |
| YE | Yellow |
| GN | Green |
| BU | Blue |
| VT | Violet |
| GY | Grey |
| WH | White |
| PK | Pink |
| GNYE | Green/Yellow |

**Note:** If you use wenglor connection cables, you'll find the corresponding wiring diagram in section 5.3.2.1.

## 4.4. Housing Dimensions
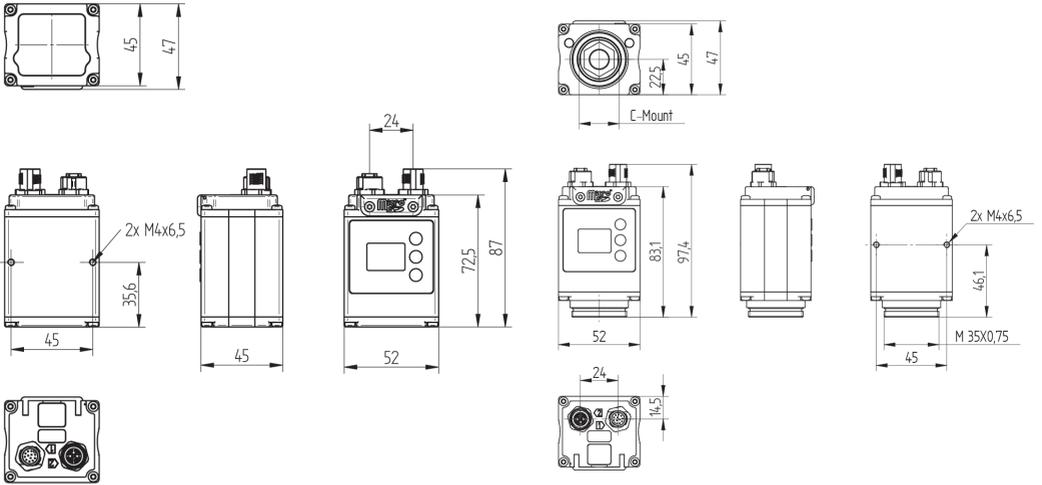


## 4.5. Control Panel



1 Up key
2 Enter key
3 Down key
4 Display

# 5. Installation and Connection

## 5.1. General Installation Instructions

All applicable electrical and mechanical regulations, standards and safety precautions must be adhered to when installing and operating the sensor. The sensor must be protected against mechanical influences. Install the weQube such that its installation position cannot be inadvertently changed. The wenglor mounting system is recommended for installing the sensor. It must be assured that the mounting screws have a thread engagement length of 5 to 7 mm.

## 5.2. System Overview



**Connection Cable**

M12, 8-pin to RJ45

| | |
|---|---|
| ZC1V001 (straight) | 2 m |
| ZAV50R502 (straight) | 5 m |
| ZC1V002 (straight) | 10 m |
| ZC1V009 (angled) | 2 m |
| ZC1V010 (angled) | 5 m |
| ZC1V011 (angled) | 10 m |

**Mounting System**

| | |
|---|---|
| ZMBID1202 | |
| ZMWZF0001 | |

**Alternative Micro SD Card**

| | |
|---|---|
| ZNNG013* | |

**Replacement Disc weQube**

| | |
|---|---|
| ZNNG012 | |

**Polarization Filter, Circular**

| | |
|---|---|
| ZNNG004 | |

**Connector Cables**

M12, 12-pin to open end

| | |
|---|---|
| ZDCL001 (straight) | 2 m |
| ZDCL002 (straight) | 5 m |
| ZDCL003 (straight) | 10 m |
| ZDCL004 (angled) | 2 m |
| ZDCL005 (angled) | 5 m |
| ZDCL006 (angled) | 10 m |

**Interface Cable**

M12, 12-pin to RS-232

| | |
|---|---|
| ZDCG002 | |

**Connection Cable**

M12, 12-pin to M12, 12-pin

| | |
|---|---|
| ZDCV001 | 2 m |
| ZDCV002 | 5 m |
| ZDCV003 | 10 m |

M12, 4-pin to M12, 4-pin

| | |
|---|---|
| BW2SG2V1-2M | 2 m |
| BG2SG2V1-2M | 2 m |
| BG2SG2V3-2M | 2 m |

**Connecting Module**

M12, 12-pin to trigger / illumination

| | |
|---|---|
| ZDCG001 | |

**Protection Housing**

| | |
|---|---|
| ZNNS001 | |
| ZNNS002 | |

**Legend**

Required accessories

Optional accessories

Included in delivery  *

**Connection Cable**

| M12, 8-pin to RJ45 | |
| --- | --- |
| ZC1V001 (straight) | 2 m |
| ZAV50R502 (straight) | 5 m |
| ZC1V002 (straight) | 10 m |
| ZC1V009 (angled) | 2 m |
| ZC1V010 (angled) | 5 m |
| ZC1V011 (angled) | 10 m |

**Mounting System**

| | |
| --- | --- |
| ZMBID1202 | |
| ZMWZF0001 | |

**Alternative Micro SD Card**

| | |
| --- | --- |
| ZNNG013* | |

**Protection Housing**

| | |
| --- | --- |
| ZSZ-02-01 | |
| ZSZ-03-01 | |

**Connector Cables**

| M12, 12-pin to open end | |
| --- | --- |
| ZDCL001 (straight) | 2 m |
| ZDCL002 (straight) | 5 m |
| ZDCL003 (straight) | 10 m |
| ZDCL004 (angled) | 2 m |
| ZDCL005 (angled) | 5 m |
| ZDCL006 (angled) | 10 m |

**Interface Cable**

| M12, 12-pin to RS-232 | |
| --- | --- |
| ZDCG002 | |

**Connection Cable**

| M12, 12-pin to M12, 12-pin | |
| --- | --- |
| ZDCV001 | 2 m |
| ZDCV002 | 5 m |
| ZDCV003 | 10 m |
| M12, 4-pin to M12, 4-pin | |
| BW2SG2V1-2M | 2 m |
| BG2SG2V1-2M | 2 m |
| BG2SG2V3-2M | 2 m |

**Connecting Module**

| M12, 12-pin to trigger / illumination | |
| --- | --- |
| ZDCG001 | |

**Lens**

| | |
| --- | --- |
| LAC9-14-K01 | 9 mm |
| LAC25-14-K02 | 25 mm |
| LAC35-16-K02 | 35 mm |

**Illuminations**

Further information is available > here

**Legend**

| | |
| --- | --- |
| Required accessories | —— |
| Optional accessories | □------□ |
| Included in delivery | * |

**Licenses:**

| | |
| --- | --- |
| ZNN1003 | PC license, offline operation, 1D/2D code module |
| DNNL002 | License, 1D/2D code module |
| DNNL001 | License, vision module |
| DNNL003 | License, OCR-Modul |

**Operating instructions:**

| | |
| --- | --- |
| ZNNG044 | Operating instructions on CD |

## 5.3. Accessory Products

### 5.3.1. Matching Mounting Technology

ZMBID1202          Mounting System
ZMWZF0001        Mounting Bracket for illumination technology


### 5.3.2. Matching Connection Technology

#### 5.3.2.1. Connector Cables

S89

| | | |
|---|---|---|
| 1 | | BN |
| 2 | | BU |
| 3 | | WH |
| 4 | | GN |
| 5 | | PK |
| 6 | | YE |
| 7 | | BK |
| 8 | | GY |
| 9 | | RD |
| 10 | | VT |
| 11 | | GYPK |
| 12 | | RDBU |
| | | S |
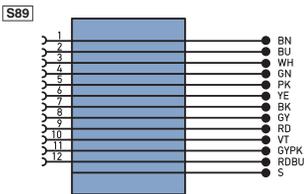
ZDCL001          M12×1 connector cable, 12-pin, 2 m, straight
ZDCL002          M12×1 connector cable, 12-pin, 5 m, straight
ZDCL003          M12×1 connector cable, 12-pin, 10 m, straight
ZDCL004          M12×1 connector cable, 12-pin, 2 m, angled
ZDCL005          M12×1 connector cable, 12-pin, 5 m, angled
ZDCL006          M12×1 connector cable, 12-pin, 10 m, angled
**Note:** The wiring diagram for the weQube is included in section 4.3.


#### 5.3.2.2. Connection Cable

ZC1V001          M12×1 connection cable, 8-pin, 2 m, to RJ45
ZAV50R502      M12×1 connection cable, 8-pin, 5 m, to RJ45
ZC1V002          M12×1 connection cable, 8-pin, 10 m, to RJ45
ZDCV001          M 12×1 connection cable, 12-pin, 2 m
ZDCV002          M 12×1 connection cable, 12-pin, 5 m
ZDCV003          M 12×1 connection cable, 12-pin, 10 m

**5.3.2.3. Connecting Module**

ZDCG001                 M12×1 connecting module, 12-pin to trigger, illumination
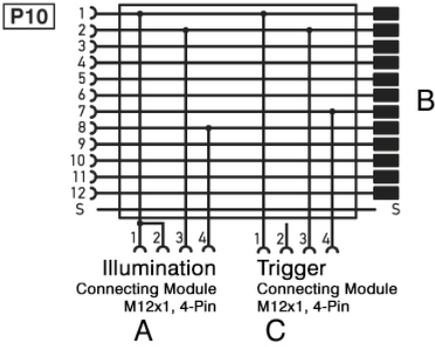


**5.3.2.4. Interface Cable**

ZDCG002                 M12×1 interface cable, 12-pin to RS-232
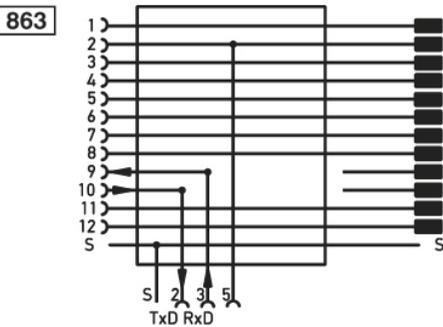
## 5.4. LED Display

The LEDs on the back of the weQube indicate the following (rear view of the weQube with display at top):

**T12**

84
78
85
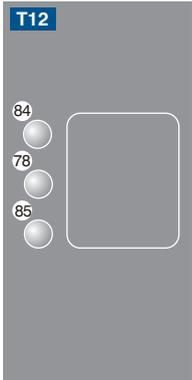
Profinet

| LED | Function |
|-----|----------|
| 84 | Communication status |
| 78 | Module status |
| 85 | Link/act LED |

| Designation | Status | Function |
|-------------|--------|----------|
| CS (communication status) (only available with Profinet devices) | Off | Connection (AR) established with controller |
| | Green | Protocol not initialized |
| | Red | No connection (AR) to controller |
| MS (module status) (only available with Profinet devices) | Red | Error (class: fatal) |
| | Blinking red | Detection function, can be switched on via engineering tool |
| L/A | Green | Link available |
| | Blinking green | Communication |

Ethernet/IP

| LED | Function |
|-----|----------|
| 84 | Network status |
| 78 | Module status |
| 85 | Link/Act-LED |

| Description | Status | Function |
|---|---|---|
| NS (Network status) | Off | No IP address |
| | green | CIP connection |
| | Blinking green | IP configured, no CIP connection |
| | red | Duplicate IP address |
| | Blinking red | CIP connection Timeout |
| MS (Module status) | Off | - |
| | green | Device works |
| | Blinking green | Standby |
| | red | Fatal error |
| | Blinking red | Device error |
| L/A | Off | No Ethernet device connected |
| | green | Link available |
| | Blinking green | communication |

## 5.5. Initial Start-Up

### 5.5.1. Cable Connection

Connect the sensor (socket 2) to the Ethernet port at the PC or the controller and connect socket 1 to power supply (see section 5.2). Power supply must be between 18 and 30 V DC.

**Caution:** Make sure that the cables have been correctly and securely connected, assuring good physical contact. The sensor's micro SD card may not be removed during operation. If the micro SD card will be replaced, disconnect the sensor from power supply first.

### 5.5.2. Sensor Network Settings

Upon shipment from the factory, the weQube's IP address is **192.168.100.1** and its subnet mask is **255.255.255.0**.

The following options are available for establishing a connection with the sensor.

#### 5.5.2.1. Adjusting Sensor Network Settings Manually

In order to be able to connect the sensor to your PC, you have to make sure that the sensor and your PC are both within the same IP address range.

Ascertain your PC's IP address and subnet mask to this end.

**Note:** You can ascertain the network settings of your Windows PC by clicking start, entering "cmd" to the "Search programs and files" line and then pressing the enter key. A command line appears. After entering "ipconfig" to this line, the PC's network settings are displayed.

If necessary, change the weQube's subnet mask, so that it coincides with the PC's. The subnet mask breaks the IP address down into a network part (places in the subnet mask occupied by the digits "255") and a device part (places in the subnet mask occupied by digits other than "255").

The network part of the weQube's IP address must coincide with the network part of the PC's IP address, and the device parts of the weQube and the PC must be different.

Example:
The following subnet mask is used for both the PC and the sensor: **255.255.255.0**.

If the PC's IP address is **192.100.100.1**, the IP address of the weQube must start as follows: **192.100.100**. The last digit of the IP address must differ from the PC's last digit, and should only occur once throughout the network. For example, the following IP address could be used for the weQube: **192.100.100.2**.

You can change the sensor's network settings with the help of weQube software (see section 10.1.1.2).

Alternatively, you can also change the sensor's IP address at the OLED display (see section 6.8.2).

**Caution:** It may be necessary to deactivate the PC's firewall in order to establish connection with the sensor. Detailed information about deactivating the Windows firewall can be found in the general instructions included on the weQube product page.

### 5.5.2.2. Adjusting Sensor Network Settings Automatically via DHCP Server

If the weQube is connected to a DHCP server, activate dynamic host configuration at the sensor either with the help of weQube software (see section 10.1.1.2) or at the OLED display (see section 6.8.2). A suitable IP address and subnet mask are assigned to the sensor when it's restarted.

### 5.5.2.3. Initial Start-Up of the weQube at a Controller

If you want to place the weQube into service at a controller, please complete the following steps:
- Connect weQube to the controller. The display at the sensor is activated when supply voltage is applied.
- Install the associated device-specific electronic description file to the hardware manager (e.g. the GS-DML for Profinet). The required file can be downloaded from **www.wenglor.com → Product World → Product search** (Order No.) → **Download**. Explanations regarding the electronic description file and its layout are included in the comprehensive operating instructions in PDF format.
- Help regarding installation of the file to the controller, as well as network planning, can be found in the help files for the respective controller. wenglor offers descriptions for individual controllers which can be downloaded from: **www.wenglor.com → Product World → Product search** (Order No.) → **Download**.

**Caution:** When operated with a controller, settings which have been changed via the website or the OLED display are overwritten by the controller.

# EN

## 5.6. Default Settings

|  |  |  | weQube |
|---|---|---|---|
| Teach+ | Number of frames |  | 10 |
| Display | Intensity |  | Screensaver |
|  | Mode |  | Text |
| Interface | Serial | Baud rate | 115.200 |
|  | Ethernet | DHCP | Off |
|  |  | IP Adress | 192.168.100.001 |
|  |  | Subnet mask | 255.255.255.000 |
|  |  | MAC Adress | See label on Sensor |
|  |  | Std. gateway | 192.168.100.254 |
|  |  | TCP/IP Port | 32001 |
| Language |  |  | English |
| Password | Enable |  | Disable |
|  | Change |  | 2013 |

# 6. Functions Description, OLED Display

Run

Teach-In
- Teach-In 1 - - - - - - - - - - - -
- Teach-In 2 - - - - - - - - - - - -
- Teach-In 3 - - - - - - - - - - - -
- Teach-In 4 - - - - - - - - - - - -
- Teach-In 5 - - - - - - - - - - - -
- Teach-In 6 - - - - - - - - - - - -
  - <T> for teach-in

Teach+
- Image Count
- Start
  - Number of frames: 0 - 1000

Display
- Rotate
- Intensity - - - - - - - - - - - - - - -
  - O Minimum
  - O Normal
  - O Maximum
  - O Power Save
  - O Screensaver
- Mode - - - - - - - - - - - - - - - - -
  - O Network
  - O Text
  - O Indication
  - O Numeric
  - O Match code
  - O I/O

Assistent

Projects
- Current Projekt
- Load Project - - - - - - - - - - - -
  - Project_1
  - Project_2
  - Project_3
- Set Start Project - - - - - - - -
  - Project_1
  - Project_2
  - Project_3

Configuration
- Load
- Save

Interface
- Serial - - - - - - - - - - - - - - - - -
  - O 9.600
  - O 19.200
  - O 38.400
  - O 115.200
- Ethernet - - - - - - - - - - - - - - -
  - DHCP - - - -
    - O Off
    - O On
  - IP-Address
  - Subnet Mask
  - Std. Gateway
  - MAC Address
  - TCP/IP Port
  - Net Reset - - - - -
    - Press <R> for Reset

Language
- O English
- O Deutsch
- O Français
- O Español
- O Italiano

Info

Reboot
- Press <R> for Reboot

Reset
- Press <R> for Reset

Password
- Enable/Disable
- Change

Smart Camera / Vision-Sensor / 1D- /2D-Code-Scanner / OCR Reader

# EN

The first time the sensor is started and after each reset, language selection and the assistant appear at first (see section 6.9).

| Language | |
|----------|---|
| English | ▲ |
| Deutsch | ↵ |
| Français | ▼ |

Navigation with the keys:
▲ : Navigate up
▼ : Navigate down.
↵ : Enter key
You can switch to the configuration menu by pressing any key.

Meanings of menu items:
◄ Back: Move up one level within the menu.
◄◄ Run: Switch to the display mode.
You can switch to the configuration menu by pressing any key.

**Note:** If no settings are adjusted in the configuration menu for a period of 30 seconds, the sensor is automatically returned to the display mode. The sensor accesses the last used menu view when a key is once again activated. If a setting is configured, it becomes active when the configuration menu is exited.

**Caution:** Do not use any sharp objects to press the keys when configuring settings, because they might otherwise be damaged.

## 6.1. Run

The sensor is switched to the display mode.
The text mode is the default setting for the display mode. The display mode can be changed to the network mode, the status mode, the numeric mode or the match code mode in the display menu (see section 6.4.2).

## 6.2. Teach-In

Subsequent sensor teach-in is possible with the display. Up to six teach options can be taught-in in this way. The parameters which are assigned to the memory locations is determined by means of the PC software. Upon delivery, no parameters are assigned to the teach-in memory locations.

| Teach-In | Select memory location for teach-in |
|---|---|
| Teach-In 1<br>Teach-In 2<br>Teach-In 3<br>Teach-In 4<br>Teach-In 5<br>Teach-In 6<br>◄ Back<br>◄◄ Run | Selection of up to 6 different memory locations for teaching in objects subsequently.<br>**Note:** In order to be able to teach in a given object to the sensor via the OLED display, the desired teach-in function must first be linked to the corresponding teach-in memory location at the display with the help of the software (see section 11.22.3.5). |

Execute teach-in using the selected memory location.

| Teach-In 1 | | Teach in certain object to the sensor. |
|---|---|---|
| Press<br><T><br>to teach in. | T<br>◄ | Teach-in procedure:<br>1) Align the sensor to the desired object.<br>2) Press the "T" key -> the parameter value is taught in. |

## 6.3. Teach+

In the case of Teach+, entire image sequences are saved to a compressed file, including all settings for the current project, for example interface settings etc. This file can be transferred to the PC with the help of weQube software (see section 10.2.3.8).

| Teach+ | Execute Teach+ |
|---|---|
| Number of frames<br>Start<br>◄ Back<br>◄◄ Run | **Number of frames:** Select the number of frames for the Teach+ process.<br>**Start:** Start archive generation for the Teach+ process. A Teach+ procedure which has been started can be aborted by pressing the "C" key. |

You can adjust the number of frames for the Teach+ process to meet your own individual requirements.

| Number of frames | | Select the number of frames for teach-in. |
|---|---|---|
| 10 | +<br>↵<br>− | Press the "+" or "–" key in order to set the number of frames for the Teach+ process to a value between 0 and 1000. |

**Note:** Quicker scrolling through numbers is made possible by pressing and holding the respective key.

# EN

## 6.4. Display

Various changes can be made to the settings at the display in order to simplify operation of the sensor.

| Display | Display settings |
|---|---|
| Rotate<br>Intensity<br>Mode<br>◄ Back<br>◄◄ Run | **Rotate:** Rotate the display 180°. The display is rotated 180° by pressing the ↵ key. The display can be returned to its original position by pressing the same key once again.<br>**Intensity:** Adjust display intensity.<br>**Mode:** Selection of various display modes for the "Run" mode |

### 6.4.1. Intensity

Display intensity can be adjusted, for example to assure that the display is still easily legible even in bright environments.

| Display | Adjusting display intensity |
|---|---|
| O Minimum<br>O Normal<br>O Maximum<br>O Energy saving<br>O Screensaver<br>◄ Back<br>◄◄ Run | **Minimum:** Display intensity is set to the smallest possible value.<br>**Normal:** Display intensity is set to the middle value.<br>**Maximum:** Display intensity is set to the highest possible value.<br>**Energy saving:** If no keys are pressed for a period of one minute, the display is switched off, and is switched back on as soon as a key is activated.<br>**Screensaver:** If no keys are pressed for a period of 30 seconds, the display is switched to the display mode and returns to the last used menu as soon as a key is activated. |

### 6.4.2. Mode

The weQube display is equipped with various display modes which can be used as default settings for the run mode.

| Mode | Selection of the display for the "Run" mode |
|------|--------------------------------------------|
| O Network<br>O Text<br>O Status<br>O Numeric<br>O Match code<br>O I/O<br>◄ Back<br>◄◄ Run | **Network:** The statuses of the various networks are displayed in the "Run" mode (TCP/IP, FTP, Profinet). Possible status displays:<br>**online:** The sensor is connected via the network.<br>**offline:** The sensor is not connected to the network. Check sensor connection.<br>**Error:** There are problems with network connection.<br>**Text:** In addition to the sensor name, any desired sensor values can be displayed in the "Run" mode. Refer to section 11.22.3.1 regarding configuration of the test display in the software.<br>**Status:** The statuses of the 6 different Boolean parameters are displayed in the "Run" mode. The following symbols may appear (see section 11.22.3.2): |

| ● | Switched |
|---|----------|
| O | Not switched |

| | |
|---|---|
| **Numeric:** | Display of the selected value, as well as the upper and lower thresholds in bar graph format (see section 11.22.3.1). |
| **Match code:** | The saved parameter, e.g. a barcode with which scanned codes are compared, is displayed in the "Run" mode. Refer to section 11.22.3.4 on how to save a match code. |
| **I/O:** | The statuses of the 6 outputs are displayed in the "Run" mode. E1 to E6 for input 1 to 6 and A1 to A6 for outputs 1 to 6.<br>O = not specified. |

# EN

## 6.5. Assistant

The assistant is started automatically when the sensor is switched on for the first time, and each time the sensor settings are reset. However, it can also be started manually in order to simplify project selection and sensor configuration.

| | | Starting the Assistant |
|---|---|---|
| The assistant helps you in selecting the most important settings in accordance with your requirements. Do you want to enter further settings? Press Y for yes or N for no, briefly press ◄ to go back and press and hold ◄ to exit. | Y | Start the assistant by pressing the "**Y**" key. |
| | N | After pressing the "**N**" key, the assistant is exited and the display is switched to the full menu. |
| | ◄ | After briefly pressing the ◄ key once, the scrolling text for using the assistant is started again. The assistant is exited after briefly pressing the ◄ key twice, and the display is switched to the full menu. By pressing and holding the ◄ key, the assistant is exited and the display is switched to the configuration menu. |

When using the assistant, you're provided with the following assistance for setting up the sensor:

| | | Loading the configuration from the SD card |
|---|---|---|
| Load configuration from SD card? | Y | If you want to transfer the settings from the SD card to the sensor, press the "Y" key. **Caution:** Current sensor settings are overwritten! |
| | N | |
| | ◄ | If you do not want to overwrite the existing sensor configuration with the settings saved to the SD card, press the "N" key. |
| | | Press the ◄ key in order to return to the initial assistant window. |

| | | Loading a project from the SD card |
|---|---|---|
| Load project from SD card? | Y | If you want to transfer projects which have been stored to the SD card to the sensor, press the "Y" key. **Caution:** The project which is currently selected at the sensor is overwritten! |
| | N | |
| | ◄ | If you **do not** want to select a project which has been saved to the SD card, press the "N" key. |
| | | Press the ◄ key in order to return to configuration selection in the assistant. |

| | | Exiting the assistant |
|---|---|---|
| You have completed all of the steps offered by the assistant. Do you want to run the assistant again? | Y N ◀ | If you want to run the assistant again, press the "**Y**" key. After pressing the "N" key, the assistant is exited and the display is switched to the display mode. After briefly pressing the ◀ key once, the scrolling text is started again. After briefly pressing the ◀ key twice, project selection is displayed in the assistant. |

## 6.6. Projects

The weQube system provides you with the opportunity of loading projects to the sensor which have been saved to the SD card, as well as defining start projects.

| **Projects** | Project Management |
|---|---|
| Current project Load project Set start project ◀ Back ◀◀ Run | **Current project:** The name of the current project is displayed. **Load project:** A stored project included in the project list, or a new project, can be loaded. It will be displayed only the first 50 projects, that are stored on the SD card. **Set start project:** One project must be specified as the start-up project. This project is executed automatically when the sensor is started. |

### 6.6.1. Current Project

| **Current project** | Display of the current project |
|---|---|
| Project name ◀ | The title of the currently loaded project is displayed. Press the ◀ key in order to return to configuration selection in the assistant. |

### 6.6.2. Loading a Project

| **Load project** | Load a project to the sensor which has been stored to the SD card. |
|---|---|
| Project_1 Project_2 Project_3 ◀ Back ◀◀ Run | Any given project can be selected and loaded to the sensor. The project name appears in abbreviated form. |

### 6.6.3. Selecting the Start Project

| Set start project | Selecting the start project |
|---|---|
| Project_1<br>Project_2<br>Project_3<br>◄ Back<br>◄◄ Run | You can select a project from the project list in the "Set start project" menu, which is then selected automatically when the sensor is started. |

## 6.7. Configuration

| Configuration | Managing sensor settings |
|---|---|
| Load<br>Save<br>◄ Back<br>◄◄ Run | **Load**: Settings saved to the SD card are loaded to the sensor.<br>**Save:** Settings currently loaded to the sensor are saved to the SD card. In the event that the sensor is replaced, configuration of the new sensor is simplified by simply replacing the SD card.<br>**Caution:** The previously stored sensor configuration is overwritten during the save operation. |

## 6.8. Interface

In addition to its serial port, the sensor is also equipped with an Ethernet port

| Interface | Interface selection |
|---|---|
| Serial<br>Ethernet<br>◄ Back<br>◄◄ Run | **Serial:** The baud rate can be selected for the serial port.<br>**Ethernet:** Settings for the Ethernet port can be configured. |

### 6.8.1. Serial interface

| Activate | Baud rate selection for the serial port |
|---|---|
| O   9,600<br>O   19,200<br>O   38,400<br>O 115,200<br>◄ Back<br>◄◄ Run | Communication via the serial port can take place at various transmission speeds. Changes do not become effective until after the sensor has been restarted. |

### 6.8.2. Ethernet

| Ethernet | Settings for the Ethernet connection |
|---|---|
| DHCP<br>IP address<br>Subnet mask<br>Std. gateway<br>MAC address<br>TCP/IP port<br>Network reset<br>◄ Back<br>◄◄ Run | **DHCP:** Display: DHCP on or DHCP off<br>**IP address:** Display of the selected IP address<br>**Subnet mask:** Display of the selected subnet mask<br>**Std. gateway:** Display of the selected standard gateway<br>**MAC address:** Display of the preselected, non-changeable MAC address<br>**TCP/IP port:** Display of the TCP/IP port<br>**Network reset:** Resets network settings to their default values<br><br>Changes do not become effective until after the sensor has been restarted. |

### 6.8.2.1. DHCP

| DHCP | DHCP server selection |
|---|---|
| O Off<br>O On<br>◄ Back<br>◄◄ Run | It's possible to activate or deactivate assignment of the network configuration to the sensor via a server. |

### 6.8.2.2. IP Address

| IP address | | Setting the IP address |
|---|---|---|
| 192168100001 | +<br>↵<br>− | The IP address can be set by pressing the "+" and "−" keys. |

| IP address | | Checking the IP address for correctness |
|---|---|---|
| 192.168.100.001<br>Entry correct? | Y<br>N<br>◄ | Correctness of the entered IP address is confirmed by pressing the "**Y**" key and the address is transferred to the sensor.<br>If necessary, the IP address can be reentered after pressing the "**N**" key.<br>After pressing the ◄ key, the display is returned to the Ethernet network menu without saving the entered IP address. |

The procedure for changing the subnet mask, the standard gateway and the TCP/IP port is analogous to entering the IP address.

**6.8.2.3. MAC Address**

| MAC Address | | Displaying the MAC Address |
|---|---|---|
| 54:4a:05:00:08:04 | ◄ | The sensor's unchangeable MAC address is displayed.<br>After pressing the ◄ key, the display is returned to the Ethernet network menu. |

**6.8.2.4. Network Reset**

| Network reset | | Resetting the Network Configuration |
|---|---|---|
| Press<br><R><br>to reset. | R<br>◄ | The network configuration can be reset by pressing "**R**".<br><br>After pressing the ◄ key, the display is returned to the Ethernet network menu. |

Refer to section 5.6 regarding default network settings.

## 6.9. Language

The menu language can be changed in the "Language" menu. The user is automatically prompted to select a language when the sensor is first started up, as well as after each reset.

| Language | Selecting a menu language |
|---|---|
| O English<br>O Deutsch<br>O Français<br>O Español<br>O Italiano<br>◄ Back<br>◄◄ Run | The selected language appears in the menus as soon as it has been selected. |

## 6.10. Info

| Info | Display of sensor information |
|---|---|
| Sensor type<br>B50S001<br><br>Product version<br>1.0.0<br><br>Serial number<br>504215773 | Sensor type, product version, serial number and status are displayed in the information menu.<br><br>These entries play an important role in the event that technical problems should occur, and when contacting **Technical Support** with questions. |

## 6.11. Restart

| Restart | | Restarting the sensor |
|---|---|---|
| Press<br><R><br>to restart. | R<br>◄ | Restating of the sensor can be forced by pressing "**R**".<br><br>After pressing the ◄ key, the display is returned to the main menu. |

## 6.12. Reset

Sensor settings (except for network settings) can be returned to their default values in the "Reset" menu. The default settings are listed in section "5.6. Default Settings" on page 22.

| Reset | | Restore default settings |
|---|---|---|
| Press<br><R><br>to reset. | R<br>◄ | All of the selected sensor settings are returned to their default values by pressing the "**R**" key.<br><br>After pressing the ◄ key, the display is returned to the main menu. |

## 6.13. Password

Password protection prevents inadvertent changes to selected settings.

| Password | Activating the password function | |
|---|---|---|
| De/activate<br>Change<br>◄ Back<br>◄◄ Run | **De/activate:** | Activate or deactivate password protection. When password protection is activated, the sensor is automatically disabled after pressing any in the "Run" mode. |
| | **Change:** | Change the password. |

If the password function is active, the password must be entered each time the sensor is operated. After the password has been correctly entered with the "+" and "−" keys, the menu is enabled and the sensor can be operated.

- The password function is deactivated upon shipment from the factory.
- Passwords can be selected within a range of 0000 to 9999.

Be sure to make a note of the new password before exiting the "change password" function! If the password is forgotten, it must be overwritten with a master password. The master password can be requested by e-mail from **support@wenglor.com**.

## 6.14. Status Information

In addition to status information and warnings in the "Info" menu, messages are also displayed as symbols in the run window.

| weQube ⚠ | Critical Error |
|---|---|
| | A critical error has occurred. |

| weQube ⚠ 0x01 | Fatal Error |
|---|---|
| | A fatal error has occurred. The sensor must be restarted. |

# 7. Installing and Updating the Software

## 7.1. Minimum Requirements

- Standard Intel Pentium, 2 GHz, 2 GB RAM
- Operating system: MS Windows XP, 7
- 150 MB available hard disk space (Recommended 500 MB)
- Ethernet interface
- Screen resolution 1024 × 960 (Recommended > 1280 × 1024)

## 7.2. Installation Procedure

First check to see whether or not a more up-to-date version of the software is available from our website. Additional support for initial start-up a well as further information regarding use of the software can be found on the microsite at www.wenglor.com/weQube.

If the software on the CD is the latest version, proceed as follows:
1. Insert the installation CD into the CD drive.
2. Run the setup program: "Install_weQube". Administrator rights are required to this end.
3. Follow the instructions which appear at the screen.
weQube software is installed.

The language setting for the software is the same as for the operating system. If a different language is desired, it can be selected in the **Settings** menu.

## 7.3. Updating the Software

1. Uninstall current weQube **software** using the Software function in the **Control Panel.**
2. The latest software version is available from the download area at our website: **www.wenglor.com**
3. The new software can be installed as described in section 7.2

Before updating the software, make sure that the firmware has been updated to the most recent version. The current version is always available from the download area at wenglor.com.

# 8. Updating the Firmware

Before setting up the sensor, check to see whether or not a newer version of the firmware is available for the weQube. You can check your sensor's firmware version in the graphic display under Info → Product Version (see section 6.10).
The most up-to-date version of the firmware can be downloaded from our website at:
**www.wenglor.com → Product World → Product search (Order no.) → Download → Software.**

**Note:** When the firmware is updated, the associated PC-software should be updated at the same time (see section 7.3).
The version number indicates whether or not the versions are compatible with each other: if the last place in the version designation changes, the versions are compatible with each other. If the middle place changes, the versions are not 100 % compatible. If the first place changes, the version are not compatible with each other at all. The exact changes included in the consecutive versions can be viewed in the versions history file in the installation directory under .../wenglor/weQube/ressources/help/changelog.text.
Projects generated with version <1.1.x are not 100 % compatible with version >1.2.x. New functions included with version 1.2.x are not available for version 1.1.x projects.

There are two different ways to execute a firmware update. Connection to the sensor must first be established.

## 8.1. Firmware Update via weQube Software

The firmware in the weQube can be updated after opening the firmware update dialog window by clicking Firmware Update in the Help menu. The following window appears:
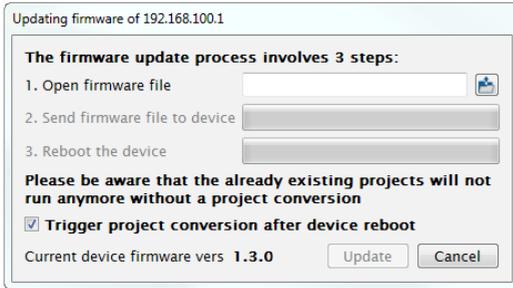


First select the corresponding firmware file and then click the update button. The firmware file is automatically transferred to the sensor, which is then restarted. The firmware update process may not be interrupted. Power to the sensor may not be interrupted during this procedure. Updating takes roughly 10 to 15 minutes.
If project files are located in the sensor's memory, it's advisable to convert them automatically after the update procedure has been completed. The checkbox for "Start project conversion after device restart" must be activated to this end. After the sensor has been restarted, the conversion program is launched.
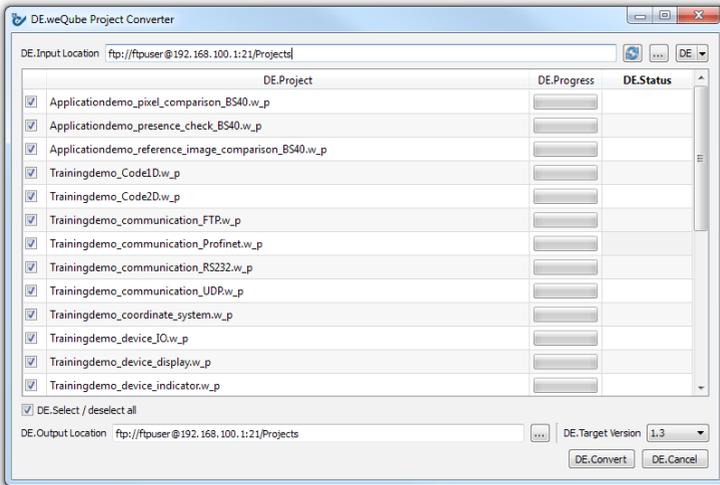
All selected projects are converted to the target version. The version designation is added to the previous project name for the converted projects. And thus Trainingsdemo.w_p becomes Trainingsdemo_V1.3.w_p. The status display for the individual projects indicates the current conversion status.

The conversion tool can also be accessed independent of the update procedure by selecting "Project Converter" from the help menu. The conversion function works for older, right on up to new project versions in both directions.

After the process has been successfully completed, a window appears with detailed information regarding the sensor.

# EN
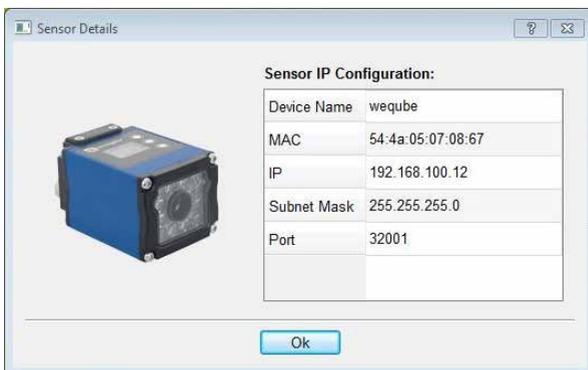
## 8.2. Firmware Update via FTP-Interface

Connection to the sensor must first be established via an FTP client.
Enter "ftp://" to the address bar in the file explorer followed by the sensor's IP address to this end, for example: ftp://192.168.100.1

The following codes have to be entered in order to access the sensor's micro SD card:
User name: ftpuser
Password

Now copy the downloaded firmware directly to the corresponding location in the file explorer (e.g. ftp://192.168.100.1/UPDT_weQube_1.1.0.tgz). The new firmware is transferred to the sensor's micro SD card. Then restart the sensor via the OLED display (see section 6). The sensor's firmware is updated during the re-start. Updating takes roughly 10 to 15 minutes.

## 8.3. Upgrade and Downgrade Options

Upgrade and downgrade options for weQube firmware are shown in the following figure.
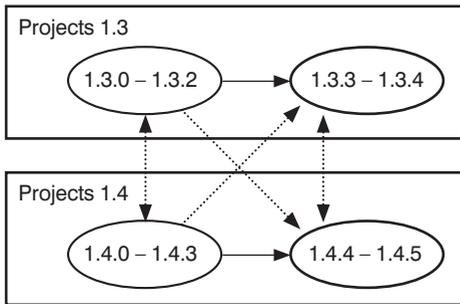


→ Upgrade only, no downgrade possible
☐ Projects are compatible within the identified range
◄·····► Upgrade or downgrade possible (no project compatibility → use project converter)
·········► Upgrade only, no downgrade possible (no project compatibility → use project converter)

> **NOTE!**
> From 1.3.0 to 1.3.2: any desired upgrade or downgrade is possible with compatible projects.
> From 1.4.0 to 1.4.3: any desired upgrade or downgrade is possible with compatible projects.

> **NOTE!**
> After updating weQube firmware to version 1.3.3, 1.3.4, 1.4.4 oder 1.4.5, downgrading to a lower firmware version is no longer possible.

# 9. License Management

The various products included on the weQube platform vary with regard to available software licenses. Licenses are available for scanning modules, for image processing modules and for offline code reading (see section "5.2. System Overview" on page 15). The scope of functions included with each product can be expanded as desired by purchasing further licenses. In order to open the license view, click licenses in the help menu, which can be accessed in the software's menu bar.
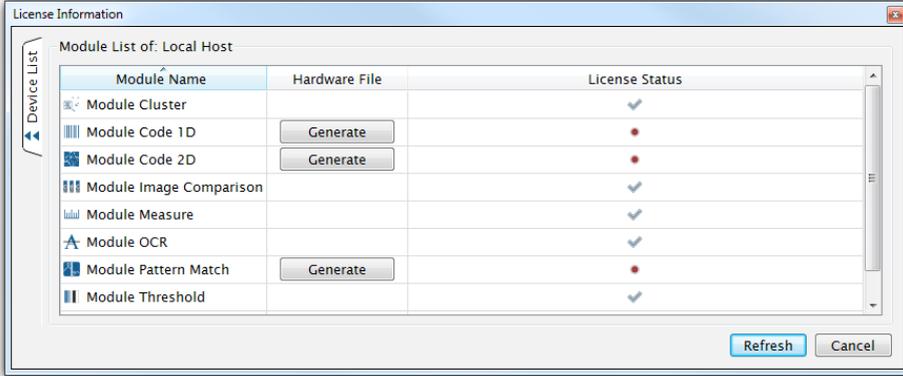


Differentiation must be made between the following two cases:

| The software is connected | The sensor's license status is displayed, including all of its licensed and unlicensed modules. |
|---|---|
| The software is not connected to the sensor (offline). | In the offline mode, all of the image processing modules are licensed. However, as a default setting the scanning modules are not licensed. Note: The PC license for offline 1D-2D code reading is required for offline code reading (see section 5.2). The USB dongle included with the offline license must always be connected to the PC during offline code reading. |

The status of each license is displayed.
- The license for the respective module is included in the current software version.
- The license for the respective module is not included in this software version.

**Subsequent ordering of licenses:**
A hardware file must first be created before licenses can be subsequently ordered for currently unlicensed modules.
Click the Generate button to this end. Send the resulting file (*.w_l) to wenglor by e-mail. After processing has been completed, you'll receive an e-mail reply from wenglor with
the enabled license as an attachment. Afterwards, a "Load" button appears in the window with the licenses under license status of the respective module. After clicking this button, the received file can be added. The corresponding module is then enabled and appears in the toolbox.

**NOTE!**
Along with the PC license for 1D-2D code reading, you also receive as USB dongle in addition to the hardware file – located on the accompanying CD. Before transferring the hardware file to your PC, plug the USB stick into your PC and do not remove it during offline code reading.

# EN

## 10. General Layout of weQube Software

Windows software, which is installed to a PC, is utilized to configure, adjust and diagnose the weQube.

### 10.1. Initial Window

The following initial window appears after the program has been started. Various options are provided by the software.



| | |
|---|---|
|  | The software establishes a connection to the sensor.<br><br>**Note:** The sensor must be correctly connected to the PC to this end (see section 5.5). |
|  | If a project file has been saved to the PC, it can be opened, or any existing project can be selected.<br>Teach+ files can be loaded after changing the file extension to "w_r". |
|  | A demo project can be selected from an applications list. Demo projects show settings used for typical applications with the help of image sequences. |
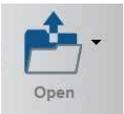
### 10.1.1. Connecting the Sensor (Connect to Device)
#### 10.1.1.1. Device list

The following window appears after clicking "Connect to Device":



**Note:** It's not possible to access the sensor simultaneously with the software and via the website. If applicable, close the website before connecting the software to the sensor. Furthermore, under no circumstances should you make changes in the software and at the OLED display at the same time.

All previously used sensors are displayed in the device list. You can search for a certain sensor in the "Device Quick Search" field, for example by entering its MAC address. The sensors can also be sorted according to various criteria. Simply click the desired heading to this end – for example click "IP" in order to sort the sensors according to IP address. Various sensor information can be added or removed by right clicking the header.

Any sensor displayed in the list can be directly connected to the software by double clicking the respective list entry.

The software starts up in the operating mode. Switch to the editing mode in order to be able to change settings in the software (see section 10.2.3.8).
The following actions can be executed after right clicking a sensor:
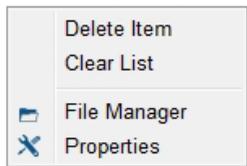
| Delete Item | The selected sensor is removed from the list. |
|---|---|
| Clear List | The entire list is deleted. |
| Edit Network Settings | The sensor's network settings are edited in a new window, even if the sensor is located in another subnet. |
| Properties | The sensor's settings can be edited. |

**10.1.1.2. The Search Network Window**

There are no sensors in the list after the software is first installed. The "Search Network" window appears automatically, which can be used to find sensors within the network. Sensors located in another subnet can also be found in this way.
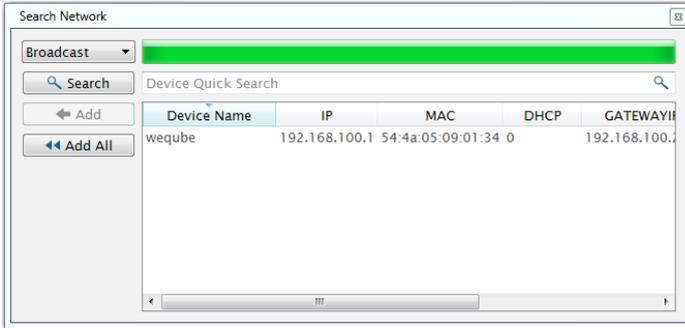


**Note:** Before adding a found sensor to the device list, it's network settings should be adjusted. Right click the respective sensor to this end, and then click "Edit network settings".
The following actions can be executed after right clicking a sensor:
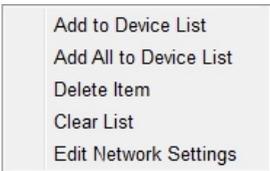


| Add to Device List | The selected sensor is added to the list of sensors. |
|---|---|
| Add All to Device List | The entire list of sensors found in the network is added to the list of sensors. |
| Delete Item | The selected sensor is removed from the list. |
| Clear List | The entire list is deleted. |
| Edit Network Settings | The sensor's network settings can be adjusted in the window shown below. |
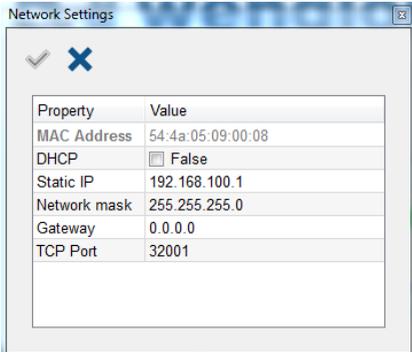
The following options can be selected from the drop down menu under "Broadcast":

| Broadcast | Sensors in another subnet can be found. |
|---|---|
| IP & Port | You can search for a certain IP address and a certain port after clicking "IP & Port". The sensors must be located in the same subnet. |

The respective search is executed by clicking the "Search" button and all of the sensors which match the search terms are displayed in the combination field under the button along with their corresponding settings. The search can be aborted by clicking the "Stop" button. After clicking the ← icon, a selected sensor can be added to the device list. Alternatively, all sensors which appear in the combination field can be added to the device list by clicking the ◄ ◄ icon. By adding a sensor to the device list you get warned to double check the IP configuration.
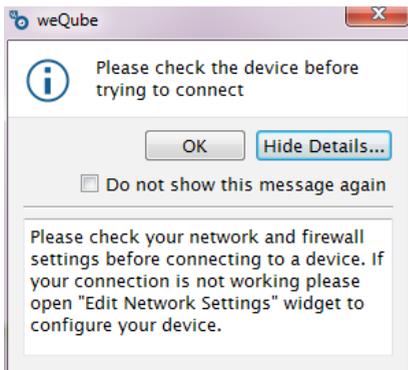
**10.1.1.3. The File Manager**

Files can be exchanged between the PC and the sensor and moved in the file manager. Access to the installed SD card is possible via the integrated FTP server.
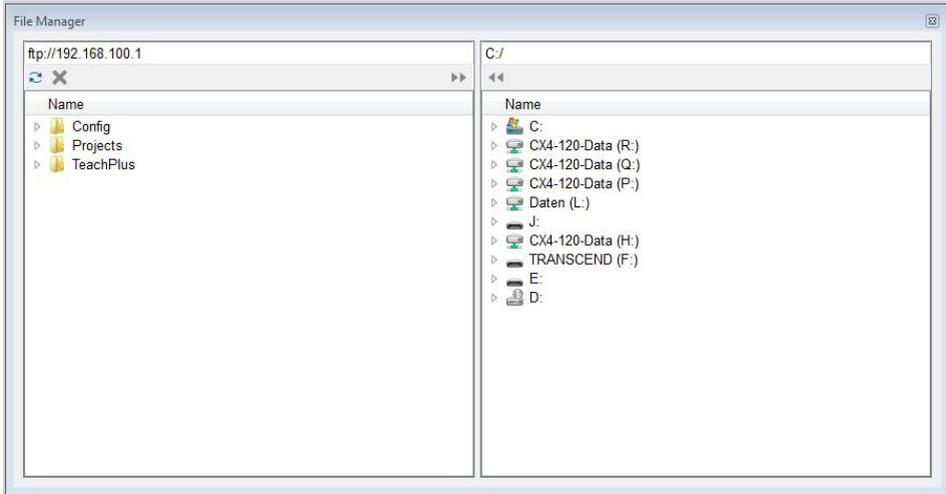
**10.1.1.4. Properties**

The sensor's system settings are displayed. The following information and settings are available:

| Property | Value |
|---|---|
| Article Number | B50M002 |
| Description | weQube |
| Serial Number | 500014785 |
| Product Version | 0.9.4 |
| Type Of Industiral Ethernet | None |
| DHCP | ☐ False |
| IP-Address | 192.168.100.1 |
| Subnet Mask | 255.255.255.0 |
| Std. Gateway | 192.168.100.255 |
| MAC-Address | 54:4a:05:09:00:08 |
| TCP/IP Port | 32001 |
| UDP State Interval | 0 |
| Enable Industrial Ethernet | ☑ True |
| RS232 Baudrate | 115200 |
| Device Name | weQube |
| Start Project | |
| Start Focus Value | -1 |
| FTP Remote IP-Address | 192.168.100.100 |
| FTP Remote Username | ftpuser |
| FTP Remote Password | passwd |
| Web Interface Password | admin |
| Display Rotation | ☐ False |
| Display Password | 2013 |
| Display Locked | ☐ False |
| Display Mode | Numeric |
| Display Intensity | Screensaver |
| Display Language | English |

| Article Number | The sensor's article number (fixed) |
|---|---|
| Description | Product name (fixed) |
| Serial Number | Serial number (fixed) |
| Product-Version | Product version (fixed) |
| Type of Industrial-Ethernet | Which type of Industrial Ethernet (Profinet) is available (fixed) |
| DHCP | Check box for activating the DHCP client |
| IP-Address | IP-Address Current IP address |
| Subnet Mask | Current subnet mask |
| Std. Gateway | Current standard gateway |
| MAC-Address | Current MAC address |
| TCP/IP Port | TCP/IP port for communication with the PC software |
| UDP-State-Interval | Interval in seconds at which service signals (UDP broadcast) are transmitted to port 32003 |
| Enabel-Industrial-Ethernet | Check box for activating Industrial Ethernet communication. |
| Ethernet Mode | Various modes are available: |
| ACD Control | Address Conflict Detection. Automatic detection of address conflicts is activated or deactivated (only with Ethernet/IP). |
| ACD PDU | Indicates which IP address is involved in the event of an IP address conflict (only with Ethernet/IP). |
| Inactivity Timeout | Indicates time after which a TCP/IP port has been closed, if it wasn't active (only with Ethernet/IP). |
| Baud rate | Baud rate for the RS-232 interface. Basic setting: 115,200 bps (8 data bits, no parity, 1 stop bit) |
| Device-Name | The name of the sensor can be made up of the following characters: uppercase and lowercase letters, numbers, dashes (–) and periods (.). The name of the sensor may not begin with "–" or ".". |
| Start-Project | Specifies which project will be loaded when the sensor is started. |
| Start-Focus-Value | -1: No focus homing takes place before advancing to the project's stored focal point.<br>0: Focus homing takes place before advancing to the project's stored focal point. |
| FTP-Remote-Address | IP address of the FTP server |
| FTP-Remote-Username | FTP user name |
| FTP-Remote-Password | FTP password |
| Display-Rotation | Check box for rotating the display |
| Display-Password | Current display password |
| Display-Locked | Check box for activating password protection of the OLED display |
| Display-Mode | Selection of the OLED mode |
| Display-Intensity | Selection of OLED intensity |
| Display-Language | Selection of the OLED language |

**10.1.2. Open**

After clicking the open icon, a project which has been saved to the PC can be opened. The following file formats can be selected:

**10.1.2.1. Project File**

Project files end with .w_p. Sensor settings and a reference image are saved to projects. Projects can be edited both online and offline. They're the standard format for application solutions.

**10.1.2.2. Teach+ File**

Teach+ files end with .w_r. Sensor settings and any desired number of images are saved to Teach+ files. They can be used for documentation and make it possible to change sensor settings in the offline mode from any-where in the world. Files which have been edited offline can be uploaded to the sensor as a project file, and the settings saved to the Teach+ file are then transferred to the sensor.

**10.1.2.3. Template Files**

Template files end with .w_t. As is also the case with project files, sensor settings and a reference image are saved to template files, but template files cannot be overwritten simply by means of saving.

**Creating Individualized Templates**
You can set up your own standards for weQube applications by creating individualized templates. They can be used, for example, in order to specify that communication for all applications will take place via Profinet, or that the scanned code always appears at the display.


Templates

**Loading Templates for Standard Applications**
As a standard feature, several template files are included on the weQube's micro SD card which cover typical applications such as checking for presence, distance measurement, 2D code reading, reference image com-parison and cluster counting.

In order to be able to open these templates and use them as a quick solution for standard applications, con-nection must first be established with the sensor (see section 10.1.1).
The micro SD card can be accessed directly by clicking the open icon (see section 10.2.3.8). After changing the file type to *.w_t, all available template files are displayed. After clicking the required template, it's transferred to the sensor. With just a few clicks, you can adjust your settings and save the solution for your application as a project file with the .w_p extension.

The most up-to-date template files can be downloaded from our microsite at www.wenglor.com/weqube. After establishing a connection with the sensor, you can select the appropriate template file by clicking the open icon at your PC, and transfer it to the sensor.

### 10.1.3. Demo Projects

After clicking demo projects, a ready-made demo project can be opened. Differentiation is made between training demos and application demos.

**Training Demos**

Training Demos

Tutorials

Training demos show sample settings for a software module. The module's mode of operation is made plainly apparent by means of the included image sequence with fictitious objects. A tutorial is available for each training demo on our microsite (www.wenglor.com/weQube), as well as on the included CD, which shows how the demo project was created step by step.

Overview of available training demos and associated tutorials:

| Training Demo | Associated Tutorial |
|---|---|
| Training demo – Localizer | Tutorial 4 – How to localize an object |
| Training demo – Region | Tutorial 5 – How to set a region of interest |
| Training demo – Threshold | Tutorial 6 – How to create a binary image in module threshold |
| Training demo – Cluster | Tutorial 7 – How to count clusters |
| Training demo – Threshold HSV | Tutorial 8 – How to use the HSV threshold module for colored images |
| Training demo – Filter | Tutorial 9 – How to filter an image |
| Training demo – Measure | Tutorial 10 – How to measure an object |
| Training demo – Reference image comparison | Tutorial 11 – How to compare an image to a reference image |
| Training demo – 1D barcode | Tutorial 12 – How to read 1D barcodes |
| Training demo – 2D code | Tutorial 13 – How to read 2D codes |
| Training demo – Match code | Tutorial 14 – How to match a code with a string |
| Training demo – Coordinate System | Tutorial 15 – How to track an object independently of its position and orientation |
| Training demo – Math, logic and numeric comparison | Tutorial 16 – How to do numeric, mathematic or logic operations with output values |
| Training demo – Digital Inputs Outputs | Tutorial 17 – How to configure weQube's input and output pins |
| Training demo – Communication FTP | Tutorial 18 – How to set up weQube's communication with FTP |
| Training demo – Communication RS-232 | Tutorial 19 – How to set up weQube's communication with RS-232 |
| Training demo – Communication UDP | Tutorial 20 – How to set up weQube's communication with UDP |
| Training demo – Communication Profinet | Tutorial 21 – How to set up weQube's communication with Profinet |
| Training demo – Statistics | Tutorial 22 – How to analyze values statistically |
| Training demo – Graphic display | Tutorial 23 – How to set up weQube's display |
| Training demo – Signal LEDs | Tutorial 24 – How to set up weQube's signal LEDs |

The training demos can be edited in order to test available setting options.

**Application Demos**



Application Demos

Application demos demonstrate solutions for complete applications with real objects. They cover typical industrial applications and provide users with a general idea of which settings can be used as solutions for certain applications.

The most important applications are included in the software as demo projects. A complete list of all application demos can be accessed on our microsite at www.wenglor.com/weQube.

## 10.2. User Interface
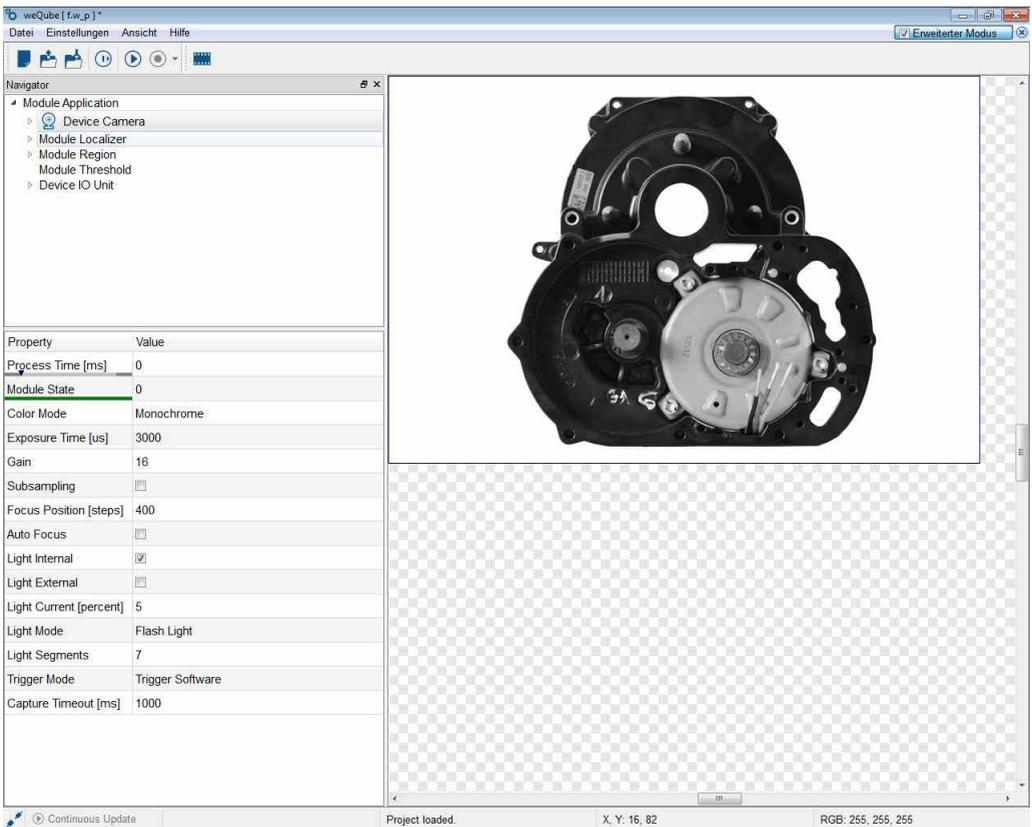


The arrangement of the user interface depicted here shows default software settings during initial use. However, the user interface can be adapted to meet you individual needs.

### 10.2.1. Common Layout Features

Numerous parts of the user interface can be set up individually. For example, the toolbar and the function field can be set to any desired position. After clicking into the dotted area at the left or at the top (a cross appears at the corresponding location), the area can be detached from the layout. This field can then be positioned at any desired position in the foreground, or it can be docked within the layout by holding the field until the blue area highlights the desired position.

Field to be **moved**
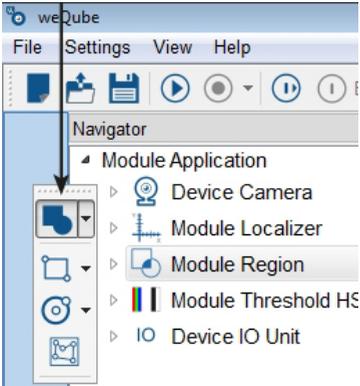


The window navigation field together with settings and results, the image container viewer, the profile, the module toolbox, the histogram and the device list area can be freely positioned or docked. These areas are characterized by the following common layout.
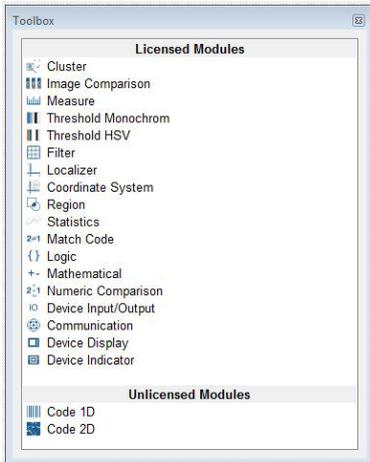


The software saves the layout of the areas.

## 10.2.2. The Menu Bar

The following actions are available in the menu bar.



### 10.2.2.1. File

| New ... | A new project is opened. |
|---|---|
| Open... | A saved project, a Teach+ file or a template file can be opened. Note: If a connection has been established with the sensor and you click the "Open" button, all files saved to the micro SD card are displayed. As a standard feature, template files are located here which make it possible for you to set up your applications quickly (see section 10.1.2.3). |
| Save | The currently open project is saved. |
| Save as | The currently open project can be saved to any desired folder by use of a new name. |
| Recent project | The most recently accessed projects are displayed and can be opened. |
| Close project | The currently open project is closed. |
| Exit | The program is exited. |

### 10.2.2.2. User accounts

Various settings can be selected for user administration.

| Log out | Logs the active user out. |
|---|---|
| Disable monitor screen | The monitor screen is disabled. The software can only be enabled again with the user password. |
| Settings | Further information on settings is included throughout this section. |
| Automatic login | If this function has been activated, the last active user account is logged in again. |

After clicking the "Settings" menu, an overview of existing users appears:

The following user account is included as a standard feature after installation:

User name: admin
Password: admin

Click the "Add" button in order to set up a new user account.

If several user accounts are set up, wenglor recommends changing the password for the user name "admin".

If the administrator password is lost, please contact wenglor's support department.

A new user account can be set up in the following window. The password must have a length at least 5 characters.



---
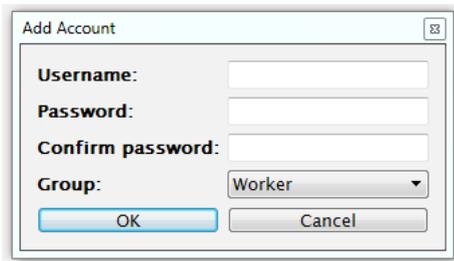
The user can be assigned to one of the following groups:

| | Operator | Set-up | Admin |
|---|---|---|---|
| Load project | × | × | × |
| Edit/save projects | | × | × |
| Start projects | × | × | × |
| Set up a new project | | × | × |
| Teach+ playback | × | × | × |
| Teach+ recording | | × | × |
| Change user account | × | × | × |
| Manage user account | | | × |
| Disable software | | × | × |
| Manual trigger | | × | × |
| Software – extended mode | | × | × |
| Change basic sensor settings | | | × |
| Upgrade licenses | | | × |
| Change software language | | × | × |
| Change basic software settings | | | × |
| Firmware update | | | × |
| File manager | | × | × |

**10.2.2.3. Settings**

**Options:**
Further settings can be selected under options.

**Projects:**
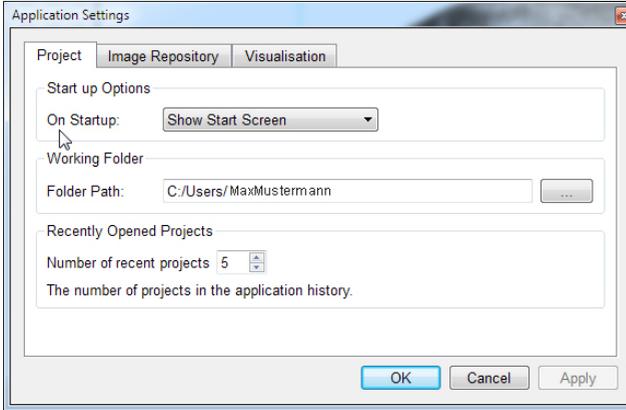


**Selection of options for program initialization:**

• Show initial window
• Open last project
• Open a certain project
• Connect to a certain device

**Work folder:**
A work folder can be selected. This folder is automatically suggested as a directory path when opening and saving projects.

**Recently opened projects:**
The number of recently opened projects can be saved. These can be displayed by clicking **Recent projects** in the **File** menu.

**Image archive:**
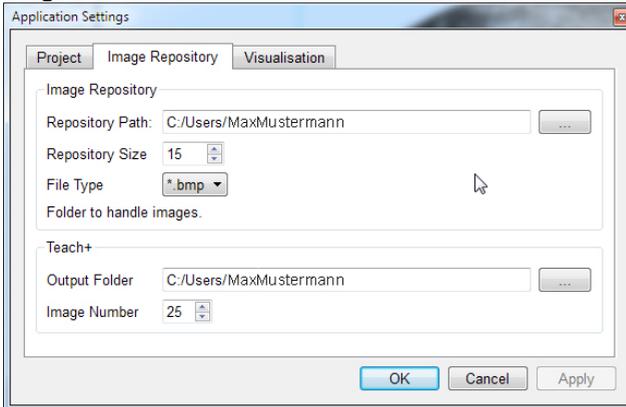


The directory path for the image archive can be selected, as well as the number of images and the image format (*.bmp or *.png).

The directory path and the number of images to be recorded are selected for the Teach+ function.

**Visualization:**
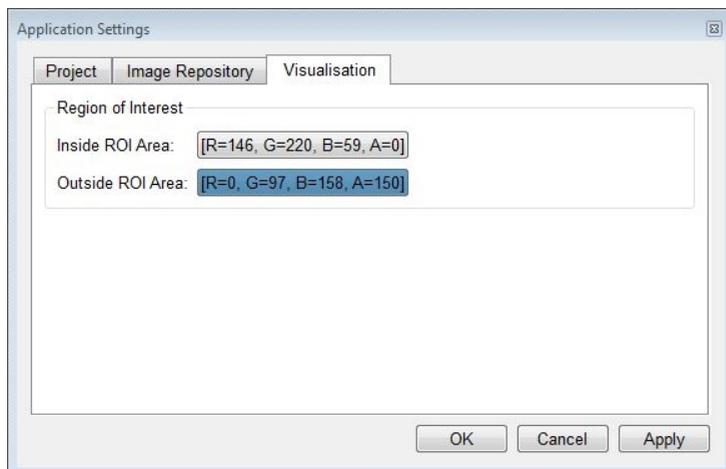


| | |
|---|---|
| **In the ROI** | Select color for the area within the region of interest (active area) |
| **Outside of the ROI** | Select color for the area outside of the region of interest (inactive area) After clicking the corresponding color preview, a window appears at which the color selection can be set. |
| **Language:** | Software language selection. Project relevant texts such as properties and values are displayed in English only and are not translated. |

**10.2.2.4. View**

Various windows can be activated or deactivated in the "View" menu.
Note: Detailed information regarding the individual areas is included in the following sections.

| | |
|---|---|
| **Image Container Viewer** | Window with an overview of all recorded images |
| **Histogram** | Window for analyzing color- and gray scale values within a certain surface area |
| **Monitoring Data from....** | Window with current sensor information |
| **Navigator** | Window with an overview of the current project |
| **Profile** | Window for analyzing color- and gray scale values along a line |
| **Process Time** | Window with an overview of current processing times for the individual modules |
| **Toolbox** | List of available tools. |
| **Device List** | See section "10.2.3.6. Network Tools" on page 61 |

| Search the Network | See section "10.1.1. Connecting the Sensor (Connect to Device)" on page 41 |
|---|---|
| File Manager | See section "10.1.1.3. The File Manager" on page 44 |
| Characteristics | See section 10.1.1.4 |
| Log Viewer | Window with the sensor's system messages |
| Project Tools | Toolbar for the entire project |
| Module Toolbar | Module-specific toolbar |

**10.2.2.5. Help**

| Information | Version information |
|---|---|
| Operating instructions | A solution to a specific problem can be searched for in the operating instructions. A PDF file reader is required to this end. |
| Licenses | Overview of current licenses for the software and the connected sensor |
| Firmware update | The firmware update procedure is started. A sensor must be connected. |

**10.2.2.6. User Mode**
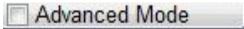
| Advanced Mode | Only visible modules appear in the function tree. Modules which will not be edited can be hidden (see section "10.2.3.1. Navigation Area, Settings/Results, Function Field" on page 57).<br><br>**Note:** Module visibility can only be changed in the advanced mode. |
|---|---|
| ☑ Advanced Mode | All modules and settings can be edited in the navigator. |

**10.2.2.7. Closing the Project**

| ⊗ | The currently open project is closed. |
|---|---|

### 10.2.3. Modifiable Windows and Areas

The following windows and areas can be shown or hidden.

#### 10.2.3.1. Navigation Area, Settings/Results, Function Field

All available modules are listed in the navigation area. Additional modules can be added with the help of the "Module Toolbox" area (see section "10.2.3.5. Toolbox" on page 61).
Settings and results for the selected module appear in the "Property" area. Furthermore, available functions are changed in the "Module Toolbar" according to the selected module.

# EN

Various settings can be selected after right clicking a module. A module can be moved to the desired position within the project tree by clicking it and holding the mouse key depressed.

| | |
|---|---|
| **Visible** | The module can be made invisible for the normal mode and thus protected against any alteration of its settings.<br>• Not crossed out: visible in the normal mode<br>• Crossed out: invisible in the normal mode |
| **Rename** | The module's name can be changed. |
| **Delete** | The selected module is deleted from the function tree.<br>**Note:** Modules can be added once again with the help of the toolbox. |
| **Copy Node Path to the Clipboard** | Copying the node value to the clipboard can be helpful in making it easier to create your own LIMA commands. |
| **Copy Module** | Copies the module along with all of its settings. The position of the newly copied module can be freely selected. |

### 10.2.3.2. Image Container Viewer

The image sequence is shown as a preview in the image container viewer, thus providing an overview of the recorded images.



Advance image sequence left    Navigation through image sequence    Traffic light evaluation    Image selection    Advance image sequence right

Start button    Current image    Filter applications

Rating of the image with stars

Load images
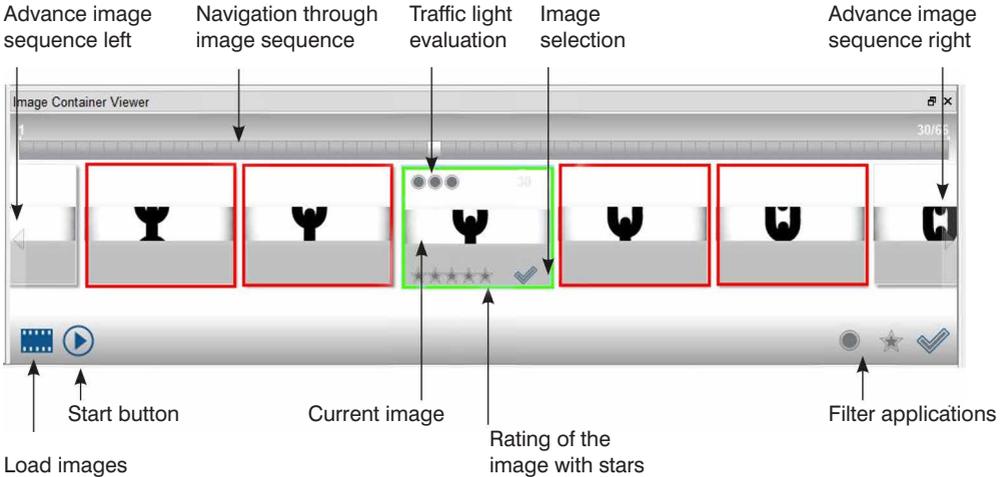
| | |
|---|---|
| Current image | The current image is displayed in the image area and appears with a blue frame in the preview provided by the image container viewer. Evaluation is performed and the results are updated. |
| Start button | Starts automatic replay of the image sequence. |
| Advance image sequence left/right | The image to the left or right of the current image is selected and displayed in the image area. |

| | |
|---|---|
| Navigation through image sequence | This bar allows for quick navigation through the image sequence, which frequently includes a large number of images |
| Image selection | A certain image can be highlighted as a selected image. |
| Rating of the image with stars | A given number of stars can be assigned to each image in order to rate its quality. |

**Traffic light evaluation**    Objects in the images can be evaluated with a traffic light system. For example:

| | |
|---|---|
| Red | The object has not been detected or is not present. |
| Yellow | The object has been detected and is defective. |
| Green | The object has been reliably detected and fulfills the specified requirements. |

**Filter applications**    Various filters can be applied to the image sequence in the image container viewer.

Star rating filter



Traffic light filter    Image Selection filter
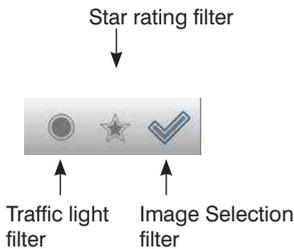
**Traffic light filter**    This filter can be set to a certain traffic light color, after which only accordingly evaluated images are displayed.

**Star rating filter**    The star rating filter for a specific number of stars only displays images with the specified star rating.

**Image selection filter**    Only the correspondingly selected images are displayed when this filter is used. Evaluation is performed for the respectively visible image.

**Note:** The three filter types can be combined as desired.

**10.2.3.3. Profile**

The profile area indicates the gray-scale values along an arrow within the image area. The gray-scale value for entirely black objects is 0, and for entirely white objects it's 255.



An arrow can be defined in the region of interest for the profile area. It's length and direction can be freely selected. The length of the arrow is depicted in the profile area along the X-axis. A gray-scale value within a range of 0 to 255 is assigned to each point within the arrow along the Y-axis, where 0 corresponds to black and 255 to white. This support system simplifies the processing of transitions.

**Note:** With threshold analysis, the gray-scale values at both sides of edges can be analyzed with the help of the profile area, making it easier to adapt entry of the threshold values (see sections 11.7 and 11.8)

**10.2.3.4. Histogram**

The histogram area indicates frequency distribution of the gray-scale values of a given surface in the region of interest.
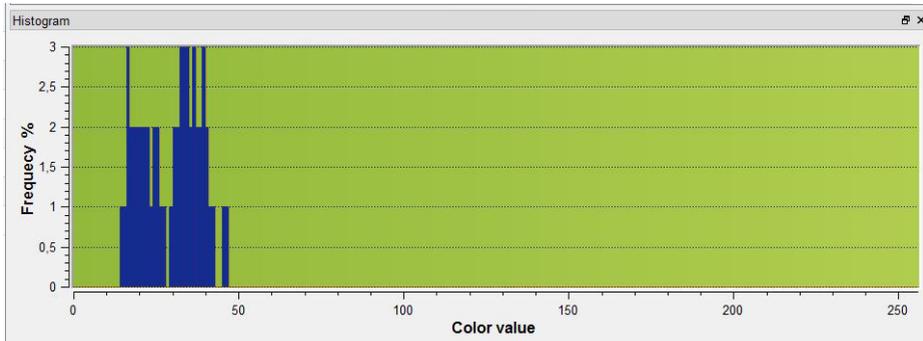


Similar to the profile area, the area to be examined must first be specified in the region of interest. This is a rectangle in the case of the histogram, whose size and position can be changed as desired. All gray-scale values from 0 to 255 appear along the X-axis. Along the Y-axis, a frequency value is assigned to each gray-scale value for the selected area. And thus the number on the Y-axis indicates the number of pixels for the corresponding gray-scale value.

**10.2.3.5. Toolbox**
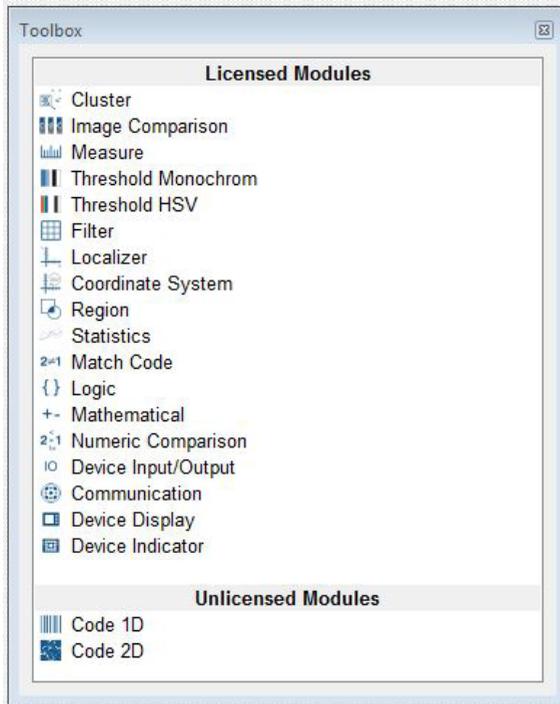


Figure: Toolbox Display Area

All modules are displayed in the **Toolbox** area which can be accessed by clicking **Toolbox i**n the **View** menu. Differentiation is made between licensed and unlicensed modules. Licensed modules can be added to the project / inspection program by means of drag and drop, or by double clicking the respective module.

**10.2.3.6. Network Tools**

Various windows can be accessed from the "Network Tools" menu.

| | |
|---|---|
| Device List | Opens the device list as described in section 10.1.1.1 |
| Search Network | Opens the search network dialog box as described in section 10.1.1.2 |
| File Manager | Opens the file manager as described in section 10.1.1.3 |
| Characteristics | Opens the sensor's settings as described in section 10.1.1.4 |

**10.2.3.7. Process Times**

**Process Times**, which can be accessed by clicking **Process Times** in the **View** menu, displays evaluation times for the individual modules.
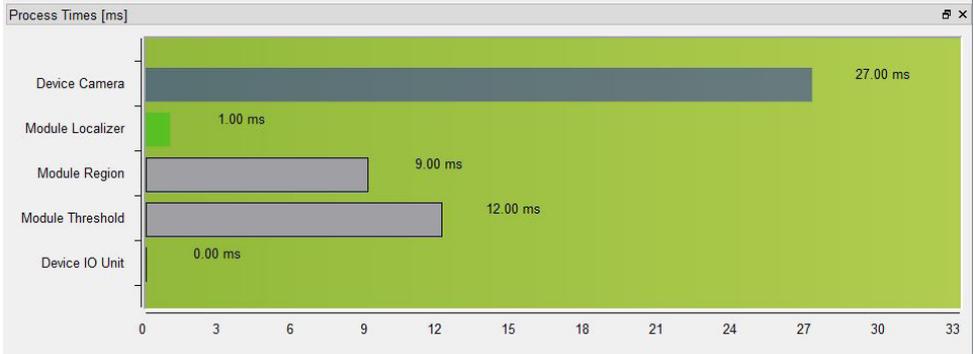


**10.2.3.8. Project Tools**

Project tools make it possible to execute important functions quickly.

| | |
|---|---|
| **New Project** | Opens a new project. |
| **Open** | Opens a project, a Teach+ file or a template file. Note: If a connection has been established with the sensor and you click the "Open" button, all files saved to the micro SD card are displayed. As a standard feature, template files are located here which make it possible for you to set up your applications quickly (see section 10.1.2.3). |
| **Save** | Saves a project file |
| **Teach+ playback** | **Note:** Recording and playback of Teach+ files are also explained in the tutorial entitled "How to use Teach+ Files", which is available on our website at www. wenglor.com. The playback function makes it possible to load and playback recorded image sequences (Teach+), including all associated project settings and interface settings. Previously recorded image sequences with the **.w_r** file extension can be reloaded to the system with the help of the **playback** function. |

A window appears at which the compressed file can be selected. The file is then decompressed at its memory location and restored to its original structure. Depending on the size of the file and the number of images it contains, decompression may take several seconds. All previously recorded images and project settings are then available.

The images can be played back automatically as an image sequence. The corresponding icon must be clicked to this end. All stored images are then played back one after the other.
After clicking the icon, the stored images are worked through as individual images. The playback mode can be exited by clicking the icon once again.

**Teach+ recording**

Note: Recording and playback of Teach+ files are also explained in the tutorial entitled "How to Use Teach+ Files", which is available on our website at www.wenglor.com.

The recording function makes it possible to compress complete image sequences, along with all of the settings for the current project, into a file and save them (Teach+).

A window appears at which the memory location can be specified for the file. All files are first copied to the target directory and then a compressed archive is created. The file is automatically named. The filename consists of the term "TeachRec_" and the date and time at which the file was created. The filename consists of the current date and time, as well as the project name.

The recording function is activated by clicking the icon. The number of images specified for the sequence is then recorded. The default value for the number of images to be recorded can be changed under options. All recorded images are then compressed, added to a single file and saved to the previously specified target directory. The target directory must be large enough to store all of the images.
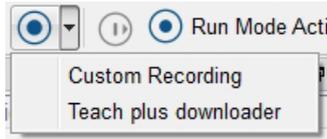
Additional recording functions appear after clicking the arrow next to the recording icon. The number of images to be recorded can be specified with the "Individual recording" function. This setting corresponds to those which can also be configured under "Options" in the "Settings" menu (see section 10.2.2.3).

If a Teach+ file has been recorded directly via the OLED display, it can be stored to the PC with the "Teach plus downloader" function..

**Run Mode active**

The live image from the sensor is refreshed cyclically in the operating mode. However, no changes can be made to the software settings in this mode.
Note: Compressing and transmitting the settings to the PC takes time and allows roughly 1 to 2 refresh operations per second in the software.

**Edit Mode**

The software settings can be changed in the edit mode. A current image is only retrieved from the sensor in the event that the module is replaced or the settings are changed.
**Note:** Priority is placed upon editing the settings in this mode. As a result, it's possible that trigger signals might be missed when settings and accepting parameters.

**10.2.3.9. Module Tools**

There are specific functions for each module which are described in the sections for each respective module.
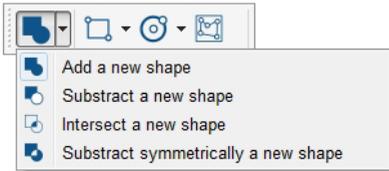


Figure: Example of a Function Window for the Region Module

**Note:** Not all of the modules have functions. Module tools, if any are available, only appear as long as a module is selected – otherwise they remain hidden.

**10.2.3.10. Online Data Monitoring Module**

There are four different windows in the Online Data Monitoring screen which include service information concerning the connected weQube.

# EN
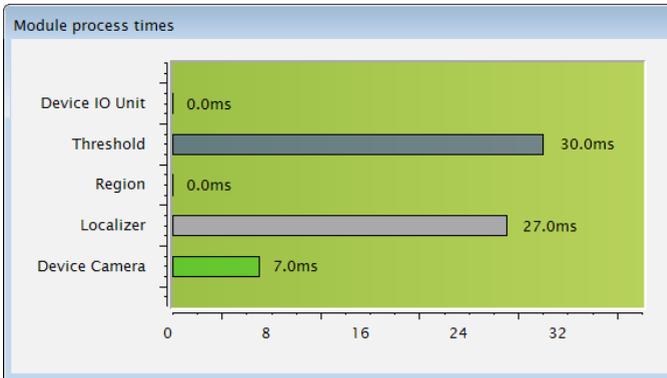
**Available/Utilized Memory**

Main memory utilization for the weQube is displayed. How much memory is available for further modules is indicated here.
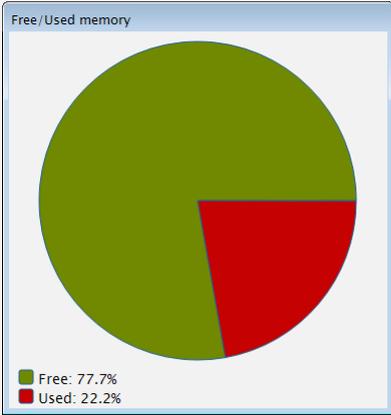


**Digital I/O Status**

The current status of the inputs and outputs is displayed. The display might not always be current in the case of fast applications.

The following icons can be used to select either a cascaded ⊞ or a split ⊞ view of the window.
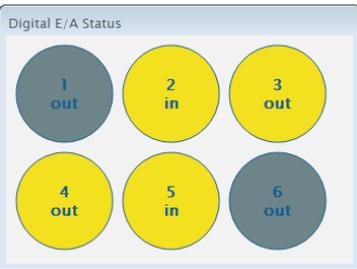
**10.2.4. Image Area**

A selected image is displayed in large format in the image area, for which all of the setting options can be configured.



Current sensor images as well as image files which have been stored to the PC can be displayed in the image area. The image files must have matching parameters (width, height and depth of focus). weQube software can load an image sequence by means of multiple selection. All of the following images must have the same image parameters as the first one. This makes it possible to process live images, and allows for processing of recorded sample images for the purpose of configuration. A context menu is opened by right clicking in the image area. The context menu varies depending on the image and the currently used module.
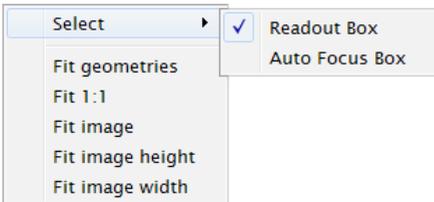


**10.2.5. The Status Bar**
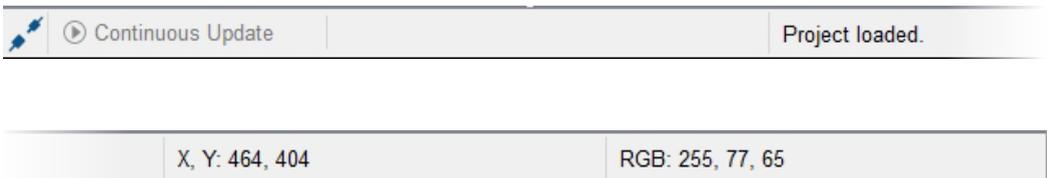




The status bar, which includes general information and image coordinates, as well as current red, yellow and blue values at the location of the mouse pointer, is located at the bottom edge of the program window.

Refreshing performance can also be influenced, i.e. whether or not camera images and parameters are cyclically taken from the sensor (run mode), or if the refresh process is suspended (edit mode). The camera image is refreshed cyclically in the run mode. No parameter changes are possible in this mode. You can switch back and forth between the two modes by simultaneously pressing the space key and the run mode / edit mode button.

Parameters can be changed in the edit mode, during which refreshing of the camera image is interrupted – camera images are not cyclically loaded from the sensor as is the case with the run mode. Each time a parameter is changed, the current camera image is loaded from the sensor.

# 11. Software Module

## 11.1. Application Module

### 11.1.1. Overview

**Objective**    The uppermost level offers an overview of the project's basic characteristics.

### 11.1.2. Setting Parameters

**Characteristics**    The following settings/results are displayed:

| | |
|---|---|
| Processing Time [ms] | Sensor processing time for the entire project |
| Module Status | Error codes for troubleshooting support (see section 18.6). |
| Processing Time, Last Run [ms] | Total processing time for the last project run is displayed. |
| Module Status, Last Run | The module status for the last run is displayed. |
| Run Counter | The number of completed evaluations since the last time power was switched on is displayed. |
| Available Memory [kB] | Currently available capacity of the sensor's flash memory is displayed. |
| Filename | The filename of the currently running project is displayed. |
| Project Version | The version of the project is displayed. The version depends on the version of the sensor firmware with which the project was created. |
| Toggle Bit | The value of this bit changes for each run from 0 to 1 and vice versa. |
| Author | The author of the project can be specified. |
| Info | An additional information text can be entered for a more accurate project description. |

## 11.2. Camera Device Module

### 11.2.1. Overview

| | |
|---|---|
| **Objective** | Set up the camera for optimized preparation of image processing. Load stored images for subsequent image processing. |
| **Prerequisites** | 1. Sensor is correctly connected (see section 5.5)<br>2. Connection has been established from the sensor to the software (see section 10.1.1) |
| **Procedure** | Various image recording settings can be changed in order to obtain the best possible camera image for subsequent image processing. For example focal point, exposure time and illumination can be adapted to the respective ambient conditions.<br>Furthermore, the camera area which is read out can be reduced in size. In this way, sensor processing time can be reduced and the refresh rate can be increased.<br>In addition to live images, stored images or image series can be loaded to the software in the offline mode. The camera supports a resolution of up to 736 x 480 pixels. |

### 11.2.2. Setting Parameters

| | |
|---|---|
| **Image Area** | If connection to the sensor has been established, the live image is displayed in the image area. If no connection has been established, the initial window appears in the image area. |
| **Blue Gain** | The image's blue content is changed by means of automatic white balancing of the color camera. This changed value can also be adjusted manually. |
| **Red Gain** | The image's red content is changed by means of automatic white balancing of the color camera. This changed value can also be adjusted manually. |
| **Property** | The following settings/results appear: |

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the process steps in the device camera module |
| Module State | Error codes to give support in error diagnosis. (see section 18.5) |
| Capture Duration | Processing time for image recording |
| Queue Position | Number of images which are currently in the input buffer |
| Color Mode | Displays the sensor's image chip variant (color or monochrome). |
| Exposure Time ($\mu$s) | Exposure time is the period of time during which the CMOS sensor receives light. Exposure time can be selected within a range of 0.017 to 30 ms. It can be adjusted in steps of 0.001 ms.<br>Short exposure times are used for dynamic processes in order to avoid motion blur.<br>Long exposure times are used for static processes.<br>• Short exposure times are used for dynamic processes in order to avoid motion blur.<br>• Long exposure times are used for static processes.<br>**Note:** Long exposure times (>1 ms) reduce light current serves as a safety mechanism and prevents overloading of the LEDs**.** |

**Property**

| | |
|---|---|
| Gain | Gain is the factor by which CMOS sensor sensitivity is increased. Please note that image interference (snow), which is associated with the CMOS sensor, is amplified as well. Gain should be set as low as possible in order to avoid unnecessary diminishing of the quality of the image. |
| Subsampling | In the case of subsampling, transmission of brightness information, and thus resolution of the camera image, is greatly reduced. This decreases the required amount of storage space and increases transmission speed (only available with monochrome image chip versions). |
| Focus Position (steps) | The focus position can be changed manually for the purpose of precision adjustment |
| Auto Focus | An in-focus range can be selected within the field of vision. The size and position of the rectangle for the auto-focus function can be changed in the auto-focus box sub-module (see section 11.17.2). Then activate the auto-focus check box, after which the sensor is focused automatically. |
| Rotate Input Image | After activation, the input image is automatically rotated 180°. |
| Light Internal | Internal illumination can be switched on and off. Integrated illumination is switched on by activating the Light Internal check box. The setting can also be changed externally by means of linking to another value or event (only possible in the "Flash Light" mode). |
| Light Mode | There are two different illumination variants: |

| | | |
|---|---|---|
| | **Flash Light** | Illumination is only activated at the moment at which image recording takes place. The LEDs are set to maximum illumination intensity. |
| | **Continuous Light** | Continuous illumination is advisable where flash illumination is considered disturbing. However, the fact that illuminance is reduced as a result, along with the sensor's service life, should be taken into consideration. |

| Light Segments | If reflection or a shadow impairs the image, individual LEDs can be switched off if necessary.<br>The following table shows the assignment of numbers to **active (white dot)** and **inactive (black dot)** LEDs (front view facing the LEDs). |
|---|---|

| | | | | |
|---|---|---|---|---|
| 1 | ○●●● <br> ○　　● <br> ○　　● <br> ○●●● | 5 | ○●●○ <br> ○　　○ <br> ○　　○ <br> ○●●○ |
| 2 | ●○○● <br> ●　　● <br> ●　　● <br> ●○○● | 6 | ●○○○ <br> ●　　○ <br> ●　　○ <br> ●○○○ |
| 3 | ○○○● <br> ○　　● <br> ○　　● <br> ○○○● | 7 | ○○○○ <br> ○　　○ <br> ○　　○ <br> ○○○○ |
| 4 | ●●●○ <br> ●　　○ <br> ●　　○ <br> ●●●○ | | |

| Trigger Mode | Selection can be made between three different trigger variants. | |
|---|---|---|
| | **Continuous** | Images are recorded and evaluated continuously and as quickly as possible. |
| | **Trigger** | Trigger pulses are generated by the application with the help of a trigger input. One input has to be set up as a trigger input in the digital I/O module (see section 11.21). An image can be recorded manually by pressing the "T" key. |
| | **Stop** | Only one trigger pulse is processed, after which all following trigger pulses are ignored. |

# EN

## Trigger Continuous:

Sequence in Live Mode

Trigger Delay = 0
Output Hold Time = 0
Event 1 Delay = 0



Capture Image

Image evaluation

Calculation results

Output

Output Capture

Output-Process

Time [ms]

0  20  40  60  80  100  120  140  160  180  200  220  240  260  280  300  320  340  360  380  400

Image 1    Image 2    Image 3    Image 4
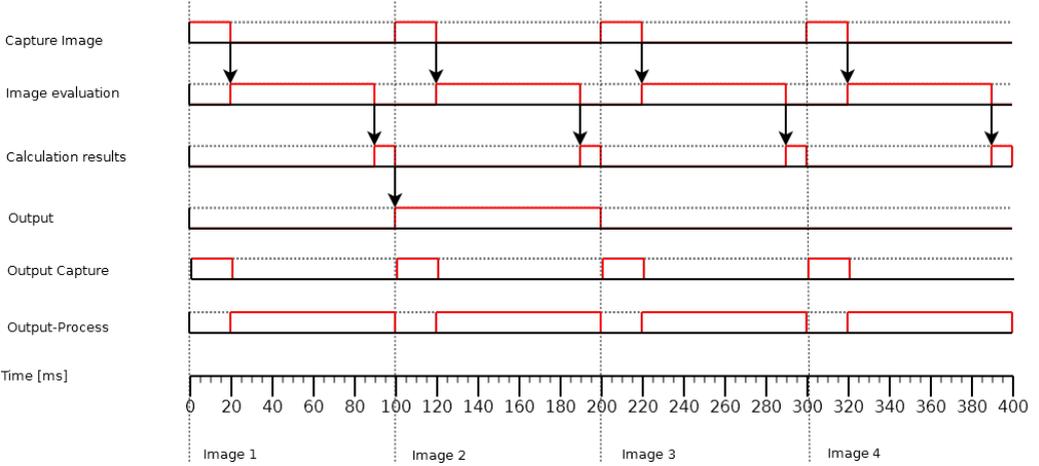
## Trigger:

Sequence in Trigger mode

Trigger Delay = 0
Output Holde Time = 0
Event 1 Delay = 0



Trigger

Capture Image

Image evaluation

Calculation results

Output

Output-Capture

Output-Process

Time [ms]

0  20  40  60  80  100  120  140  160  180  200  220  240  260  280  300  320  340  360  380

Image 1    Image 2
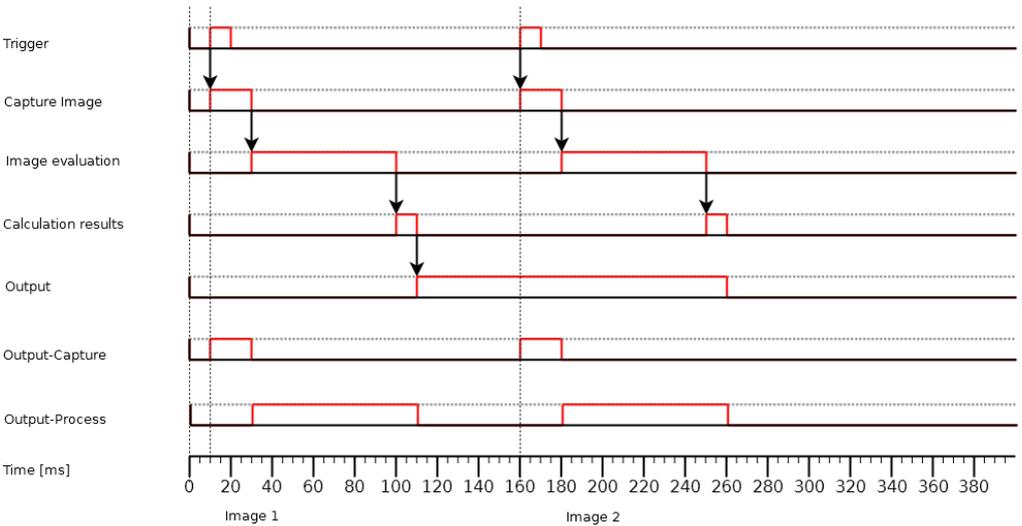
**Function Field**   Stored images can be loaded to projects without any connection to the sensor.

| | |
|---|---|
| | Load stored images to the software. The image container appears. Several images can be selected at once by pressing and holding the CTRL key. Note: Image sizes of up to 736 x 480 pixels can be loaded to the software. |

**11.2.2.1.White Balancing**

Activating White Balancing

Procedure:
The view is changed to the module's input image when the "White Balancing" tool is activated. After clicking the place in the image which should be defined as "white" in the application, the algorithm ascertains the image coordinates, from which it calculates the new "white value". The algorithm calculates the new values for the image's red and blue content. The image is then redisplayed with the changed values.

**Note:** The white balancing function is only available with color versions of the weQube.

**11.2.3. Configuration**

The device camera module includes the following configuration options:

- Image Sensor
- Readout Box
- Auto Focus Box

# EN

## 11.2.3.1. Image Sensor

**Objective**   Sensor image details can be displayed.

**Property**   The following settings/results are displayed:

| | |
|---|---|
| Image Type | Display of the image type |
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |
| Width (px) | Width of the sensor image |
| Height (px) | Height of the sensor image |

The following settings/results are displayed under raw 8-bit:

| | |
|---|---|
| Size | Number of pixels read out |
| Bits per pixel | Display of the number of bits required to transmit one pixel |
| Channel Type | Various channels can be used depending on the image chip variant and the selected settings. |

## 11.2.3.2. Readout Box Sub-Module

**Objective**   The camera range which should actually be read out can be selected. With the help of a smaller readout box, transmission time is **reduced** and the refresh rate is **increased**.

**Note:** The area to be examined must lie completely within the readout box.

**Image Area**   As a default feature, the readout box encompasses the entire camera image.
It appears in the image area as a dashed frame, where it can be adjusted.

**Property**   Readout box settings are also displayed in the settings/results area.

| | |
|---|---|
| Width | Width of the readout box |
| Height | Height of the readout box |

The following settings/results are displayed under origin:

| | |
|---|---|
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |

**11.2.3.3. Auto-Focus Box**

**Objective**   The sensor can be automatically focused to various objects. Well focused images can be recorded as a result, which make good image processing possible.

**Note:** After positioning the auto-focus box, automatic focusing can be executed under settings/results in the device camera module. The auto-focus check box must be activated to this end.

**Image Area**   The auto-focus box is displayed in the image area, where it can also be adjusted. The position and the size of the auto-focus rectangle can be varied. The area to be focused on must be contained within one working distance. It's advisable to select a high-contrast area.

**Property**   Focus box settings can also be changed in the settings/results area.

| Width | Width of the readout box |
|-------|--------------------------|
| Height | Height of the readout box |

The following settings/results are displayed under origin:

| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
|--------|--------------------------------------------------------------------|
| Y (px) | |

## 11.3. Module Localizer

### 11.3.1. Overview

**Objective**

Objects can be tracked and reliably detected. The following image processing functions are set up on the basis of this coordinate system.

The localizer module allows for translatory tracking. The coordinate system's X and Y positions are adjusted to this end, but **not** its rotary position.

And thus the localizer is suitable for objects for which rotary position is irrelevant. Furthermore, an easy to detect feature which stands out from the rest of the image (especially high-contrast area, special shape, edge or corner) is helpful for successful tracking.

**Note:** In addition to translatory tracking, rotary tracking is also possible. This can be set up in the coordinate system module (see section 11.4).

**Prerequisites**

1. Sensor is correctly connected (see section 5.5)
2. Connection has been established from the sensor to the software (see section 10.1.1)
3. The camera is configured / images are selected (see section 11.3)

**Procedure**

The module includes a movable teach box with a size of 16 x 16 pixels. This can be positioned at a reliably detectable area (especially high-contrast area, special shape, edge or corner) and taught in under settings in the localizer module. Alternatively, the location in the teach box with the highest contrast can be taught in automatically.

In every recorded image, the area within the specified search box is then detected which **most closely** corresponds to the taught in area. The **gray-scale values** in the areas serve as a basis for comparison. The coordinate system is aligned to the point of closest correspondence to the taught in area, and the object is thus translatorally tracked.

**Note:** No rotary tracking with rotation of the coordinate system can be executed with this model. The coordinate system module must be used in order to perform rotary tracking (see section 11.4).

**11.3.2. Settings**

**Image Area**     The coordinate system, which can be aligned to a taught in feature, is displayed. The X-axis appears red, the Y-axis green.

**Settings/Results**     The following settings/results appear.

| | |
|---|---|
| Process Time | Sensor processing time for the process steps in the localizer module |
| Module State | Error codes to give support in error diagnosis. (see section 18.5) |
| Smallest Difference | The difference in the number of pixels between the previously taught in teach image and the currently found teach image is read out. The results provide an indication of the probability that the currently found reference is the correct reference. |
| Teach Reference Auto | A possible position (area with highest contrast) is automatically detected for the teach box within the specified search box. The coordinate system for tracking is aligned to this taught in box. The results may serve as a good starting value. In case the found position is not unique you should specify the reference position manually. The setting can also be changed externally by means of linking to another value or event. |
| Teach Reference | The reference specified in the teach box for the teach window can be taught in and is then used as a reference value for all other images. The setting can also be changed externally by means of linking to another value or event.<br><br>The coordinate system for tracking is aligned to this taught in box.<br><br>**Note:** The area to be taught in must be positioned at a location with as much contrast as possible in the teach box sub-module before the teaching process. |
| Input Image | Selection of the channel for the image input |

### 11.3.3. Configuration

The localizer module includes the following configuration options:

- Coordinate System
- Search-Box.
- Teach Image
- Teach-Box.

#### 11.3.3.1. Coordinate System

**Objective**   Details regarding the calculated output coordinate system can be displayed in the sub-module. Input coordinate systems in the project tree can be linked against this output coordinate system for tracking purpose.

**Property**   The following settings/results are displayed:

| | |
|---|---|
| Phi (degrees) | Rotation of the coordinate system in degrees |

The following settings/results are displayed under origin:

| | |
|---|---|
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |

#### 11.3.3.2. Search Box

**Objective**   The area can be specified within which closest correspondence to the taught in area should be detected. This area should include all possible positions of the feature to be detected (especially high-contrast area, special shape, edge or corner), in order to assure correct alignment.

Comparison with the taught in box is only conducted within the search area. A smaller search box results in less processing time and a higher refresh rate. In addition to this, a clearly delimited area increases process stability, because small, clearly defined areas are less susceptible to interference.

**Image Area**   As a standard feature, the teach box with a size of 16 × 16 pixels is displayed at the upper left-hand edge of the image in the image area. The teach box can be enlarged to 96 × 96 pixels. Processing time required by the module increases along with the size of the teach box. Its position within the image area can be freely varied. The teach box is then taught-in in the localizer module (see section 11.3.2).

**Property**   The following settings/results are displayed:

| | |
|---|---|
| Width | Width of the search box along the X-axis. |
| Height | Height of the search box along the Y-axis. |

The following settings/results are displayed under origin:

| | |
|---|---|
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |

### 11.3.3.3. Teach Image

**Objective**   The last taught in teach box is displayed in the upper left-hand corner. It's used as a reference value for future search operations.

**Property**   The following settings/results are displayed under origin:

| | |
|---|---|
| Image Type | Display of the image type |
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |
| Width (px) | Width of the teach image |
| Height (px) | Height of the teach image |

The following settings/results are displayed under raw 8-bit:

| | |
|---|---|
| Size | Number of pixels read out |
| Bits per Pixel | Display of the number of bits required to transmit one pixel |
| Channel Type | Type of the image channel" |

### 11.3.3.4. Teach Box

**Objective**   A reliably detectable area (especially high-contrast area, special shape, edge or corner) with a size of 16 x 16 pixels can be specified within the image area and then taught in to the settings for the localizer module. This taught in area serves as a reference value. Detection of closest correspondence to this taught in area is then detected in the search area of every image.

**Image Area**   As a standard feature, the teach box with a size of 16 x 16 pixels is displayed at the upper left-hand edge of the image in the image area. Its position within the image area can be freely varied. The teach box is then taught in to the localizer module (see section 11.3.2).

**Property**   The following settings/results are displayed:

| | |
|---|---|
| Width | Width of the search box along the X-axis |
| Height | Height of the search box along the Y-axis |

The following settings/results are displayed under origin:

| | |
|---|---|
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |

# EN

## 11.4. Module Coordinate System

### 11.4.1. Overview

**Objective**
Objects can be tracked and reliably detected. Further image processing can be set up on the basis of this coordinate system.

The coordinate system module allows for translatory and rotary tracking. The coordinate system's X and Y positions, as well as its, are adjusted to this end.

The coordinate system is suitable for tracking objects whose rotary position can change.

**Note:** In addition to rotary tracking, translatory tracking is also possible. Pure translatory tracking is possible with the localizer module (see section 11.10.2).

**Prerequisites**
1. Sensor is correctly connected (see section 5.5)
2. Connection has been established from the sensor to the software (see section 10.1.1)
3. The camera is configured / images are selected (see section 11.2)

**Abbreviated Procedure**
First of all, how the coordinate system is laid out can be individually specified. Various algorithms are available.

Edge transitions along search rays can then be detected with the help of search lines. A point is generated at the edge on this search line, which can be defined as an origin or a point along the X or the Y-axis.

## 11.4.2. Settings

**Image Area**     The coordinate system set up by means of the specified method is displayed.

**Property**     The following settings/results appear.

| | |
|---|---|
| Process Time | Sensor processing time for the process steps in the localizer module |
| Module State | Error codes to give support in error diagnosis. (see section 18.5) |
| Input Image | Selection of the channel for the image input |
| Construction Method | The coordinate system can be set up in different ways: |
| | **1 point origin** — One point defines the origin of the translatory/rotary coordinate system. |
| | **1 point X-axis, 1 point Y-axis** — One point defines the X-axis and one defines the Y-axis, by means of which a translatory coordinate system is created. |
| | **1 point origin, 1 point X-axis** — One point defines the origin and one point defines the X-axis of the translatory/rotary coordinate |
| | **2 points X-axis, 1 point Y-axis** — Two points define the X-axis and one point defines the Y-axis of the translatory/rotary coordinate system |
| Tracking Method | The way in which the points should be tracked can be specified. |
| | **No** — The points are not tracked. |
| | **Yes** — The points are tracked in the X and Y directions. |
| | **Horizontally** — The points are only tracked in the X direction. |
| | **Vertically** — The points are only tracked in the Y direction. |
| | **Tracking Point:** Only available if the Construction Method uses more than one point. 1. Pt.: Tracking of all points related to this point 1. 2. Pt.: Tracking of all points related to this point 2. 3. Pt. (if available): Tracking of all points related to this point 3." |

### 11.4.3. Configuration

The coordinate system module includes the following configuration options:
- Coordinate System
- Construction Method

#### 11.4.3.1. Coordinate System

**Objective**   Details regarding the calculated output coordinate system can be displayed in the sub-module. Input coordinate systems in the project tree can be linked against this output coordinate system for tracking purpose.

**Property**   The following settings/results are displayed under origin:

| | |
|---|---|
| Phi (degrees) | Rotation of the coordinate system in degrees |

| | |
|---|---|
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |

#### 11.4.3.2. Construction Method

**Objective**   Specify a point for setting up the X or Y-axis within the image. Various algorithms are available.

**Image Area**   Depending on the construction method, either a fixed point or a search ray is displayed in the image area. In the case of the search ray, the detected point appears purple.

| **Property** | The following settings/results appear – 1 to 3 points can appear depending on the previously selected construction method. |

| | |
|---|---|
| Algorithm Point 1 | Selection for the construction method: |
| | Fix — A fixed point is specified as point 1. |
| | Edge on Line — An edge transition is looked for along a search line. The detected point is specified as point 1. |
| | Point (fixed or linked) — A fixed point is specified as point 1. It's also possible to use a result point from another module as a coordinate point. |
| | Edge on Line — An edge transition is looked for along a search line. The detected point is specified as point 1. |
| | Edge on Arc — An edge transition is looked for on an arc. The detected point is specified as point 1. |
| | Segment on Line — Segments are looked for along a line. The center of either the largest or the smallest segment can be specified as point 1. |
| | Segment on Arc — Segments are looked for on an arc. The center of either the largest or the smallest segment can be specified as point 1. |
| | Segment on Circle — Segments are looked for on a circle. The center of either the largest or the smallest segment can be specified as point 1. |
| Algorithm Point 2 | Selection for the construction method: |
| | Fix — A fixed point is specified as point 2. |
| | Edge on Line — An edge transition is looked for along a search line. The detected point is specified as point 2. |
| | Point (fixed or linked) — A fixed point is specified as point 1. It's also possible to use a result point from another module as a coordinate point. |
| | Edge on Line — An edge transition is looked for along a search line. The detected point is specified as point 1. |
| | Edge on Arc — An edge transition is looked for on an arc. The detected point is specified as point 1. |
| | Segment on Line — Segments are looked for along a line. The center of either the largest or the smallest segment can be specified as point 1. |
| | Segment on Arc — Segments are looked for on an arc. The center of either the largest or the smallest segment can be specified as point 1. |
| | Segment on Circle — Segments are looked for on a circle. The center of either the largest or the smallest segment can be specified as point 1. |

| Algorithm Point 3 | Selection for the construction method: | |
|---|---|---|
| | Fix | A fixed point is specified as point 3. |
| | Edge on Line | An edge transition is looked for along a search line. The detected point is specified as point 3. |
| | Point (fixed or linked) | A fixed point is specified as point 1. It's also possible to use a result point from another module as a coordinate point. |
| | Edge on Line | An edge transition is looked for along a search line. The detected point is specified as point 1. |
| | Edge on Arc | An edge transition is looked for on an arc. The detected point is specified as point 1. |
| | Segment on Line | Segments are looked for along a line. The center of either the largest or the smallest segment can be specified as point 1. |
| | Segment on Arc | Segments are looked for on an arc. The center of either the largest or the smallest segment can be specified as point 1. |
| | Segment on Circle | Segments are looked for on a circle. The center of either the largest or the smallest segment can be specified as point 1. |

**Construction Method**

Edge on Line

First of all, the search line's gray-scale values are determined. Then a derivative is generated from the gray-scale values in order to ascertain where an edge is located. If several edges are found, polarity and the "find by" specification determine which edge will be used as a point for the coordinate system.
Example: The first transition from dark to bright should be detected as an edge in the following image.
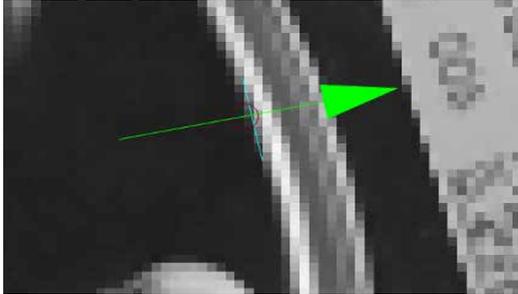


The search line's gray-scale values are represented in the profile.
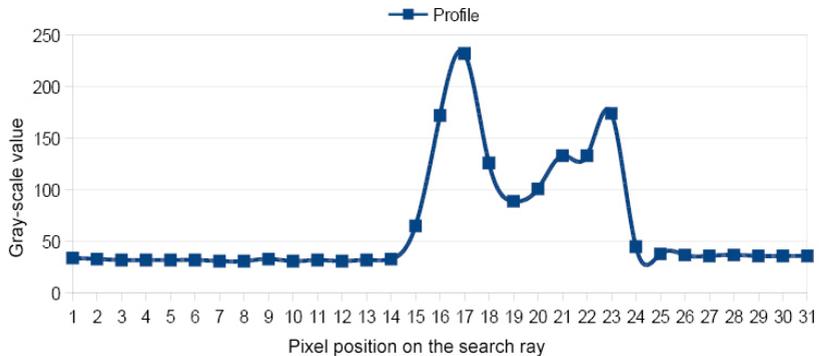
The profile's derivatives are shown in this diagram for edge widths of both 3 and 9. If the positive threshold gradient is 150 and the negative threshold gradient is -120, edges are detected close to the pixels 16, 18 and 24 (if an edge width of 3 has been selected), because the derivative exceeds the positive threshold gradient and or lies below the negative threshold gradient at these points. In contrast, no edges would be detected with an edge width of 9.

Pixel position on the search ray

By using First Score as a setting for Find by and using Dark to Bright as a setting for Edge Polarity, it can be assured that the first transition from dark to bright is used as a point for the coordinate system.

The setting of Edge Width dictates how long a new brightness value has to be retained in order for the transition to be recognized as an edge. In the above example, the new value is retained only briefly, which causes flattening and shifting to the left of the derivative with the larger edge width. The amount of change in brightness an edge has to demonstrate in order to be accepted can be adjusted by setting the threshold gradient values. The higher the value is, the sharper the edge has to be. In order to be able to detect unsharp edges, the absolute value have to be set accordingly low.

| Edge Polarity | Expected Brightness Characteristics | |
| --- | --- | --- |
| | Either | Both bright to dark and dark to bright transitions are searched for. |
| | Bright to Dark | Only bright to dark transitions are searched for. |
| | Dark to Bright | Only dark to bright transitions are searched for. |

| Find by | This parameter can be used to specify which of the detected edges will be used on the search line. |||
|---|---|---|---|
| | **Best Score** | If several edge transitions are detected on the search line, the transition with the greatest contrast is selected. ||
| | **First Score** | If several edge transitions are detected on the search line, the first transition in the search direction is selected. ||
| | **Last Score** | If several edge transitions are detected on the search line, the last transition in the search direction is selected. ||
| Edge Width (px) | The setting Edge Width controls the sensitivity of brightness changes. **Note:** • An Edge Width of 3 pixels represents the highest sensitivity in contrast in the image. • An Edge Width of 9 pixels smoothes the gray profile to ignore the noise. |||
| Threshold Gradient Pos (GrM) | Threshold Gradient Pos defines the threshold of the positive gradient. **Note:** The gradient represents the change of brightness from pixel to the next. The higher the contrast of an edge the higher the gradient. |||
| Threshold Gradient Neg (GrM) | Threshold Gradient Neg defines the threshold of the negative gradient. **Note:** The gradient represents the change of brightness from pixel to the next. The higher the contrast of an edge the higher the gradient. |||
| Edge Point | The coordinates of the detected edge transition are displayed under "Edge Point": |||
| | **X (px)** | Coordinate of the sensor image coordinate system (see section 18.3) ||
| | **Y (px)** | ||
| Orientation | Default | The edge transition search direction corresponds to the direction in which the search ray has been drawn. ||
| | Swap | The edge transition search direction is the opposite of the direction in which the search ray has been drawn. ||

# EN

| **Construction Method** | Edge on Arc |
|---|---|

The construction method is the same as for "edge on line". The difference is the search geometry. In the case of "edge on line", edge jumps are looked for along a line. In the case of "edge on arc", edge jumps are looked for on an arc.

| Edge Polarity | Expected Brightness Characteristics | |
|---|---|---|
| | Either | Both bright to dark and dark to bright transitions are searched for. |
| | Bright to Dark | Only bright to dark transitions are searched for. |
| | Dark to Bright | Only dark to bright transitions are searched for. |

| Find by | This parameter can be used to specify which of the detected edges will be used on the search line. | |
|---|---|---|
| | Best Score | If several edge transitions are detected on the search line, the transition with the greatest contrast is selected. |
| | First Score | If several edge transitions are detected on the search line, the first transition in the search direction is selected. |
| | Last Score | If several edge transitions are detected on the search line, the last transition in the search direction is selected. |

| Edge Width (px) | "Edge width" influences detection sensitivity for brightness fluctuations. **Note:** An edge width of 3 pixels reacts to even the smallest contrast change in the image. An edge width of 9 pixels smooths the brightness profile over a distance of 9 pixels and ignores small irregularities. |
|---|---|
| Threshold Gradient Pos (GrM) | Threshold Gradient Pos specifies the positive gradient acceptance threshold. **Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. |
| Threshold Gradient Neg (GrM) | Threshold Gradient Neg specifies the negative gradient acceptance threshold. **Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. |

| Edge Point | The coordinates of the detected edge transition are displayed under "Edge Point": | |
|---|---|---|
| | X (px) | Coordinate of the image sensor coordinate system (see section "18.3. Coordinate system" on page 198) |
| | Y (px) | |
| | The search line, with which the edge transitions can be found, is defined by means of two points which are specified with their X and Y coordinates. The following settings/results are displayed for points 1 and 2 under "Search Ray". | |
| | X (px) | Coordinate of the image sensor coordinate system (see section "18.3. Coordinate system" on page 198) |
| | Y (px) | |
| Orientation | Default | The edge transition search direction corresponds to the direction in which the search ray has been drawn. |
| | Swap | The edge transition search direction is the opposite of the direction in which the search ray has been drawn. |

**Construction Method**

Segment on Line

The construction method is the same as for "edge on line". The difference is that adjacent segments are looked for in the search geometry. The beginning or end of a segment is defined by an edge. The search for edges corresponds to the search used with the "edge on line" construction method.

| Segments True Count | The number of segments detected in the search geometry is displayed. The upper and lower thresholds can be adjusted manually. |
|---|---|
| Edge Width | "Edge width" influences detection sensitivity for brightness fluctuations.<br>**Note:** An edge width of 3 pixels reacts to even the smallest contrast change in the image. An edge width of 9 pixels smooths the brightness profile over a distance of 9 pixels and ignores small irregularities. |
| Threshold Gradient Pos (GrM) | Threshold Gradient Pos specifies the positive gradient acceptance threshold.<br>**Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. |

| | |
|---|---|
| Threshold Gradient Neg (GrM) | Threshold Gradient Neg specifies the negative gradient acceptance threshold.<br>**Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. |
| Segments Max Count | Maximum number of segments to be expected. |
| Segments Minimum Length | Minimum length of the segments |
| Segments Maximum Length | Maximum length of the segments |

| Sort Rule | The rule used for sorting segments can be defined. | |
|---|---|---|
| | Position on Search Geometry | The order in which the segments are found. |
| | Size | Segments are sorted by size in descending order. |
| Segment Brightness | Bright | Only bright objects are seen as segments. |
| | Dark | Only dark objects are seen as segments. |
| Orientation | Default | The edge transition search direction corresponds to the direction in which the search ray has been drawn. |
| | Swap | The edge transition search direction is the opposite of the direction in which the search ray has been drawn. |

**Construction Method**

Segment on Arc

The construction method is the same as for "edge on line". The difference is that adjacent segments are looked for in the search geometry. The beginning or end of a segment is defined by an edge. The search for edges corresponds to the search used with the "edge on line" construction method.

| | | |
|---|---|---|
| Segments True Count | The number of segments detected in the search geometry is displayed. The upper and lower thresholds can be adjusted manually. | |
| Edge Width | "Edge width" influences detection sensitivity for brightness fluctuations.<br>**Note:** An edge width of 3 pixels reacts to even the smallest contrast change in the image. An edge width of 9 pixels smooths the brightness profile over a distance of 9 pixels and ignores small irregularities. | |
| Threshold Gradient Pos (GrM) | Threshold Gradient Pos specifies the positive gradient acceptance threshold.<br>**Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. | |
| Threshold Gradient Neg (GrM) | Threshold Gradient Neg specifies the negative gradient acceptance threshold.<br>**Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. | |
| Segments Max Count | Maximum number of segments to be expected. | |
| Segments Minimum Length | Minimum length of the segments | |
| Segments Maximum Length | Maximum length of the segments | |
| Sort Rule | The rule used for sorting segments can be defined. | |
| | Position on Search Geometry | The order in which the segments are found. |
| | Size | Segments are sorted by size in descending order. |
| Segment Brightness | Bright | Only bright objects are seen as segments. |
| | Dark | Only dark objects are seen as segments. |
| Segments Max Count | Maximum number of segments to be expected in the search geometry. | |
| Orientation | Default | The edge transition search direction corresponds to the direction in which the search ray has been drawn. |
| | Swap | The edge transition search direction is the opposite of the direction in which the search ray has been drawn. |

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| | |
|---|---|
| **Construction Method** | Segment on Circle |

The construction method is the same as for "edge on line". The difference is that adjacent segments are looked for in the search geometry. The beginning or end of a segment is defined by an edge. The search for edges corresponds to the search used with the "edge on line" construction method.

| | |
|---|---|
| Segments True Count | The number of segments detected in the search geometry is displayed. The upper and lower thresholds can be adjusted manually. |
| Edge Width | "Edge width" influences detection sensitivity for brightness fluctuations.<br>**Note:** An edge width of 3 pixels reacts to even the smallest contrast change in the image. An edge width of 9 pixels smooths the brightness profile over a distance of 9 pixels and ignores small irregularities. |
| Threshold Gradient Pos (GrM) | Threshold Gradient Pos specifies the positive gradient acceptance threshold.<br>**Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. |
| Threshold Gradient Neg (GrM) | Threshold Gradient Neg specifies the negative gradient acceptance threshold.<br>**Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. |
| Segments Max Count | Maximum number of segments to be expected. |
| Segments Minimum Length | Minimum length of the segments |
| Segments Maximum Length | Maximum length of the segments |
| Sort Rule | The rule used for sorting segments can be defined. |
| | Position on Search Geometry — The order in which the segments are found relative to the zero angle. |
| | Size — Segments are sorted by size in descending order. |

| Segment Brightness | Bright | Only bright objects are seen as segments. |
|---|---|---|
| | Dark | Only dark objects are seen as segments. |
| Segments Max Count | Maximum number of segments to be expected in the search geometry. | |
| Orientation | Default | The edge transition search direction corresponds to the direction in which the search ray has been drawn. |
| | Swap | The edge transition search direction is the opposite of the direction in which the search ray has been drawn. |

## 11.5. Module Region

### 11.5.1. Overview

**Objective**

The relevant region of interest used for evaluation should be as large as necessary and as small as possible.

A small, precisely defined area results in faster evaluation and a higher refresh rate. This allows for faster application runtimes because image recording and processing are quicker. Furthermore, object or feature detection is more reliable because fewer noise pixels can occur within the evaluated area.

The object to be detected must lie fully within the selected area, because reliable object detection cannot otherwise be assured.

**Prerequisites**

1. Sensor is correctly connected (see section 5.5)
2. Connection has been established from the sensor to the software (see section 10.1.1)
3. The camera is configured / images are selected (see section 11.2)
4. If applicable, tracking is configured (see sections 11.3 and 11.4)

**Abbreviated Procedure**

Any desired area can be specified as the region of interest by adding, removing or customizing shapes. In addition to existing standard shapes, any number of various shapes can also be added and linked by means of mathematical set theories.

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## 11.5.2. Settings

**Image Area**     The region of interest is highlighted green in the image area (default setting).

**Property**     The following settings/results appear.

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the process steps in the region module. |
| Module State | Error codes to give support in error diagnosis. (see section 18.5) |
| Input Image | Selection of the image input |
| Coordinate System | Selection can be made regarding how the region of interest should be tracked. |

**Function Field**     New shapes can be added to the toolbar module.

1. Select the mathematical operation.

| | | |
|---|---|---|
|  | **Add shape** | The new shape should be added to the overall shape. |
|  | **Subtract shape** | The new shape should be removed to the overall shape. |
|  | **Subtract symmetric** | The common area of the new shape is removed from the overall shape. |
|  | **Intersect shape** | The common area of the new shape and the overall shape should be selected. |

**Note:** The order of the shapes is dictated by the order in which they are created and cannot be subsequently changed. As a result, the overall shape of all previously existing shapes is always used for the offsetting of shapes.

2. Select a new shape.

| | | |
|---|---|---|
| | **Rectangle two points** | A rectangle is drawn with two points. The first corner of the rectangle is specified within the image area by left clicking with the mouse. The diagonally opposite corner of the rectangle is specified with a second click. |
| | **Rectangle three points** | A rectangle is drawn with three points. The first corner of the rectangle is specified within the image area by left clicking with the mouse. The next click specifies one of the neighboring corners and the third click specifies the location of the side of the rectangle opposite the side defined by the first two clicks. |
| | **Circle two points** | A circle is drawn with two points. The first click specifies the center of the circle. The radius of the circle is specified by means of the second click. |
| | **Circle three points** | A circle is drawn with three points. Three points around the circumference of the circle are specified with three mouse clicks. |
| | **Polygon** | A polygon can be created with any desired number of clicks. Each click specifies one of the polygon's corners. Processing of the shape is ended by double clicking the last corner. Polygons can be specially processed within the image area. Individual points can be deleted by pressing and holding the Ctrl+Shift key and clicking the respective point with the left mouse key. A new point can be added to the polygon by pressing and holding the Alt+Shift key and left clicking at the desired side of the polygon. |

3. Draw a new shape within the image area as described.
Newly added shapes also appear in the list under "Set".

**11.5.3. Configuration**

The region module includes the following configuration options:

- Region.
- Set.

Other shapes which are added also appear in addition to the standard shape (rectangle) under "Set".

**11.5.3.1. Region**

| | |
|---|---|
| **Objective** | The selected region of interest can be examined. |
| **Image Area** | The output region, which can be linked as an input region in the following modules, appears white. |
| **Property** | The following settings/results for the module's input image appear under "Image": |

| Image Type | Display of the image type |
|---|---|
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |
| Width (px) | Image width |
| Height (px) | Image height |

The following settings/results are displayed under mask for the input image.

| Size | Number of pixels in the input image |
|---|---|
| Bits per Pixel | Display of the number of bits required to transmit one pixel |
| Channel Type | The mask channel type is displayed. |

The bounding box is positioned such that it encloses the entire specified region. The following settings/results are displayed:

| Width (px) | Width of the bounding box |
|---|---|
| Height (px) | Height of the bounding box |

The following settings/results are displayed for the bounding box under origin:

| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
|---|---|
| Y (px) | |

**11.5.3.2. Set**

**Objective**

All of the individual shapes used in the image area, as well as the overall shape, can be adapted to the application.

1 rectangle is available as standard features.

**Note:** Not only can the overall shape and the two standard shapes be edited, new shapes can also be added with the help of the toolbar module (see section 9.4.2).

**Image Area**

The selected shapes are displayed in the image area and can be edited there as well.

Before the respective shape can be edited, it has to be clicked in the navigator under "Set". Alternatively, the overall shape can be selected by clicking "Set".

| Change position | Click the respective shape in the image area and hold the mouse key depressed until the shape has been dragged to the desired position. |
|---|---|
| Change size | Click one of the corners of the respective shape in the image area. Hold the mouse key depressed until the shape reaches the desired size. |
| Rotate shape | 1. Position the pivot reference point.<br>2. Rotate the shape at the pivot point.<br><br>Pivot point<br><br>Pivot reference point |

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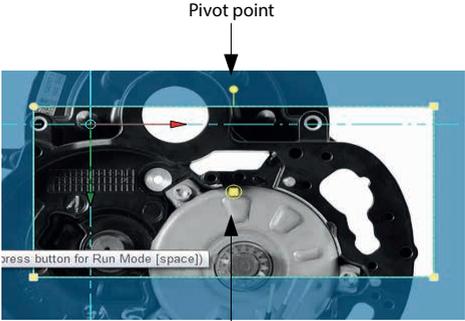
| | | |
|---|---|---|
| **Property** | Shapes can also be edited in the settings/results field. Depending on the respective shape, a specific selection of the parameters included in the following overall list can be changed. | |

| | | |
|---|---|---|
| X-coordinate | Coordinate of the sensor image coordinate system (see section 18.3) | |
| Y-coordinate | | |
| Width | Width of the shape along the X-axis | |
| Height | Height of the shape along the Y-axis | |
| Phi | Rotation of the shape in degrees | |
| Set operation | A mathematical operation can be selected. | |
| | Add | The shape is added to the overall shape.. |
| | Subtract | The shape is removed from the overall shaped. |
| | Subtract Symmetric | The common area of the new shape is removed from the overall shape. **Note:** The area which is enclosed by the new shape only is added to the overall shape. |
| | Intersect | Only the common area shared by the respective shape and the overall shape is selected as the region of interest. |
| Diameter | Diameter of a circle | |

## 11.6. Module Filter

### 11.6.1. Overview

| | |
|---|---|
| **Objective** | Filters are used to highlight desired image characteristics and to suppress undesired image characteristics. |
| **Prerequisites** | 1. Sensor is correctly connected (see section 5.5)<br>2. Connection has been established from the sensor to the software (see section 10.1.1)<br>3. The camera is configured / images are selected (see section 11.2)<br>4. If applicable, tracking is configured (see sections 11.3 and 11.4)<br>5. Region of interest is specified (see section 11.5) |
| **Procedure** | The desired type of filter can be selected and applied to the desired region. |

## 11.6.2. Settings

**Image Area**    Current filter settings are displayed in the selected region of interest.

**Property**    The following settings/results appear.

| Process Time [ms] | Sensor processing time for the process steps |
|---|---|
| Module State | Error codes to give support in error diagnosis. (see section 18.5) |
| Input Region | Selection of the region to which the filter will be applied |
| Input Image | Selection of the channel for the image input |
| Filter Type | Predefined, performance-optimized filters can be selected directly. Freely definable filters have kernel sizes of 3×3 and 5×5. |

**Off**    Input image = output image

**Sobel**    Edge and smoothing filters:
- **Homogeneous** areas appear **black**
- **Edges** appear **white**
- Edges are highlighted, even if they have relatively minimal gray-scale transitions

**Gauss**    "Low-pass filter" (smaller structures are lost, larger ones are retained):
- The image becomes softer
- Snow is reduced
- Inhomogeneous surfaces become more homogeneous
- Edges are highlighted, even if they have relatively minimal gray-scale transitions

**Median**    The median is a soft-focus filter. The gray-scale value of a pixels is replaced by the median of all gray-scale values of the neighboring pixels. This is accomplished by placing all pixels in the specified surroundings in ascending order and replacing the current pixel with the mean value (the median) of the ascending sequence.
- Smoothing of the image while retaining edge steepness
- Sharpness is retained because the edges do not become blurred.
- Small, sporadic noise pixels are eliminated.

| Filter Type | **Dilatation** | Dilatation belongs to the morphological filter functions. These image processing functions are used to emphasize or increase objects of a specific shape and/or size |
|---|---|---|

**Dilatation**

Dilatation belongs to the morphological filter functions. These image processing functions are used to emphasize or increase objects of a specific shape and/or size
- (white portions are strengthened)
- or deleted
- To smooth edges
- To remove errors or "noise"
- To "fill up" specific segments in an image

Effects of a dilatation:
- Adds points to the edges of the objects according to the form and color of the neighboring point.
- Small distortions and gaps are closed and disappear irrevocably.
- Objects that are close to each other can be connected to each other.

**Erosion**

Erosion belongs to the morphological filter functions. These image processing functions are used to emphasize or reduce objects of a specific shape and/or size
- (black portions are strengthened)
- or deleted
- To smooth edges
- To remove errors or "noise"
- To "fill up" specific segments in an image.

Effects of an erosion:
- Adds points to the edges of the objects according to the form and color of the neighboring point.
- Small distortions and gaps are closed and disappear irrevocably.
- Closes objects.

**Oppening**

The opening filter is the succession of an erosion and a dilatation. Erosion closes gaps of dark structures while dilatation reverses thickening of the dark objects. The increase in the surface of the dark objects that occurs in erosion is removed again through dilatation.

Effects of the opening:
- Contours are markedly emphasized even with relatively low gray value transitions.

| Filter Type | **Closing** | Analogously to the opening filter, the closing filter is the succession of a dilatation and an erosion. Erosion closes gaps of bright structures while dilatation reverses thickening of the bright objects. The increase in the surface of the bright objects that occurs in dilatation is removed again through erosion. |
| --- | --- | --- |

Effects of the closing:
• Contours are markedly emphasized even with relatively low gray value transitions.

**Sharpen** The Sharpen Filer enhance the line structures or other details in an image.

**Matrix** Creating Your Own Filters – 3×3 or 5×5:
Where filters are used, the surrounding pixels are generally analyzed for each pixel. This results in a calculated value for the respective pixel, which is used in the output image of the filter module.
The following weighting can be used with the 3×3 filter in order to create a vertical edge filter.

| -1 | 0 | 1 |
| --- | --- | --- |
| -1 | 0 | 1 |
| -1 | 0 | 1 |

The gray-scale value of the output image needs to be determined for the following central pixel. The gray-scale values of the input image's surrounding pixels are ascertained first of all to this end.

| 50 | 120 | 105 |
| --- | --- | --- |
| 90 | 80 | 60 |
| 80 | 100 | 100 |

During calculation, each gray-scale value is multiplied by the weighting factor. The individual values are added up and then divided by 9. The result is the gray-scale value of the central pixel for the output image.
$50 \times (-1) + 90 \times (-1) + 80 \times (-1) + 120 \times 0 + 80 \times 0 + 100 \times 0 + 105 \times 1 + 60 \times 1 + 100 \times 1 = 45$
$45 \div 9 = 5$

### 11.6.3. Configuration

As a standard feature, the region module includes the following configuration options:
• Output Image

**11.6.3.1. Output Image**

| | |
|---|---|
| **Objective** | The filter module's output image can be linked as an input image in the following modules. |
| **Image Area** | The output region, which can be linked as an input region in the following modules, appears white. |
| **Property** | The following settings/results appear in the filter module's output image: |

| Image Type | Display of the image type |
|---|---|
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |
| Width (px) | Image width |
| Height (px) | Image height |

The following settings/results are displayed under 8-bit:

| Size | Number of pixels in the input image |
|---|---|
| Bit per Pixel | Display of the number of bits required for transmission |
| Channel Type | The binary channel type is displayed. |

## 11.7. Module Threshold
### 11.7.1. Overview

| | |
|---|---|
| **Objective** | In order to be able to evaluate, measure or count objects, the images have to be converted to black and white binary images as a preparatory step. The objective is to separate the foreground from the background. This is the only way to assure simple subsequent evaluation of the images. |
| **Prerequisites** | 1. Sensor is correctly connected (see section 5.5)<br>2. Connection has been established from the sensor to the software (see section 10.1.1)<br>3. The camera is configured / images are selected (see section 11.2)<br>4. If applicable, tracking is configured (see sections 11.3 and 11.4)<br>5. Region of interest is specified (see section 11.5)<br>6. If applicable, a filter is activated (see section 11.6) |
| **Procedure** | The limits for the gray-scale values which will determine which pixels appear black and which appear white can be specified.<br>The histogram and the profile which display brightness values and distribution may be helpful for the threshold value process (see sections 10.2.3.4 and 10.2.3.3). |

## 11.7.2. Settings

**Image Area**  A preview of the threshold analysis appears in the image area.
The threshold value process is only applied within the selected region of interest.
Depending on the gray-scale values and the selected settings, the pixels in the region of interest become either black or white (white: foreground, black: background).

**Property**  The following settings/results appear.

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the process steps |
| Module State | Error codes to give support in error diagnosis. (see section 18.5) |
| Pixel Count | Display of the number of white pixels counted in the region of interest. The upper and lower thresholds of the pixel value can be adjusted. |
| Input Region | Selection of the region for the threshold process |
| Input Image | Selection of the image input |
| Teach | The current number of detected pixels (pixel count value) is taught-in. The range between minimum and maximum remains unchanged, but the minimum and maximum values of the pixel count value are adjusted such that the current number of detected pixels is half way between the two values. |
| Mode | Threshold values can be adjusted statically or adaptively. |

**Note:** Threshold values can be dynamically corrected in order to compensate for minimal brightness fluctuation or different surface finishes. However, brightness differences can only be compensated for in settings which are already relatively **stable** by means of this adaptive adjustment.

| | |
|---|---|
| **Static** | Thresholds are set to fixed values with the **Threshold Low** and **Threshold High** functions. |
| **Adaptive by Reference** | The threshold value is calculated on the basis of the mean value of the respective surface and is thus corrected. Range 1: Foreground >= Background (foreground is brighter than background) Range 2: Foreground < Background (background is brighter than foreground) |
| **Adaptive by Histogram** | The threshold values can be ideally adjusted by repositioning the arrows in the histogram, in which pixel distribution is displayed along with the corresponding gray-scale values. However, settings can also be entered manually with the help of the **Offset** and the **Quantile 1 and 2** functions. |

| | |
|---|---|
| Threshold Low / Threshold High | The lower and upper gray-scale threshold values can be set in the **static mode:**<br>a) The lower threshold is less than the upper threshold.<br>• Pixels with gray-scale values between the two thresholds appear white.<br>• Pixels with gray-scale values which fall short of the lower threshold or exceed the upper threshold appear black.<br>b) The lower threshold is greater than the upper threshold.<br>• Pixels with gray-scale values between the two thresholds appear black.<br>• Pixels with gray-scale values which fall short of the upper threshold or exceed the lower threshold appear white.<br><br>**Note:** The profile and the histogram (see sections 10.2.3.3 and 10.2.3.4), which show the gray-scale values and their distribution, simplify the specification of the lower and upper gray-scale threshold values. For example, the limit values at both sides of the edges can also be specified by means of the profile, and the thresholds can be accordingly adjusted. Histogram calculation is carried out for the entire image and is not restricted to a single region. |
| Quantile 1 / Quantile 2 | Quantiles 1 and 2 are required for **adaptive adjustment in the histogram:**<br>• Quantile 1 specifies how many values from the gray-scale value distribution should be less that the lower gray-scale threshold value as a percentage from the bottom up.<br>• Quantile 2 specifies how many values from the gray-scale value distribution should be greater that the upper gray-scale threshold value as a percentage from the top down. |
| Offset | Offset can be adjusted by means of the **adaptive setting with histogram and reference.**<br>With the help of the offset, the settings for the lower and upper gray-scale threshold values are shifted either up or down by an amount equal to the offset. |

**Function Field**    A window can be opened in the function field which serves as an adjustment tool for the threshold module.

 Opening the adjustment tool

The gray area identifies the area for black pixels.
The red area identifies the area for white pixels.


**11.7.2.1.Magic Wand**

The tool "Magic Wand" is an adjustment aid for "Module Threshold" and "Module Threshold HSV". With this tool the first settings for the threshold values can be achieved. It is possible that there will be a need to tune the threshold values afterwards.

 Opening the tool


**The Procedure:**
While activating the tool "Magic Wand" the View changes to the linked input image. Clicking to the position in the image that is defined as foreground in the application will determine the coordinates and forward them to the algorithm. The algorithm calculates the new binarization thresholds (Threshold Low and Threshold High), and these results can be seen after.

**Calculation of the threshold values:**
Threshold Low = Brightness value at position of click - 20
Threshold High = Brightness value at position of click + 20
Both threshold values are limited to a range of [0...255].

**Attention:** The Module Threshold HSV calculates the threshold values for all three channels.

### 11.7.3. Configuration

As a standard feature, the threshold module includes the following configuration options:
- Output Image.

#### 11.7.3.1. Output Image

**Objective**     The threshold module's output image can be linked as an input image in the following modules.

**Property**     The following settings/results appear in the filter module's output image:

| | |
|---|---|
| Image Type | Display of the image type |
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |
| Width (px) | Image width |
| Height (px) | Image height |

The following settings/results are displayed under binary:

| | |
|---|---|
| Size | Number of pixels in the image |
| Bit per Pixel | Display of the number of bits required to transmit one pixel |
| Channel Type | The binary channel type is displayed. |

## 11.8. Module Threshold HSV

### 11.8.1. Overview

| | |
|---|---|
| **Objective** | Teach in certain colors and differentiate them from other colors. |

**Prerequisites**
1. Sensor is correctly connected (see section 5.5)
2. Connection has been established from the sensor to the software (see section 10.1.1)
3. The camera is configured / images are selected (see section 11.2)
4. If applicable, tracking is configured (see sections 11.3 and 11.4)
5. Region of interest is specified (see section 11.5)
6. If applicable, a filter is activated (see section 11.6)

**Procedure**

A binary black and white image must be generated in order to be able to process objects. The objective is to separate the foreground from the background. Suitable parameter values are selected for the respective application to this end (hue, saturation and brightness). In order to make best possible use of options offered by the filters, a brief overview of the HSV color space is provided in the following.

A color is broken down into three channels in HSV color space.
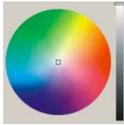


**H** (hue)
**S** (saturation)
**V** (brightness value)

**Hue H** can have a value within a range of 0° to 360°, and is generally depicted as a circle. All colors are represented within the circle. Red is at 0°, green is at 120° and blue is at 240°. All of the various hues lie between these points. Black and white are not included as hues. They are achieved by means of saturation and brightness. The circle is divided into steps of 0 to 255 for the Vision Sensor.

**Saturation S** is the luminosity of a given color. If saturation is set to its maximum value, a pure color appears. If saturation is set to its minimum value, a gray-scale value appears which is dependent upon the current brightness value (V). All colors between gray and the pure color can be found between these minimum and maximum values.

**Brightness value V** is the brightness of a color ranging from black to maximum brightness. Attainable maximum brightness is dependent upon saturation.
A color with a brightness value of 0 appears black regardless of H and S. A color with a maximum brightness value appears as the brightest variant of the respective H-S combination, regardless of its H and S values.

Example:

| H=0 (red) | H=0 (red) | H=170 (blue) | H=85 (green) |
|---|---|---|---|
| S=255 | S=255 | S=0 | S=255 |
| V=128 | V=255 | V=128 | V=255 |

---

**Advantages for Digital Image Processing**

This results in a decisive advantage for digital image processing. A hue can be detected regardless of its brightness. For example, a shade of blue can be recognized independent of ambient luminosity. This is not possible in RGB color space.

**Application**

The setting selected at the color filter determines which colors will be allowed to pass through the filter and which will not.

If all shades of red need to be filtered out of a colorful image, the H value filter must be utilized. The filter thresholds must be set above and below the desired shade of red. All colors between the two thresholds are allowed to pass through the filter.

If all shades of red between the H thresholds should be allowed to pass through the filter for this application regardless of saturation and brightness, the S and V filters can be deactivated. However, if only the luminous shades of red should be allowed to pass through the filter, the saturation filter must be activated and all colors beginning with a given gray-scale value up to maximum saturation must be allowed to pass through.

If only the dark shades of red should be allowed to pass through the filter, the brightness filter must be adjusted such that the upper threshold is set to the brightest desired value and the lower threshold to 0 (black).

The hue and saturation filters cannot be used in applications for which a gray image or a single-color imprint needs to be evaluated. An image which consists exclusively of identical hues with varying brightness values can only be analyzed with the brightness filter.

If a color image includes black, white or gray areas and certain shades of color must be permitted to pass through the filter, the saturation filter has to be used and must be set for colors with high saturation values. Black, white and gray tones do not have any defined H values, and are thus allocated a color at random. These must be sorted out by means of their characteristic saturation value (= 0).

Example:



If the red area in this image needs to be detected (allowed to pass through the filter), the H filter must be set so that all shades of red are allowed to pass. However, due to that fact that white areas are included (white frame) which need to be suppressed, the saturation filter must also be used.

The settings required for each individual filter are described in the following. One or more filters can be selected in order to generate the digitized black and white image.

The **histogram** and the **profile** which display brightness values and distribution may be helpful to this end (see sections 10.2.3.4 and 10.2.3.3).

## 11.8.2. Settings

**Image Area**　　　A preview of the HSV threshold analysis appears in the image area. The preview is for the selected region only.

**Property**　　　The following settings/results appear:

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the process steps |
| Module State | Error codes to give support in error diagnosis (see section 18.5) |
| Pixel Count | Display of the number of white pixels counted in the region of interest |
| Input Region | Selection of the region for the threshold process |
| Input Image | Selection of the channel for the image input |
| Teach | The currently selected settings for the HSV channels are taught in and are applied to all other images. |

**Function Field**　　　A window can be opened in the function field which serves as an adjustment tool for the HSV threshold module.

Opening the adjustment tool　　　　Opening the Magic Wand tool (see Section 11.7.2.1)

Graphic Shifting of Thresholds

# EN
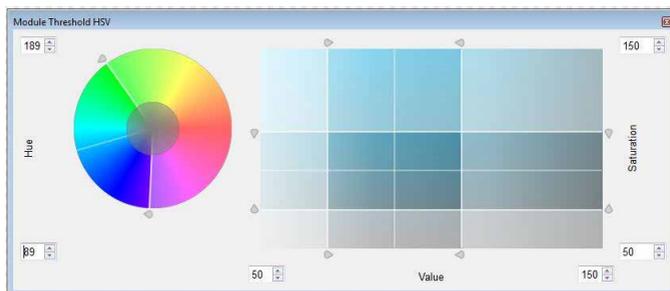
### 11.8.3. Configuration

The HSV threshold module includes the following configuration options:
* Output Image
* Hue
* Value
* Saturation

#### 11.8.3.1. Output Image

**Objective**
The HSV threshold module's output image can be linked as an input image in the following modules.

**Property**
The following settings/results appear in the HSV threshold module's output image:

| | |
|---|---|
| Image Type | Display of the image type |
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |
| Width (px) | Image width |
| Height (px) | Image height |

The following settings/results are displayed under binary:

| | |
|---|---|
| Size | Number of pixels in the image |
| Bit per Pixel | Display of the number of bits required to transmit one pixel |
| Channel Type | The binary channel type is displayed. |

#### 11.8.3.2. Hue

**Objective**
The hue filter can be adjusted.

**Property**
The following settings/results appear.

| | |
|---|---|
| Active | The hue filter can be activated or deactivated. |
| Threshold Low | Sets the lower threshold for hue. |
| Threshold High | Sets the upper threshold for hue. |

**11.8.3.3. Value**

| Objective | The brightness filter can be adjusted. |
|-----------|----------------------------------------|

**Property**     The following settings/results appear.

| Active | The brightness filter can be activated or deactivated. |
|--------|--------------------------------------------------------|
| Threshold Low | Sets the lower threshold for brightness. |
| Threshold High | Sets the upper threshold for brightness. |

**11.8.3.4. Saturation**

| Objective | The saturation filter can be adjusted. |
|-----------|----------------------------------------|

**Property**     The following settings/results appear.

| Active | The saturation filter can be activated or deactivated. |
|--------|--------------------------------------------------------|
| Threshold Low | Sets the lower threshold for saturation. |
| Threshold High | Sets the upper threshold for saturation. |

# 11.9. Module Cluster

### 11.9.1. Overview

| Objective | Detect, count or sort objects reliably in order to check for presence and correct quantity. |
|-----------|---------------------------------------------------------------------------------------------|
| Prerequisites | 1. Sensor is correctly connected (see section 5.5)<br>2. Connection has been established from the sensor to the software (see section 10.1.1)<br>3. The camera is configured / images are selected (see section 11.2)<br>4. If applicable, tracking is configured (see sections 11.3 and 11.4)<br>5. Region of interest is specified (see section 11.5)<br>6. If applicable, a filter is activated (see section 11.6) |
| Procedure | The minimum and maximum number of neighboring pixels which make up a cluster need to be specified. It's also possible to specify the maximum number of objects to be counted, as well as the criteria according to which the objects will be sorted. |

# EN

## 11.9.2. Settings

**Image Area**   Detected clusters appear in the image area with a light blue frame.

**Property**   The following settings/results are displayed:

| | |
|---|---|
| Process-Time [ms] | Sensor processing time for the module |
| Module State | Error codes to give support in error diagnosis (see section 18.5) |
| Cluster True Count | The number of objects in the image area which has been detected using the corresponding settings is displayed. |
| Input Image | Selection of the image input |
| Cluster Size Min | The minimum number of adjoining white pixels can be specified, so that the respective area is counted as a cluster. |
| Cluster Size Max | The maximum number of adjoining white pixels can be specified, so that the respective area is still counted as a cluster. |
| Cluster Gap | **Connected 4** Only directly adjacent white pixels (above, below to the left and to the right) are interpreted as belonging together to a single object. |
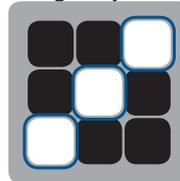


Three clusters are counted in the example.

**Connected 8**   Pixels joined by their corners are also interpreted as belonging together to a single object.
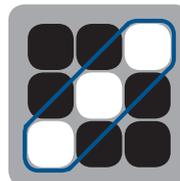


Only one cluster is counted in the example.

| Cluster Max Count | The maximum number of clusters which should be counted can be specified. This size is assigned to the cluster list. |
|---|---|
| Sort Rule | The rule used for sorting clusters can be defined. |

| | | |
|---|---|---|
| | **Size** | Detected clusters can be sorted according to size. The clusters appear in the cluster list in order of descending surface area. |
| | **Center of Gravity X** | Detected clusters are sorted according to the location of their center of gravity along the X-axis, and objects appear from left to right in the cluster list. |
| | **Center of Gravity Y** | Detected clusters are sorted according to the location of their center of gravity along the Y-axis, and objects appear from top to bottom in the cluster list. |
| | **Center of Gravity YX** | Detected clusters are sorted according to the location of their center of gravity along the X and Y-axes, and objects appear from top left to bottom right in the cluster list. |

### 11.9.3. Configuration

The cluster module includes the following configuration options:
• Cluster List

**11.9.3.1. Cluster List**

| | |
|---|---|
| **Objective** | Detected clusters are listed in this sub-module in order to subsequently transmit their position, number of pixels etc. via an output. |
| **Prerequisites** | The following settings/results are displayed for any selected cluster: |

| Pixel-Size | The number of pixels in the cluster is displayed. |
|---|---|

A matchbox is placed around the detected cluster. The matchbox's settings/results can be displayed.

| Width (px) | Matchbox width |
|---|---|
| Height (px) | Matchbox height |

The following settings/results are displayed for the matchbox under origin:

| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
|---|---|
| Y (px) | |

The following settings/results are displayed under pixel size:

| Pixel-Size | The number of pixels in the cluster is displayed. |
|---|---|

The coordinates of the cluster's center of gravity are displayed under center of gravity:

| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
|---|---|
| Y (px) | |

## 11.10. Module Measure

### 11.10.1. Overview

| | |
|---|---|
| **Objective** | Specify and perform dimensional conformance inspections of distances, lengths, diameters or angles. Lines and circles are found with the help of search rays. Distances and angles can be measured between detected lines or points. |
| **Image Area** | 1. Sensor is correctly connected (see section 5.5)<br>2. Connection has been established from the sensor to the software (see section 10.1.1)<br>3. The camera is configured / images are selected (see section 11.2)<br>4. If applicable, tracking is configured (see sections 11.3 and 11.4) |
| **Abbreviated Procedure** | Specify dimensional inspection of position, distance, length, diameter or angle and perform measurement. |

**11.10.2. Settings**

**Property**

The following settings/results appear:

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the module |
| Module State | Error codes to give support in error diagnosis (see section 18.5) |
| Input Image | Selection of the channel for the image input |
| Coordinate System | Selection can be made regarding how the functions should be tracked. |

**Function Field**

| | | |
|---|---|---|
| | Line | A line is drawn. An edge is detected on the basis of this search line. |
| | Circle | A circle is drawn which is defined by means of two points. An edge is detected on the basis of this search circle. |
| | Circle | A circle is drawn which is defined by means of three points. An edge is detected on the basis of this search circle. |
| | Distance | The distance between different points or lines is calculated. |
| | Angle | The angle between two lines is ascertained. A line is defined by a starting point and an end point. The detected angle corresponds to the angle of intersection of the two lines in the direction towards their starting points. |
| | Segment on Line | A line is drawn. Segments are looked for on this line. |
| | Segment on Circle | A circle is drawn which is defined by means of two points. Segments are looked for on this circle. |
| | Segment on Arc | An arc is drawn which is defined by means of a starting point, an end point and a radius. Segments are looked for on this arc. |

**Set**
Utilized geometric search forms such as lines and circles are listed in the Set sub-module.

# EN

**11.10.2.1. Find Line**

| | |
|---|---|
| **Objective** | Detect an edge. |
| **Procedure** | First of all, activate the function in the toolbar. After the tool Find Line has been acti-vated, a line can be defined. The first click specifies the starting point, and the second click the end point of the sought after line. |
| | Search rays are generated perpendicular to this line. In accordance with the selected settings for edge polarity, find by and edge width, as well as positive and negative gradient threshold, an edge is searched for on each of these search rays (see section 11.4.3.1). These detected edges form a scatter plot through which only a single line is drawn, for which the clearance to the scatter plot is as small as possible. Individual points may be detected as outliers and ignored during the next iteration step (renewed best-fit calculation). This best-fit calculation is executed as many times as selected under fitting iterations. |
| **Property** | The following settings/results are displayed: |

| Edge Polarity | Expected Brightness Characteristics | |
|---|---|---|
| | **Either** | Both bright to dark and dark to bright transi-tions are searched for. |
| | **Bright to Dark** | Only bright to dark transitions are searched for. |
| | **Dark to Bright** | Only dark to bright transitions are searched for. |
| Find by | This parameter can be used to specify which of the detected edges will be used on the search line. | |
| | **Best Score** | If several edge transitions are detected on the search line, the transition with the greatest con-trast is selected. |
| | **First Score** | If several edge transitions are detected on the search line, the first transition in the search direc-tion is selected. |
| | **Last Score** | If several edge transitions are detected on the search line, the last transition in the search direc-tion  is selected. |
| Edge Width (px) | The setting Edge Width controls the sensitivity of brightness changes. **Note:** <ul><li>An Edge Width of 3 pixels represents the highest sensitivity in con-trast in the image.</li><li>An Edge Width of 9 pixels smoothes the gray profile to ignore the noise.</li></ul> | |

**Property**

| | | |
|---|---|---|
| | Threshold Gradient Pos | Threshold Gradient Pos defines the threshold of the positive gradient.<br>**Note:** The gradient represents the change of brightness from pixel to the next. The higher the contrast of an edge the higher the gradient. |
| | Threshold Gradient Neg | Threshold Gradient Neg defines the threshold of the negative gradient.<br>**Note:** The gradient represents the change of brightness from pixel to the next. The higher the contrast of an edge the higher the gradient. |
| | Threshold Outlier Distance | Maximum distance to the detected shape which must be maintained by a point, in order for it to be used in the next iteration. Points which are farther away than this distance are treated as outliers. |
| | Fitting Iterations | Number of best-fit calculations which are carried out in order that the distance of the detected points on the search lines from the line becomes as small as possible. Outliers are not used for subsequent best-fit calculations.<br>Note: The larger the value, the more iteration steps are executed. Under certain circumstances a shape can be more closely approximated as a result, but calculation time may be increased as well. |
| | Search Ray Length | Length of the search rays, along which an edge transition is searched for. |
| | Search Ray Interval | Distance between the search rays, along which an edge transition is searched for. Generally speaking, the use of several search rays increases accuracy, but also requires more computing time.<br>Note: Enlarging the interval is especially effective for faster evaluation. |
| | Search Ray Orientation | The direction of the search ray can be turned 180° with this setting. |
| | Point Usage [%] | The percentage indicates how many points will be used to ascertain the line. |
| | Point Usage Strategy | The points which should be used to ascertain the line are specified. Selection can be made between the first and the last points on the search line. The search direction is made apparent by the direction of the arrow in the search geometry in the image. |

The detected line, which is defined by means of two points, is listed under found geometry. The following settings/results are displayed for points 1 and 2:

| | |
|---|---|
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |

A search line is required in order to detect a line. This search geometry is also defined by means of two points.

| | |
|---|---|
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |

# EN

**Objective**  Detect an edge.

**Procedure**  After the toolbar has been activated, a circle can be drawn by means of two or three clicks.

Search rays are generated perpendicular to this circular line. In accordance with the selected settings for edge polarity, find by and edge with, as well as positive and negative gradient threshold, an edge is searched for on each of these search rays (see section 11.4.3.1). These detected edges form a scatter plot through which only a single circular line is drawn, for which the clearance to the scatter plot is as small as possible. Individual points may be detected as outliers and ignored during the next iteration step (renewed best-fit calculation). This best-fit calculation is executed as many times as selected under fitting iterations.

**Property**  The following settings/results are displayed:

| Edge Polarity | Expected Brightness Characteristics | |
|---|---|---|
| | **Either** | Both bright to dark and dark to bright transitions are searched for. |
| | **Bright to Dark** | Only bright to dark transitions are searched for. |
| | **Dark to Bright** | Only dark to bright transitions are searched for. |
| Find by | This parameter can be used to specify which of the detected edges will be used on the search line. | |
| | **Best Score** | If several edge transitions are detected on the search line, the transition with the greatest contrast is selected. |
| | **First Score** | If several edge transitions are detected on the search line, the first transition in the search direction is selected. |
| | **Last Score** | If several edge transitions are detected on the search line, the last transition in the search direction is selected. |
| Edge Width (px) | The setting Edge Width controls the sensitivity of brightness changes. <br> • An Edge Width of 3 pixels represents the highest sensitivity in contrast in the image. <br> • An Edge Width of 9 pixels smoothes the gray profile to ignore the noise. | |
| Threshold Gradient Pos | Threshold Gradient Pos defines the threshold of the positive gradient. <br> **Note:** The gradient represents the change of brightness from pixel to the next. The higher the contrast of an edge the higher the gradient. | |

**Property**

| | |
|---|---|
| Threshold Gradient Neg | Threshold Gradient Neg defines the threshold of the negative gradient.<br>**Note:** The gradient represents the change of brightness from pixel to the next. The higher the contrast of an edge the higher the gradient. |
| Threshold Outlier Distance | Maximum distance to the detected shape which must be maintained by a point, in order for it to be used in the next iteration. Points which are farther away than this distance are treated as outliers. |
| Fitting Iterations | Number of best-fit calculations which are carried out in order that the distance of the detected points on the search lines from the circular line becomes as small as possible. Outliers are not used for subsequent best-fit calculations.<br>Note: The larger the value, the more iteration steps are executed. Under certain circumstances a shape can be more closely approximated as a result, but calculation time may be increased as well. |
| Search Ray Length | Length of the search rays, along which an edge transition is searched for. |
| Search Ray Interval | Distance between the search rays, along which an edge transition is searched for. Generally speaking, the use of several search rays increases accuracy, but also requires more computing time.<br>Note: Enlarging the interval is especially effective for faster evaluation. |
| Search Ray Orientation | The direction of the search ray can be turned 180° with this setting. |
| Point Usage [%] | The percentage indicates how many points will be used to ascertain the circle. |
| Point Usage Strategy | The points which should be used to ascertain the circle are specified. Selection can be made between the first and the last points on the search line. The search direction is made apparent by the direction of the arrow in the search geometry in the image. |

The detected circle is listed under found geometry, and is defined by means of a center and a diameter.
The following settings/results are displayed under found geometry:

| | |
|---|---|
| Diameter (px) | The circle's diameter is displayed. The diameter tolerance can be adjusted so that the circle's diameter can be linked to an output. |

**Property**  The settings/results of the detected geometry are displayed under center:

| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
|--------|--------|
| Y (px) | |

A search circle is required in order to detect a circle. This search geometry is defined by means of a center and a diameter.
The following settings/results can be edited under search geometry:

| Diameter (px) | The search circle's diameter is displayed. |
|--------|--------|

The search circle's following settings/results can be edited under circle:

| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
|--------|--------|
| Y (px) | |

### 11.10.2.3. Measure Distance

**Objective**  Ascertain distance between two points, or between a point and a line.

**Procedure**  First of all, activate the function in the toolbox.
Click the first point or line, and then click the second point or line.

**Property**  The following settings/results appear.

| Output Distance (px) | Distance is displayed in pixels. The value can be furnished with any desired upper and lower thresholds. Click the ascertained value to this end, and then click the button. Enter the desired upper and lower threshold values to the window which then appears. | |
|--------|--------|--------|
| Calculation Method | The type of distance calculation to be used is specified: | |
| | **Geometrical Distance** | Shortest distance between a point and a line (perpendicular) |
| | **Center to Center** | Shortest distance between the center of two segments. |

The coordinates of the detected distance are displayed under output geometry. The distance is measured between two points, which are in turn defined by their X and Y coordinates:

| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
|--------|--------|
| Y (px) | |

**11.10.2.4. Measure Intersection**

**Objective**    The angle between two lines is measured.

**Procedure**    First of all, activate the function in the toolbox.
Click the first line, and then the second.

**Property**    The following settings/results appear.

| | |
|---|---|
| Output Angle (degrees) | The angle between the two lines is displayed. A line is defined by a starting point and an end point. The detected angle corresponds to the angle of intersection of the two lines in the direction towards their starting points. The value can be furnished with any desired upper and lower thresholds. Click the ascertained value to this end, and then click the button. Enter the desired upper and lower threshold values to the window which then appears. |

The coordinates of the detected intersection are displayed under output intersection point:

| | |
|---|---|
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |

**11.10.2.5.Measure Segment on Line Sub-Module**

**Objective**     Segments are looked for along a line.

**Procedure**     First of all, activate the function in the toolbar. After the tool has been activated, a line can be defined. The first click specifies the starting point, and the second click the end point of the sought after line.
Edges are looked for on each of these lines in accordance with the settings for edge width, positive threshold gradient, negative threshold gradient and segment brightness (see section 11.4.3.2).
The detected edges serve as starting and end points of the various segments. There are different parameters which influence the number and length of the segments to be detected.

**Property**      The following settings/results are displayed:

| | |
|---|---|
| Segments True Count | The number of detected segments is displayed. |
| Edge Width | "Edge width" influences detection sensitivity for brightness fluctuations.<br>**Note:**<br>• An edge width of 3 pixels reacts to even the smallest contrast change in the image.<br>• An edge width of 9 pixels smooths the brightness profile over a distance of 9 pixels and ignores small irregularities. |
| Threshold Gradient Pos [GrM] | Threshold Gradient Pos specifies the positive gradient acceptance threshold.<br>**Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. |
| Threshold Gradient Neg [GrM] | Threshold Gradient Neg specifies the negative gradient acceptance threshold.<br>**Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. |
| Segments Max Count | Maximum number of segments to be expected. |
| Segments Minimum Length | Minimum length of the segments |
| Segments Maximum Length | Maximum length of the segments |

**Property**

| Sort Rule | The rule used for sorting segments can be defined. | |
|---|---|---|
| | Position on Search Geometry | Sorting is based on the position on the search ray. The results depend on the orientation setting. |
| | Size [Longest First] | Segments are sorted in descending order beginning with the longest segment. |
| | Size [Shortest First] | Segments are sorted in ascending order beginning with the shortest segment. |
| Segment Brightness | This setting specifies whether bright or dark segments will be evaluated. | |
| Orientation | The search direction can be turned 180° with this setting. | |

**11.10.2.6. Measure Segment on Circle Sub-Module**

**Objective**       Segments are looked for on a circle.

**Procedure**      After the tool has been activated, a circle can be drawn by means of two clicks.
Edges are looked for on the circle in accordance with the settings for edge width, positive threshold gradient, negative threshold gradient and segment brightness (see section 11.4.3.2).
The detected edges serve as starting and end points of the various segments. There are different parameters which influence the number and length of the segments to be detected.

The following settings/results are displayed:

| Segments True Count | The number of detected segments is displayed. |
|---|---|
| Edge Width | "Edge width" influences detection sensitivity for brightness fluctuations.<br>**Note:**<br>• An edge width of 3 pixels reacts to even the smallest contrast change in the image.<br>• An edge width of 9 pixels smooths the brightness profile over a distance of 9 pixels and ignores small irregularities. |
| Threshold Gradient Pos [GrM] | Threshold Gradient Pos specifies the positive gradient acceptance threshold.<br>**Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. |

**Property**

| | | |
|---|---|---|
| Threshold Gradient Neg [GrM] | Threshold Gradient Neg specifies the negative gradient acceptance threshold.<br>**Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. | |
| Segments Max Count | Maximum number of segments to be expected. | |
| Segments Minimum Length | Minimum length of the segments | |
| Segments Maximum Length | Maximum length of the segments | |
| Sort Rule | The rule used for sorting segments can be defined. | |
| | Position on Search Geometry | Sorting is based on the position on the search ray. The results depend on the orientation setting. |
| | Size [Longest First] | Segments are sorted in descending order beginning with the longest segment. |
| | Size [Shortest First] | Segments are sorted in ascending order beginning with the shortest segment. |
| Segment Brightness | This setting specifies whether bright or dark segments will be evaluated. | |
| Orientation | The search direction can be turned 180° with this setting. | |

### 11.10.2.7. Measure Segment on Arc Sub-Module

**Objective**       Segments are looked for on an arc.

**Procedure**      First of all, activate the function in the toolbar. Specify the center of the arc by clicking the desired point. The second click defines the starting angle and the third click the end angle, thus resulting in an arc.
Edges are looked for on the arc in accordance with the settings for edge width, positive threshold gradient, negative threshold gradient and segment brightness (see section 11.4.3.2).
The detected edges serve as starting and end points of the various segments. There are different parameters which influence the number and length of the segments to be detected.

**Property**

The following settings/results are displayed:

| | |
|---|---|
| Segments True Count | The number of detected segments is displayed. |
| Edge Width | "Edge width" influences detection sensitivity for brightness fluctuations.<br>**Note:**<br>• An edge width of 3 pixels reacts to even the smallest contrast change in the image.<br>• An edge width of 9 pixels smooths the brightness profile over a distance of 9 pixels and ignores small irregularities. |
| Threshold Gradient Pos [GrM] | Threshold Gradient Pos specifies the positive gradient acceptance threshold.<br>**Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. |
| Threshold Gradient Neg [GrM] | Threshold Gradient Neg specifies the negative gradient acceptance threshold.<br>**Note:** The gradient corresponds to the change in brightness from one pixel to the next. The higher the edge's contrast, the larger the gradient. |
| Segments Max Count | Maximum number of segments to be expected. |
| Segments Minimum Length | Minimum length of the segments |
| Segments Maximum Length | Maximum length of the segments |
| Sort Rule | The rule used for sorting segments can be defined.<br><br>Position on Search Geometry — Sorting is based on the position on the search ray. The results depend on the orientation setting.<br><br>Size [Longest First] — Segments are sorted in descending order beginning with the longest segment.<br><br>Size [Shortest First] — Segments are sorted in ascending order beginning with the shortest segment. |
| Segment Brightness | This setting specifies whether bright or dark segments will be evaluated. |
| Orientation | The search direction can be turned 180° with this setting. |

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## 11.11. Module Code 1D

### 11.11.1. Overview

**Objective**
All common 1D codes can be read with the 1D code module.
The following 1D codes can be read: Code39, Code128, 2/5 Industrial, 2/5 Interleaved, Codabar, EAN-13, EAN-13 Add-On 2, EAN13 Add-On 5, EAN-8, EAN-8 Add-On 2, EAN-8 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, Code 93, MSI, PharmaCode, RSS-14, RSS-14 Truncated, RSS-14 Stacked, RSS-14 Stacked Omnidir, RSS Limited, RSS Expanded, RSS Expanded Stacked.

**Prerequisites**
1. Sensor is correctly connected (see section 5.5)
2. Connection has been established from the sensor to the software (see section 10.1.1)
3. The camera is configured / images are selected (see section 11.2)

**Procedure**
Various code settings can be entered in order to assure reliable code recognition.

### 11.11.2. Settings

**Property**
The following settings/results appear.

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the process steps |
| Module State | Error codes to give support in error diagnosis (see section 18.5) |
| Reading True Count | The number of codes detected in the image. |
| Input Image | Selection of the channel for the image input |
| Code Type | The type of code can be selected:<br>Code39, Code128, 2/5 Industrial, 2/5 Interleaved, Codabar, EAN-13, EAN-13 Add-On 2, EAN13 Add-On 5, EAN-8, EAN-8 Add-On 2, EAN-8 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, Code 93, MSI, PharmaCode, RSS-14, RSS-14 Truncated, RSS-14 Stacked, RSS-14 Stacked Omnidir, RSS Limited, RSS Expanded, RSS Expanded Stacked |
| Read Timeout | The time during which the sensor attempts to read the code. If reading is not successful within this period of time, the process is aborted and the reading results are rendered invalid. Time can be set within a range of 0 to 20 seconds in steps of 1 ms. Aborting the read attempt takes about 20 ms. The module's minimum processing time is thus also 20 ms. |
| Reading Max Count | The maximum number of codes to be read from the image is specified. |
| Quality Grading | Quality grading of the code in accordance with ISO/IEC 15416 can be activated. **Note:** Activation of this functions increases the module's decoding time.<br>**Note:** The results of the code evaluation in accordance with the standard can be found in the configuration reading list (see section "11.11.3.1. Reading List" on page 127). |

### 11.11.3. Configuration

The 1D code module includes the following configuration options:
- Reading List
- Search Box
- Enhanced Parameter

**11.11.3.1. Reading List**

**Property**    The following settings/results are displayed:

| Reading #1 | Scanned Code. |
|---|---|
| Quality | If quality grading according to ISO 15416 is activated, the results of quality testing are displayed at this level. The evaluation of code quality is specified as a number between 0 and 4, 0 being the worst and 4 the best evaluation. |

| | **Overall Quality** | Minimum of all individual grades |
|---|---|---|
| | **Decode** | Is set to 4 when the reflectance profile of the symbol could be decoded according to the reference decode algorithm for the symbology and 0, otherwise. |
| | **Symbol Contrast** | "The range between the minimum and the maximum value in the reflectance profile. A strong contrast results in a good grading" |
| | **Minimum Reflectance** | Is set to 4 if the lowest reflectance value in the scan reflectance profile is lower or equal to 0.5 of the maximum reflectance value. Otherwise a value of 0 is assigned |
| | **Minimum Edge Contrast** | Grades the minimum of the edge contrast values measured in the reflectance profile |
| | **Modulation** | Indicates how strong the amplitudes of the barcode elements are. Big amplitudes make the assignment of the elements to bars or spaces more certain, resulting in a high modulation grade |
| | **Defects** | Grading of reflectance irregularities found within elements and quiet zones |
| | **Decodability** | Reflects deviations of the element widths from the nominal widths defined for the corresponding symbology |
| | **Additional Requirements** | Barcode symbology specific requirements: mostly regarding the required quiet zones, but sometimes it can be also related to wide/narrow ratio, inter character gaps, guarding patterns or further symbology specific characteristics |

Note: More detailed information regarding the results of quality testing can be found in the corresponding standard.

| Envelope | The read code surrounding polygon. |
|---|---|

**11.11.3.2. Search Box**

| | |
|---|---|
| **Objective** | The region of interest within codes are detected can be specified. With the help of a smaller search box, processing time is **reduced** and the refresh rate is **increased**. **Note:** The area to examined must lie completely within the search box. |
| **Image Area** | By default, the search box encompasses the entire camera image. It appears in the image area as a dashed frame, where it can be adjusted. |
| **Property** | Search box settings are also displayed in the settings/results area. |

| Width | Width of the search box |
|---|---|
| Height | Height of the search box |

The following settings/results are displayed for the search box under origin:

| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
|---|---|
| Y (px) | |

**11.11.3.3. Enhanced Parameter**

| | |
|---|---|
| **Element Size Min** | Minimum size of barcode elements, i.e. the minimum width of bars and spaces. For small barcodes, the value should be reduced to 1.5. In the case of huge barcodes, the value should be increased, which results in a shorter execution time. Typical values: [1.5…10.0] Default: 2.0 |
| **Element Size Max** | Maximum size of barcode elements, i.e. the maximum width of bars and spaces. This value should be sufficiently high in order to find the complete barcode region. On the other hand the value should be adequately low such that two neighboring barcodes are not fused into a single one. Typical values: [4.0…60.0] Default: 8.0 |
| **Element Height Min** | Minimum barcode height. The default value of this parameter is −1, meaning that the barcode reader automatically derives a reasonable height from the other parameters. Just for very flat and very high barcodes a manual adjustment of this parameter can be necessary. In the case of a barcode with a height of less than 16 pixels the respective height should be set by the user. Note, that the minimum value is 8 pixels. If the barcode is very high, i.e. 70 pixels and more, manually adjusting to the respective height can lead to a speedup of the subsequent finding and reading operation. Typical values: [−1, 8…64]  Default: -1 |

| **Number of Scanlines** | Maximum number of scanlines used during the scanning of a (candidate) barcode. If 'Number of Scanlines' is not set (the parameter has a value of 0) the maximum number of scanlines is determined internally and it will be 10 for all single-row barcodes, 20 for RSS-14 Stacked Omnidirectional, respectively, and 55 for RSS Expanded Stacked. With this parameter, you can improve performance in two cases. In the first case, the image contains many false candidates. While the barcode itself is usually decoded after one or two scans (except for stacked barcodes, see below), a false candidate is scanned with the default value of 10 scanlines, which increases the runtime unnecessarily. Reducing the number of scanlines can therefore improve performance in images with many false candidates. As a rule of thumb, images with higher quality need less scanlines than images of lower quality. For an average image, a value between 2 and 5 should be sufficient. If a barcode can, however, not be detected after reducing the number of scanlines, the number has to be increased again. The second case concerns stacked barcodes (currently RSS-14 Stacked, RSS-14 Stacked Omnidirectional, and RSS Expanded Stacked). Here, all scanlines are evaluated, in contrast to single-row barcodes (e.g., Code 128, EAN 13, or RSS Limited) where the scanning stops after the code is decoded successfully. Since the scanning of the scanlines is actually one of the most time consuming parts of the barcode algorithm, adjusting 'Number of Scanlines' might result in essential performance improvements.<br>This is especially valid for RSS Expanded Stacked. A RSS Expanded Stacked symbol might have up to 11 rows and therefore 55 scanlines are required to robustly detect all of them. If only symbols with smaller number of rows are expected, one can reduce 'Number of Scanlines' leaving 1.5 to 5 scanlines per row.<br>Typical values: [0, 5, 10, 20…] Default: 0 |
|---|---|
| **Min Identical Scanlines** | The minimum number of scanning lines which deliver the same result, which is necessary in order to accept the deciphering of a symbol. If this parameter has not been set (i.e. if it has a value of 0), the barcode is deciphered as soon as a scanning line has been successfully decoded.<br>The probability that the barcode will be read incorrectly can be reduced with this parameter. The standard value of 0 is recommended for all barcode types except for 2/5 Industrial and 2/5 Interleaved. In the case of code types 2/5 Industrial and 2/5 Interleaved, a value of at least 2 is recommended in order to minimize incorrect reading. It's also advisable to select a value of 2 or higher in order to prevent reading barcodes inadvertently, especially when image quality is poor or the edges of the bars can't be clearly detected. |
| **Orientation** | Expected barcode orientation. A potential (candidate) barcode contains bars with similar orientation. The 'Orientation' and 'Orientation Tolerance' parameters are used to specify the range ['Orientation'- 'Orientation Tolerance', 'Orientation'+'Orientation Tolerance']. The barcode algorithm processes a candidate barcode only when the average orientation of its bars lies in this range. If the barcodes are expected to appear only in certain orientations in the processed images, one can reduce the orientation range adequately. This enables an early identification of false candidates and hence shorter execution times. This adjustment can be used for images with a lot of texture, which includes fragments tending to result in false barcode candidates. The reading direction of the barcodes is ignored, which results in relevant orientation values only in the range [−90.0…90.0]. Typical values: [−90.0…90.0] |

| | |
|---|---|
| **Orientation Tolerance** | Orientation tolerance. Please refer to the explanation of 'Orientation' parameter for further information. As explained there, relevant orientation values are only in the range of [-90.0…90.0], which means that with 'Orientation Tolerance' = 90 the whole range is spanned. Therefore valid values for 'Orientation Tolerance' are only in the range of [0.0…90.0]. The default value 90.0 means that no restriction on the barcode candidates is performed. Typical values: [0.0…90.0] Default: 90.0 |
| **Start Stop Tolerance** | Enforces a tolerant ('high') or strict ('low') searching criteria, while inspecting a scanline for a start or stop pattern, respectively. A more tolerant criteria will generally increase the detection chances of a barcode, provided that a clear symbol is imaged in the processed image. On the other side, it might result in false detections in noisy images or images containing symbols from other symbologies. Less tolerant criteria increase the robustness against false detections, but might reduce the general detection rate. Currently, there are two distinct criteria implemented only for Code 128. List of values: ['high', 'low'] Default: 'high' |
| **Threshold** | 'Threshold' defines a threshold, which is a relative value with respect to the dynamic range of the scanline pixels. The barspace-sequence of a barcode is determined with a scanline measuring the position of the edges. Finding these edges requires the mentioned threshold. In the case of disturbances in the barcode region or a high noise level, the value of 'Threshold' should be increased. Typical values: [0.05…0.2] Default: 0.05 |
| **Threshold Absolute** | If a scanline is laid in an image region with no or just very small gray value dynamic range (e.g., in a white region with all gray values near 255), the edge detection threshold based on 'Threshold Absolute' would be computed unreasonably small. This leads typically to the detection of a big amount of false edges. 'Threshold Absolute' is used to prevent such misdetections. If the threshold value based on 'Threshold' gets smaller than the value of 'Threshold Absolute', the latter is used as threshold instead. By default, 'Threshold Absolute' is set to 5.0. A greater value might be more appropriate for images with high noise levels. On the other hand, in noise-free images with very weak contrast, this parameter might disturb the detection of real edges, so it might be necessary to reduce it or even completely disable it by setting it to 0.0. Typical values: [0.0…10.0] Default: 5.0 |
| **Max Different Orientation** | A potential barcode region contains bars, and hence edges, with a similar orientation. The value "Max Different Orientation" denotes the maximum difference in this orientation between adjacent pixels and is specified in degrees. If a barcode is of bad quality with jagged edges, the parameter "Max Different Orientation" should be set to higher values. If the barcode is of good quality "Max Different Orientation" can be set to lower values, thus reducing the number of potential but false barcode candidates. Typical values: [2…20] Default: 10 |
| **Check Character** | For barcodes with a facultative check character, this parameter determines whether the check character is taken into account or not. If the barcode has a check character, 'Check Character' should be set to 'present' and thus the check character is tested. In that case, a barcode result is returned only if the check sum is correct. For 'Check Character' set to 'absent' no check sum is computed and barcode results are returned as long as they were successfully decoded. Barcodes with a facultative check character are, e.g. Code 39, Codabar, 2/5 Industrial and 2/5 Interleaved. List of values: ['absent', 'present'] Default: 'absent' |

| | |
|---|---|
| **Composite Code** | EAN.UPC barcodes can have an additional 2D Composite code component append-ed. If 'Composite Code' is set to 'CCA/B' the composite component will be found and decoded. By default, 'Composite Code' is set to 'none' and thus it is disabled. If the searched barcode symbol has no attached composite component, just the result of the barcode itself is returned. Composite codes are supported only for barcodes of the RSS family. List of values: ['none', 'CC-A/B'] Default: 'none' |
| **UPCE Encodation** | For UPC-E barcodes, different output formats can be used. By default, 'UPCE Enco-dation' is set to 'ucc-12' and the decoded string will be returned in UCC-12 format (consisting of 12 digits). If 'UPCE Encodation' is set to 'zero-suppressed', the result will be returned in zero-suppressed format (with suppressed zeros at defined places). This format consists of a leading zero, six encoded digits, and an implicitly encoded check digit. This corresponds to the format demanded by ISO/IEC 15420 standard. List of values: ['ucc-12', 'zero-suppressed'] Default: 'ucc-12' |

## 11.12. Module Code 2D

### 11.12.1. Overview

**Objective**

All common 2D codes can be read with the 2D code module.

The following 2D codes can be read:
- Data Matrix ECC 200
- QR Code
- PDF417

**Prerequisites**

1. Sensor is correctly connected (see section 5.5)
2. Connection has been established from the sensor to the software (see section 10.1.1)
3. The camera is configured / images are selected (see section 11.2)

**Procedure**

An object with a corresponding 2D code is read.

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## 11.12.2. Settings

**Property**  The following settings/results appear.

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the module |
| Module State | Error codes to give support in error diagnosis (see section 18.5) |
| Reading True Count | The number of 2D codes which have been read is displayed. |
| Teach | Reading of the current 2D code is adjusted to the respective conditions. |
| Input Image | Selection of the channel for the image input |
| Code Type | The type of 2D code can be selected.<br>• Data Matrix ECC 200<br>• QR Code<br>• PDF417 |
| Recognition | In the case of poor code quality, it's advisable to set this parameter to enhanced or maximum.<br><br>**Standard**  Easily legible 2D codes are recognized quickly and reliably in the standard mode.<br><br>**Enhanced**  Difficult 2D codes can be read in the enhanced mode. However, processing takes longer.<br><br>**Maximum**  Even partially destroyed 2D codes can be read in the maximum mode. However, this mode requires the biggest amount of processing time. |
| Read Timeout [s] | The time during which the sensor attempts to read the code. If reading is not successful within this period of time, the process is aborted and the reading results are rendered invalid. Time can be set within a range of 0 to 20 seconds in steps of 1 ms. Aborting the reading process takes about 20 ms, and thus the module's minimum processing time is 20 ms. |
| Reading Max Count | The maximum number of codes to be read simultaneously can be specified. Up to 20 codes can be read during one image recording operation. |
| Quality Grading | Quality grading of the code can be activated. **Note:** Activation of this function increases the module's decoding time.<br><br>**None**  No quality grading<br><br>**ISO/IEC 15415**  Quality grading in accordance with ISO/IEC15415<br><br>**AIM DPM-1-2006**  Quality grading in accordance with AIM DPM-1-2006<br>**Note:** Only available for ECC200 and QR Code.<br><br>**Note:** The results of the code evaluation in accordance with the selected standard can be found in the configuration reading list (see section 11.4.3.1). |

### 11.12.3. Configuration

The 2D code module includes the following configuration options:
* Reading List
* Search Box
* Enhanced Parameter

**11.12.3.1. Reading List Sub-Module**

**Property**   The following settings/results are displayed:

| Reading #1 | Reading Code. |
|---|---|
| Quality ISO/ IEC 15415 | According to the standard the grades are whole numbers from 0 to 4, where 0 is the lowest and 4 the highest grade. It is important to note what, even though the implementation is strictly based on the standard, the computation of the print quality grades depends on the preceding decoding algorithm. Thus, different data code readers (of different vendors) can potentially produce slightly different results in the print quality assessment" |
| | **Overall Quality**   Minimum of all individual grades |
| | **Contrast**   Range between minimum and maximum pixel intensity in the data code domain. A strong contrast results in a good grading |
| | **Modulation**   Indicates how strong the amplitudes of the data code modules are. Big amplitudes make the assignment of the modules to black or white more certain, resulting in a high modulation grade. It is to note that the computation of the modulation grade is influenced by the specific level of error correction capacity, meaning that the modulation degrades less for codes with higher error correction capacity |
| | **Fixed Pattern Damage**   Degradation or damage of the fixed pattern, or the respective quiet zones, is assessed with the Fixed Pattern Damage quality |
| | **Decode**   Always takes the grade 4, meaning that the code could be decoded |
| | **Axial Non-uniformity**   Due to a potentially oblique view of the camera onto the data code or a defective fabrication of the data code itself, the width to height ratio can be distorted. This deterioration results in a degraded Axial Nonuniformity |
| | **Grid Non-uniformity**   If apart from an affine distortion the data code is subject to perspective or any other distortions too this degrades the Grid Nonuniformity quality |

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| Property | | | |
|---|---|---|---|
| | Quality ISO/<br>IEC 15415 | **Unused Error Correction** | As data codes are redundant codes, errors in the modules or codewords can be corrected. The amount of error correcting capacities which is not already used by the present data code symbol is expressed in the Unused Error Correction quality. In a way, this grade reflects the reliability of the decoding process. Note, that even codes with an Unused Error Correction grading of 0, which could possibly mean a false decoding result, can be decoded in a reliable way, because the implemented decoding functionality is more sophisticated and robust compared to the reference decode algorithm proposed by the standard |

The following results appear after quality testing in accordance with DPM-1-2006. The evaluation of code quality is specified as a number between 0 and 4, 0 being the worst and 4 the best evaluation.

| Quality AIM<br>DPM-1-2006 | | |
|---|---|---|
| | **Overall Quality** | Minimum of all individual grades |
| | **Cell Contrast** | Range between minimum and maximum pixel intensity in the data code domain. A strong contrast results in a good grading |
| | **Cell Modulation** | Indicates how strong the amplitudes of the data code modules are. Big amplitudes make the assignment of the modules to black or white more certain, resulting in a high modulation grade. It is to note that the computation of the modulation grade is influenced by the specific level of error correction capacity, meaning that the modulation degrades less for codes with higher error correction capacity |
| | **Fixed Pattern Damage** | Degradation or damage of the fixed pattern, or the respective quiet zones, is assessed with the Fixed Pattern Damage quality |
| | **Decode** | Always takes the grade 4, meaning that the code could be decoded |
| | **Axial Nonuniformity** | Due to a potentially oblique view of the camera onto the data code or a defective fabrication of the data code itself, the width to height ratio can be distorted. This deterioration results in a degraded Axial Nonuniformity |
| | **Grid Nonuniformity** | If apart from an affine distortion the data code is subject to perspective or any other distortions too this degrades the Grid Nonuniformity quality |

| Property | Quality AIM DPM-1-2006 | Unused Error Correction | As data codes are redundant codes, errors in the modules or codewords can be corrected. The amount of error correcting capacities which is not already used by the present data code symbol is expressed in the Unused Error Correction quality. In a way, this grade reflects the reliability of the decoding process. Note, that even codes with an Unused Error Correction grading of 0, which could possibly mean a false decoding result, can be decoded in a reliable way, because the implemented decoding functionality is more sophisticated and robust compared to the reference decode algorithm proposed by the standard |
|---|---|---|---|
| | | Mean Light | Estimation for the quality of the processed image The value of Mean Light is not a grade specified with AIM DPM-1-2006 standard. It is an estimation for the quality of the processed image computed as the mean gray-scale value of the centers of the light data code modules. It is a value between 0.0 and 1.0, corresponding to 0% to 100% of the maximum gray-scale value. |
| | | **Note:** More detailed information regarding the results of quality testing can be found in the corresponding standards. | |
| | Envelope | The read code surrounding polygon. | |

### 11.12.3.2. Search Box

**Objective**

The image area within which codes are detected can specified. With the help of a smaller search box, transmission time is **reduced** and the refresh rate is **increased**. **Note:** The area to be examined must be lie completely within the search box.

**Image Area**

By default, the search box encompasses the entire camera image. It appears in the image area as a dashed frame, where it can be adjusted.

**Property**

Search box settings are also displayed in the settings/results area.

| Width | Width of the readout box |
|---|---|
| Height | Height of the readout box |

The following settings/results are displayed for the search box under origin:

| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
|---|---|
| Y (px) | |

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## 11.12.4. General settings for all Code Types

**Property** The following settings/results appear.

| | |
|---|---|
| Polarity | Describes the polarity of the symbol in the image, i.e., the parameter determines if the symbol appears light on a dark background or dark on a light background. Values: 'dark_on_light', 'light_on_dark', 'any'. Default: 'dark_on_light' (Enhanced: 'any') |
| Mirrored | Describes whether the symbol is or may be mirrored (which is equivalent to swapping rows and columns of the symbol). Values: 'no', 'yes', 'any' Default: 'any' |
| Contrast Min | Minimum contrast between the foreground and the background of the symbol (this measure corresponds with the minimum gradient between the symbol's foreground and the background). Values: [1…100] Default: 30 (Enhanced: 10) |
| Small Modules Robustness | Robustness of the decoding of data codes with very small module sizes. Setting the parameter 'Small Modules Robustness' to 'high' increases the likelihood of being able to decode data codes with very small module sizes. Additionally in that case the minimum module size should also be adapted accordingly, thus 'Module Size Min' and 'Module Width Min' (PDF417) should be set to the expected minimum module size and width, respectively. Setting 'Small Modules Robustness' to 'high' can significantly increase the internal memory usage. Thus, in the default case 'Small Modules Robustness' should be set to 'low'. Values: 'low', 'high' Default: 'low' (Enhanced: 'low', Maximum: 'high') |
| Strict Model | Controls the behavior while detecting symbols that could be read but that do not fit the model restrictions on the size of the symbols. They can be rejected (strict model, set to 'yes') or returned as a result independent of their size and the size specified in the model (lax model, set to 'no'). Values: 'yes' (strict), 'no' (not strict) Default: 'yes' |

### 11.12.5. Data Matrix ECC 200

| Property | | |
|---|---|---|
| Symbol Columns Min | Minimum number of module columns in the symbol. Value range: [10…144] − even Default: 10 | |
| Symbol Columns Max | Maximum number of module columns in the symbol. Value range: [10…144] − even Default: 144 | |
| Symbol Rows Min | Minimum number of module rows in the symbol. Value range: [8…144] − even Default: 8 | |
| Symbol Rows Max | Maximum number of module rows in the symbol. Value range: [8…144] − even Default: 144 | |
| Symbol Shape | Possible restrictions on the module shape (rectangle and/or square). Attention: setting the symbol shape all previously made restrictions concerning the symbol size may change. For 'square' the minimum of 'Symbol Columns Min' and 'Symbol Rows Min' and the maximum of 'Symbol Columns Max' and 'Symbol Rows Max' will be used. Additional restrictions can be seen in the following table: | |

| | 'any' | 'rectangle' | 'square' |
|---|---|---|---|
| 'Symbol Columns Min' | 10 | 18 | 10 |
| 'Symbol Columns Max' | 144 | 48 | 144 |
| 'Symbol Rows Min' | 8 | 8 | 10 |
| 'Symbol Rows Max' | 144 | 16 | 144 |

| Property | | |
|---|---|---|
| | Furthermore, if 'Symbol Columns Min' is larger than 'Symbol Rows Max', the setting for 'Symbol Shape' is ignored and its value set to 'rectangle'. If 'Finder Pattern Tolerance' is set to 'high' or 'any', the value of 'Symbol Shape' may speed up the symbol search significantly if it is set to 'rectangle' or 'square'. Values: 'rectangle', 'square', 'any' Default: 'any' | |
| Module Size Min | Minimum size of the modules in the image in pixels. Values: [1…100] Default: 6 (Enhanced: 2, Maximum: 1) | |
| Module Size Max | Maximum size of the modules in the image in pixels. Values: [2…100] Default: 20 (Enhanced: 100) | |
| Module Gap Min | Minimum gap in direction of the symbol rows and columns. Values: 'no', 'small', 'big' Default: 'no' | |
| Module Gap Max | Maximum gap in direction of the symbol rows and columns. Values: 'no', 'small', 'big' Default: 'small' (Enhanced: 'big') | |
| Slant Max | Maximum deviation of the angle of the Lshaped finder pattern from the (ideal) right angle (the angle is specified in radians and corresponds to the distortion that occurs when the symbol is printed or during the image acquisition). Value range: [0.0…0.5235] Default: 0.1745 = 10° (Enhanced: 0.5235 = 30°) | |

| Property | Finder Pattern Tolerance | Tolerance of the search with respect to a disturbed or missing finder pattern. The finder pattern includes the L-shaped side as well as the opposite alternating side. Dependent on this parameter, different algorithms are used during the symbol search. In one case ('low'), it is assumed that the finder pattern is present to a high degree and shows almost no disturbances. In the other case ('high'), the finder pattern may be heavily disturbed or missing completely without influencing the recognition and the reading of the symbol. Note, however, that in this mode the parameters for the symbol search should be restricted as narrow as possible. Otherwise the run-time may significantly increase. Also note that the two algorithms slightly differ from each other in terms of robustness. This may lead to different results depending on the value of 'Finder Pattern Tolerance' even if the finder pattern of the symbol is not disturbed. For example, if 'high' is chosen, only symbols with an equidistant module grid can be found (see below), and hence the robustness to perspective distortions is decreased. Finally, if 'Finder Pattern Tolerance' is set to 'any' both algorithms are applied. Values: 'low', 'high', 'any' Default: 'low' (Enhanced: 'low', Maximum: 'any') |
|---|---|---|
| | Module Grid | Describes whether the size of the modules may vary (in a specific range) or not. Dependent on this parameter different algorithms are used for calculating the module's center positions. If it is set to 'fixed', an equidistant grid is used. Allowing a variable module size ('variable'), the grid is aligned only to the alternating side of the finder pattern. With 'any' both approaches are tested one after the other. Please note that the value of 'Module Grid' is ignored if 'Finder Pattern Tolerance' is set to 'high'. In this case an equidistant grid is assumed. Values: 'fixed', 'variable', 'any' Default: 'fixed' (Enhanced: 'any') |

### 11.12.6. QR Code

| Property | Model Type | Type of the QR Code model. The old QR Code Model 1 and the newer Model 2 are supported. Values: 1, 2, 'any' Default: 'any' |
|---|---|---|
| | Version Min | Minimum symbol version. The symbol version is directly linked to the symbol size. Symbols of version 1 are 21x21 modules in size, version 2 = 25x25 modules, etc. up to version 40 = 177x177 modules. The maximum size of Model 1 symbols is 73x73 = version 14. Value range: [1…40] (Model 1: [1…14]) Default: 1 |
| | Version Max | Maximum symbol version. Value range: [1…40] (Model 1: [1…14]) Default: 40 |
| | Symbol Size Min | Minimum size of the symbol in modules. This parameter can be used as an alternative to 'Version Min'. Value range: [21…177] (Model 1: [21…73]) Default: 21 |
| | Symbol Size Max | Maximum size of the symbol in modules. This parameter can be used as an alternative to 'Version Max': Value range: [21…177] (Model 1: [21…73]) Default: 177 |
| | Module Size Min | Minimum size of the modules in the image in pixels. Values: [1…100] Default: 6 (Enhanced: 2, Maximum: 1) |
| | Module Size Max | Maximum size of the modules in the image in pixels. Values: [2…100] Default: 20 (Enhanced: 100) |

| Property | Module Gap Min | Minimum gap in direction of the symbol rows and columns. Values: 'no', 'small', 'big' Default: 'no' |
|---|---|---|
| | Module Gap Max | Maximum gap in direction of the symbol rows and columns. Values: 'no', 'small', 'big' Default: 'small' (Enhanced: 'big') |
| | Position Pattern Min | Number of position detection patterns that have to be visible for generating a new symbol candidate. Value range: [2, 3] Default: 3 (Enhanced: 2) |

## 11.12.7. PDF417

| Property | Symbol Columns Min | Minimum number of data columns in the symbol in codewords, i.e., excluding the codewords of the start/stop pattern and of the two row indicators. Value range: [1…30] Default: 1 |
|---|---|---|
| | Symbol Columns Max | Maximum number of data columns in the symbol in codewords, i.e., excluding the two codewords of the start/stop pattern and of the two indicators. Value range: [1…30] Default: 20 (Enhanced: 30) |
| | Symbol Rows Min | Minimum number of module rows in the symbol. Value range: [3…90] Default: 5 (Enhanced: 3) |
| | Symbol Rows Max | Maximum number of module rows in the symbol. Value range: [3…90] Default: 45 (Enhanced: 90) |
| | Module Width Min | Minimum module width in the image in pixels. Values: [1…100] Default: 3 (Enhanced: 2, Maximum: 1) |
| | Module Width Max | Maximum module width in the image in pixels. Values: [2…100] Default: 15 (Enhanced: 100) |
| | Module Aspect Min | Minimum module aspect ratio (module height to module width). Values: [0.5…20.0] Default: 1.0 |
| | Module Aspect Max | Maximum module aspect ratio (module height to module width). Values: [0.5…20.0] Default: 4.0 (Enhanced: 10.0) |

# EN

## 11.13. Module Image Comparison

### 11.13.1. Overview

**Objective**     Objects can be compared with the stored Reference Image and any deviations can be reliably detected with the help of the Module Image Comparison.

**Prerequisites**     1. Sensor is correctly connected (see section 5.5)
2. Connection has been established from the sensor to the software
   (see section 10.1.1)
3. Region of interest is specified (see section 11.5)

**Procedure**     First of all, one or more images (see Teach Image Count) of good parts will be used to calculate the Reference Image.

Then the Input Image will be compared pixel by pixel with the Reference Image. If the deviation of a pixel is bigger than the value of the pixel in the Threshold Image, the pixel will be marked as an error (white) in the Output Image. If the deviation is smaller than the value of pixel in the Threshold Image, the pixel of the Input Image is marked as an accepted (black) value in the Output Image (only visible in Advanced Mode).
The errors are also visible if you click in the Module Image Comparison itself. To make them more visible, they are marked red.

### 11.13.2. Settings

**Image Area**     Deviations from the reference object are displayed as red pixels in the image area.
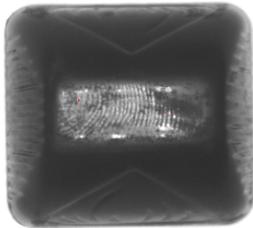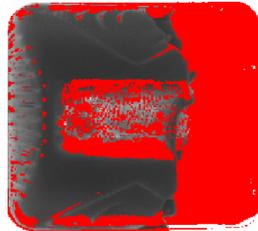
**Reference Object**          **Displayed Deviation from the Reference Object**

**Property**

The following settings/results are displayed:

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the module |
| Module State | Error codes to give support in error diagnosis (see section 18.5) |
| Pixel Count | Number of pixels by which the respective image deviates from the original image. The larger the number, the greater the deviation from the original image. |
| Input Image | Selection of the Input Image. |
| Input Region | Selection of the region for image comparison. |
| Threshold Background | "Threshold value for acceptable brightness differences between a pixel of the Input Image and a pixel of the Reference Image on the whole image except the detected edges (see Threshold Border). The higher the value, the higher the tolerance. |
| | Range 0-255: Value 0: Highest sensitivity, even the slightest brightness differences are marked as errors. |
| Threshold Border | Threshold value for acceptable brightness differences along the detected edges (see Edge Sensitivity (%) and Threshold Image). Setting of values: see Threshold Background |
| Edge Broadening (px) | Pixel width of the edges – the detected edges will be broadened by this value |
| Teach Image Count | The number of images whose characteristics are combined into a reference image. |
| Teach | Activation of the teach-in process. After a successful teach-in process, a display appears indicating how many of the image recordings have been combined into a reference image. |
| Edge Sensitivity (%) | A setting which determines which percentage of the detected edges will be evaluated as edges of the Reference Image. The default value is 20%. |

# EN

### 11.13.3. Configuration

The image comparison module includes the following configuration:

- Output Image.
- Reference Image.
- Threshold Image.

#### 11.13.3.1. Output Image

**Objective**    The differences between the reference image and the current image are displayed as a binary image after clicking the Output Image. Errors are marked white, accepted values are marked black.

**Property**    The following settings/results are displayed:

| | |
|---|---|
| Image Type | Display of the image type |
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |
| Width (px) | Image width |
| Height (px) | Image height |

The following settings/results are displayed under Binary:

| | |
|---|---|
| Size | Number of pixels in the image |
| Bits per Pixel | Display of the number of bits required to transmit one pixel |
| Channel Type | The binary channel type is displayed. |

### 11.13.3.2. Reference Image

**Objective**     The taught in reference image is displayed after clicking the Reference Image.

**Property**      The following settings/results are displayed:

| Image Type | Display of the image type |
|---|---|
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |
| Width (px) | Image width |
| Height (px) | Image height |

The following settings/results are displayed under 8-bit:

| Size | Number of pixels in the image |
|---|---|
| Bits per Pixel | Display of the number of bits required to transmit one pixel |
| Channel Type | The generic 8-bit channel type is displayed. |

The following settings/results are displayed under Transformed Mask:

| Size | Number of pixels in the image |
|---|---|
| Bits per Pixel | Display of the number of bits required to transmit one pixel |
| Channel Type | The mask channel type is displayed. |

### 11.13.3.3. Threshold Image

**Objective**     The binary threshold image is displayed after clicking the Threshold Image.

**Property**      The following settings/results are displayed:

| Image Type | Display of the image type |
|---|---|
| X (px) | Coordinate of the sensor image coordinate system (see section 18.3) |
| Y (px) | |
| Width (px) | Image width |
| Height (px) | Image height |

The following settings/results are displayed under 8-bit:

| Size | Number of pixels in the image |
|---|---|
| Bits per Pixel | Display of the number of bits required to transmit one pixel |
| Channel Type | The generic 8-bit channel type is displayed. |

# EN

## 11.14. Module OCR (optical character reader)

### 11.14.1. Overview

**Goal**      Read letters, numbers and symbols.

**Prerequisites**     1. The sensor is correctly connected (see section 5.5).
2. Connection has been established from the sensor to the software (see section 10.1.1).
3. The camera is configured / images are selected (see section 11.2).
4. If applicable, tracking is configured (see sections 11.3.2 and 11.4).

**Procedure**     First specify the region within which the characters are located. Then select the segmentation settings. The next step involves associating the detected character with a letter or a number.

### 11.14.2. Parameter Settings

**Characteristic**     The following settings/results are displayed:

| | |
|---|---|
| Processing time [ms] | Sensor processing time for the module |
| Module status | Error codes for troubleshooting support  (see section 18.6). |
| Segments found | Number of detected characters |
| Reading results | Read-out of all reading results for all detected lines. The lines are separated from each other by a line feed (LF). |
| Input image | Selection of the channel for image input |
| Coordinate system | Selection can be made regarding how the OCR module should be tracked. |
| Reading timeout [ms] | The time during which an attempt is made to read the characters. If reading is not successful within this period of time, the process is aborted and the reading results are rendered invalid. |
| Maximum number of segments | The maximum number of segments is specified. |

### 11.14.3. Configuration

The OCR module includes the following configuration options:
- Results list
- Segment list
- Search region
- Find lines
- Binarization
- Segmentation
- Classification
- Replacement

#### 11.14.3.1. Results List

**Characteristic**  The following settings/results are displayed:

| | |
|---|---|
| Reading results #0…n | The characters read from the detected line are displayed. |

Reading results are read out for each detected line.

#### 11.14.3.2. Segment List

**Goal**  Detected characters are listed in the sub-module in order to provide information concerning the detected segment. This information can be used to further optimize the overall settings.

**Characteristic**  The following settings/results are displayed for any given selected segment:

| | |
|---|---|
| Assigned character | If an appropriate character has been found in the character set, it's displayed. Otherwise, the default replacement character appears, namely a question mark (?). |
| Lower threshold value | Lowest binarization value that has been used to binarize the character. |
| Upper threshold | Highest binarization value that has been used to binarize the character. |
| Height | Height of the character |
| Width | Width of the character |
| Scoring | Specifies the value which indicates how closely the scanned character coincides with the utilized character from the character set. If no comparable character is found in the character set, the assessment value is 0. If the scanned character coincides precisely to the utilized character from the character set, the value is 1000. |

**11.14.3.3. Search Region**

**Goal**  The area of the image within which characters will be searched for can be specified. Using a small search region **reduces** evaluation time and **increases** the refresh rate.

**Characteristic**  The following settings/results are displayed for any given selected segment
The following settings/results for the search region are displayed under reference point:

| | |
|---|---|
| X (px) | Coordinate of the image sensor's coordinate system (see section 18.3. |
| Y (px) | |

The search region settings are also displayed in the characteristics:

| | |
|---|---|
| Width (px) | Search box width |
| Height (px) | Search box height |
| Phi (degrees) | Search box rotation angle |

**11.14.3.4. Find Lines**

**Goal**  The module can read out several lines from a search region. The presettings for the lines to be expected are entered under "find lines".
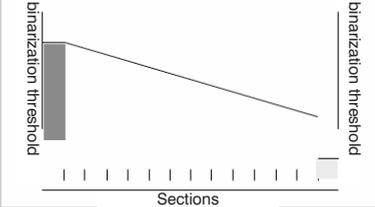
**Characteristic**  The following settings/results are available:

| | |
|---|---|
| Line detection | This function is initially deactivated. The search algorithm is activated by switching the mode to standard. |
| Angle [degrees] | If the angle range is set to 0, the module automatically calculates the angle of the rows with reference to the search region. The resulting value is displayed. |
| Maximum number of lines | The number of lines to be expected is specified. |
| Angle range [degrees] | The angle between the search region and the expected lines is specified. If this value is set to 0, the module calculates the angle automatically. |
| Min. line height (px) | Minimum height of the expected lines |
| Max. line height (px) | Maximum height of the expected lines |
| Min. line spacing (px) | The search algorithm of each line is expanded by one-third of the line spacing value in positive or negative direction. |

**11.14.3.5. Binarization**

**Goal**

The characters are separated from the background with the help of the binarization threshold. It must be determined which type of character is involved and which operating mode needs to be used. Selection can be made between several binarization modes.

**Characteristic**

The following settings/results are available:

| Contrast | The mode of application is specified, i.e. dark characters on a light background or light characters on a dark background. | |
|---|---|---|
| Threshold value mode | The following options are available: | |
| | **Manual** | The binarization threshold is set manually by specifying the lower and upper threshold values. |
| | **Calculation** | The binarization threshold is calculated automatically by the OCR algorithm. |
| | **Linear** | This mode is used when a linear brightness profile can be detected in the image.  |
| | **Non-linear** | This mode is used when the image is not homogeneously illuminated. In the cease of non-linear calculation of the binarization threshold, the image is broken down into predetermined sections, and the best possible binarization threshold is calculated for each.  |
| Linear/non-linear threshold value splitting | This value specifies into how may parts the search region will be split up in order to calculate the individual threshold values. | |

**11.14.3.6. Segmentation**

**Goal**    The characters are separated from each other with the help of segmentation. The module makes use of various automatic methods. If these automatic methods do not lead to the desired results, various segmentation settings can be entered manually.

**Characteristic**    The following settings/results are available:

| | |
|---|---|
| Min. character height [px] | The minimum height of the character to be detected is specified. |
| Max. character height [px] | The maximum height of the character to be detected is specified. |
| Min. character width [px] | The minimum width of the character to be detected is specified. |
| Max. character width [px] | The maximum width of the character to be detected is specified. |
| Min. cluster size [px] | The minimum number of pixels which must be contained by a segment in order to be detected as a character |
| Max. cluster size [px] | The maximum number of pixels which may be contained by a segment in order to be detected as a character |

Max. character height    **10.Mai.2008**    **27548452a**   Min. character height

Min. character width      Max. character width      Min. Character spacing

| | |
|---|---|
| Smallest outlier | If the requirements concerning height, width and cluster size are fallen short of, the detected segment is disregarded. |
| Largest outlier | If the requirements concerning height, width and cluster size are exceeded, the detected segment is disregarded. |
| Vertical pixel pitch [px] | The vertical pixel pitch for fonts which are made up of individual pixels is specified. |
| Horizontal pixel pitch [px] | The horizontal pixel pitch for fonts which are made up of individual pixels is specified. |
| Distribution | The following options are available: |

| | | |
|---|---|---|
| | Standard | Fixed distribution of the characters is assumed. Character spacing and angle do not vary. |
| | Variable | Distribution of the characters with regard to spacing, angle and size may vary. |
| | Dynamic | Distribution of the characters with regard to spacing, angle and size may vary greatly. |

| Characteristic | Character spacing [px] | Character spacing specifies the expected number of pixels between the segments. |
|---|---|---|
| | Replacement character | If a detected character cannot be found in the taught-in character set, the replacement character is displayed. |
| | Inclination mode | The minimum width of the character to be detected is specified. |
| | Inclination angle [degrees] | The inclination angle of the characters can be specified. The value can lie within a range of -45° to + 45°. |



### 11.14.3.7. Classification

**Goal**

Classification specifies as of which degree of conformity a character is selected from the character set. The higher the degree of conformity, the more precisely the characters must conform.

**Characteristic**

The following settings/results are available:

| Acceptance value | The current character is compared with the character from the character set and coincidence is evaluated. The higher the value the greater the coincidence. The acceptance value specifies the minimum degree of coincidence which must be achieved for the character to be read out as recognized. |
|---|---|

### 11.14.3.8. Insert

**Goal**

This function makes it possible to filter the detected characters on the basis of certain criteria.

**Characteristic**

The following settings/results are available:

| Pattern | This is used to specify at which place which character can be used in the results read-out. Which characters are associated with which abbreviation is defined in the set sub-step. |
|---|---|

One letter from the defined set must be entered per place in the output value. If the field is empty, the reading results from the OCR module are read out without restriction.

**Set**    The following patterns have already been specified:

| N | 0123456789 |
|---|---|
| A | ABCDEFGHIJKLMNOPQRSTUVWXYZ (uppercase letters) |
| a | abcdefghijklmnopqrstuvwxyz (lowercase letters) |
| H | 0123456789ABCDEF (hexadecimal, uppercase) |
| h | 0123456789abcdef (hexadecimal, lowercase) |
| O | 1234567 (octal numbers only) |
| N | A set of characters can be defined by the user. An explicit letter must be assigned to the subset as a characteristic. |

### 11.14.3.9. Teaching Characters In

**Goal**    If characters from the fonts OCR-A or OCR-B need to be read, the included OCR-A and OCR-B fonts can be used. If the characters are from any other font, they first have to be taught in.

**Function field**    New characters can be taught in to the toolbar module. Taught-in characters can be managed with the help of a character editor.

| | Teach line in | All of the characters within the search region are taught in. |
|---|---|---|
| | Character editor | The character editor is a separate window which makes it possible to manage taught-in characters, as well as to save and load fonts. |

The character editor manages the currently used character set. Additional information is available for each character, such as height and width. The number of hits indicates how frequently the character has been used since the program was last started. If the same character has been taught in more than once, information concerning the number of hits is helpful for finding out whether or not a character is actually necessary for the current application. After clicking the small image, a larger image of the taught-in character is displayed.

Each character can be individually removed from the character set by clicking the X in the respective column.

Note: The smaller the character set, the higher the evaluation speed.
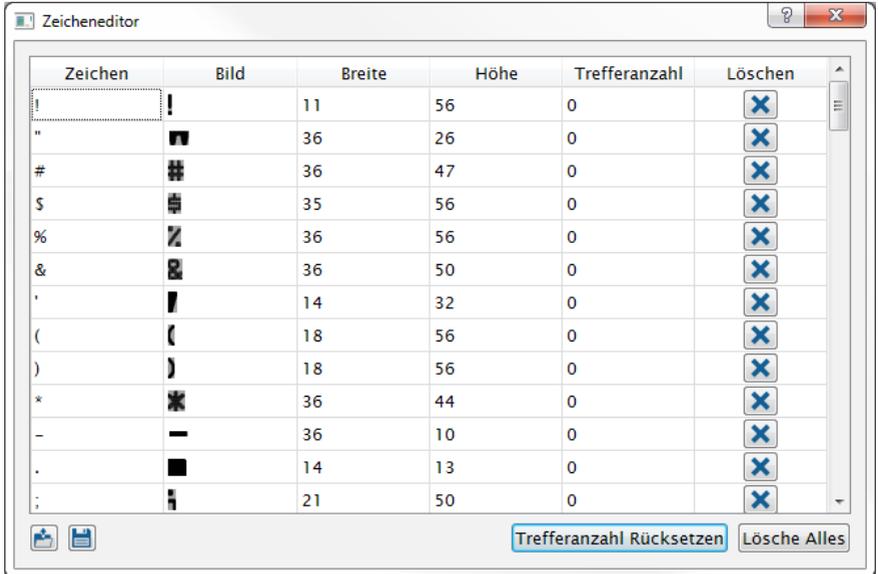
The current character is compared with the character from the character set and coincidence is evaluated. The higher the value the greater the coincidence. The acceptance value specifies the minimum degree of coincidence which must be achieved for the character to be read out as recognized.



to load    to save
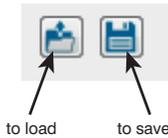
## 11.15. OCR-Tip

This chapter is intended to explain the basic requirements for setting up wenglor's OCR Reader. By considering several important attributes, it can be determined whether or not this product is suitable for the respective application.

In actual practice, a great number of ambient conditions influence whether or not reading will be successful. This document only deals with the issues of geometry and contrast.

The most important attributes are:
- Character geometry
- Quiet zone
- Background / contrast

### 11.15.1. Basic Character Geometry

- The OCR Reader functions ideally as of a **character height of 25 pixels**. In this case, as a rule, the gap between the characters are large enough for the characters to be separated.
- The OCR Reader functions ideally when the gap between the characters is **half as large as the character width**.
- If "non-linear calculation of the binarization threshold" is used, the gap between the characters should not be any larger than one character. Otherwise the gap itself might be recognized as a character under certain circumstances. In this case, two objects should be used.
- Processing time has a **quadratic relationship to character size**. If a character string with a character height of 25 pixels requires 20 ms for the reading algorithm, time is increased to 80 ms for a character height of 50 pixels.

### 11.15.1.1. Examples

| | |
|---|---|
| Font: Arial Standard<br>Height: 30 pixels<br>→ "02" cannot be segmented. | MHD 19.02.2011 |
| Font: OCR B<br>Height: 30 pixels<br>→ All characters can be readily segmented. | MHD 19.02.2011 |
| Font: OCR B<br>Height: 30 pixels<br>Binarization: "non-linear calculation"<br>→ Excessively large spaces are seen as separate segments. | MHD 19.02.2011 |
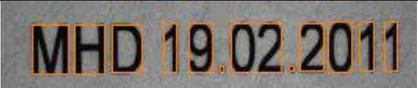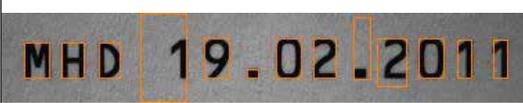
### 11.15.2. Size of the ROI

If the region of interest is too large, the algorithm for determining the binarization threshold does not function reliably.

The following rule of thumb applies:
Left/right edge spacing:       1 x character width
Top/bottom edge spacing:     0.5 x character width

This **"quiet zone"** should not be interfered with by other characters or objects.

Furthermore, processing time also increases when the ROI is too large.

If the position of the character string to be read is not consistent in actual practice, it's usually better to use localization instead of a very large ROI. Processing time for localization plus reading is usually less than required for a large ROI.

**11.15.2.1. Examples**

| | |
|---|---|
| Ideal edge spacing<br>Reading time: 25 ms |  |
| Edge spacing too large: The segmentation function detects additional object because an incorrect binarization threshold is calculated due to the large surface area of the image.<br><br>Reading time: 120 ms |  |
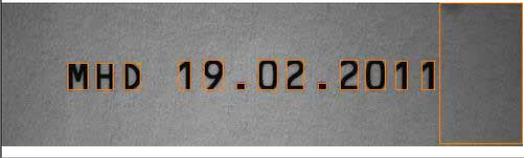
## 11.15.3. Background

A homogenous background is always ideal for character segmentation. Structures included in the background which have an intensity similar to that of the characters make reading impossible.

Under certain circumstances, colored structures can be eliminated by using the right illumination color. If fine structures are present in the background, it may be helpful to make use of a Gaussian filter or set the optics slightly out of focus depending upon character size.

| | |
|---|---|
| Character string with structure in background<br>→ segmentation is not possible. |  |
| Character string with structure in background<br>→ segmentation functions correctly. |  |
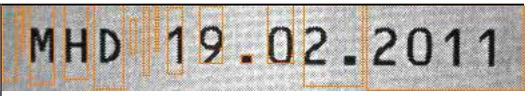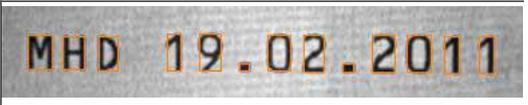
## 11.15.4. Contrast

The "binarization" stage must find a suitable binarization threshold for separating the characters from the background on the basis of image contrast. The OCR module is equipped with various binarization functions to this end.

If contrast (difference in intensity between characters and background) is constant over the entire ROI, 20 intensity values are enough for display.

If contrast varies within the ROI (e.g. due to inhomogeneous illumination), there should be a plain difference between the characters and the background. The sensor functions ideally if the image is set up with black characters (intensity = 0) and a gray background. In this case, brightness differences within the characters are outside of the image chip's dynamic range, and the characters are entirely black.

On the other hand, an attempt can be made to fully over-illuminate the background (white, i.e. intensity = maximum). In this way, structures in the background can no longer be detected and only the characters are gray.

**11.15.4.1. Examples**

| | |
|---|---|
| Dark illumination, structures in the characters are not visible. | MHD 19.02.2011 |
| Background over-illuminated, small structures in the background are not visible. | MHD 19.02.2011 |

## 11.16. Module Pattern Match

### 11.16.1. Overview

**Objective**      Recognize objects in an image

**Prerequisite**
1) The sensor is correctly connected (see section 5.5).
2) Connection has been established from the sensor to the software (see section 10.1.1).
3) The camera is configured / images are selected (see section 11.21).

**Procedure**      First of all, specify the object or a distinctive element of the object which needs to be recognized. Then specify tolerances for rotational orientation. Teach in and you're done.

### 11.16.2. Setting Parameters

**Characteristic**    The following settings/results are displayed:

| | |
|---|---|
| Processing Time [ms] | Sensor processing time for the module |
| Module State | Error code for troubleshooting support  (see section 18.6) |
| Reading True Count | The number of detected objects is displayed. |
| Input Image | Selection of the channel for image input |
| Reading Timeout [ms] | The time during which the sensor attempts to detect the object. If nothing has been successfully detected after this duration has expired, the search is aborted and the result is set to invalid. Time can be set within a range of 0 to 20 seconds in steps of 1 ms. Aborting the read attempt takes about 20 ms. The module's minimum processing time is thus also 20 ms. |
| Reading Max Count | The maximum number of objects to be detected can be selected. Up to 20 objects can be detected simultaneously. |

| Characteristic | | |
|---|---|---|
| Shape Models | Number of different models which should be detected. Up to 10 different models can be taught in. |
| Pyramid Levels | With a value of 0, the algorithm automatically optimizes the number of model points. A value of 1 specifies that model points will be looked for in the original image, and thus this setting is the slowest. If the value is increased to 2, the resolution of the original image is reduced by means of subsampling. Possible model points are thus also reduced and the process is accelerated. It must be noted that although processing time is reduced as the pyramid steps value is increased, accuracy is also reduced. We recommend leaving the setting at a value of 0, i.e. automatic. |
| Angle Start [deg] | This parameter specifies in which negative direction the model can be turned from the taught-in position. It describes the start angle from which the angle of rotation is determined on the basis of angle range. For example, if a start angle of -15° and an angle range of 30° are selected, the model can move within a range of -15° to +15°. |
| Angle Extent [deg] | Angle extent specifies the possible range of angles of rotation for the model. |
| Angle Step [deg] | The angle step parameter specifies the individual increments within the selected angle range. The angle step parameter should be set on the basis of the object's size. Smaller models have only a number of different discrete rotations within the image. For this reason, a larger angle step should be selected for smaller objects. |
| Scale Min | This parameter specifies the lower limit of the possible scaling range which will be searched. A value of 1 corresponds to the model's original size. |
| Scale Max | This parameter specifies the upper limit of the possible scaling range which will be searched. A value of 1 corresponds to the model's original size. |
| Scale Step | Scale Step specifies the increment within the scaling range. As is also the case with the angle step parameter, scaling step should be set on the basis of the object's size. |

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| Characteristic | Optimization | In the case of especially large models, it may be advisable to select the number of model points by setting the optimization parameter to a value other than "-". In the case of smaller models, reducing the number of points does not result in any acceleration. | |
|---|---|---|---|
| | | Auto | The number of points is reduced automatically by the algorithm. |
| | | - | No optimization is conducted. All object points are saved. |
| | | Min Point Reduction | There are three different levels for reducing the number of points of a taught-in model. Reducing the number of points can be very helpful for large objects. |
| | | Med Point Reduction | |
| | | Max Point Reduction | |
| | | Regeneration | If this parameter is selected, a new model is generated each time an image is recorded. It must be noted that regeneration in the case of large rotation or scaling values increases memory occupation. Regeneration also takes a great deal of time. |
| | | No Regeneration | Regeneration of models is deactivated. |
| | Metric | The metrics setting specifies the conditions under which the sample will still be recognized within the image. | |
| | | Polarity – Active | The object in the image must demonstrate the same contrast characteristics as the model. For example, if the model is a bright object against a dark background, the object is only detected within the image if it's brighter than the background. |
| | | Global Polarity – Ignore | The model is also detected when the contrast characteristics are exactly the opposite of those of the taught-in object. |
| | | Local Polarity – Ignore | If this value is selected, contrast polarity may only change amongst various parts of the model, but the polarity of model points within the same part of the model may not change The term "Local Polarity – Ignore" must be correctly understood. It means that changes in polarity between neighboring parts of the model don't influence the score and are thus ignored. |

| **Characteristic** | Contrast | The contrast parameter specifies which gray-scale contrast the model's points must demonstrate. Contrast is a measure of local gray-scale differences between the object and the background, as well as between the parts of the object. | |
|---|---|---|---|
| | | Auto | Contrast, upper and lower threshold values, and hysteresis are calculated automatically. |
| | | Auto-Contrast | Only the contrast values are determined automatically. |
| | | Auto-Contrast Hysteresis | The hysteresis threshold values are determined automatically. |
| | | Auto Minimum Magnitude | The minimum contrast magnitude is only used for creating the model – the other influencing variables are not used. |
| | | Numeric Value | This value specifies the minimum contrast value of an edge transition which must be achieved. The edge is only used for model generation if this value is reached. |
| | Min Contrast | The minimum gray-scale contrast which the model will have to have within the image later on during detection is specified here. In other words, this parameter represents a demarcation of the sample from noise within the image. For this reason, a good value corresponds to the range of gray-scale change which is caused by noise within the image. For example, if gray-scale values fluctuate within a range of 10 due to noise, the value should be set to 10. The value must be less than the contrast parameter value. | |
| | Min Score | Specify the quality of coincidence – the higher the value is set the more quickly evaluation is completed, but quality is reduced. | |
| | Max Overlap | This parameter specifies how much of a taught-in model may be covered up, and nevertheless still detected as present. | |

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| Characteristic | Sub Pixel | The sub pixel parameter defines whether the position and the orientation of the detected model will be read out with accuracy down to the pixel or the sub pixel. | |
|---|---|---|---|
| | | --- | The object's coordination and angle of rotation are read out with an accuracy of down to 1 pixel. |
| | | Interpolation | When interpolation is activated, the algorithm examines the position of the object on the basis of neighboring pixels, angles and scaling around the best coincidence match. The results are accurate down to roughly one twentieth of a pixel. Interpolation is very fast and can be activated for most applications. |
| | | Smallest Squares | The smallest squares parameter works against the interpolation parameter. This function requires a great deal of computing time. |
| | | Smallest Squares – High | |
| | | Smallest Squares – Very High | |
| | | Max. Deformation 1 | Sometimes no objects are found, or only objects with a minimal coincidence value, because they're highly deformed relative to the taught-in model. The max. deformation parameter specifies by how many pixels the detected object can differ from the taught-in object. Selection can be made between the Max. Deformation 1 and the Max. Deformation 2 parameters. |
| | | Max. Deformation 2 | |
| | Greediness | "Greediness" of the search heuristics (0: reliable but slow, 1: fast but matches may be overlooked). | |

### 11.16.3. Configuration

The pattern matching module includes the following configuration options:
• Results list
• Search box
• Teach Box
• Shape models

**11.16.3.1. Results List Sub-Module**

**Characteristic**    The following settings/results are displayed:

| Reading #1 | The name of the detected object is displayed. |
|---|---|
| Quality | The displayed number describes the quality of coincidence between the detected object and the taught-in models. The number can lie between 0 (not recognized) and 1 (full coincidence to the taught-in model). |
| Coordinate System | Details concerning the initial coordinate system are displayed. The coordinate system is comprised of the following parameters:<br>Phi (degrees): coordinate system rotation in degrees<br>X (px): distance of the coordinate system from the left-hand edge of the image chip<br>X (px): distance of the coordinate system from the top edge of the image chip |

**11.16.3.2. Search Box Sub-Module**

**Objective**    The image area within which objects are detected can be specified. Using a small search box reduces processing time and increases the image refresh rate.

**Image Area**    As a default feature, the search box encompasses the entire camera image. It appears in the image area as a dashed frame, where it can be adjusted.

**Characteristics**    Search box settings are also displayed in the settings/results area.

| Width (px) | Search box width |
|---|---|
| Height (px) | Search box height |

The following settings are displayed under origin.

| X (px) | Coordinates of the image sensor's coordinate system (see section 18.3) |
|---|---|
| Y (px) | |

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**11.16.3.3. Teach Box**

**Objective**    The region which encompasses the object or the distinctive element is displayed and defined here.

**Characteristics**    Teach region settings are also displayed in the settings/results area.

| Width (px) | Teach region width |
|---|---|
| Height (px) | Teach region height |

The following settings are displayed under reference point.

| X (px) | Coordinates of the image sensor's coordinate system (see section 18.3) |
|---|---|
| Y (px) | |

**11.16.3.4. Shape Model**

**Objective**    Several objects can be taught-in. Each object is saved to the sensor as a separate shape model.

**Characteristics**    Each shape model has a "teach-in" button. The current object is taught-in as a shape model when this button is clicked.
After a model has been taught in successfully, its drawn into the camera image. It's possible to subsequently edit the taught-in shape model in order to eliminate any interference. An additional window can be opened to this end via the Shape model Outline parameter. The window appears after clicking the icon [ ... ]. The following window appears:
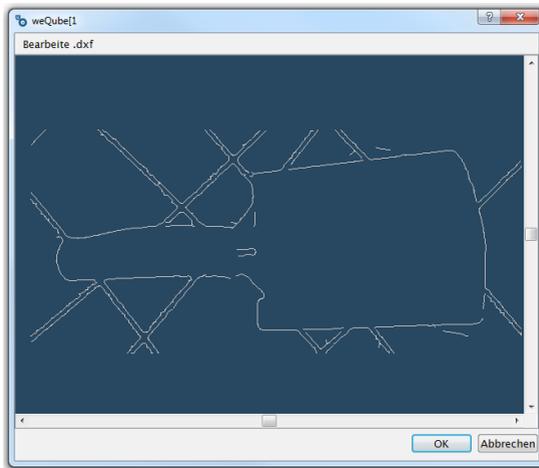
After clicking "Edit.dxf", the mouse pointer turns into a red dot. This dot can be used to delete individual lines from the detected model. After correction of the model has been completed, the new contour is transmitted to the sensor by clicking OK. The "Undo" function negates the last change. The "Redo" function is the opposite of the "Undo" function and thus deletes the restored areas.
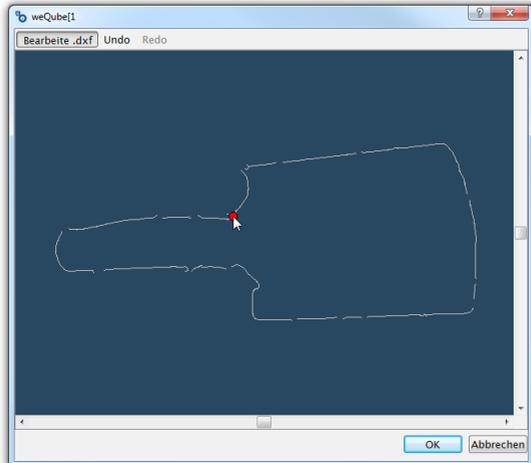


### 11.16.4. Tips

Make sure you have a sharp image with high contrast.
- Move the search region into the middle of the object. Enlarge the search region such that the object or feature you want to detect is enclosed.
- Teach the object in. It may take several seconds until the weQube teach-in process has been completed. Detected contours are displayed in the image. If additional, unnecessary contours are displayed which are not necessarily required for object detection, they should be removed with the help of the contour model editor. A larger number of contours to be searched for extends evaluation time, but it also improves the quality of the results. The ideal relationship between a minimal number of contours and best possible quality varies from application to application.
- Is it possible for the object to turn in the application? If so, the starting angle and the angle range should be set. For example, if it's possible for an object to turn 30 %, set the starting angle to −15 and the angle range to 30. With these settings, the object can rotate within a range of −15° to 15° from the previously taught-in position, and it's still recognized. It must be kept in mind that finding rotated objects requires computing time at the weQube. For this reason, the rotation angle should only be as large as necessary in order to prevent the need for unnecessary computing time.

The following parameters influence evaluation speed:
- Increase the minimum coincidence value step-by-step until the object is no longer detected. Then return to the last value that worked.
- Increase the aggressiveness parameter until pattern matching fails, and then reduce the coincidence value. If this doesn't deliver the desired results, return to the last values with which the object was found.
- Reduce the permissible rotation angle to a minimum.
- Reduce the search region to the size which is actually required for the application.
- Be sure to use contour models which demonstrate prominent structures that differ from the rest of the image. When recording the image, make sure that the prominent structures can be easily detected in the image. It's better to use large, prominent structures then small, faint structures. This can have a significant effect on speed.

## 11.17. Module Match Code

### 11.17.1. Overview

| | |
|---|---|
| **Objective** | Determine whether or not the scanned code corresponds with the taught in match code. |
| **Prerequisites** | 1. Sensor is correctly connected (see section 5.5)<br>2. Connection has been established from the sensor to the software (see section 10.1.1)<br>3. The camera is configured / images are selected (see section 11.3) |
| **Procedure** | With the appropriate settings, a match code can be entered via this module. |

## 11.17.2. Settings

**Property**    The following settings/results appear.

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the process steps |
| Module State | Error codes to give support in error diagnosis (see section 18.5) |
| Input String | The match code can either be entered statically as text or as a combination of text and characters, or dynamic reference can be made to a software parameter via a link. |
| Any Match | If any character string is identical to the input string, the parameter is set to 1 (check box activated). |
| No Match | If no character string is identical to the input string, the parameter is set to 1 (check box activated). |
| Number Elements | Number of possible texts for comparison |

### 11.17.2.1. Number Elements

**Property**    The following settings/results appear:

| | |
|---|---|
| Match | Display indicating whether or not the match code comparison was successful. Box activated: evaluation successful |
| Mismatch | Display indicating whether or not the match code comparison was successful. Box activated: evaluation unsuccessful |
| Match Code | The text or combination of characters to which comparison will take place is selected. The following wildcards are also available for the characters: |

| Place Holder | For Character |
|---|---|
| * | Any number of characters |
| ? | Exactly one character |
| [abc] | a, b or c may appear at this position. |
| [^A] | Any character other than A at this position |

| | |
|---|---|
| Match Teach | The current text or combination of characters is saved as a match code. |

# EN

## 11.18. Module Logic

### 11.18.1. Overview

**Objective**      Logically linking several values to each other.

**Prerequisites**  1. Sensor is correctly connected (see section 5.5)
2. Connection has been established from the sensor to the software (see section 10.1.1)
3. The camera is configured / images are selected (see section 11.2)

**Procedure**      First of all, the values which will be linked to each other have to be identified. Fixed values, as well as results, can be used. The logic calculation is conducted step by step. Initially, the first two values are logically linked to each other and the result is then linked to the next value, and so forth. The logic is calculated in a cascaded manner.

### 11.18.2. Settings

**Property**       The following settings/results appear.

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the module |
| Module State | Error codes to give support in error diagnosis (see section "18.5. weQube Software Module States" on page 201) |
| Output | The results are displayed. |
| Math Function | The type of mathematical function is specified:<br>• AND<br>• OR<br>• XORs<br>• NAND<br>• NOR |
| Input A | Fixed value or variable event from the application |
| Input B | Fixed value or variable event from the application |

## 11.19. Module Math

### 11.19.1. Overview

| | |
|---|---|
| **Objective** | Perform a mathematical operation with two numbers. |
| **Prerequisites** | 1. Sensor is correctly connected (see section "5.5. Initial Start-Up" on page 20)<br>2. Connection has been established from the sensor to the software (see section "10.1.1. Connecting the Sensor (Connect to Device)" on page 41)<br>3. The camera is configured / images are selected (see section "11.2. Camera Device Module" on page 69) |
| **Procedure** | First of all, the mathematical operands are specified which will be used to perform a mathematical operation with two numeric values. Fixed values, as well as results, can be used. |

### 11.19.2. Settings

**Property**  The following settings/results are displayed:

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the module |
| Module State | Error codes to give support in error diagnosis (see section "18.5. weQube Software Module States" on page 201) |
| Output | The calculated results are displayed. |
| Math Function | The type of mathematical function is specified:<br>• +<br>• −<br>• *<br>• / |
| Input #n | Fixed value or variable event from the application |
| Max. Inputs | Specifies the maximum number of inputs. Fixed values or variable results from the application can be assigned to these inputs. |

## 11.20. Module Numeric Comparison

### 11.20.1. Overview

**Objective**    Compare two numbers with each other.

**Prerequisites**
1. Sensor is correctly connected (see section "5.5. Initial Start-Up" on page 20)
2. Connection has been established from the sensor to the software (see section "10.1.1. Connecting the Sensor (Connect to Device)" on page 41)
3. The camera is configured / images are selected (see section "11.2. Camera Device Module" on page 69)

**Procedure**    First of all, the mathematical operands are specified which will be used to compare the two numeric values. Fixed values, as well as results, can be used.

### 11.20.2. Settings

**Property**    The following settings/results appear.

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the module |
| Module State | Error codes to give support in error diagnosis (see section "18.5. weQube Software Module States" on page 201) |
| Output | The calculated results are displayed. |
| Math Function | The type of mathematical function is specified:<br>• A > B<br>• A < B<br>• A >= B<br>• A <= B<br>• A != B |
| Input #n | Fixed value or variable event from the application |
| Max. Inputs | Specifies the maximum number of inputs. Fixed values or variable results from the application can be assigned to these inputs. |

## 11.21. Device IO Unit

### 11.21.1. Overview

**Objective**   The inputs and outputs can be configured in order to specify which action will take place as the result of a given event.

**Prerequisites**   1. Sensor is correctly connected (see section 5.5)
2. Connection has been established from the sensor to the software (see section 10.1.1)
3. The camera is configured / images are selected (see section 11.2)

**Procedure**   Any desired results can be assigned to an output.
Any desired inputs can be configured as well.

### 11.21.2. Settings

**Property**   The following settings/results appear.

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the module |
| Module State | Error codes to give support in error diagnosis (see section 18.5) |
| Error Handling | This setting can be used to set performance of the properties when a linked event demonstrates an error status. |

### 11.21.3. Configuration

The I/O unit module includes the following configuration options:

• IO Timings
• Digital IO 1
• Digital IO 2
• Digital IO 3
• Digital IO 4
• Digital IO 5
• Digital IO 6

The digital I/Os are originally preset as follows:

| Digital IO | N0. | Type | Polarity | Mode | Linking/Function |
|---|---|---|---|---|---|
| | 1 | Output | Positive | PNP | Threshold, pixel count module |
| | 2 | Output | Positive | PNP | - |
| | 3 | Output | Positive | PNP | - |
| | 4 | Output | Positive | PNP | Process output |
| | 5 | Input | Positive | - | Trigger |
| | 6 | Output | Negative | Push-Pull | Flash output (external illumination) |

**11.21.3.1. IO Timings**

**Objective**  Time settings can be selected for the inputs and outputs.

**Property**

| Process Time [ms] | Sensor processing time for the module |
|---|---|
| Module State | Error codes to give support in error diagnosis (see section 18.5) |
| Timing Unit | Milliseconds / quadrature pulse<br>If "Timing Unit" is set to quadrature pulse, all other time values must also be entered in pulses, and not in any unit of measure for time. The internal counter is triggered either by a millisecond tick or by quadrature pulses. |
| Trigger Delay | Delay time between the trigger signal and image acquisition can be set within a range of 0 to 10,000 ms.<br> |

Sequence in Trigger mode with Trigger Delay

Trigger Delay = 20
Output Hold Time = 0
Event 1 Delay = 0

| **Property** | Output Hold Time | Output hold time specifies the duration of the output signal. Output signal duration can be set within a range of 0 to 10,000 ms. **Note:** With an output hold time of 0 (default value), the output retains its status until a subsequent calculation causes its status to change. |

Sequence in Trigger mode with Trigger Delay and Output Hold Time
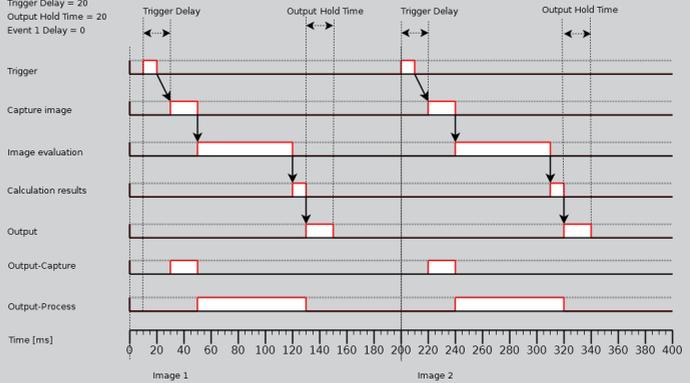
| Event 1 to 4 Delay | Output signal delay can have a value within a range of 0 to 10,000 ms or pulses (in the case of a rotary encoder input). The output must be linked to the corresponding event delay to this end. Up to 4 different delays can be selected, which can be linked as often as desired to corresponding outputs. |
|---|---|

Sequence in Trigger mode and Trigger Delay/Event Delay/Output Holdtime
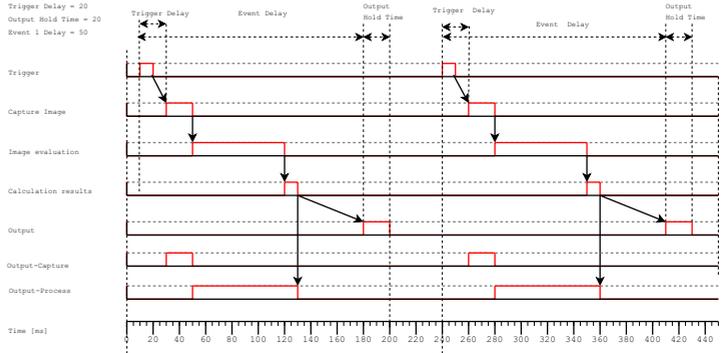
| **Property** | Event 1 to 4 Delay | **Note:** In the trigger mode, the next trigger signal for renewed image recording might be generated although the sensor is still busy with image evaluation or calculation. In this case, the output process signal has not yet been reset to "1", so that the trigger signal does not cause renewed image recording at the sensor. An "empty" image is generated which is subjected to the entire image processing sequence, thus leading to negative results. This assures that there's a result for each and every trigger pulse. |
|---|---|---|



Sequence in Trigger mode with Trigger-Queue and ignored Trigger
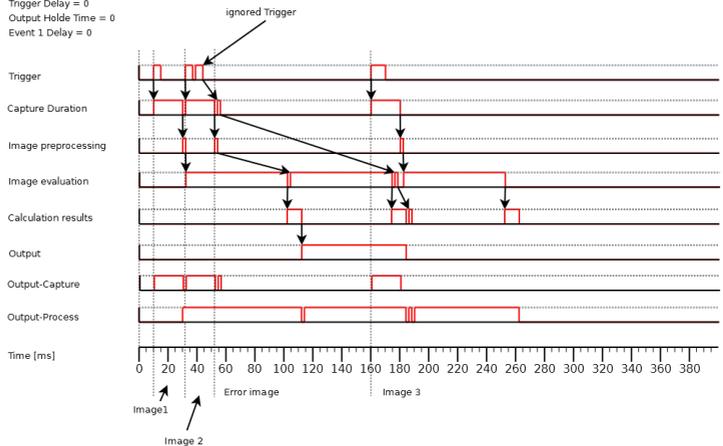
**11.21.3.2. Digital I/Os 1 to 6 Sub-Module**

**Objective**   The digital inputs and outputs can be configured.

**Property**

| Process Time [ms] | Sensor processing time for the module | |
|---|---|---|
| Module State | Error codes to give support in error diagnosis (see section 18.5) | |
| IO Value | The input or output is activated or deactivated. | |
| IO Type | The type of input or output can be specified:<br>• Type Nothing.<br>• Type Input.<br>• Type Output. | |
| IO Logic | Output logic is specified.<br>• Logic Positive.<br>• Logic Negative. | |
| IO Function | The function of the output is specified. | |
| | **Output** | Fixed value or variable event from the application |
| | **Output Flash** | Illumination output for external illumination |
| | **Output Capture** | If the output signal is high, the sensor records an image. If a trigger pulse is generated during this time, an empty image is generated and an internal error occurs. This error image is forwarded to the downstream processes. It's assured that no trigger pulses are lost. |
| | **Output Project Selection** | This output is used to acknowledge successful switching from one project to another. Further information is included in section 12. |
| | **Input Level** | The input is at high level for as long as a signal is applied to the input. As soon as the signal is interrupted, the input is reset to low level. |
| | **Input Edge** | The input is set to high level as soon as a positive edge is applied to the input. Thereafter, the input is reset to low level. |
| | **Input Trigger** | The sensor generates an evaluation as soon as a trigger pulse is applied to the input. This input is exclusively responsible for image acquisition. |
| | **Input Quadrature** | The input is used as a rotary encoder input. Note: In the case of a rotary encoder, two signals are read out which are out of phase with each other. |

Channel A

Channel B

| | These two signals have to be connected to two sensor pins, regardless of order. The selected pins have to be connected to Input Quadrature in weQube software. Furthermore, the timing unit has to be set to quadrature pulses under IO timings (see section 11.21.3.1). All IO timings are then displayed in pulses instead of milliseconds. |
| | **Example:** A further pin can now be used as a hardware trigger input and the number of pulses required to cause image recording after the hardware trigger signal has occurred can be entered to the trigger delay settings. You can also set up an event delay in order to specify after how many pulses certain outputs will be switched. |
| Input Project Selection | The input is used to change projects and reacts to the project change pulse sequence. Further information is included in section 12. |
| Output Mode | The polarity of the output is specified.<br>• PNP<br>• NPN<br>• Push-Pull |
| Event Link | The output can be linked to one of the four 4 event delays. As a result, the output is switched with a delay amounting to the time selected under IO timings (see section 11.21.3.1). |

### 11.21.3.3. Error Handling

This setting can be used to set performance of the properties when a linked event demonstrates an error status.

**Property**     Individual texts can be displayed:

| Substitute BOOL Types by | If this checkbox has been activated, all properties of the Boolean type are replaced by the active value, if the linked file type demonstrates an error. |

## 11.22. Device Display

### 11.22.1. Overview

| | |
|---|---|
| **Objective** | The display can be adapted to meet your individual needs. |
| **Prerequisites** | 1. Sensor is correctly connected (see section 5.5)<br>2. Connection has been established from the sensor to the software (see section 10.1.1)<br>3. The camera is configured / images are selected (see section 11.2) |
| **Procedure** | After the type of display has been specified, the desired values or results can be displayed depending on the selected setting. |

### 11.22.2. Settings

**Property**   The following settings/results appear.

| Process Time [ms] | Sensor processing time for the module |
|---|---|
| Module State | Error codes to give support in error diagnosis (see section 18.5) |

### 11.22.3. Configuration

The display module includes the following configuration options:
• Text
• Indication
• Numeric
• Match code
• Teach

#### 11.22.3.1. Text

**Objective**   Individual texts and specific results can be displayed:

**Property**

| Text 1 | Line 1 can be entered statically, or it can be linked to a value in the software. |
|---|---|
| Text 2 | Line 2 can be entered statically, or it can be linked to a value in the software. |
| Text 3 | Line 3 can be entered statically, or it can be linked to a value in the software. |
| Text 4 | Line 4 can be entered statically, or it can be linked to a value in the software. |

**11.22.3.2. Indication**

**Objective**       Six different Boolean states can be displayed, for example output switching statuses.

**Property**

| | |
|---|---|
| Indication 1 | Link to the desired parameter. |
| Indication 2 | Link to the desired parameter. |
| Indication 3 | Link to the desired parameter. |
| Indication 4 | Link to the desired parameter. |
| Indication 5 | Link to the desired parameter. |
| Indication 6 | Link to the desired parameter. |

**11.22.3.3. Numeric**

**Objective**       Display a line of text and a numeric value, including a bar graph.

**Property**

| | |
|---|---|
| Description | A descriptive text or any desired parameter can be entered. |
| Value | Link to the desired parameter |

**11.22.3.4. Match code**

**Property**

| | |
|---|---|
| Match code | Link to the desired match code results |

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**11.22.3.5. Teach**

**Objective**  Up to six different parameters can be changed via the OLED menu. OLED menu →
select "Teach" and then the corresponding number. After pressing the T key at the
sensor, the currently ascertained value is accepted.





→ Teach and the corresponding number can then be selected at the OLED. After
pressing the T key at the sensor, the currently ascertained value is accepted.

**Property**

| Teach 1 | Link to the desired parameter |
|---------|-------------------------------|
| Teach 2 | Link to the desired parameter |
| Teach 3 | Link to the desired parameter |
| Teach 4 | Link to the desired parameter |
| Teach 5 | Link to the desired parameter |
| Teach 6 | Link to the desired parameter |

**11.22.4. Error Handling**

This setting can be used to set performance of the properties when a linked event demonstrates an error status.

**Property**  Individual texts can be displayed:

| Substitute BOOL Types by | If this checkbox has been activated, all properties of the Boolean type are replaced by the active value, if the linked file type demonstrates an error. |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Substitute INT Types by | The numeric value can be specified which is used as a substitute value in the event of a linked data type which is faulty. |
| Substitute STRING Types by | The text is specified which is used as a substitute text, when the linked data type is faulty. |

## 11.23. Device Indicator

### 11.23.1. Overview

**Objective**   The indicator LEDs can be used to simplify the visualization of parameter statuses, for example whether or not objects are good or defective.

**Note**   In order to use the indicator LEDs, select the flash light mode (see section 11.2.2). In continuous light mode the indicator LEDs are inactive in order to avoid interferences of the image.

**Prerequisites**
1. Sensor is correctly connected (see section 5.5)
2. Connection has been established from the sensor to the software (see section 10.1.1)
3. The camera is configured / images are selected (see section 11.2)

**Procedure**   The red and green indicator LEDs included in the sensor's internal illumination can be assigned to events, so that they light up when the respective event occurs.

### 11.23.2. Settings

**Property**   The following settings/results appear.

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the module |
| Module State | Error codes to give support in error diagnosis (see section 18.5) |
| Green Indicator Value | The green LED can be switched on or off statically. It can also be dynamically linked to other nodes signilling events |
| Red Indicator Value | The red LED can be switched on or off statically. It can also be dynamically linked to other nodes signilling events |
| Green Logic | Logic for the green LED can be edited.<br>• Logic Positive<br>• Logic Negative |
| Red Logic | Logic for the red LED can be edited.<br>• Logic Positive<br>• Logic Negative |

### 11.23.3. Error Handling

This setting can be used to set performance of the properties when a linked event demonstrates an error status.

**Property**   Individual texts can be displayed:

| | |
|---|---|
| Substitute BOOL Types by | If this checkbox has been activated, all properties of the Boolean type are replaced by the active value, if the linked file type demonstrates an error. |

# EN

## 11.24. Device Communication

### 11.24.1. Overview

**Objective**  Sensor communication dictates how data can be transmitted to the sensor, and how the sensor itself transmits data.

**Prerequisites**  1. Sensor is correctly connected (see section 5.5)
2. Connection has been established from the sensor to the software (see section 10.1.1)

**Procedure**  Various communication options can be selected and the respective settings can be adapted. UDP or RS-232 can be selected in addition to Profinet, FTP server and client.

### 11.24.2. Settings

**Property**  The following settings/results appear.

| Process Time [ms] | Sensor processing time for the module |
| --- | --- |
| Module State | Error codes to give support in error diagnosis (see section 18.5) |

### 11.24.3. Configuration

The communication module includes the following configuration options:

- Industrial Ethernet
- UDP
- RS-232
- FTP or SD Card

**11.24.3.1. RS-232**

**Objective**     Transmit current results and data via the RS-232 port.

**Property**      The following settings/results appear.

| | |
|---|---|
| Process Time [ms] | Sensor processing time for the module |
| Module State | Error codes to give support in error diagnosis (see section 18.5) |
| Preamble | The characters specified here precede the output data. |
| Postamble | The characters specified here follow the output data. |
| Delimiter | The delimiter used to separate the individual data packets from each other is specified here. |
| Output | The preview of the output value is displayed, which consists of preamble, delimiter and postamble. |
| String Count | The number of desired values to be transmitted is defined.<br><br>**String Count 1...8**<br>The value can be entered statically or linked to a value. This value is then transmitted via the interface. |

**11.24.3.2. Industrial Ethernet**

**Objective** The Industrial Ethernet interface can be configured.

**Property**

| | |
|---|---|
| Process-Time [ms] | Sensor processing time for the process steps |
| Module State | Error codes to give support in error diagnosis (see section "18.5. weQube Software Module States" on page 201) |
| Interface Type | Note concerning Profinet: Depending on the type of sensor, the corresponding interface type must be selected here. |
| Slot Count | The same slot which is used in the controller must be entered here. |

Six Slots are available

| | | |
|---|---|---|
| Slot 1 | Set to project change as a default value. In order to be able to select a given project via the Profinet interface, the project name on the sensor's micro SD card must be saved using the following format: "xx_testproject" (x: any whole number from 0 to 9). Example: 01_testproject. Up to 254 projects can be addressed via the Profinet interface. **Note:** Slot 1 cannot be changed manually. In order to change a project via the Profinet interface, you only need to enter the settings to the controller – the communication module is unnecessary to this end. | |
| Slot 2 | Set to Profinet state as a default value. A list of possible states can be found in the appendix in section "18.2. weQube status information" on page 197. **Note:** Slot 2 cannot be changed manually. | |
| Slot 3-6 | Freely configurable | |
| | **Process Time [ms]** | Sensor processing time for the process steps |
| | **Module State** | Error codes for troubleshooting support (see section 18.6) |
| | **Slot Number** | Corresponds to the controller's slot number |
| | **Module ID** | Number specified by the DDBF |
| | **Submodule ID** | Number specified by the DDBF |
| | **Data Size** | Volume of data which is transmitted or received |
| | **Direction** | Specifies the direction of data transmission PL c to device or device to PL c |
| | **Data Nodes** | Number of data packets |

| Property | Slot 3-6 | Data type | The following types of data are available for transmission to the controller:<br><br>• 16 Byte Input (4 DINT).<br>• 16 Byte Input (4 REAL).<br>• 1 Byte Input (8 BOOL).<br>• 128 Byte Input (2 CHAR[64]).<br>• 1024 Byte Input (1 CHAR[1024]).<br>• 16 Byte Output (4 DINT).<br>• 16 Byte Output (4 REAL).<br>• 1 Byte Output (8 BOOL).<br>• 128 Byte Output (2 CHAR[64]).<br>• 32 byte input (2 CHAR[16])<br>• 64 byte input (2 CHAR[32])<br>• 256 byte input (2 CHAR[128])<br>• 512 byte input (2 CHAR[256])<br>• 32 byte output (2 CHAR[16])<br>• 64 byte output (2 CHAR[32])<br>• 256 byte output (2 CHAR[128])<br>• 512 byte output (2 CHAR[256]) |
|---|---|---|---|

**Note:** The sensor settings must correspond exactly to the controller settings.
The GSDML file is available from the download area on our website at wenglor.com.
The GSDML file is also included on the product CD provided with the sensor.

**11.24.3.3. UDP**

**Objective**

Configure the UDP interface (user datagram protocol).
**Note:** In the case of UDP, data are streamed from the sensor to the network without checking to determine whether or not the data is received or who receives it.

**Property**

The following settings/results appear.

| Process Time [ms] | Sensor processing time for the module |
|---|---|
| Module State | Error codes to give support in error diagnosis (see section "18.5. weQube Software Module States" on page 201) |
| Preamble | The characters specified here precede the output data. |
| Postamble | The characters specified here follow the output data. |
| Delimiter | The delimiter used to separate the individual data packets from each other is specified here. |
| Output | The preview of the output value is displayed, which consists of preamble, delimiter and postamble. |
| String Count | The number of desired values to be transmitted is defined. **String Count 1...8** The value can be entered statically or linked to a value. This value is then transmitted via the interface. |

**11.24.3.4. FTP or SD Card**

| Objective | Configure the FTP interface. |
|---|---|

Files can be written from the sensor to a PC via an FTP server, for example in order to compile error images or to document all objects.

**Prerequisite:** A corresponding FTP server must be set up (see appendix "18.1. Setting up an FTP Server at a PC" on page 196), and adequate memory capacity must be available.

Alternatively, the files can also be saved to the SD card in the sensor.

**Property**

| Process Time [ms] | Sensor processing time for the module | |
|---|---|---|
| Module State | Error codes to give support in error diagnosis (see section "18.5. weQube Software Module States" on page 201) | |
| Data Sink | **FTP** | The images can be saved to an FTP server within the network. The sensor functions as an FTP client in this case. Access data for the FTP server have to be saved along with the sensor settings (see section "10.1.1.4. Properties" on page 45). |
| | **SD Card** | The respective images are saved to the SD card located in the sensor. **Note:** Memory capacity at the SD card is limited, which means that only a certain number images can be saved there. When the SD card is full, additional images to be saved are lost. |
| Blocking Mode | The speed at which data are saved to an FTP server or the SD card varies. Saving may take longer than the evaluation process. As a result, some events might not be saved. For example, this could be the case when images are saved along with events. The evaluation process can be suspended until saving has been successfully completed. The blocking mode must be activated to this end (activate the check box). | |
| Filename | The filename consists of: Filename_consecutive number | |
| Save Image Type | Before an image can be stored, its type must be defined. | |
| Save Image Compression | This setting defines whether the image is stored in uncompressed BMP format, or whether it should be stored in compressed JPG format. It is important to note if you using a compressed image it will come to quality losses. The compressed image should not be used later as an input image. | |

**Property**

| Image | Link to the desired image in the sensor |
|---|---|
| Observer | This Boolean value determines whether or not an image is saved. If this value is linked, the application can be set up such that, for example, only error images are saved. Network load is reduced as a result, and data are pre-filtered.<br>If the Boolean value have the status "false" the image will be saved. |

String:

| Process Time [ms] | Sensor processing time for the process steps |
|---|---|
| Module State | Error codes to give support in error diagnosis (see section "18.5. weQube Software Module States" on page 201) |
| Preamble | The characters specified here precede the output data. |
| Postamble | The characters specified here follow the output data. |
| Delimiter | The delimiter used to separate the individual data packets from each other is specified here. |
| Output | The preview of the output value is displayed, which consists of preamble, delimiter and postamble. |
| String Count | The number of desired values to be transmitted is defined.<br><br>String Count 1...8<br>The value can be entered statically or linked to a value. This value is then transmitted via the interface. |

## 11.24.4. Error Handling

This setting can be used to set performance of the properties when a linked event demonstrates an error status.

**Property**

Individual texts can be displayed:

| Substitute BOOL Types by | If this checkbox has been activated, all properties of the Boolean type are replaced by the active value, if the linked file type demonstrates an error. |
|---|---|
| Substitute INT Types by | The numeric value can be specified which is used as a substitute value in the event of a linked data type which is faulty. |
| Substitute STRING Types by | The text is specified which is used as a substitute text, when the linked data type is faulty. |

# 11.25. Module Statistics

### 11.25.1. Overview

| | |
|---|---|
| **Objective** | The application can be fine-tuned on the basis of statistical sensor data. |
| **Prerequisites** | 1. Sensor is correctly connected (see section 5.5)<br>2. Connection has been established from the sensor to the software (see section 10.1.1)<br>3. The camera is configured / images are selected (see section 11.2) |
| **Procedure** | Various statistical data can be calculated and displayed. Up to 100 most recently acquired values can be analyzed. |

### 11.25.2. Settings in the Statistics Module

**Property** The following settings/results appear.

| Process Time [ms] | Sensor processing time for the process steps |
|---|---|
| Module State | Error codes to give support in error diagnosis (see section 18.5) |
| Channel Count | Number of parameters which will be acquired for statistical purposes |

**Function Field** Insertion of the statistics field

| | |
|---|---|
|  | Statistical evaluations are displayed in a separate area. |

Statistics window

# EN
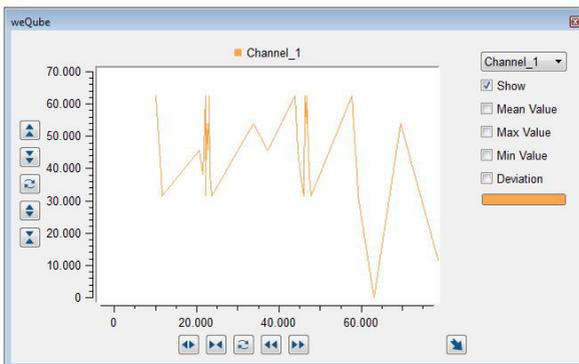
### 11.25.3.  Configuration

Under channel count, the statistic module includes the configuration, which depends on the number of channels to be observed:
• Channel #1

**11.25.3.1. Channel # 1**

| **Objective** | A certain value can be analyzed. |
|---|---|
| **Property** | The following settings/results are displayed: |

| Minimum | The lowest value of the most recently observed measured value results is indicated. |
|---|---|
| Maximum | The highest value of the most recently observed measured value results is indicated. |
| Mean | The arithmetic mean value is calculated from the most recently observed measured value results. |
| Standard Deviation | Standard deviation is determined on the basis of the most recently observed measured value results. Standard deviation is the square root of the sum of the squared differences from the mean value divided by the number of values. $$s = \sqrt{\frac{1}{n} * \sum_{i=1}^{n}(x_i - \bar{x})^2}$$ |
| Trend | All observed measured value results are subdivided into new and old events by means of the trend ratio. The arithmetic mean value is determined for the old, as well as for the new measured values. The difference between these arithmetic mean values is the trend. Note: If the trend is close to 0, the measured value has remained relatively constant during the observation time period. |
| Good | The most recently observed measured value results are used to determine how often the measured value is within the specified tolerance. The good portion is indicated as a percentage of all analyzed values. |
| Input to Track | A variable application result can be linked to statistical evaluation. |
| Reset Statistic | All most recently observed measured value results, listed under result values, are deleted. |

| Ratio for Trend | All observed measured value results are subdivided into older and newer results. The ratio of the number of older results to the number of newer results is indicated as the trend ratio. This ratio is set to 1 as a default value. Example of a trend ratio of 1.5 for 5 observed values <br><br>  <br><br> This setting is used for the calculation of the trend. <br> Note: The larger the trend ratio, the more influence individual outliers have on the trend. |
|---|---|
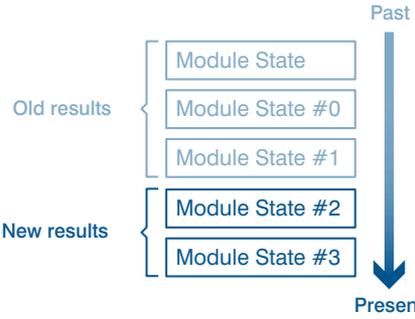
# 12. Project Change via Digital I/O

Projects which have been saved to the sensor can also be selected and loaded without an Ethernet connection or an OLED display.

In order to be able to select a given project via the digital I/O interface, the project name on the sensor's micro SD card must be saved using the following format: „xxx_testproject" (x: any whole number from 0 to 9). Example: 01_testproject. Up to 254 projects can be addressed via the digital I/O interface.

## 12.1. Software Settings

The "Input Project Selection" function must be assigned to one of the inputs in the Device I/O Unit module. This input is then used to change projects.

If the "Output Project Selection" function is also assigned to another output, weQube reads out the project number as a pulse sequence via this output. The number of pulses corresponds to the number of the previously selected project.

The settings of the two inputs and outputs must be identical for all projects, because problems might otherwise occur when changing projects.

## 12.2. Procedure

The sensor is switched to the project change mode by applying a voltage of greater than 7 V (high) to the previously selected input pin for a duration of T_EN.

Each positive edge is counted in the project change mode (one positive edge = project 1, two positive edges = project 2 etc.), until a voltage of less than 2 V (low) has been applied to the project change input for a duration of T_DIS.

If an output has been set up as a feedback output (project change output), the project selection is read out from this output using the number of pulses to identify the project number.
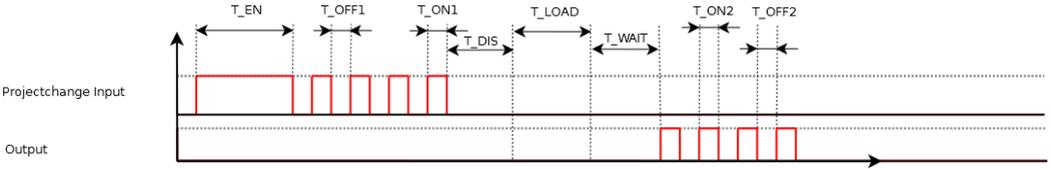


| Designation | Typical | Min | Max |
|---|---|---|---|
| T_EN | 2000 ms | 1000 ms | 5000 ms |
| T_OFF1 | 250 ms | 100 ms | 1000 ms |
| T_ON1 | 250 ms | 100 ms | 1000 ms |
| T_DIS | 1000 ms | 1000 ms | - |
| T_LOAD | 12000 ms | 10000 ms | 15000 ms |
| T_WAIT | 1000 ms | - | - |
| T_OFF2 | 250 ms | - | - |
| T_ON2 | 250 ms | - | - |

# 13. Network Settings

The weQube is equipped with a web-based configuration interface which functions independent of the operating systems. You can configure the sensor conveniently at a standard web browser. (see section 18.4)

# 14. Web-Based Configuration

In order to operate the weQube at an Ethernet LAN, the sensor and the remote station, for example a computer, must be located in the same network. The sensor's IP address is set to 192.168.100.1, the subnet mask is set to 255.255.255.0 and the standard gateway is set to 192.168.100.254. The operating instructions always assume that these default values are used.

Further information on changing the IP address and deactivating the firewall – with reference to your operating system – can be found in the general instructions included on the weQube product page at: www.wenglor.com → Product World → Product search (Order no.) → Download → General instructions.

Note: It's not possible to access the sensor simultaneously with the software and via the website. If applicable, disconnect the sensor from the software before opening the website. Furthermore, under no circumstances should you enter settings simultaneously via the website and at the OLED display.

Note: If a DHCP server has been connected, it automatically assigns an IP address to the sensor. The assigned IP address can be viewed at the OLED display (see section 6.8.2) and entered to the address line in the browser, in order to open the sensor's website.

Note: The web interface has been tested with PC-based browsers. Error-free performance cannot be 100% assured for mobile devices.

## 14.1. Invoking the Administration Interface

Start the web browser. Enter the sensor's IP address to the address line in your browser and press the enter key. The IP address is preset to 192.168.100.1.

Example: http://192.168.100.1/

The "General Device" overview page and the sensor's live image are not password protected. A password prompt appears when other pages are accessed. The following user data are preset upon shipment from the factory.

**User name: admin**
**Password: admin**

The password can be changed in the "Device Settings" page.

# EN

## 14.2. Page Layout

The website is subdivided into 4 areas:

**1. Language selection**
The website can be changed from English (default language) to German with the language selection function.

**2. Display**
The current display appears on all pages just like it does at the sensor itself.

**3. Category selection**
The web-based settings are subdivided into five categories.
- **General device information:** overview page with general information regarding the weQube
- **Device settings:** network and display setting for the weQube, as well as sensor configuration and password change
- **Project:** project administration settings
- **Teach-in:** generate Teach+ files and teach characteristics in to the sensor
- **Live image:** the current sensor image is displayed

**4. Page content**
Depending on which category is selected, the corresponding page content is displayed.

## 14.3. Device, General

After a connection has been established, the **"Device, General"** overview page is displayed.



| General product information | |
|---|---|
| Part number | B50M002 |
| Product version | 1.0.0 |
| Producer | wenglor sensoric GmbH |
| Description | weQube |
| Serial number | 500014785 |
| MAC Address | 54:4a:05:09:00:08 |

| **Order number** | The order number is the article number by means of which the weQube can be ordered from wenglor. |
|---|---|
| **Product version** | The product version is the sensor's version number. |
| **Manufacturer** | The manufacturer of the weQube is wenglor. |
| **Description** | The description indicates the type of product. Differentiation is made amongst the following types:<br>• weQube Decode<br>• weQube Vision<br>• weQube |
| **Serial number** | The serial number can be used to trace the product back to detailed manufacturing information. |
| **MAC address** | The sensor's MAC address is unique and is required for the identification of Ethernet products. |

The following data are also displayed for Ethernet sensors:

| **Real-time Ethernet status** | The status of the Ethernet connection is indicated: offline, online ... |
|---|---|
| **Device name** | A unique name can be freely assigned to each device via the Profinet controller. The device name appears in the first line of the display as well. If no name is assigned, ... |

## 14.4. Device Settings

Network and display settings, the sensor configuration and password changes can be entered under device settings. The following screenshot shows the default settings.



### 1. Network settings

The IP address can be assigned automatically, or a specific IP address can be used. If a specific IP address is used, the following settings must be entered:

| | |
|---|---|
| **IP address** | Enter the sensor's IP address.<br>**Note:** The PC and the sensor have to use the same IP address (see section on network settings). |
| **Subnet mask** | The subnet mask specifies the prefix length. It stipulates the number of bits at the beginning of the IP address for the network prefix. |
| **Standard gateway** | Specifies the IP address of the gateway in order to be able to communicate beyond the boundaries of the subnet. |

**Warning: Error-free operation of the product can only be assured if correct network settings are entered via the web interface. If any incorrect entries are made, it may no longer be possible to contact the device within the network.**

**2. Network Reset**

In the event of a network reset, the network settings are returned to their default values (see section 5.6). The network settings become effective after the sensor is restarted. The sensor settings remain unchanged.

**3. Display Settings**

Refer to section 6.4.2 for a description of the display settings.

**4. Configuration**

Refer to section 6.7 for a description of the sensor configuration.

**5. Password**

The password for the website can be changed here. An additional window appears at which a new password can be entered after the existing password has been successfully entered.
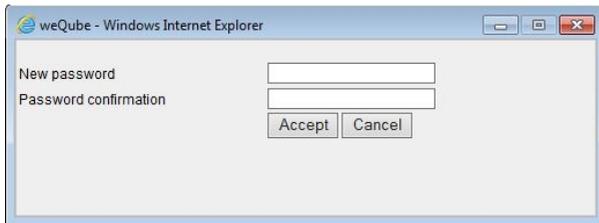


## 14.5. Projects



Projects saved to the SD card can be loaded, or can be selected as a start project.

# EN

## 14.6. Teach-In



Refer to section 11.22.3.5 for a description of teach-in options.

## 14.7. Image
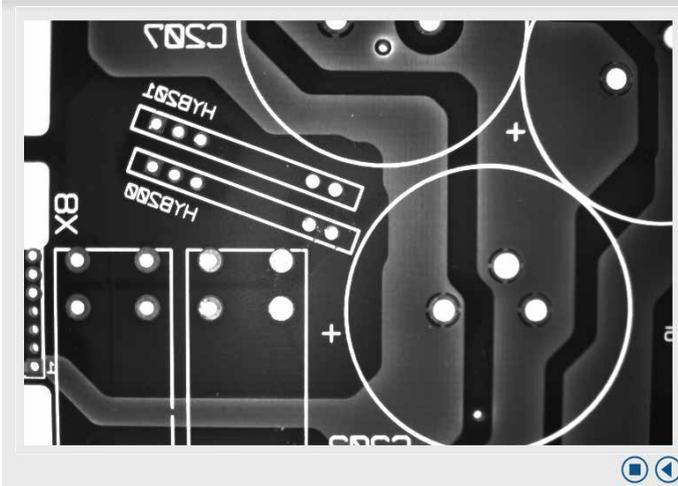


The current sensor image is displayed in the live image window. Display begins as soon as the "Live Image" tab is clicked. The live image can be frozen for purposes of error analysis by clicking the "Stop" button.

## 15. Maintenance Instructions

- This wenglor sensor is maintenance-free.
- It's advisable to clean the protective disc and to check screw joints, as well as plug connections and clamp connectors, at regular intervals.
- Do not use any solvents or cleaning agents which might damage the sensor.

## 16. Proper Disposal

wenglor sensoric GmbH does not accept the return of unusable or irreparable products. Respectively valid national waste disposal regulations apply to product disposal.

## 17. Exclusion of Liability

wenglor sensoric GmbH, hereinafter referred to as wenglor, makes explicit reference to the fact that the information contained in these operating instructions may be subject to continuous further development and technical changes. The operating instructions do not imply any guarantee from wenglor with regard to the described technical procedures or specific product characteristics. wenglor assumes no liability for printing errors or other inaccuracies contained in these operating instructions, unless wenglor was verifiably aware of such errors at the point in time at which the operating instructions were prepared. Furthermore, wenglor herewith explicitly informs the user that these operating instructions are only a general description of technical procedures whose implementation may not be suitable in all cases as described in this document.

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www.wenglor.com

# EN

## 18. Appendix

### 18.1. Setting up an FTP Server at a PC

Suitable software is required in order to set up an FTP server at a PC. Examples include:

- FileZilla Server
- Serv-U
- CesarFTP

A user must be created in the software, so that the FTP server knows who is permitted to access data.

**Note:** Avoid simple, overgeneralized passwords in order to provide your FTP server with adequate security.

You can add folders to your FTP server and specify access rules. These rules stipulate whether users are able to read, edit and/or deleted files.

After the server has been linked to the outside world, it can be reached via the Internet by making the following entry to your browser:

ftp:// + IP address assigned by the provider

Example:
ftp://99.123.12.34

The following access codes have to be entered in order to access the sensor's micro SD card:
User name: ftpuser
Password:

**Note:** In order to make it possible for the FTP server to accept incoming connections, it may be necessary to reconfigure the Windows firewall. Firewall configuration can be accessed under Control Panel → Windows-Firewall → Exceptions.

## 18.2. weQube status information

The following weQube status information may appear (see section "6.14. Status Information" on page 34).

| Bit | Section | Signal | Description |
|---|---|---|---|
| 0 | General | Information | Busy |
| 1 | | Warning | There is at least one bit set, level = Warning |
| 2 | | Critical Error | There is at least one bit set, level = Critical Error |
| 3 | | Fatal Error | There is at least one bit set, level = Fatal Error |
| 4 | | reserved | for future use, value=0 |
| 5 | | reserved | for future use, value=0 |
| 6 | Peripheral | TCP/IP | There is an error concerning the TCP/IP socket |
| 7 | | UDP | There is an error concerning the UDP socket |
| 8 | | Industrial Ethernet | There is an error concerning industrial ethernet |
| 9 | | Camera | There is an error concerning the built in image chip |
| 10 | | Digital IO | There is an error concerning the built in digital io stage or the rotary decoder |
| 11 | | Focus & Illumination | There is an error concerning the built in Focus&Illumination controller |
| 12 | | UART | There is an error concerning the UART device |
| 13 | | reserved | for future use, value=0 |
| 14 | Memory | Flash | There is an error concerning the flash access |
| 15 | | RAM | There is an error concerning the RAM access |
| 16 | | SD-Card | There is an error concerning the sd-card access, 1 if not mounted |
| 17 | | File access | There is an error concerning a general file access |
| 18 | | Compatibility | There is an error concerning the version of the loaded project |
| 19 | | reserved | for future use, value=0 |
| 20 | Temperature | Over temperature | The inside temperature is higher than a predefined level |
| 21 | | Under temperature | The inside temperature is lower than a predefined level |
| 22 | | reserved | for future use, value=0 |
| 23 | | reserved | for future use, value=0 |
| 24 | Image Processing | Sequencing | There is an error concerning IData vision engine |
| 25 | | Processing | There is an error concerning a vision module |
| 26 | | Trigger | There is an error concerning HW trigger |
| 27 | | reserved | for future use, value=0 |
| 28 | reserved | reserved | for future use, value=0 |
| 29 | | reserved | for future use, value=0 |
| 30 | | reserved | for future use, value=0 |
| 31 | | reserved | for future use, value=0 |

# EN

## 18.3. Coordinate system

By use of coordinates, the position inside a coordinate system is defined uniquely (surface, volume etc.) The sensor operates in a predominantly two-dimensional image in which a point P (X, Y) is defined by the X and Y components.

We distinguish three Cartesian coordinate systems with different reference points.
• Image sensor coordinate system
• Image coordinate system
• Input coordinate system

All the coordinate systems follow the definition of a right-handed coordinate system.

### 18.3.1. Right handed coordinate system
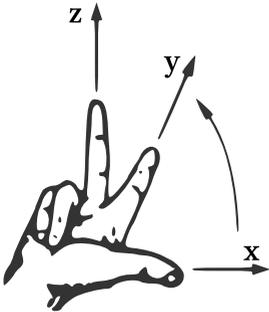


Source: Wikipedia
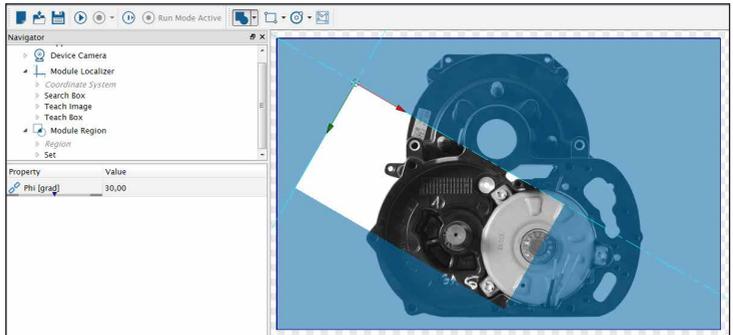
**Note:** The right handed coordinate system is rotated 180° by the X-axis to follow a popular representation.

• X-axis (red)
• Y-axis (green)
• Mathematical positive direction of rotation

## 18.3.2. Image sensor coordinate system

The image sensor coordinate system represents the coordinates on the real CMOS chip area.
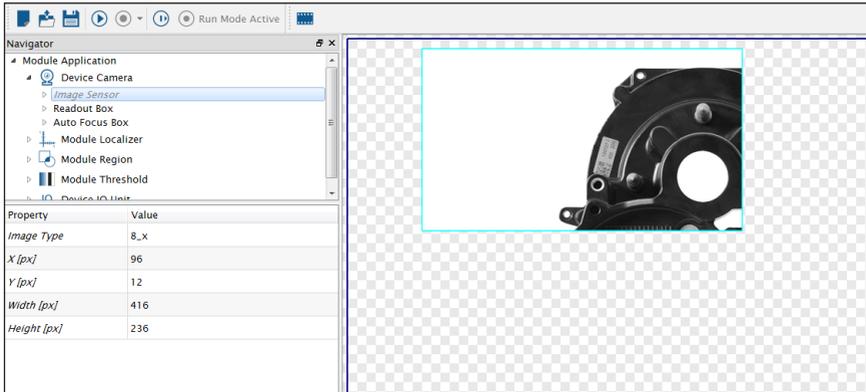


- The coordinate origin is placed in the top left of the image sensor (the blue rectangle represents the light sensitive area of the image sensor)
- X-axis (positive counting to the right)
- Y-axis (positive counting to the bottom)

## 18.3.3. Image coordinate system

The image coordinate system is related to the image sensor origin.
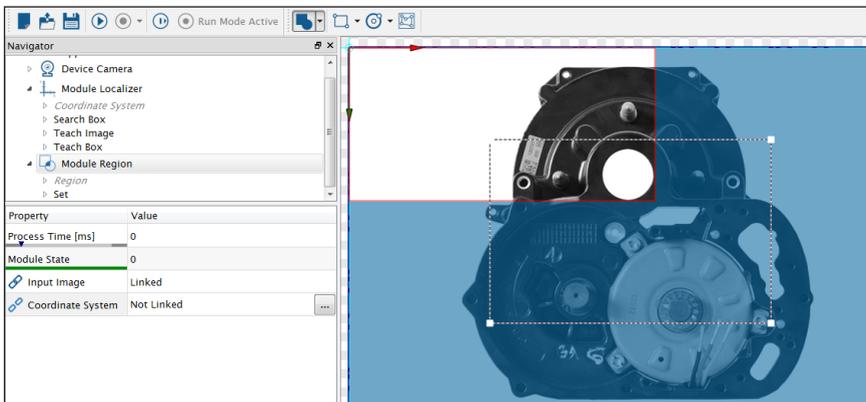


- The coordinate origin is placed in the top left of the image sensor
- X-axis (positive counting to the right)
- Y-axis (positive counting to the bottom)

### 18.3.4. Input coordinate system

The input coordinate system is related to the image origin and can be placed and rotated individually.
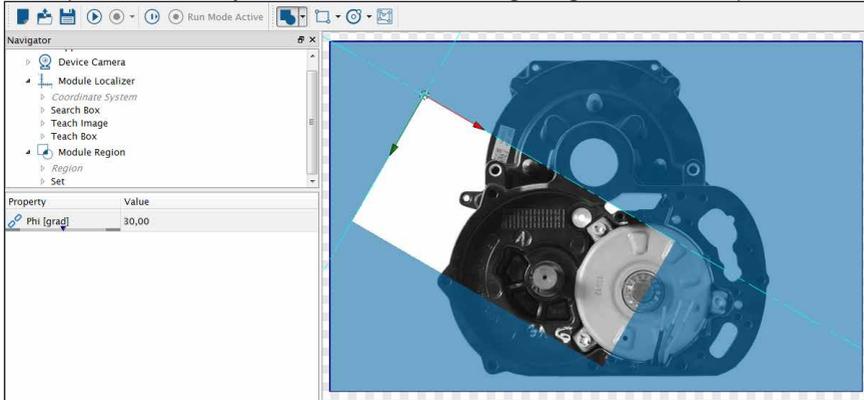


- The coordinate origin is initially placed in the top left of the image
- X-axis (positive counting to the right)
- Y-axis (positive counting to the bottom)

**Note:** In case where an input coordinate system is linked against an output coordinate system it, behaves as an output coordinate system only. Output coordinates systems can not be edited, and follow the calculated values (e.g. tracking of regions and other tools).

## 18.4. Network Settings

| Protocol | Port | Description |
|---|---|---|
| TCP/IP | 32001 | This port is used for Communication with weQube by the LIMA-Protocol. This port is selectable. It is not allowed to use the ports mentioned below. |
| UDP | 32002 | This port is used to send the device state as a subnet broadcast. Process data configured in Module Communication is sent out in the same way. It is not allowed to change this port. |
| UDP | 32003 | This port is used to send LIMA commands to the weQube. Attention: UDP can transfer a maximum of 65535 byte. It is easier to send commands with more data by TCP/IP. This port is used to send short commands like <T/> to the weQube in cases where trigger mode is used. It is not allowed to change this port. |
| UDP | 32004 | This port is used by the weQube to reply to commands that are received by port 32003. It is not allowed to change this port. |
| FTP | 21 | This port is reserved for the integrated ftp server. It is not allowed to change this port. |
| TELNET | 23 | This port is reserved for the built in telnet access. This access is reserved for internal purpose. It is not allowed to change this port. |
| HTTP | 80 | This port is reserved for the built in HTTP webserver. It is not allowed to change this port. |

## 18.5. weQube Software Module States

There is a description in the weQube manual in section 9. Here is some additional information.

If you need further license keys for your weQube do the following:
1. Open your weQube PC application and use the "Connect to Device" button.
2. Note the MAC address of your weQube sensor down (Device List).
3. Double click the related sensor entry to establish a connection to the device.
4. Open the license information by pressing the menu entry "Help -> Licenses".
5. Select the module you wanna license and press the "Generate" button to save the Hardware File.
6. Send the file to wenglor by e-mail.
**Attention: If you have more than one weQube send one e-mail per weQube.**
Write always the following e-mail subject: weQube License Request for ##:##:##:##:##:##
7. Replace the ##:##:##:##:##:## in the subject with the MAC address of your weQube.
Example: weQube License Request for 54:4A:05:07:13:13
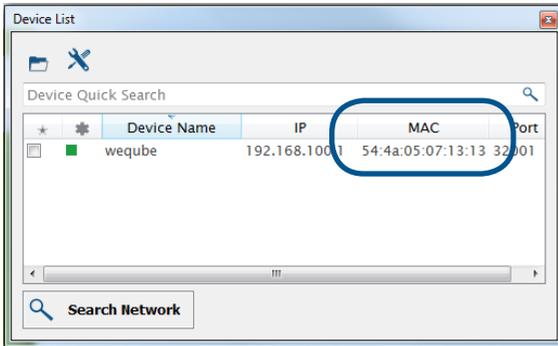


Image 1: MAC Address in Device List
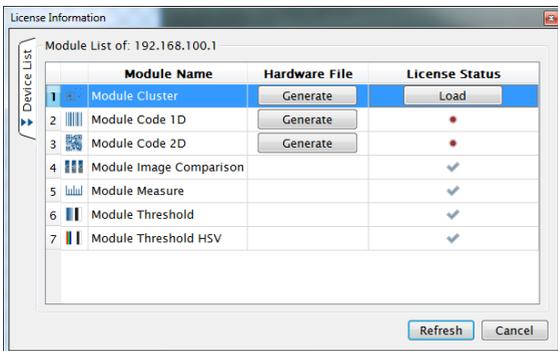


Image 2: License window

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# EN

## How to install a license file:

1. For every license request you get an e-mail with one validation file. Do steps 2 to 6 for each validation file.
2. Save the validation file to the PC the weQube application is installed on.
3. Open your weQube PC application and use the "Connect to Device" button.
4. Open the license information by pressing the menu entry "Help ➜ Licenses".
5. Select the module you want to license and press the "Load" button to load the validation file you previously saved.
6. The new license will be activate by adding the related module from the tool box to your project or simply reload the active project.

## 18.6. weQube Software Module States

There are specific states for each software module, which can be displayed in each module's module state.

**Error Code weQube**

| | |
|---|---|
| 0 | no error |
| 1001 | undefined |
| 1010 | Input value error |
| 1011 | Return value error |
| 1012 | Internal data error |
| 1020 | alignment error |
| 1030 | Function not implemented |
| 1040 | Image not linked |
| 1050 | Invalid operation |
| 1060 | Module Timeout |
| 1098 | Exception, bad allocation |
| 1099 | Exception |
| 1100 | Module unlicensed |
| 1101 | Module init failed |
| 1102 | Module not taught |
| 10000-19999 | internal error of Data structure |
| 21201 | Wrong type of control parameter: 1 |
| 21202 | Wrong type of control parameter: 2 |
| 21203 | Wrong type of control parameter: 3 |
| 21204 | Wrong type of control parameter: 4 |
| 21205 | Wrong type of control parameter: 5 |
| 21206 | Wrong type of control parameter: 6 |
| 21207 | Wrong type of control parameter: 7 |
| 21208 | Wrong type of control parameter: 8 |
| 21209 | Wrong type of control parameter: 9 |
| 21210 | Wrong type of control parameter: 10 |
| 21211 | Wrong type of control parameter: 11 |
| 21212 | Wrong type of control parameter: 12 |
| 21213 | Wrong type of control parameter: 13 |
| 21214 | Wrong type of control parameter: 14 |
| 21215 | Wrong type of control parameter: 15 |
| 21216 | Wrong type of control parameter: 16 |
| 21217 | Wrong type of control parameter: 17 |
| 21218 | Wrong type of control parameter: 18 |
| 21219 | Wrong type of control parameter: 19 |

| | |
|---|---|
| 21220 | Wrong type of control parameter: 20 |
| 21301 | Wrong value of control parameter: 1 |
| 21302 | Wrong value of control parameter: 2 |
| 21303 | Wrong value of control parameter: 3 |
| 21304 | Wrong value of control parameter: 4 |
| 21305 | Wrong value of control parameter: 5 |
| 21306 | Wrong value of control parameter: 6 |
| 21307 | Wrong value of control parameter: 7 |
| 21308 | Wrong value of control parameter: 8 |
| 21309 | Wrong value of control parameter: 9 |
| 21310 | Wrong value of control parameter: 10 |
| 21311 | Wrong value of control parameter: 11 |
| 21312 | Wrong value of control parameter: 12 |
| 21313 | Wrong value of control parameter: 13 |
| 21314 | Wrong value of control parameter: 14 |
| 21315 | Wrong value of control parameter: 15 |
| 21316 | Wrong value of control parameter: 16 |
| 21317 | Wrong value of control parameter: 17 |
| 21318 | Wrong value of control parameter: 18 |
| 21319 | Wrong value of control parameter: 19 |
| 21320 | Wrong value of control parameter: 20 |
| 21350 | Wrong value of component (see reset_obj_db()) |
| 21351 | Wrong value of gray value component (see reset_obj_db()) |
| 21401 | Wrong number of values of control parameter: 1 |
| 21402 | Wrong number of values of control parameter: 2 |
| 21403 | Wrong number of values of control parameter: 3 |
| 21404 | Wrong number of values of control parameter: 4 |
| 21405 | Wrong number of values of control parameter: 5 |
| 21406 | Wrong number of values of control parameter: 6 |
| 21407 | Wrong number of values of control parameter: 7 |
| 21408 | Wrong number of values of control parameter: 8 |
| 21409 | Wrong number of values of control parameter: 9 |
| 21410 | Wrong number of values of control parameter: 10 |
| 21411 | Wrong number of values of control parameter: 11 |
| 21412 | Wrong number of values of control parameter: 12 |
| 21413 | Wrong number of values of control parameter: 13 |
| 21414 | Wrong number of values of control parameter: 14 |
| 21415 | Wrong number of values of control parameter: 15 |
| 21416 | Wrong number of values of control parameter: 16 |
| 21417 | Wrong number of values of control parameter: 17 |
| 21418 | Wrong number of values of control parameter: 18 |
| 21419 | Wrong number of values of control parameter: 19 |
| 21420 | Wrong number of values of control parameter: 20 |
| 21500 | Number of input objects too big |
| 21501 | Wrong number of values of object parameter: 1 |
| 21502 | Wrong number of values of object parameter: 2 |
| 21503 | Wrong number of values of object parameter: 3 |
| 21504 | Wrong number of values of object parameter: 4 |
| 21505 | Wrong number of values of object parameter: 5 |
| 21506 | Wrong number of values of object parameter: 6 |
| 21507 | Wrong number of values of object parameter: 7 |
| 21508 | Wrong number of values of object parameter: 8 |

| | |
|---|---|
| 21509 | Wrong number of values of object parameter: 9 |
| 21510 | Number of output objects too big |
| 22000 | Wrong specification of parameter (error in file: xxx.def) |
| 22001 | Initialize Halcon: reset_obj_db(Width,Height,Components) |
| 22002 | Used number of symbolic object names too big |
| 22003 | No license found |
| 22004 | Lost connection to license server |
| 22005 | No modules in license (no VENDOR_STRING) |
| 22006 | No license for this operator |
| 22007 | Time zone offset from GMT is > 24 hours |
| 22008 | Vendor keys do not support this platform |
| 22009 | Bad vendor keys |
| 22010 | Unknown vendor key type |
| 22011 | malloc() call failed |
| 22012 | Vendor keys have expired |
| 22013 | Second call to lc_init() (multiple jobs), and vendor keys do not support multiple jobs |
| 22014 | Vendor key data not supplied |
| 22015 | lmclient.h/liblmgr.a version mismatch |
| 22016 | Networking software not available on this machine |
| 22017 | Old vendor keys supplied |
| 22018 | License key in license file does not match other data in file |
| 22019 | Encryption handshake with daemon failed |
| 22020 | 'key' structure is incorrect type, or feature Err:520 NULL, or num_licenses Err:520 0 |
| 22021 | System clock has been set back. This error can only occur when the FEATURE line contains an expiration date |
| 22022 | Version argument is invalid floating point format |
| 22023 | License server busy starting another copy of itself -0 retry |
| 22024 | Cannot establish a connection with a license server |
| 22025 | Feature is queued. Lc_status will determine when it is available |
| 22026 | Vendor keys do not support this function |
| 22027 | Checkout request filtered by the vendor-defined filter routine |
| 22028 | Checkout exceeds MAX specified in options file |
| 22029 | All licenses in use |
| 22030 | No license server specified for counted license |
| 22031 | Can not find feature in the license file |
| 22032 | Server has different license file than client -0 client's license has feature, but server's does not |
| 22033 | License file does not support a version this new |
| 22034 | This platform not authorized by license -0 running on platform not included in PLATFORMS list |
| 22035 | License server busy -0 the request should be retried (This is a rare occurrence) |
| 22036 | could not find license.dat |
| 22037 | Invalid license file syntax |
| 22038 | Cannot connect to a license server |
| 22039 | No TCP license service exists |
| 22040 | No socket connection to license manager server |
| 22041 | Invalid host |
| 22042 | Feature has expired |
| 22043 | Invalid date format in license file |
| 22044 | Invalid returned data from license server |
| 22045 | Cannot find SERVER hostname in network database |
| 22046 | Cannot read data from license server |

| | |
|---|---|
| 22047 | Cannot write data to license server |
| 22048 | Error in select system call |
| 22049 | Feature checkin failure detected at license |
| 22050 | Users are queued for this feature |
| 22051 | License server does not support this version of this feature |
| 22052 | Request for more licenses than this feature supports |
| 22053 | Cannot read /dev/kmem |
| 22054 | Cannot read /vmunix |
| 22055 | Cannot find ethernet device |
| 22056 | Cannot read license file |
| 22057 | Feature not yet available (wrong time/date set?) |
| 22058 | No such attribute |
| 22059 | Clock difference too large between client and server |
| 22060 | Feature database corrupted in daemon |
| 22061 | Duplicate selection mismatch for this feature |
| 22062 | User/host on EXCLUDE list for feature |
| 22063 | User/host not on INCLUDE list for feature |
| 22064 | Feature was never checked out |
| 22065 | Invalid FLEXlm key data supplied |
| 22066 | Clock setting check not available in daemon |
| 22067 | Date too late for binary format |
| 22068 | FLEXlm not initialized |
| 22069 | Server did not respond to message |
| 22070 | Request rejected by vendor-defined filter |
| 22071 | No FEATURESET line present in license file |
| 22072 | Incorrect FEATURESET line in license file |
| 22073 | Cannot compute FEATURESET line |
| 22074 | socket() call failed |
| 22075 | setsockopt() failed |
| 22076 | Message checksum failure |
| 22077 | Cannot read license file from server |
| 22078 | Not a license administrator |
| 22079 | lmremove request too soon |
| 22080 | Attempt to read beyond the end of LF path |
| 22081 | SYS$SETIMR call failed |
| 22082 | Internal FLEXlm Error -0 Please report to Globetrotter Software |
| 22083 | FLEXadmin API functions not available |
| 22084 | Invalid PACKAGE line in license file |
| 22085 | Server FLEXlm version older than client's |
| 22086 | Incorrect number of USERS/HOSTS INCLUDED in options file – see server log |
| 22087 | Server doesn't support this request |
| 22088 | This license object already in use |
| 22089 | Future license file format or misspelling in license file |
| 22090 | Feature removed during lmreread or wrong SERVER line hostid |
| 22091 | This feature is available in a different license pool |
| 22092 | Network connect to THIS_HOST failed |
| 22093 | Server node is down or not responding |
| 22094 | The desired vendor daemon is down |
| 22095 | The decimal format license is typed incorrectly |
| 22096 | All licenses are reserved for others |
| 22097 | Terminal Server remote client not allowed |
| 22098 | Cannot borrow that long |

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| | |
|---|---|
| 22099 | License server out of network connections |
| 22100 | Wrong index for output object parameter |
| 22101 | Wrong index for input object parameter |
| 22102 | Wrong index for image object (too big or too small) |
| 22103 | Wrong number region/image component (see: HGetComp) |
| 22104 | Wrong relation name |
| 22105 | Access to undefined gray value component |
| 22106 | Wrong image width |
| 22107 | Wrong image height |
| 22108 | Undefined gray value component |
| 22200 | Inconsistent data of data base (typing) |
| 22201 | Wrong index for input control parameter |
| 22202 | Data of data base not defined (internal error) |
| 22203 | Number of operators too big |
| 22205 | User extension not properly installed |
| 22206 | Number of packages too large |
| 22207 | No such package installed |
| 22300 | Dongle not attached, or can't read dongle |
| 22301 | Missing Dongle Driver |
| 22302 | FLEXlock checkouts attempted |
| 22303 | SIGN= attribute required |
| 22304 | CRO not supported for this platform |
| 22305 | BORROW failed |
| 22306 | BORROW period has expired |
| 22307 | FLOAT_OK license must have exactly one dongle hostid |
| 22308 | Unable to delete local borrow info |
| 22309 | Support for returning aborrowed license early is not enabled |
| 22310 | Error returning borrowed license on server |
| 22311 | Error when trying to checkout just a PACKAGE(BUNDLE) |
| 22312 | Composite Hostid not initialized |
| 22313 | An item needed for Composite Hostid missing or invalid |
| 22314 | Borrowed license doesn't match any known server license |
| 22315 | Error enabling event log |
| 22316 | Event logging is disabled |
| 22317 | Error writing to event log |
| 22318 | Timeout |
| 22319 | Bad message command |
| 22320 | Error writing to socket, peer has closed socket |
| 22321 | Attempting to generate version specific license tied to a single hostid, which is composite |
| 22322 | Version-specific signatures are not supported for uncounted licenses |
| 22323 | License template contains redundant signature specifiers |
| 22324 | Invalid V71_LK signature |
| 22325 | Invalid V71_SIGN signature |
| 22326 | Invalid V80_LK signature |
| 22327 | Invalid V80_SIGN signature |
| 22328 | Invalid V81_LK signature |
| 22329 | Invalid V81_SIGN signature |
| 22330 | Invalid V81_SIGN2 signature |
| 22331 | Invalid V84_LK signature |
| 22332 | Invalid V84_SIGN signature |
| 22333 | Invalid V84_SIGN2 signature |
| 22334 | License key required but missing from the license certificate |

| | |
|---|---|
| 22335 | Bad AUTH= signature |
| 22336 | TS record invalid |
| 22337 | Cannot open TS |
| 22338 | Invalid Fulfillment record |
| 22339 | Invalid activation request received |
| 22340 | No fulfillment exists in trusted storage which matches the request |
| 22341 | Invalid activation response received |
| 22342 | Can't return the fulfillment |
| 22343 | Return would exceed max count(s) |
| 22344 | No repair count left |
| 22345 | Specified operation is not allowed |
| 22346 | User/host on EXCLUDE list for entitlement |
| 22347 | User/host not in INCLUDE list for entitlement |
| 22348 | Activation error |
| 22349 | Invalid date format in trusted storage |
| 22350 | Message encryption failed |
| 22351 | Message decryption failed |
| 22352 | Bad filter context |
| 22353 | SUPERSEDE feature conflict |
| 22354 | Invalid SUPERSEDE_SIGN syntax |
| 22355 | SUPERSEDE_SIGN does not contain a feature name and license signature |
| 22356 | ONE_TS_OK is not supported in this Windows Platform |
| 22357 | Internal error -178 |
| 22358 | Only one terminal server remote client checkout is allowed for this feature |
| 22359 | Internal error -180 |
| 22360 | Internal error -181 |
| 22361 | Internal error -182 |
| 22362 | More than one ethernet hostid not supported in composite hostid definition |
| 22363 | The number of characters in the license file paths exceeds the permissible limit |
| 22364 | Invalid TZ keyword syntax |
| 22365 | Invalid time zone override specification in the client |
| 22366 | The time zone information could not be obtained |
| 22367 | License client time zone not authorized for license rights |
| 22368 | Invalid syntax for VM_PLATFORMS keyword |
| 22369 | Feature can be checked out from physical machine only |
| 22370 | Feature can be checked out from virtual machine only |
| 22371 | Vendor keys do not support Virtualization feature |
| 22372 | Checkout request denied as it exceeds the MAX limit specified in the options file |
| 22373 | Binding agent API -0 Internal error |
| 22374 | Binding agent communication error |
| 22375 | Invalid Binding agent version |
| 22452 | HALCON id out of range |
| 22800 | Wrong hardware knowledge file format |
| 22801 | Wrong hardware knowledge file version |
| 22802 | Error while reading the hardware knowledge |
| 22803 | Error while writing the hardware knowledge |
| 22804 | Tag in hardware knowledge file not found |
| 22805 | No cpu information in hardware knowledge file found |
| 22806 | No aop information in hardware knowledge file found |
| 22807 | No aop information for this HALCON variant found |
| 22808 | No aop information for this HALCON architecture found |
| 22809 | No aop information for specified Operator found |

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| | |
|---|---|
| 22810 | Unknown aop model |
| 22811 | Wrong tag derivate in hardware knowledge file |
| 22812 | Internal error while processing hardware knowledge |
| 22813 | Optimizing aop was canceled |
| 22830 | Wrong access to global variable |
| 22831 | Used global variable does not exist |
| 22832 | Used global variable not accessible via GLOBAL_ID |
| 22835 | Halcon server to terminate is still working on a job |
| 22837 | No such HALCON software agent |
| 22838 | Hardware check for parallelization not possible on a single-processor machine |
| 22839 | Sequential HALCON does not support parallel hardware check (use Parallel HALCON instead) |
| 22840 | Initialization of agent failed |
| 22841 | Termination of agent failed |
| 22842 | Inconsistent hardware description file |
| 22843 | Inconsistent agent information file |
| 22844 | Inconsistent agent knowledge file |
| 22845 | The file with the parallelization information does not match to the currently HALCON version/revision |
| 22846 | The file with the parallelization information does not match to the currently used machine |
| 22847 | Inconsistent knowledge base of HALCON software agent |
| 22848 | Unknown communication type |
| 22849 | Unknown message type for HALCON software agent |
| 22850 | Error while saving the parallelization knowledge |
| 22851 | Wrong type of work information |
| 22852 | Wrong type of application information |
| 22853 | Wrong type of experience information |
| 22854 | Unknown name of HALCON software agent |
| 22855 | Unknown name and communication address of HALCON software agent |
| 22856 | cpu representative (HALCON software agent) not reachable |
| 22857 | cpu refuses work |
| 22858 | Description of scheduling resource not found |
| 22859 | Not accessible function of HALCON software agent |
| 22860 | Wrong type: HALCON scheduling resource |
| 22861 | Wrong state: HALCON scheduling resource |
| 22862 | Unknown parameter type: HALCON scheduling resource |
| 22863 | Unknown parameter value: HALCON scheduling resource |
| 22864 | Wrong post processing of control parameter |
| 22867 | Error while trying to get time (time query) |
| 22868 | Error while trying to get the number of processors |
| 22869 | Error while accessing temporary file |
| 22900 | Error while forcing a context switch |
| 22901 | Error while accessing the cpu affinity |
| 22902 | Error while setting the cpu affinity |
| 22950 | Wrong synchronization object |
| 22952 | Wrong thread object |
| 22953 | Input Object was not initialized |
| 22954 | Input control parameter is not initialized |
| 22955 | Output Object parameter is not initialized |
| 22956 | Output control parameter is not initialized |
| 22970 | creation of pthread failed |
| 22971 | pthread-detach failed |

| | |
|---|---|
| 22972 | pthread-join failed |
| 22973 | Initialization of mutex variable failed |
| 22974 | Deletion of mutex variable failed |
| 22975 | Lock of mutex variable failed |
| 22976 | Unlock of mutex variable failed |
| 22977 | failed to signal pthread condition variable |
| 22978 | failed to wait for pthread condition variable |
| 22979 | failed to init pthread condition variable |
| 22980 | failed to destroy pthread condition variable |
| 22981 | failed to signal event |
| 22982 | failed to wait for an event |
| 22983 | failed to init an event |
| 22984 | failed to destroy an event |
| 22985 | failed to create a tsd key |
| 22986 | failed to set a tsd key |
| 22987 | failed to get a tsd key |
| 22988 | failed to free a tsd key |
| 22989 | aborted waiting at a barrier |
| 22990 | 'Free list' is empty while scheduling |
| 22991 | Communication partner not checked in |
| 22992 | you can not start the communication system while running it |
| 22993 | Communication partner not checked in |
| 23010 | Region completely outside of the image domain |
| 23011 | Region (partially) outside of the definition range of the image |
| 23012 | Intersected definition range region / image empty |
| 23013 | Image with empty definition range (=> no gray values) |
| 23014 | No common image point of two images |
| 23015 | Wrong region for image (first row < 0) |
| 23016 | Wrong region for image (column in last row >= image width) |
| 23017 | Number of images unequal in input parameters |
| 23018 | Image height too small |
| 23019 | Image width too small |
| 23020 | Internal error: multiple call of HRLInitSeg() |
| 23021 | Internal error: HRLSeg() not initialized |
| 23022 | Wrong size of filter for Gauss |
| 23033 | Filter size exceeds image size |
| 23034 | Filter size have to be odd |
| 23035 | Filter is too big |
| 23036 | Input region is empty |
| 23040 | Row value of a coordinate $> 2^{15}-1$ |
| 23041 | Row value of a coordinate $< -2^{15}$ |
| 23042 | Column value of a coordinate $> 2^{15}-1$ |
| 23043 | Column value of a coordinate $< -2^{15}$ |
| 23100 | Wrong segmentation threshold |
| 23101 | Unknown feature |
| 23102 | Unknown gray value feature |
| 23103 | Internal error in HContCut |
| 23104 | Error in HContToPol: distance of points too big |
| 23105 | Error in HContToPol: contour too long |
| 23106 | Too many rows (IPImageTransform) |
| 23107 | Scaling factor = 0.0 (IPImageScale) |
| 23108 | Wrong range in transformation matrix |

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| | |
|---|---|
| 23109 | Internal error in IPvvf: no element free |
| 23110 | Number of input objects is zero |
| 23111 | At least one input object has an empty region |
| 23112 | Operation allowed for rectangular images 2**n only |
| 23113 | Too many relevant points (IPHysterese) |
| 23114 | Number of labels in image too big |
| 23115 | No labels with negative values allowed |
| 23116 | Wrong filter size (too small ?) |
| 23117 | Images with different image size |
| 23118 | Target image too wide or too far on the right |
| 23119 | Target image too narrow or too far on the left |
| 23120 | Target image too high or too far down |
| 23121 | Target image too low or too far up |
| 23122 | Number of channels in the input parameters are different |
| 23123 | Wrong color filter array type |
| 23124 | Wrong color filter array interpolation |
| 23125 | Homogeneous matrix does not represent an affine transformation |
| 23126 | Inpainting region too close to the image border |
| 23127 | Source and destination differ in size |
| 23128 | To many Features |
| 23129 | Reflection axis undefined |
| 23131 | Concurrence Matrix: too little columns for quantisation |
| 23132 | Concurrence Matrix: too little rows for quantisation |
| 23133 | Wrong number of columns |
| 23134 | Wrong number of rows |
| 23135 | Number has too many digits |
| 23136 | Matrix is not symmetric |
| 23137 | Matrix is too big |
| 23138 | Wrong structure of file |
| 23139 | Lesser than 2 matrices |
| 23140 | Not enough memory |
| 23141 | Can not read the file |
| 23142 | Can not open file for writing |
| 23143 | Too many lookup table colors |
| 23145 | Too many Hough points (lines) |
| 23146 | Target image has got wrong height (not big enough) |
| 23147 | Wrong interpolation mode |
| 23148 | Region not compact or not connected |
| 23170 | Wrong filter index for filter size 3 |
| 23171 | Wrong filter index for filter size 5 |
| 23172 | Wrong filter index for filter size 7 |
| 23173 | Wrong filter size; only 3/5/7 |
| 23175 | Number of suitable pixels too small to reliably estimate the noise |
| 23200 | Different number of entries/exits in HContCut |
| 23250 | Wrong XLD type |
| 23252 | Internal error: border point is set to FG |
| 23253 | Internal error: maximum contour length exceeded |
| 23254 | Internal error: maximum number of contours exceeded |
| 23255 | Contour too short for fetch_angle_xld |
| 23256 | Regression parameters of contours already computed |
| 23257 | Regression parameters of contours not yet entered! Please compute them by calling regress_cont_xld |

| | |
|---|---|
| 23258 | Data base: XLD object has been deleted |
| 23259 | Data base: object has no XLD-ID |
| 23260 | Internal error: wrong number of contour points allocated |
| 23261 | Contour attribute not defined |
| 23262 | Ellipse fitting failed |
| 23263 | Circle fitting failed |
| 23264 | All points classified as outliers (ClippingFactor too small) |
| 23265 | Quadrangle fitting failed |
| 23266 | No points found for at least one side of the rectangle |
| 23267 | A contour point lies outside of the image |
| 23274 | Not enough valid points for fitting the model |
| 23275 | No ARC/INFO world file |
| 23276 | No ARC/INFO generate file |
| 23278 | Unexpected end of file while reading DXF file |
| 23279 | Cannot read DXF-group code from file |
| 23280 | Inconsistent number of attributes per point in DXF file |
| 23281 | Inconsistent number of attributes and names in DXF file |
| 23282 | Inconsistent number of global attributes and names in DXF file |
| 23283 | Cannot read attributes from DXF file |
| 23284 | Cannot read global attributes from DXF file |
| 23285 | Cannot read attribute names from DXF file |
| 23286 | Wrong generic parameter name |
| 23289 | Internal DXF I/O error: Wrong data type |
| 23290 | Isolated point while contour merging |
| 23291 | Constraints (MaxError/MaxDistance) cannot be fulfilled |
| 23300 | Syntax error in file for training |
| 23301 | Maximum number of attributes per example exceeded |
| 23302 | Not possible to open file for training |
| 23303 | Too many data sets for training |
| 23304 | Wrong key for data for training |
| 23305 | Too many examples for one data set for training |
| 23306 | Too many classes |
| 23307 | Maximum number of cuboids exceeded |
| 23308 | Not possible to open classificator's file |
| 23309 | Error while saving the classificator |
| 23310 | Not possible to open protocol file |
| 23311 | Classificator with this name is already existent |
| 23312 | Maximum number of classificators exceeded |
| 23313 | Name of classificator is too long, $>= 20$ |
| 23314 | Classificator with this name is not existent |
| 23315 | Current classificator is not defined |
| 23316 | Wrong id in classification file |
| 23317 | The version of the classifier is not supported |
| 23318 | Serialized item does not contain a valid classifier |
| 23330 | Wrong covariance initialization |
| 23331 | The version of the GMM training samples is not supported |
| 23332 | Wrong training sample format |
| 23333 | Invalid file format for Gaussian Mixture Model (GMM) |
| 23334 | The version of the Gaussian Mixture Model (GMM) is not supported |
| 23335 | Internal error while training the GMM |
| 23336 | Singular covariance matrix |
| 23337 | No samples for at least one class |

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| 23338 | Too few samples for at least one class |
| 23340 | GMM has not been trained yet |
| 23341 | No training samples stored in the classifier |
| 23342 | Serialized item does not contain a valid Gaussian Mixture Model (GMM) |
| 23350 | Unknown output function |
| 23351 | Target vector not in 0-1 encoding |
| 23352 | No training samples stored in the classifier |
| 23353 | Invalid file format for MLP training samples |
| 23354 | The version of the MLP training samples is not supported |
| 23355 | Wrong training sample format |
| 23356 | MLP is not a classifier; use OutputFunction = 'softmax' in create_class_mlp |
| 23357 | Invalid file format for multilayer perceptron (MLP) |
| 23358 | The version of the multilayer perceptron (MLP) is not supported |
| 23359 | Wrong number of image channels |
| 23360 | Number of MLP parameters too large |
| 23361 | Serialized item does not contain a valid multilayer perceptron (MLP) |
| 23370 | Wrong number of image channels |
| 23371 | A look-up table can be build only for a 2 or 3 channel classifier |
| 23372 | Cannot create a look-up table. Please choose a larger 'bit_depth' or select 'fast' for 'class_selection'. |
| 23380 | No training samples stored in the classifier |
| 23381 | Invalid file format for SVM training samples |
| 23382 | The version of the SVM training samples is not supported |
| 23383 | Wrong training sample format |
| 23384 | Invalid file format for support vector machine (SVM) |
| 23385 | The version of the support vector machine (SVM) is not supported |
| 23386 | Wrong class |
| 23387 | Nu was chosen too big |
| 23388 | SVM training failed |
| 23389 | Old SVM and new SVM do not match |
| 23390 | SVM contains no trained support vectors |
| 23391 | Kernel is not an RBF kernel |
| 23392 | Train data does not contain all classes |
| 23393 | SVM not trained |
| 23394 | Classifier not trained |
| 23395 | Serialized item does not contain a valid support vector machine (SVM) |
| 23401 | Wrong rotation number |
| 23402 | Wrong letter for Golay element |
| 23403 | Wrong reference point |
| 23404 | Wrong number of iterations |
| 23405 | Mophology: system error |
| 23406 | Wrong type of boundary |
| 23407 | Morphology: wrong number of input objects |
| 23408 | Morphology: wrong number of output objects |
| 23409 | Morphology: wrong number of input control parameter |
| 23410 | Morphology: wrong number of output control parameter |
| 23411 | Morphology: structuring element is infinite |
| 23412 | Morphology: wrong name for structuring element |
| 23500 | Wrong number of run length rows (chords): smaller than 0 |
| 23501 | Number of chords too big. Increase 'current_runlength_number' using set_system! |
| 23502 | Run length row with negative length |

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| 23503 | Run length row >= image height |
| 23504 | Run length row < 0 |
| 23505 | Run length column >= image width |
| 23506 | Run length column < 0 |
| 23507 | For CHORD_TYPE: Number of row too big |
| 23508 | For CHORD_TYPE: Number of row too small |
| 23509 | For CHORD_TYPE: Number of column too big |
| 23510 | Exceeding the maximum number of run lengths while automatical expansion |
| 23511 | Internal error: Region->compl neither TRUE/FALSE |
| 23512 | Internal error: Region->max_num < Region->num |
| 23513 | Internal error: number of chords too big for num_max |
| 23514 | Operator cannot be implemented for complemented " |
| 23520 | Image width < 0 |
| 23521 | Image width > MAX_FORMAT |
| 23522 | Image height < 0 |
| 23523 | Image height > MAX_FORMAT |
| 23524 | Image width <= 0 |
| 23525 | Image height <= 0 |
| 23550 | Too many segments |
| 23551 | 'int8' images are available on 64 bit systems only |
| 23600 | Point at infinity cannot be converted to a Euclidean point |
| 23601 | Covariance matrix could not be determined |
| 23602 | RANSAC algorithm didn't find enough point correspondences |
| 23603 | RANSAC algorithm didn't find enough point correspondences |
| 23604 | Internal diagnosis: fallback method had to be used |
| 23605 | Projective transformation is singular |
| 23606 | Mosaic is under-determined |
| 23607 | Input covariance matrix is not positive definite |
| 23620 | Inconsistent number of point correspondences |
| 23621 | At least one image cannot be reached from the reference image |
| 23622 | The image with specified index does not exist |
| 23623 | Matrix is not a camera matrix |
| 23624 | Skew is not zero |
| 23625 | Illegal focal length |
| 23626 | Distortion is not zero |
| 23627 | It is not possible to determine all parameters for variable camera parameters |
| 23628 | No valid implementation selected |
| 23629 | Kappa can only be determined with the gold-standard method |
| 23630 | Conflicting number of images and projection mode |
| 23631 | Error in projection: Point not in any cube map |
| 23632 | No solution found |
| 23640 | Illegal combination of estimation method and parameters to be determined |
| 23650 | Invalid file format for FFT optimization data |
| 23651 | The version of the FFT optimization data is not supported |
| 23652 | Optimization data was created with a different HALCON variant (Sequential HALCON / Parallel HALCON) |
| 23653 | Storing of the optimization data failed |
| 23654 | Serialized item does not contain valid FFT optimization data |
| 23660 | No contours suitable for self-calibration found |
| 23661 | No stable solution found: please change the inlier threshold or select contours manually |
| 23662 | Instable solution: please choose more or different contours |
| 23663 | Not enough contours for calibration: please select contours manually |

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| 23700 | Epipoles are within the image domain: no rectification possible. |
| 23701 | Fields of view of both cameras do not intersect each other. |
| 23750 | Invalid sheet-of-light handle |
| 23751 | No sheet-of-light model available |
| 23752 | Wrong input image size (width) |
| 23753 | Wrong input image size (height) |
| 23754 | The bounding-box around the profile region does not fit the domain of definition of the input image |
| 23755 | Calibration extend not set |
| 23756 | Undefined disparity image |
| 23757 | Undefined domain for disparity image |
| 23758 | Undefined camera parameter |
| 23759 | Undefined pose of the lightplane |
| 23760 | Undefined pose of the camera coordinate system |
| 23761 | Undefined transformation from the coordinate system of the camera to the coordinate system of the lightplane |
| 23762 | Undefined movement pose for xyz calibration |
| 23763 | Wrong value of scale parameter |
| 23764 | Wrong parameter name |
| 23765 | Wrong type of parameter method |
| 23766 | Wrong type of parameter ambiguity |
| 23767 | Wrong type of parameter score |
| 23768 | Wrong type of parameter calibration |
| 23769 | Wrong type of parameter number_profiles |
| 23770 | Wrong type of element in parameter camera_parameter |
| 23771 | Wrong type of element in pose |
| 23772 | Wrong value of parameter method |
| 23773 | Wrong type of parameter min_gray |
| 23774 | Wrong value of parameter ambiguity |
| 23775 | Wrong value of parameter score_type |
| 23776 | Wrong value of parameter calibration |
| 23777 | Wrong value of parameter number_profiles |
| 23778 | Wrong type of camera |
| 23780 | Wrong number of values of pose |
| 23850 | The light source positions are linearly dependent |
| 23851 | No sufficient image indication |
| 23852 | Internal error: Function has equal signs in HZBrent |
| 23900 | Kalman: Dimension n,m or p has got a undefined value |
| 23901 | Kalman: File does not exist |
| 23902 | Kalman: Error in file (row of dimension) |
| 23903 | Kalman: Error in file (row of marking) |
| 23904 | Kalman: Error in file (value is no float) |
| 23905 | Kalman: Matrix A is missing in file |
| 23906 | Kalman: Matrix C is missing in file |
| 23907 | Kalman: Matrix Q is missing in file |
| 23908 | Kalman: Matrix R is missing in file |
| 23909 | Kalman: G or u is missing in file |
| 23910 | Kalman: Covariant matrix is not symmetric |
| 23911 | Kalman: Equation system is singular |
| 24050 | Image data management: object is a object tupel |
| 24051 | Image data management: object has been deleted already |
| 24052 | Image data management: wrong object-ID |

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| 24053 | Image data management: object tupel has been deleted already |
| 24054 | Image data management: wrong object tupel-ID |
| 24055 | Image data management: object tupel is a object |
| 24056 | Image data management: object-ID is NULL (0) |
| 24057 | Image data management: object-ID outside the valid range |
| 24058 | Image data management: access to deleted image |
| 24059 | Image data management: access to image with wrong key |
| 24060 | Image data management: access to deleted region |
| 24061 | Image data management: access to region with wrong key |
| 24062 | Image data management: wrong value for image channel |
| 24063 | Image data management: index too big |
| 24064 | Image data management: index not defined |
| 24100 | No OpenCL available |
| 24101 | OpenCL Error occured |
| 24102 | No compute device available |
| 24104 | Out of compute device memory |
| 24105 | Invalid work group shape |
| 24106 | Invalid compute device |
| 25100 | Wrong (logical) window number |
| 25101 | Error while opening the window |
| 25102 | Wrong window coordinates |
| 25103 | It is not possible to open another window |
| 25104 | Device resp. operator not available |
| 25105 | Unknown color |
| 25106 | No window has been opened for desired action |
| 25107 | Wrong filling mode for regions (fill or margin) |
| 25108 | Wrong gray value (0..255) |
| 25109 | Wrong pixel value (use value of get_pixel(P) only) |
| 25110 | Wrong line width (see: query_line_width(Min,Max)) |
| 25111 | Wrong name of cursor |
| 25112 | Wrong color table (see: query_lut(Name) |
| 25113 | Wrong representation mode (see: query_insert(Mode)) |
| 25114 | Wrong representation color (see: query_color(List)) |
| 25115 | Wrong dither matrix (binary image representation) |
| 25116 | Wrong image transformation (name or image size) |
| 25117 | Unsuitable image type for image transformation |
| 25118 | Wrong zooming factor for image transformation |
| 25119 | Wrong representation mode |
| 25120 | Wrong code of device |
| 25121 | Wrong number for father window |
| 25122 | Wrong window size |
| 25123 | Wrong window type |
| 25124 | No current window has been set |
| 25125 | Wrong color combination or range (RGB) |
| 25126 | Wrong number of pixels set |
| 25127 | Wrong value for comprise (object or image) |
| 25128 | set_fix with 1/4 image levels and static not valid |
| 25129 | set_lut not valid in child windows |
| 25130 | Number of concurrent used color tables is too big |
| 25131 | Wrong device for window dump |
| 25132 | Wrong window size for window dump |
| 25133 | System variable DISPLAY (setenv) not defined |

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| 25134 | Wrong thickness for window margin |
| 25135 | System variable DISPLAY has been set wrong (<host>:0.0) |
| 25136 | Too many fonts loaded |
| 25137 | Wrong font name |
| 25138 | No valid cursor position |
| 25139 | Window is not a textual window |
| 25140 | Window is not a image window |
| 25141 | String too long or too high |
| 25142 | Too little space in the window rightwards |
| 25143 | Window is not suitable for the mouse |
| 25144 | Here Windows on a equal machine is permitted only |
| 25145 | Wrong mode while opening a window |
| 25146 | Wrong window mode for operation |
| 25147 | Operation not possible with fixed pixel |
| 25148 | Color tables for 8 image levels only |
| 25149 | Wrong mode for pseudo real colors |
| 25150 | Wrong pixel value for LUT |
| 25151 | Wrong image size for pseudo real colors |
| 25152 | Error in procedure HRLUT |
| 25153 | Wrong number of entries in color table for set_lut |
| 25154 | Wrong values for image area |
| 25155 | Wrong line pattern |
| 25156 | Wrong number of parameters for line pattern |
| 25157 | Wrong number of colors |
| 25158 | Wrong value for mode of area creation (0,1,2) |
| 25159 | Spy window is not set (set_spy) |
| 25160 | No file for spy has been set (set_spy) |
| 25161 | Wrong parameter output depth (set_spy) |
| 25162 | Wrong window size for window dump |
| 25163 | Wrong color table: wrong file name or query_lut() |
| 25164 | Wrong color table: empty string ? |
| 25165 | Using this hardware set_lut('default') is allowed only |
| 25166 | Error while calling online help |
| 25167 | Row can not be projected |
| 25168 | Operation is unsuitable using a computer with fixed color table |
| 25169 | Computer represents gray scales only (no colors) |
| 25170 | LUT of this display is full |
| 25171 | Internal error: wrong color code |
| 25172 | Wrong type for window attribute |
| 25173 | Wrong name for window attribute |
| 25174 | Negative height of area (or 0) |
| 25175 | Negative width of area (or 0) |
| 25176 | Window not completely visible |
| 25177 | Font not allowed for this operation |
| 25178 | Operation not possible (window was created in different thread) |
| 25179 | Depth was not stored with window |
| 25180 | Internal error: only RGB-Mode |
| 25181 | No more (image-)windows available |
| 25182 | Object index was not stored with window |
| 25183 | Operator does not support primitives without point coordinates |
| 25184 | Operator not available with Windows Remote Desktop |
| 25185 | No OpenGL support available |

| 25186 | No depth information available |
|---|---|
| 25187 | OpenGL error occurred |
| 25188 | Required framebuffer object is unsupported |
| 25189 | OpenGL accelerated hidden surface removal not supported on this machine |
| 25190 | Invalid window parameter |
| 25191 | Invalid value for window parameter |
| 25192 | Unknown mode |
| 25195 | Invalid value for navigation mode |
| 25196 | Internal file error |
| 25197 | Error while file synchronization |
| 25198 | Insufficient rights on file |
| 25199 | Bad file descriptor |
| 25200 | File not found |
| 25201 | Error while writing image data (sufficient memory ?) |
| 25202 | Error while writing image descriptor (sufficient memory ?) |
| 25203 | Error while reading image data (format of image too small ?) |
| 25204 | Error while reading image data (format of image too big ?) |
| 25205 | Error while reading image descriptor: file too small |
| 25206 | Image matrices are different |
| 25207 | Help file not found (setenv HALCONROOT <Halcon- Homedirectory>) |
| 25208 | Help index not found (setenv HALCONROOT <Halcon- Homedirectory>) |
| 25209 | File <standard_input> can not be closed |
| 25210 | <standard_output/error> can not be closed |
| 25211 | File can not be closed |
| 25212 | Error while writing to file |
| 25213 | Exceeding of maximum number of files |
| 25214 | Wrong file name |
| 25215 | Error while opening the file |
| 25216 | Wrong file mode |
| 25217 | Wrong type for pixel (e.g. byte) |
| 25218 | Wrong image width (too big ?) |
| 25219 | Wrong image height (too big ?) |
| 25220 | File already exhausted before reading an image |
| 25221 | File exhausted before terminating the image |
| 25222 | Wrong value for resolution (dpi) |
| 25223 | Wrong output image size (width) |
| 25224 | Wrong output image size (height) |
| 25225 | Wrong number of parameter values: format description |
| 25226 | Wrong parameter name for operator |
| 25227 | Wrong slot name for parameter |
| 25228 | Operator class is missing in help file |
| 25229 | Wrong or inconsistent help/*.idx or help/*.sta |
| 25230 | File help/*.idx not found (setenv HALCONROOT <Halcon- Homedirectory>) |
| 25231 | File help/*.sta not found (setenv HALCONROOT <Halcon- Homedirectory>) |
| 25232 | Inconsistent file help/*.sta |
| 25233 | No explication file (.exp) found |
| 25234 | No file found in known graphic format |
| 25235 | Wrong graphic format |
| 25236 | Inconsistent file halcon.num |
| 25237 | File not a TIFF file |
| 25238 | Wrong file format |
| 25239 | gnuplot could not be started |

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| 25240 | Output file for gnuplot could not be opened |
| 25241 | Not a valid gnuplot output stream |
| 25242 | No PNM format |
| 25243 | Inconsistent or old help file ($HALCONROOT/help) |
| 25244 | Wrong file handle |
| 25245 | File not open |
| 25246 | No files in use so far (none opened) |
| 25247 | Invalid file format for regions |
| 25248 | Error while reading region data: Format of region too big. |
| 25250 | Invalid handle for a serial connection |
| 25251 | Serial port not open |
| 25252 | No serial port available |
| 25253 | Could not open serial port |
| 25254 | Could not close serial port |
| 25255 | Could not get serial port attributes |
| 25256 | Could not set serial port attributes |
| 25257 | Wrong baud rate for serial connection |
| 25258 | Wrong number of data bits for serial connection |
| 25259 | Wrong flow control for serial connection |
| 25260 | Could not flush serial port |
| 25261 | Error during write to serial port |
| 25262 | Error during read from serial port |
| 25270 | Serialized item does not contain valid regions |
| 25271 | The version of the regions is not supported |
| 25272 | Serialized item does not contain valid images |
| 25273 | The version of the images is not supported |
| 25274 | Serialized item does not contain valid XLD objects |
| 25275 | The version of the XLD objects is not supported |
| 25276 | Serialized item does not contain valid objects |
| 25277 | The version of the objects is not supported |
| 25280 | File has not been opened in text format |
| 25281 | File has not been opened in binary file format |
| 25282 | Cannot create directory |
| 25283 | Cannot remove directory |
| 25300 | No image acquisition device opened |
| 25301 | Image acquisition: wrong color depth |
| 25302 | Image acquisition: wrong device |
| 25303 | Image acquisition: determination of video format not possible |
| 25304 | Image acquisition: no video signal |
| 25305 | Unknown image acquisition device |
| 25306 | Image acquisition: failed grabbing of an image |
| 25307 | Image acquisition: wrong resolution chosen |
| 25308 | Image acquisition: wrong image part chosen |
| 25309 | Image acquisition: wrong pixel ratio chosen |
| 25310 | Image acquisition: handle not valid |
| 25311 | Image acquisition: instance not valid (already closed?) |
| 25312 | Image acquisition: device cannot be initialized |
| 25313 | Image acquisition: external triggering not supported |
| 25314 | Image acquisition: wrong camera input line (multiplex) |
| 25315 | Image acquisition: wrong color space |
| 25316 | Image acquisition: wrong port |
| 25317 | Image acquisition: wrong camera type |

| 25318 | Image acquisition: maximum number of acquisition device classes exceeded |
| 25319 | Image acquisition: device busy |
| 25320 | Image acquisition: asynchronous grab not supported |
| 25321 | Image acquisition: unsupported parameter |
| 25322 | Image acquisition: timeout |
| 25323 | Image acquisition: invalid gain |
| 25324 | Image acquisition: invalid field |
| 25325 | Image acquisition: invalid parameter type |
| 25326 | Image acquisition: invalid parameter value |
| 25327 | Image acquisition: function not supported |
| 25328 | Image acquisition: incompatible interface version |
| 25329 | Image acquisition: could not set parameter value |
| 25330 | Image acquisition: could not query parameter setting |
| 25331 | Image acquisition: parameter not available in current configuration |
| 25332 | Image acquisition: device could not be closed properly |
| 25333 | Image acquisition: camera configuration file could not be opened |
| 25334 | Image acquisition: callback type not supported |
| 25335 | Image acquisition: device lost |
| 25400 | Image type is not supported |
| 25401 | Invalid pixel format |
| 25402 | Internal JPEG-XR error |
| 25403 | Invalid format string |
| 25404 | Maximum number of channels exceeded |
| 25405 | Unspecified error in JPEG-XR library |
| 25406 | Bad magic number in JPEG-XR library |
| 25407 | Feature not implemented in JPEG-XR library |
| 25408 | File read/write error in JPEG-XR library |
| 25409 | Invalid file format in JPEG-XR library |
| 25500 | Error while closing the image file |
| 25501 | Error while opening the image file |
| 25502 | Premature end of the image file |
| 25503 | Image dimensions too large for this file format |
| 25504 | Image too large for this HALCON version |
| 25505 | Too many iconic objects for this file format |
| 25510 | File is no PCX-File |
| 25511 | PCX: unknown encoding |
| 25512 | PCX: More than 4 image plains |
| 25513 | PCX: Wrong magic in color table |
| 25514 | PCX: Wrong number of bytes in span |
| 25515 | PCX: Wrong number of bits/pixels |
| 25516 | PCX: Wrong number of plains |
| 25520 | File is no GIF-File |
| 25521 | GIF: Wrong version (not 87a/89a) |
| 25522 | GIF: Wrong descriptor |
| 25523 | GIF: Wrong color table |
| 25524 | GIF: Premature end of file |
| 25525 | GIF: Wrong number of images ';' |
| 25526 | GIF: Wrong image extension '!' |
| 25527 | GIF: Wrong left top width |
| 25528 | GIF: Cyclic index of table |
| 25529 | GIF: Wrong image data |
| 25530 | File is no Sun-Raster-File |

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| 25531 | SUN-Raster: Wrong header |
| 25532 | SUN-Raster: Wrong image width |
| 25533 | SUN-Raster: Wrong image height |
| 25534 | SUN-Raster: Wrong color map |
| 25535 | SUN-Raster: Wrong image data |
| 25536 | SUN-Raster: Wrong type of pixel |
| 25540 | XWD: Wrong type of pixel |
| 25541 | XWD: Wrong visual class |
| 25542 | XWD: Wrong X10 header |
| 25543 | XWD: Wrong X11 header |
| 25544 | XWD: Wrong X10 colormap |
| 25545 | XWD: Wrong X11 colormap |
| 25546 | XWD: Wrong pixmap |
| 25547 | XWD: unknown version |
| 25548 | XWD: Error while reading an image |
| 25550 | TIFF: Error while reading a file |
| 25551 | TIFF: Wrong colormap |
| 25552 | TIFF: Too many colors |
| 25553 | TIFF: Wrong photometric interpretation |
| 25554 | TIFF: Wrong photometric depth |
| 25555 | TIFF: Image is no binary file |
| 25556 | TIFF: Image format not supported by HALCON |
| 25557 | TIFF: Wrong specification of the TIFF file format |
| 25558 | TIFF: TIFF file is corrupt |
| 25559 | TIFF: A required TIFF tag is missing the the TIFF file |
| 25560 | File is no BMP-File |
| 25561 | BMP: Premature end of file |
| 25562 | BMP: Incomplete header |
| 25563 | BMP: Unknown bitmap format |
| 25564 | BMP: Unknown compression format |
| 25565 | BMP: Wrong color table |
| 25566 | BMP: Write error on output |
| 25567 | BMP: File does not contain a binary image |
| 25570 | JPEG: wrong number of components in image |
| 25571 | JPEG: unknown error from libjpeg |
| 25572 | JPEG: no implementet feature in libjpeg |
| 25573 | JPEG: file access error in libjpeg |
| 25574 | JPEG: tmp file access error in libjpeg |
| 25575 | JPEG: memory error in libjpeg |
| 25576 | JPEG: Error in input image |
| 25580 | PNG: File is not a PNG file |
| 25581 | PNG: Unknown interlace type |
| 25582 | PNG: Unsupported color type |
| 25583 | PNG: Image is no binary file |
| 25590 | JPEG-2000: File corrupt |
| 25591 | JPEG-2000: Image has more than 28 significant bits |
| 25592 | JPEG-2000: Error while encoding |
| 25600 | Socket can not be set to block |
| 25601 | Socket can not be set to unblock |
| 25602 | Received data is no tuple |
| 25603 | Received data is no image |
| 25604 | Received data is no region |

| 25605 | Received data is no xld object |
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| 25606 | Error while reading from socket |
| 25607 | Error while writing to socket |
| 25608 | Illegal number of bytes with get_rl |
| 25609 | Buffer overflow in read_data |
| 25610 | Socket can not be created |
| 25611 | Bind on socket failed |
| 25612 | Socket information is not available |
| 25613 | Socket cannot listen for incoming connections |
| 25614 | Connection could not be accepted |
| 25615 | Connection request failed |
| 25616 | Hostname could not be resolved |
| 25617 | No data on socket |
| 25618 | Unknown tuple type on socket |
| 25619 | Timeout occured on socket |
| 25620 | No more sockets available |
| 25621 | Socket is not initialized |
| 25622 | Invalid socket |
| 25623 | Socket is NULL |
| 25624 | Received data type is too large |
| 25625 | Wrong socket protocol |
| 25626 | Received data does not contain packed data |
| 25627 | Error when handling the parameter |
| 25628 | Format specification does not match the data |
| 25629 | Invalid format specification |
| 25630 | Received data is no serialized item |
| 25678 | XLD object data can only be read by HALCON XL |
| 25700 | Too many contours/polygons for this file format |
| 25750 | The version of the quaternion is not supported |
| 25751 | Serialized item does not contain a valid quaternion |
| 25752 | The version of the homogeneous matrix is not supported |
| 25753 | Serialized item does not contain a valid homogeneous matrix |
| 25754 | The version of the homogeneous 3D matrix is not supported |
| 25755 | Serialized item does not contain a valid homogeneous 3D matrix |
| 25756 | The version of the tuple is not supported |
| 25757 | Serialized item does not contain a valid tuple |
| 25758 | Tuple data can only be read on 64-bit systems |
| 25759 | The version of the camera parameters (pose) is not supported |
| 25760 | Serialized item does not contain valid camera parameters (pose) |
| 25761 | The version of the internal camera parameters is not supported |
| 25762 | Serialized item does not contain valid internal camera parameters |
| 26000 | Access to undefined memory area |
| 26001 | Not enough memory available |
| 26002 | Memory partition on heap has been overwritten |
| 26003 | HAlloc: 0 bytes requested |
| 26004 | Tmp-memory management: Call freeing memory although nothing had been allocated |
| 26005 | Tmp-memory management: Null pointer while freeing |
| 26006 | Tmp-memory management: could not find memory element |
| 26007 | Memory management: wrong memory type allocated |
| 26021 | Not enough video memory available |
| 26040 | System parameter for memory-allocation inconsistent |
| 26041 | No memory block allocated at last |

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| 26500 | Process creation failed |
| 27000 | Wrong index for output control parameter |
| 27001 | Wrong number of values: output control parameter (see: HPut*Par |
| 27002 | Wrong type: output control parameter (see: HPut*Par) |
| 27003 | Wrong data type for object key (input objects) |
| 27004 | Range for integer had been passed |
| 27005 | Inconsistent Halcon version |
| 27006 | Not enough memory for strings allocated |
| 27007 | Internal error: Proc is NULL |
| 27100 | Wrong list structure using input objects |
| 27101 | Wrong input object parameter (not bound) |
| 27102 | Wrong input control parameter (not bound) |
| 27103 | Wrong output object parameter (already bound) |
| 27104 | Wrong output control parameter (already bound) |
| 27105 | Unknown symbolic object key (input objects) |
| 27200 | Wrong number of output object parameter |
| 27300 | Wrong number of input parameter |
| 27400 | System error: output type <string> expected |
| 27401 | System error: output type <long> expected |
| 27402 | System error: output type <float> expected |
| 27403 | Object parameter is a zero pointer ('_' not allowed) |
| 27404 | Tupel had been deleted; values are not valid any more |
| 27430 | CPP-interface internal error: wrong object mode |
| 27431 | Wrong number of regions (> 1) for type HRegion |
| 27432 | Wrong number of images (> 1) for type HImage |
| 27433 | Tupel with undefined values |
| 27500 | No contact to RPC server |
| 27501 | Error in remote procedure call |
| 27600 | Parameter value is neither a list nor a atom |
| 28000 | Unknown operator name |
| 28001 | register_comp_used is not activated (see set_system) |
| 28002 | Unknown operator class |
| 28101 | convol/mask: error while opening the file |
| 28102 | convol/mask: premature end of file |
| 28103 | convol/mask: conversion error |
| 28104 | convol/mask: wrong row-/column number |
| 28105 | convol/mask: mask size overflow |
| 28106 | convol/mask: too many elements entered |
| 28107 | convol: wrong margin type |
| 28108 | convol: no mask object has got empty region |
| 28110 | convol: Weight factor is 0 |
| 28111 | convol: inconsistent number of weights |
| 28112 | rank: wrong rank value |
| 28113 | convol/rank: error while handling margin |
| 28114 | Error while parsing filter mask file |
| 28120 | Wrong number of coefficients for convolution (sigma too big?) |
| 28200 | No valid ID for data set |
| 28201 | No data set active (set_bg_esti) |
| 28202 | ID already used for data set (is not poosible) |
| 28204 | No data set created (create_bg_esti) |
| 28205 | Not possible to pass an object list |
| 28206 | Image has other size than the background image in data set |

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| 28207 | Up-date-region is bigger than background image |
| 28208 | Number of statistic data sets is too small |
| 28209 | Wrong value for adapt mode |
| 28210 | Wrong value for frame mode |
| 28300 | Maximum number of fonts exceeded |
| 28301 | Wrong ID (Number) for font |
| 28302 | OCR internal error: wrong ID |
| 28303 | OCR not initialised: no font was read in |
| 28304 | No font activated |
| 28305 | OCR internal error: wrong threshold in angle determination |
| 28306 | OCR internal error: wrong attribute |
| 28307 | The version of the OCR classifier is not supported |
| 28308 | OCR File: inconsistent number of nodes |
| 28309 | OCR File: File too short |
| 28310 | OCR: internal error 1 |
| 28311 | OCR: internal error 2 |
| 28312 | Wrong type of OCR tool (no 'box' or 'net') |
| 28313 | The version of the OCR training characters is not supported |
| 28314 | Image too large for training file |
| 28315 | Region too large for training file |
| 28316 | Protected training file |
| 28317 | Wrong password for protected training file |
| 28318 | Serialized item does not contain a valid OCR classifier |
| 28320 | Invalid file format for MLP classifier |
| 28321 | The version of the MLP classifier is not supported |
| 28322 | Serialized item does not contain a valid MLP classifier |
| 28330 | Invalid file format for SVM classifier |
| 28331 | The version of the SVM classifier is not supported |
| 28332 | Serialized item does not contain a valid k-NN classifier |
| 28333 | Invalid file format for k-NN classifier |
| 28340 | Invalid text model |
| 28341 | Invalid text result |
| 28350 | OCV system not initialized |
| 28351 | The version of the OCV tool is not supported |
| 28353 | Wrong name for an OCV object |
| 28354 | Training has already been applied |
| 28355 | No training has been applied to the character |
| 28356 | Serialized item does not contain a valid OCV tool |
| 28370 | Wrong number of function points |
| 28371 | List of values is not a function |
| 28372 | Wrong ordering of values (not ascending) |
| 28373 | Illegal distance of function points |
| 28374 | Function is not monotonic |
| 28375 | Wrong function type |
| 28400 | You have to indicate at least 3 calibration points |
| 28402 | No calibration table found |
| 28403 | Error while reading calibration table description file |
| 28404 | Minimum threshold while searching for ellipses |
| 28405 | Read error / format error in calibration table description file |
| 28406 | Error in projection: $s\_x = 0$ or $s\_y = 0$ or $z = 0$ |
| 28407 | Error in inverse projection |
| 28408 | Not possible to open camera parameter file |

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|---|---|
| 28409 | Format error in file: no colon |
| 28410 | Format error in file: 2. colon is missing |
| 28411 | Format error in file: semicolon is missing |
| 28412 | Not possible to open camera parameter (pose) file |
| 28413 | Format error in camera parameter (pose) file |
| 28414 | Not possible to open calibration target description file |
| 28415 | Not possible to open postscript file of calibration target |
| 28416 | Error while norming the vector |
| 28417 | Fitting of calibration target failed |
| 28418 | No next mark found |
| 28419 | Normal equation system is not solvable |
| 28420 | Average quadratic error is too big for 3D position of mark |
| 28421 | Non elliptic contour |
| 28422 | Wrong parameter value slvand() |
| 28423 | Wrong function results slvand() |
| 28424 | Distance of marks in calibration target description file is not possible |
| 28425 | Specified flag for degree of freedom not valid |
| 28426 | Minimum error did not fall below |
| 28427 | Wrong type in Pose (rotation / translation) |
| 28428 | Image size does not match the measurement in camera parameters |
| 28429 | Point could not be projected into linescan image |
| 28430 | Diameter of calibration marks could not be determined |
| 28431 | Orientation of calibration plate could not be determined |
| 28432 | Calibration plate does not lie completely inside the image |
| 28433 | Wrong number of calibration marks extracted |
| 28434 | Unknown name of parameter group |
| 28435 | Focal length must be non-negative |
| 28436 | Function not available for cameras with telecentric lenses |
| 28437 | Function not available for line scan cameras |
| 28438 | Ellipse is degenerated to a point |
| 28439 | No orientation mark found |
| 28440 | Camera calibration did not converge |
| 28441 | Error in calibration data, try to recalibrate with improved input data! |
| 28442 | Point cannot be distorted |
| 28451 | Model not optimized yet -0 no results can be queried |
| 28452 | Model not postprocessed yet -0 no auxiliary results can be queried |
| 28453 | Calibration setup: fields of view do not intersect |
| 28454 | Camera type and camera parameters incompatible |
| 28455 | Calibration setup: incompatible camera types |
| 28456 | Camera type not supported |
| 28457 | Invalid camera index |
| 28458 | Invalid calibration object index |
| 28459 | Invalid calibration object pose index |
| 28460 | Undefined camera |
| 28461 | Indices: ambiguous observation index |
| 28462 | Undefined calibration object |
| 28463 | Invalid file format for calibration data model |
| 28464 | The version of the calibration data model is not supported |
| 28465 | Zero-motion in line scan camera parameters |
| 28466 | Calibration setup: multiple cameras and/or calibration objects not supported for camera type |
| 28467 | Incomplete observation data |

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| 28468 | Invalid file format for camera setup model |
| 28469 | The version of the camera setup model is not supported |
| 28470 | Full HALCON calibration plate description required |
| 28471 | Invalid observation index |
| 28472 | Serialized item does not contain a valid camera setup model |
| 28473 | Serialized item does not contain a valid calibration data model |
| 28474 | Invalid tool pose index |
| 28475 | Undefined tool pose |
| 28476 | Feature or operation not supported for current calibration data model type |
| 28490 | Feature or operation not supported for current stereo model type |
| 28491 | Feature or operation available only in 'persistent' mode |
| 28492 | Invalid bounding box |
| 28493 | Image sizes must be identical with the corresponding camera parameters from the camera setup |
| 28494 | Bounding box lies partially or completely behind the base line of at least one camera pair |
| 28495 | Ambigious calibration: Please, recalibrate with improved input data! |
| 28496 | Pose of calibration plate could not be determined! |
| 28500 | Invalid file format for template |
| 28501 | The version of the template is not supported |
| 28502 | Error during changing the file mode (t/b) |
| 28503 | Inconsistent match file: coordinates out of range |
| 28505 | The image(s) is not a pyramid (wrong zooming factor?) |
| 28506 | Number of template points too small |
| 28507 | Template data can only be read by HALCON XL |
| 28508 | Serialized item does not contain a valid NCC model |
| 28509 | Serialized item does not contain a valid template |
| 28510 | Number of shape model points too small |
| 28511 | Gray-value-based and color-based shape models cannot be searched simultaneously |
| 28512 | Shape model data can only be read by HALCON XL |
| 28513 | Shape model was not created from XLDs |
| 28514 | Serialized item does not contain a valid shape model |
| 28530 | Initial components have different region types |
| 28531 | Solution of ambiguous matches failed |
| 28532 | Computation of the incomplete gamma function not converged |
| 28533 | Too many nodes while computing the minimum spanning arborescence |
| 28534 | Component training data can only be read by HALCON XL |
| 28535 | Component model data can only be read by HALCON XL |
| 28536 | Serialized item does not contain a valid component model |
| 28537 | Serialized item does not contain a valid component training result |
| 28540 | Size of the training image and the variation model differ |
| 28541 | Variation model has not been prepared for segmentation |
| 28542 | Invalid variation model training mode |
| 28543 | Invalid file format for variation model |
| 28544 | The version of the variation model is not supported |
| 28545 | Training data has already been cleared |
| 28546 | Serialized item does not contain a valid variation model |
| 28550 | No more measure objects available |
| 28551 | Measure object is not initialized |
| 28552 | Invalid measure object |
| 28553 | Measure object is NULL |
| 28554 | Measure object has wrong image size |
| 28555 | Invalid file format for measure object |

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| 28556 | The version of the measure object is not supported |
| 28557 | Measure object data can only be read by HALCON XL |
| 28558 | Serialized item does not contain a valid measure object |
| 28570 | Metrology model is not initialized |
| 28571 | Invalid metrology model |
| 28572 | Invalid metrology object |
| 28573 | Not enough valid measures for fitting the metrology object |
| 28575 | Invalid file format for metrology model |
| 28576 | The version of the metrology model is not supported |
| 28577 | Fuzzy function is not set |
| 28578 | Serialized item does not contain a valid metrology model |
| 28600 | Dynamic library could not be opened |
| 28601 | Dynamic library could not be closed |
| 28602 | Symbol not found in dynamic library |
| 28650 | Not enough information for radiometric calibration |
| 28700 | Unknown barcode |
| 28701 | Wrong number of modules |
| 28702 | Wrong number of elements |
| 28703 | Unknown character (for this code) |
| 28705 | wrong name for attribute in barcode descriptor |
| 28706 | Wrong thickness of element |
| 28707 | No region found |
| 28708 | Wrong type of barcode |
| 28720 | Invalid barcode handle |
| 28721 | List of barcode models is empty |
| 28722 | Training cannot be done for multiple barcode types |
| 28723 | Cannot get barcode type specific parameter with get_bar_code_param. Use get_bar_code_param_specific |
| 28724 | Cannot get this object for multiple barcode types. Try again with single barcode type |
| 28725 | Invalid file format for barcode model |
| 28726 | The version of the barcode model is not supported |
| 28800 | Specified code type is not supported |
| 28801 | Wrong foreground specified |
| 28802 | Wrong matrix size specified |
| 28803 | Wrong symbol shape specified |
| 28804 | Wrong generic parameter name |
| 28805 | Wrong generic parameter value |
| 28806 | Wrong symbol printing mode |
| 28807 | Symbol region too near to image border |
| 28808 | No rectangular module boundings found |
| 28809 | Couldn't identify symbol finder |
| 28810 | Symbol region with wrong dimension |
| 28811 | Classification failed |
| 28812 | Decoding failed |
| 28813 | Reader programing not supported |
| 28820 | General 2d data code error |
| 28821 | Corrupt signature of 2d data code handle |
| 28822 | Invalid 2d data code handle |
| 28823 | List of 2d data code models is empty |
| 28825 | Invalid 'Candidate' parameter |
| 28829 | Unexpected 2d data code error |
| 28830 | Invalid parameter value |
| 28831 | Unknown parameter name |

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|---|---|
| 28832 | Invalid value for 'polarity' |
| 28833 | Invalid value for 'symbol_shape' |
| 28834 | Invalid symbol size |
| 28835 | Invalid module size |
| 28836 | Invalid value for 'module_shape' |
| 28837 | Invalid value for 'orientation' |
| 28838 | Invalid value for 'contrast_min' |
| 28839 | Invalid value for 'measure_thresh' |
| 28840 | Invalid value for 'alt_measure_red' |
| 28841 | Invalid value for 'slant_max' |
| 28842 | Invalid value for 'L_dist_max' |
| 28843 | Invalid value for 'L_length_min' |
| 28844 | Invalid module gap |
| 28845 | Invalid value for 'default_parameters' |
| 28846 | Invalid value for 'back_texture' |
| 28847 | Invalid value for 'mirrored' |
| 28848 | Invalid value for 'classificator' |
| 28849 | Invalid value for 'persistence' |
| 28850 | Invalid model type |
| 28851 | Invalid value for 'module_roi_part' |
| 28852 | Invalid value for 'finder_pattern_tolerance' |
| 28853 | Invalid value for 'mod_aspect_max' |
| 28854 | Invalid value for 'small_modules_robustness' |
| 28863 | Invalid module aspect ratio |
| 28864 | Invalid layer num |
| 28865 | Wrong data code model file version |
| 28866 | Serialized item does not contain a valid 2D data code model |
| 28900 | Unknown parameter name |
| 28901 | Invalid value for 'num_levels' |
| 28902 | Invalid value for 'optimization' |
| 28903 | Invalid value for 'metric' |
| 28904 | Invalid value for 'min_face_angle' |
| 28905 | Invalid value for 'min_size' |
| 28910 | The projected model is too large " |
| 28920 | Invalid value for 'longitude_min' |
| 28921 | Invalid value for 'longitude_max' |
| 28922 | Invalid value for 'latitude_min' |
| 28923 | Invalid value for 'latitude_max' |
| 28924 | Invalid value for 'cam_roll_min' |
| 28925 | Invalid value for 'cam_roll_max' |
| 28926 | Invalid value for 'dist_min' |
| 28927 | Invalid value for 'dist_max' |
| 28928 | Invalid value for 'num_matches' |
| 28929 | Invalid value for 'max_overlap' |
| 28933 | Invalid value for 'border_model' |
| 28940 | Pose is not well-defined |
| 28941 | Invalid file format for 3D shape model |
| 28960 | Invalid file format for descriptor model |
| 28961 | The version of the descriptor model is not supported |
| 28962 | Invalid value for 'radius' |
| 28963 | Invalid value for 'check_neighbor' |
| 28964 | Invalid value for 'min_check_neighbor_diff' |
| 28965 | Invalid value for 'min_score' |

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| 28966 | Invalid value for 'sigma_grad' |
| 28967 | Invalid value for 'sigma_smooth' |
| 28968 | Invalid value for 'alpha' |
| 28969 | Invalid value for 'threshold' |
| 28970 | Invalid value for 'depth' |
| 28971 | Invalid value for 'number_trees' |
| 28972 | Invalid value for 'min_score_descr' |
| 28973 | Invalid value for 'patch_size' |
| 28974 | Invalid value for 'tilt' |
| 28975 | Invalid value for 'guided_matching' |
| 28976 | Invalid value for 'subpix' |
| 28977 | Too few feature points can be found |
| 28978 | Invalid value for 'min_rot' |
| 28979 | Invalid value for 'max_rot' |
| 28980 | Invalid value for 'min_scale' |
| 28981 | Invalid value for 'max_scale' |
| 28982 | Invalid value for 'mask_size_grd' |
| 28983 | Invalid value for 'mask_size_smooth' |
| 28984 | Model broken |
| 28985 | Invalid value for 'descriptor_type' |
| 28986 | Invalid value for 'matcher' |
| 28987 | Too many point classes -0 model storing in a file is not possible |
| 28988 | Serialized item does not contain a valid descriptor model |
| 29000 | Function not implemented on this machine |
| 29001 | Image to process has wrong gray value type |
| 29002 | Wrong image component (see: get_system(obj_images,H)) |
| 29003 | Undefined gray values |
| 29004 | Wrong image format for operation (too big or too small) |
| 29005 | Wrong number of image components for image output |
| 29006 | String is too long (max. 1024 characters) |
| 29007 | Wrong pixel type for this operation |
| 29008 | Operation not realized yet for this pixel type |
| 29009 | Image is no color image with three channels |
| 29010 | Image acquisition devices are not supported in the demo version |
| 29011 | Packages are not supported in the demo version |
| 29020 | Internal error: Unknown value |
| 29021 | Image domain too small. |
| 29022 | Input dimension too small |
| 29023 | Draw operator has been canceled |
| 29050 | Operator is not available in this restricted version of HALCON |
| 29051 | Packages are not available in this restricted version of HALCON |
| 29052 | The selected image acquisition interface is not available in this restricted version of HAL-CON |
| 29100 | Too many unknown variables in linear equation |
| 29101 | No (unique) solution for the linear equation |
| 29102 | Too little equations in linear equation |
| 29200 | Matrix is not invertible |
| 29201 | Singular value decomposition did not converge |
| 29202 | Matrix has too few rows for singular value partition |
| 29203 | Eigenvalue computation did not converge |
| 29204 | Eigenvalue computation did not converge |
| 29205 | Matrix is singular |

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| 29206 | Function matching did not converge |
| 29207 | Input matrix undefined |
| 29208 | Input matrix with wrong dimension |
| 29209 | Input matrix is not quadratic |
| 29210 | Matrix operation failed |
| 29211 | Matrix is not positive definite |
| 29212 | One element of the matrix is zero: Division by zero |
| 29213 | Matrix is not an upper triangular matrix |
| 29214 | Matrix is not a lower triangular matrix |
| 29215 | One element of the matrix is negative |
| 29216 | Matrix file: Invalid character |
| 29217 | Matrix file: Matrix incomplete |
| 29218 | Invalid file format for matrix |
| 29219 | Resulting matrix has complex values |
| 29220 | Wrong value in matrix of exponents |
| 29221 | The version of the matrix is not supported |
| 29222 | Serialized item does not contain a valid matrix |
| 29230 | Internal error: wrong Node |
| 29231 | Inconsistent red black tree |
| 29250 | Internal error: Wrong LAPACK parameter |
| 29260 | Number of points too small for spherical triangulation |
| 29261 | First three points are collinear in spherical triangulation |
| 29262 | Spherical triangulation contains identical input points |
| 29263 | Internal error: array not allocated large enough for spherical triangulation |
| 29264 | Spherical Voronoi diagram contains degenerate triangle |
| 29265 | Internal error: inconsistent spherical triangulation |
| 29266 | Spherical Voronoi diagram contains self-intersecting polygon |
| 29267 | Internal error: inconsistent spherical polygon data |
| 29268 | Internal error: Ambiguous great circle arc intersection |
| 29269 | Internal error: Ambiguous great circle arc |
| 29270 | Internal error: Illegal parameter |
| 29280 | Not enough points for planar triangular meshing |
| 29281 | The first three points of the triangular meshing are collinear |
| 29282 | Planar triangular meshing contains identical input points |
| 29283 | Invalid points for planar triangular meshing |
| 29284 | Internal error: allocated array too small for planar triangular meshing |
| 29285 | Internal error: planar triangular meshing inconsistent |
| 29300 | Eye point and reference point coincide |
| 29400 | Timeout occurred |
| 29401 | Invalid value for timeout |
| 29450 | Invalid value for 'sub_object_size' |
| 29451 | Invalid value for 'min_size' |
| 29452 | Invalid number of least-squares iterations |
| 29453 | Invalid value for 'angle_step' |
| 29454 | Invalid value for 'scale_r_step' |
| 29455 | Invalid value for 'scale_c_step' |
| 29456 | Invalid value for 'max_angle_distortion' |
| 29457 | Invalid value for 'max_aniso_scale_distortion' |
| 29458 | Invalid value for 'min_size' |
| 29459 | Invalid value for 'cov_pose_mode' |
| 29460 | Model contains no calibration information |
| 29461 | Generic parameter name does not exist |

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| 29462 | Provided camera parameters have different resolution than image |
| 29463 | Invalid file format for deformable model |
| 29464 | The version of the deformable model is not supported |
| 29465 | Invalid 'deformation_smoothness' |
| 29466 | Invalid 'expand_border' |
| 29467 | Model origin outside of axis-aligned bounding rectangle of template region |
| 29468 | Serialized item does not contain a valid deformable model |
| 29500 | 3D Object Model has no points |
| 29501 | 3D Object Model has no faces |
| 29502 | 3D Object Model has no normals |
| 29506 | Invalid file format for 3D surface model |
| 29507 | The version of the 3D surface model is not supported |
| 29508 | Serialized item does not contain a valid 3D surface model |
| 29510 | Invalid 3D file |
| 29511 | Invalid 3D object model |
| 29512 | Unknown file type |
| 29513 | The version of the 3D object model is not supported |
| 29514 | Required attribute missing in 3D object model |
| 29515 | Required points missing in 3D object model |
| 29516 | Required normals missing in 3D object model |
| 29517 | Required triangulation missing in 3D object model |
| 29518 | Required polylines missing in 3D object model |
| 29519 | Required triangle neighborhood missing in 3D object model |
| 29520 | Required polygons missing in 3D object model |
| 29521 | Required 2D mapping missing in 3D object model |
| 29522 | Required primitive missing in 3D object model |
| 29523 | Required 3D shape model missing in 3D object model |
| 29524 | Required extended attribute missing in 3D object model |
| 29525 | Serialized item does not contain a valid 3D object model |
| 29526 | Primitive in 3D object model has no extended data |
| 29527 | Operation invalid, 3D object model already contains triangles |
| 29528 | Operation invalid, 3D object model already contains lines |
| 29529 | Operation invalid, 3D object model already contains faces or polygons |
| 29530 | For at least one input 3D object model no neighbor with sufficient surface overlap is available. |
| 29531 | All components of points must be set at once |
| 29532 | All components of normals must be set at once |
| 29533 | Number of values doesn't correspond to number of already existing points |
| 29534 | Number of values doesn't correspond to number of already existing normals |
| 29535 | Number of values doesn't correspond to already existing triangulation |
| 29536 | Number of values doesn't correspond to length of already existing polygons |
| 29537 | Number of values doesn't correspond to length of already existing polylines |
| 29538 | Number of values doesn't correspond to already existing 2D mapping |
| 29539 | Number of values doesn't correspond to already existing extended attribute |
| 29550 | Triangles of the 3D object model are not suitable for this operator |
| 29551 | Too few suitable 3D points in the 3D object model |
| 29580 | Invalid file format for serialized items |
| 29581 | Serialized item: premature end of file |
| 29600 | Invalid value for 'image_resize_method' |
| 29601 | Invalid value for 'image_resize_value' |
| 29602 | Invalid value for 'rating_method' |
| 29603 | At least one type of image information must be added |

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| 29604 | Sample identifier does not contain color information |
| 29605 | Sample identifier does not contain texture information |
| 29606 | Sample image does not contain enough information |
| 29607 | Sample identifier does not contain unprepared data (use add_sample_identifier_preparation_data) |
| 29608 | Sample identifier has not been prepared yet (use prepare_sample_identifier) |
| 29609 | Sample identifier does not contain untrained data (use add_sample_identifier_training_data) |
| 29610 | Sample identifier has not been trained yet (use train_sample_identifier) |
| 29611 | Sample identifier does not contain result data |
| 29612 | Sample identifier must contain at least two training objects (use add_sample_identifier_training_data) |
| 30000 | no error |
| 30001 | Input invalid |
| 30002 | Input negative |
| 30003 | Input exceeded range |
| 30004 | Memory exceeded boundary |
| 30004 | Memory allocation failure |
| 30006 | Memory pointer null |
| 30007 | DMA failure |
| 30008 | File open failure |
| 30009 | File read failure |
| 30010 | File write failure |
| 30011 | File close failure |
| 30012 | File format failure |
| 30013 | Warning low memory |
| 40000 | No error occurred in camera device. |
| 40001 | Initialization of image chip driver failed. |
| 40002 | Converting image to RGB or HSV failed. |
| 40003 | The capture process timed out. |
| 40004 | Arming video driver failed -> driver is in error state. |
| 40005 | Setting up image chip failed while changing size. |
| 40006 | Setting up video driver failed while changing size. |
| 40007 | Setting up image chip failed while changing brightness. |
| 40008 | Setting light mode failed -> typically UART communication. |
| 40009 | Setting focus pos. failed -> typically UART communication. |
| 40010 | Auto focus process failed -> typically UART communication. |
| 50001 | Indicates the configuration is invalid. |
| 50002 | Indicates the configuration API was not initialized. |
| 50003 | Indicates the configuration API was already initialized. |
| 50004 | Indicates that a function argument was invalid. |
| 50005 | Indicates a channel was defined twice. |
| 50006 | One has tried to define more than 2 quadrature channels. |
| 50007 | Indicates that more than 1 TRIGGER inputs is defined. |
| 50008 | Indicates that more than 1 READY signal is defined. |
| 50009 | Indicates that more than 1 FLASH output is defined. |
| 50010 | Indicates that more than 1 PROCESS output is defined. |
| 50011 | Indicates that more than 1 CAPTURE output is defined. |
| 50012 | Indicates that more than 1 PROJECT_SELECT feedback output defined. |
| 50013 | Indicates that more than 1 PROJECT_SELECT intput is defined. |
| 50014 | Indicates invalid configuration of timer/quadrature. |
| 50015 | Indicates PRU couldn't started. |

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## 18.7. Changelog operating instructions

| Version | Date | Description / changes | Respective software version |
|---|---|---|---|
| 1.0.0 | 18.02.14 | Initial version of operating instructions | Software: 1.0.X<br>Firmware: 1.0.X |
| 1.1.0 | 23.05.14 | Features:<br>• Introduction of project template files<br>• Update of the training demo files<br>• Enhancements of the Module Image Comparison visualization<br>• Magic Wand for Module Threshold and Module Threshold HSV<br>• Enhanced parameters for Module Code 1D/2D<br>• Special character editor for e.g. Device Communication<br>• Text edit supports scientific format<br>• Optimization of the „Advanced Mode" | Software: 1.1.X<br>Firmware: 1.1.X |
| 1.2.0 | 23.02.15 | Features:<br>• Extended functionality of the coordinate system module<br>• Enlarged localizer teach box<br>• Introduction of new measuring methods for the measuring module<br>• User management<br>• New trigger functions / camera module<br>• Trigger queue<br>• Project change via digital I/O<br>• Rename modules<br>• Shortened read timeout for 1D and 2D codes<br>• Introduction of online data monitoring<br>• Industrial Ethernet as trigger input<br>• Expanded data information in Teach+ files<br>• Error handling | Software: 1.2.0<br>Firmware: 1.2.0 |
| 1.3.0 | 17.11.15 | Features:<br>• Project Converter<br>• new languages for the software<br>• Modul OCR<br>• Ethernet/IP<br>• copy Moduls<br>• move Modules | Software: 1.2.0<br>Firmware: 1.2.0 |
| 1.3.1 | 04.03.16 | Features:<br>• Correcting typos | Software: 1.3.x<br>Firmware: 1.3.x |
| 1.3.2 | 12.04.16 | Features:<br>OCR-Tips | Software: 1.3.x<br>Firmware: 1.3.x |
| 1.3.3 | 31.08.16 | • Minor enhancements<br>• Adaptation of the technical data | Software: 1.3.x<br>Firmware: 1.3.x |
| 1.4.0 | 17.02.17 | Features:<br>• Module Pattern matching | Software: 1.4.x<br>Firmware: 1.4.x |

| 1.4.2 | 24.04.17 | Features: <br> • DXF Editor Module Pattern matching | Software: 1.4.x <br> Firmware: 1.4.x |
|-------|----------|-------------------------------------------------|----------------------------------|
| 1.4.5 | 14.08.18 | Correct upgrade and downgrade options | Software 1.4.x <br> Firmware 1.4.x |

## 18.8. Software changelog

### 18.8.1. Firmware changelog

| Version | Release date | Description / changes | Compatibility |
|---------|--------------|-----------------------|---------------|
| 1.2.2 | 12.06.15 | Patch release <br> Bug fixes: <br> • Folder structure will be created on new SD Cardat startup <br> • Loading a configuration from another sensor does not delete existing license keys <br> • Change Projects over display up to 50 projects <br> • Device IO Unit: Module State set on error conditions <br> • Module Statistics: Process time calculated correct <br> • OLED Display: Clear warning symbol <br> • Online Data Monitoring support for large projects <br> • Profinet Sensors can be found <br> • Trigger Input (Industrial Ethernet) link get lost on project load <br> • Handle circular dependencies for images <br> • Coordinate System: No error when points are linked <br> • Device State message in DHCP mode <br> • HW trigger works after use of magic wand <br> • minor bugs | Projects: 1.2.x <br> PC Software: 1.2.x |
| 1.3.0 | 17.11.15 | Minor release <br><br> Features: <br> • Module OCR <br> • Ethernet/IP <br> • Support of weQube C-Mount <br><br> Bug fixes: <br> • no separator between preamble and postamble characters <br> • Output queue can't get asynchron <br> • Profinet trigger resets internal links <br> • PROFINET project load only on project slot change <br> • PROFINET initialize slots after a project change <br> • Localizer on sensor and PC calculate the same result | Projects: 1.3.0 |

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| Version | Release date | Description / changes | Compatibility |
|---|---|---|---|
| 1.3.1 | 26.02.16 | Bug fixes:<br>• Licence check works for large projects<br>• Double Min and Max values available after project load<br>• PROFINET device connect to PLC after update form 1.2.x<br>• Increase performance of Module Filter<br>• OLED only accept a valid password<br>• No crash after project changes<br>• Double values linked to string are not truncated<br>• ReduceTrigger Delay jitter<br>• Minor Bugs | Projects: 1.3.x |
| 1.3.2 | 29.04.16 | Bug fixes:<br>• Error Handling works after Project reopen<br>• Device IO Unit Output Hold Time in ms -PROFINET using webserver may not break the connection<br>• PROFINET Trigger does not crash the sensor<br>• OCR Multiline correct segmentation of 2nd line<br>• FTP Transfer of string files stop after observing | Projects: 1.3.x |
| 1.3.3 | 03.04.18 | Compatible with new flash memory<br><br>**Note!**<br>After updating the device to this version, downgrading to a lower firmware version is no longer possible (see section "8.3. Upgrade and Downgrade Options" on page 38). | Projekte 1.3.x |
| 1.3.4 | 14.08.18 | Bug fixes:<br>• Loading projects and creating new projects<br><br>**Note!**<br>After updating the device to this version, downgrading to a lower firmware version is no longer possible (see section "8.3. Upgrade and Downgrade Options" on page 38). | Projects 1.3.x |

| Version | Release date | Description / changes | Compatibility |
|---------|--------------|----------------------|---------------|
| 1.4.0 | 17.02.17 | Minor Release<br>Functions:<br>• Rotation of the input image<br>• White balancing (color version)<br>• Toggle bit<br>• Pattern matching<br>• Industrial Ethernet, new data types<br>• Measuring module, point usage<br>• Logic module, several inputs<br>• Math module, several inputs<br>• Extended temperature range<br><br>Bug fixes:<br>• Read-out box with weQube C mount<br>• Ethernet/IP byte order is not changed correctly after loading a project.<br>• Changing over to the flash mode switches internal illumination off.<br>• Memory leak during project loading eliminated<br>• Profinet trigger causes processor to crash | Projects: 1.x.x<br>Firmware: 1.4.x |
| 1.4.1 | 15.03.17 | Bug fixes:<br>• When a new Halcon license is added, existing Halcon licenses for the weQube are lost. | Projects: 1.4.x<br>Firmware: 1.4.x |
| 1.4.2 | 03.05.17 | Bug fixes:<br>• Projectconverter<br>• Input linking for Module Pattern Match doesn't work<br>• Sensor reboot<br>• Magic wand Module Threshold HSV blocks Software<br>• Readtimeout Modul Pattern Match<br>• Module Math rounding error<br>• Firmwareupdate can fail in special situations | Projects: 1.4.x<br>Firmware: 1.4.x |
| 1.4.3 | 13.12.17 | Features:<br>• Pattern matching module: Extended teach-in and timeout performance<br><br>Bug fixes:<br>• FTP connection<br>• Memory assignment in the cluster module<br>• Pattern matching module: Detected patterns correspond with the results list<br>• Memory handling in the 1D code module<br>• Teach+ with display device | Projects: 1.4.x<br>Firmware: 1.4.x |

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| Version | Release date | Description / changes | Compatibility |
|---------|--------------|----------------------|---------------|
| 1.4.4 | 03.04.18 | • Compatible with new flash memory<br><br>Bug fixes:<br>• Optimizations for displaying the website at HMIs<br>• Correction of angles indicated in the pattern matching module<br><br>**Note!**<br>• After updating the device to this version, downgrading to a lower firmware version is no longer possible (see section "8.3. Upgrade and Downgrade Options" on page 38). | Projects: 1.4.x<br>Firmware: 1.4.x |
| 1.4.5 | 20.07.18 | Bug fixes:<br>• Improved Profinet behavior after a reconnect<br><br>**Note!**<br>• After updating the device to this version, downgrading to a lower firmware version is no longer possible (see section "8.3. Upgrade and Downgrade Options" on page 38). | Projets: 1.4.x<br>Firmware 1.4.x |

**18.8.2. Software changelog**

| Version | Release date | Description / changes | Compatibility |
|---|---|---|---|
| 1.0.4 | 27.01.14 | Initial market launch version.<br>This software version was delivered on the CDs with the first products | Projects: 1.0.x<br>PC Software: 1.0.x |
| 1.0.7 | 18.02.14 | Final market launch version<br>Features:<br>• Introduction of project template files<br>• Update of the training demo files<br>• Enhancements of the Module Image Comparison visualization<br>Bug fixes:<br>• FTP connection<br>• Timeout handling<br>• Minor bug fixes (see bugzilla for details) | Projects: 1.0.x<br>PC Software: 1.0.x |
| 1.1.0 | 26.05.14 | First minor release<br>Features:<br>• Magic Wand for Module Threshold and Module Threshold HSV<br>• Enhanced parameters for Module Code 1D/2D<br>• Special character editor for e.g. Device Communication<br>• Text edit supports scientific format<br>• Optimization of the „Advanced Mode"<br>Bug fixes:<br>• FTP<br>• Updater<br>• Teach$^+$ downloader<br>• License file<br>• Memory leaks<br>• Timeout handling e.g. loading of complex project files<br>• Minor bug fixes (see bugzilla for details)<br>Updates:<br>• USB dongle driver V6.6 | Projects: 1.1.x/1.0.x<br>PC Software: 1.1.x/1.0.x |
| 1.1.1 | 26.05.14 | Features:<br>• Text edit supports scientific format<br>Bug fixes:<br>• Memory leaks<br>• Minor bug fixes | Projects: 1.1.x/1.0.x<br>PC Software: 1.1.x/1.0.x |

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| Version | Release date | Description / changes | Compatibility |
|---------|--------------|------------------------|----------------|
| 1.1.5 | 09.09.14 | Features:<br>• Signed installer<br>• „Download" link<br>• New parameters in Module Application: Process Time Last Run; Module State Last Run<br>• New clean up functionality after deleting a tool in the Module Measure → tool dependencies are checked and all related tools will be removed.<br>Bug fixes:<br>• Loading .w_r file fails if path contains special characters like „ä"<br>• Minor bug fixes | Projects: 1.1.x/1.0.x<br>PC Software: 1.1.x/1.0.x |
| 1.1.6 | 08.12.14 | Bug fixes:<br>• Image defects, small image excerpts<br>• Streaks in the image / dark images after restarting<br>• Image comparison module<br>• Barcode module: sporadic no-reads<br>• Different results with the same image defects<br>• LIMA run command<br>• Flash memory | Projects: 1.1.x / 1.0.x<br>PC Software: 1.1.x / 1.0.x |
| 1.1.7 | 12.12.14 | Bug fixes:<br>• Faulty read-out of the 1D code license file | Projects: 1.1.x / 1.0.x<br>PC Software: 1.1.x / 1.0.x |
| 1.2.0 | 23.02.15 | Minor release.<br>Features:<br>• Device Camera: **New image acquisition is independent from the algorithm processing as long the image buffer (10 images) does have free capacity.**<br>• Device Camera: Illumination setting can be linked (Light Internal, Light External)<br>• Device Camera: ProfiNet Trigger<br>• Device Communication (Digital Output): **Forced to the enhancements in the Device Camera the "Ready" digital output is no longer supported the way it was in earlier versions. New flags "Process" and "Capture" are available in new projects. If you load a version 1.1.x or earlier in the sensor, the deprecated "Ready" output keeps in the project tree as is. In this case the sensor hardware signals the "Ready" flag as a "Process" flag!**<br>• Device Display: Linking the I/O states to the Device Display<br>• Device IO Unit: Project change by digital I/O control<br>• Module Code 1D: Property "Read Timeout" unit changed from [s] to [ms]. Conversion is automatically done if needed. | Projects: 1.2.x / 1.2.x<br>PC Software: 1.2.x / 1.2.x |

| Version | Release date | Description / changes | Compatibility |
|---------|--------------|----------------------|---------------|
| 1.2.0 | 23.02.15 | • Module Code 1D: Advanced settings<br>• Module Code 2D: Property "Read Timeout" unit changed from [s] to [ms]. Conversion is automatically done if needed.<br>• Module Measure: New tools<br>Find Arc<br>Segments on Line<br>Segments on Circle<br>Segments on Arc<br>• Module Coordinate System: New tools<br>Edge on Arc<br>Segment on Line<br>Segment on Circle<br>Segment on Arc<br>• Linkable point (you may use a point calculated by any tool in the tree e.g. Center of Gravity of the Module Cluster)<br>• Module Application: Project Version<br>• Module Localizer: Search Box can be resized now. Performance warning!<br>• Error handling for communication devices (value substitution)<br>• Teach+: New data:<br>Device type (article number)<br>IP settings<br>• Teach+: File name time stamp support<br>• LIMA communication over RS232<br>• GUI: Online Data Monitoring:<br>Digital I/O status<br>Available memory chart<br>Processing time chart<br>• GUI: User account support<br>• GUI: Manual trigger by the user (press the key "t")<br>• GUI: Rename support of tools (Device, Module) in the project tree<br>Updates:<br>• Translations | Projects: 1.2.x / 1.2.x<br>PC Software: 1.2.x / 1.2.x |
| 1.2.2 | 12.06.15 | Patch release<br>Bug fixes:<br>• Searching for connected sensors failed in case of a different subnet mask<br>• Module Measure: No calculation in some complex project configurations<br>• Decimal separator<br>• No zooming of modifiers, characters etc. from now on<br>• Minor bug fixes<br>• Translations | Projects: 1.2.x<br>Firmware: 1.2.x |

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| Version | Release date | Description / changes | Compatibility |
|---|---|---|---|
| 1.3.0 | 17.11.15 | Minor Release<br><br>Features:<br>Localization/ translations: Complete support of English, Chinese, Turkey, Hungarian, Dutch, Portuguese, Spanish, Italian, German, French<br>Project converter<br>Application starter for all supported project versions<br>File association support: *.w_p, *.w_r, *.w_t<br>Move \| Copy \| Paste of modules in the project tree. (Info: Devices can not be copied due to hardware dependencies)<br>Visualization of Device Indicator status in the Image Container Viewer<br>Visibility handling of selected tools<br>Open dialog supports all file type filters<br>Default project name at "Save as..."<br>Path of node by right click on node (Advanced Mode needs to be activated)<br>Minor logging support<br><br>Bug fixes:<br>Minor bug fixes<br><br>Updates:<br>Manuals, English and German<br>Localization/ translations | Projects: 1.x.x<br>Firmware: 1.3.0 |
| 1.3.1 | 26.02.16 | Bug fixes:<br>• Application crash by drag and drop action of modules in the Navigator view. This occurs in combination with special characters only!<br>• Device Camera Readout Box representation when Subsampling active<br>• Double Min and Max values available after project load<br>• Rounding of double data editor<br>• Update training demos<br>• Project preview works in online mode | Projects: 1.1.x<br>Firmware: 1.3.x |
| 1.3.2 | 29.04.16 | Bug fixes:<br>• Update Manual section Module Threshold<br>• OCR Multiline correct segmentation of 2nd line<br>• Link list do not allow illegal links | Projekte 1.1.x<br>Firmware 1.3.x |

| Version | Release date | Description / changes | Compatibility |
|---------|--------------|----------------------|---------------|
| 1.4.0 | 17.02.17 | Minor Release<br>Functions:<br>• Rotation of the input image<br>• White balancing (color version)<br>• Toggle bit<br>• Pattern matching<br>• Industrial Ethernet, new data types<br>• Measuring module, point usage<br>• Logic module, several inputs<br>• Math module, several inputs<br>• Extended temperature range<br><br>Updates:<br>• Operating instructions<br>• Translations | Projects: 1.1.x<br>Firmware: 1.4.x |
| 1.4.1 | --- | --- | --- |
| 1.4.2 | 03.05.17 | Bug fix release:<br>Features:<br>Module Pattern Match – Activation of the Pattern Match model editor functionality.<br>Bug fixes:<br>• Project Converter – Several issues.<br>  **Note:** Reconvert projects from 1.3 to 1.4 with the latest converter to fix these issues!<br>• Module Pattern Match – Teach by general I/O action input fixed.<br>• Minor bug fixes and performance optimizations.<br><br>Updates:<br>Manuals, English, German, Italian<br>Localization/ translations | Projects: 1.1.x<br>Firmware: 1.4.x |
| 1.4.3 | 13.12.17 | Features:<br>• Pattern matching module: Extended teach-in and timeout performance<br><br>Bug fixes:<br>• FTP connection<br>• Memory assignment in the cluster module<br>• Pattern matching module: Detected patterns correspond with the results list<br>• Memory handling in the 1D code module<br>• Teach+ with display device | Projects: 1.4.x<br>Firmware: 1.4.x |

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| Version | Release date | Description / changes | Compatibility |
|---------|--------------|----------------------|---------------|
| 1.4.4 | 03.04.18 | • Compatible with new flash memory<br><br>Bug fixes:<br>• Optimizations for displaying the website at HMIs<br>• Correction of angles indicated in the pattern matching module<br><br>**Note!**<br>After updating the device to this version, downgrading to a lower firmware version is no longer possible (see section "8.3. Upgrade and Downgrade Options" on page 38). | Projects: 1.4.x<br>Firmware: 1.4.x |
| 1.4.5 | 20.07.18 | Bug fixes:<br>• Improved Profinet behavior after a reconnect<br>• Improved behavior at firmware updates<br><br>**Note!**<br>After updating the device to this version, downgrading to a lower firmware version is no longer possible (see section "8.3. Upgrade and Downgrade Options" on page 38). | Projets 1.4.x<br>Firmware 1.4.x |

# 19. EU Declaration of Conformity

The EU declaration of conformity can be found on our website at www.wenglor.com in download area.