Contents and general safety information

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Edition .............................. en 0608NH

Designation ............................ P.BE-SBO-Q-EN

Order-no. .............................. 548 319

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Contents and general safety information

Intended use

The Compact Vision System type SBO-...-Q-... has been designed for installation in a machine or into an automated system. It allows parts to be analyzed with respect to quality and position.

The Compact Vision System type SBO-...-Q-... may only be used as follows:

– only in an industrial environment
– as intended
– in original status without unauthorized modifications. Only the conversions or modifications described in the documentation supplied with the product are permitted.
– in perfect technical condition.

When used together with conventional accessory components, such as sensors and actuators, the specified limits for pressures, temperatures, electrical data, torques etc. must be complied with. National and local safety regulations must also be observed.
Range of application and certifications

The product fulfils the requirements of the EU directives and is marked with the CE marking symbol.

Standards and test values, which the product must comply with and fulfil, can be found in the section “Technical data”. The product-relevant EU directive can be found in the declaration of conformance.

Product designs, which are marked with the following symbol, fulfil the requirements of the:

- Recognized Component Marks for Canada and the United States

Only for use in Class 2 circuits.

Note
Note the following if your application must comply with the specifications of the “Recognized Component Marks for Canada and the United States:”

- Rules for complying with the UL certification can be found in the UL-specific brief operating instructions. The technical specifications listed there apply first.
- The technical specifications in this documentation may show deviating values.
Safety information

**Caution**
During commissioning and programming, the safety regulations listed in this manual and in the documentation for the controller and the other components used must always be observed.

The user must ensure that no one is within the sphere of influence of the connected actuators. Access to the possible danger area must be prevented by suitable measures such as barricades and warning signs.

---

**Caution**
Electrostatically sensitive components! Electrostatic discharges can damage the internal electronics.
- Do not open the housing. Observe the handling specifications for electrostatically sensitive devices.

---

**Caution**
A dirty and scratched lens or a dirty and scratched safety window can lead to visual defects. Make sure that the safety window / lens are not scratched. Do not use any abrasive cleaning agents.

Clean the lens or the safety window if they are dirty or if there are dirt deposits on them:
- with an air gun or with clean un lubricated compressed air.
- with a soft moist cloth and non-abrasive cleaning agents.
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Caution
If the permissible temperature range is exceeded, e.g. by powerful external sources of light, this can lead to system faults and cause damage.

- Mount the Compact Vision System in a well ventilated location, especially screened from the heat emitted by other devices and from sources of light.

Service

Please consult your local Festo repair service if you have any technical problems.

Target group

This description is intended exclusively for technicians trained in control and automation technology who have experience in installing and commissioning electronic systems.
Important user instructions

Danger categories

This description contains instructions on the possible dangers which can occur if the product is not used correctly. This information is marked with a signal word (Warning, Caution, etc.), printed on a shaded background and marked additionally with a pictogram. A distinction is made between the following danger warnings:

- **Warning**
  
  ... This means that failure to observe this instruction may result in serious personal injury or material damage.

- **Caution**
  
  ... This means that failure to observe this instruction may result in personal injury or material damage.

- **Note**
  
  ... This means that failure to observe this instruction may result in material damage.

The following pictogram marks passages in the text which describe activities using electrostatically sensitive devices:

Electrostatically sensitive devices: Improper handling can result in damage to components.
Identification of special information
The following pictograms mark passages in the text containing special information.

**Pictograms**

Information:
Recommendations, tips and references to other sources of information.

Accessories:
Information on necessary or useful accessories for the Festo product.

Environment:
Information on the environment-friendly use of Festo products.

**Text designations**

- The bullet point indicates activities which may be carried out in any order.

1. Numerals denote activities which must be carried out in the sequence specified.
   - Arrowheads indicate general lists.
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Notes regarding this description

Note
This manual refers to the following versions:

<table>
<thead>
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<th>Hardware/software</th>
<th>Version</th>
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<td>Compact Vision System SBO..-Q...</td>
<td>from release 3.2.0.0 from hardware version AB0905</td>
</tr>
<tr>
<td>CheckKon</td>
<td>from Version 4.0</td>
</tr>
<tr>
<td>CheckOpti</td>
<td>from Version 3.0</td>
</tr>
<tr>
<td>SBO-DeviceManager</td>
<td>from Version 1.0</td>
</tr>
</tbody>
</table>

Tab. 0/1: Hardware versions and software releases

This description contains general basic information on connecting, installing and operating the Compact Vision System. Additional information on commissioning, parameterizing and diagnosing with the software packages can be found in the software package help systems.

<table>
<thead>
<tr>
<th>Type</th>
<th>Title</th>
<th>Contents</th>
</tr>
</thead>
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<td>Electronics description (this description)</td>
<td>Compact Vision System type SBO..-Q...</td>
<td>Connecting, installing and operating the Compact Vision System</td>
</tr>
<tr>
<td>Help system for the CheckKon software</td>
<td>CheckKon Help</td>
<td>Functional description of CheckKon</td>
</tr>
<tr>
<td>Help system for the CheckOpti software</td>
<td>CheckOpti Help</td>
<td>Functional description of CheckOpti</td>
</tr>
<tr>
<td>Description</td>
<td>SBO-DeviceManager Help</td>
<td>Functional description of the SBO-DeviceManager</td>
</tr>
</tbody>
</table>

Tab. 0/2: Documentation for the Compact Vision System
Product-specific terms and abbreviations

The following product-specific abbreviations are used in this description:

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<thead>
<tr>
<th>Term/abbreviation</th>
<th>Meaning</th>
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<tr>
<td>Aperture</td>
<td>Opening through which light passes through the lens onto the image sensor surface. The larger the opening or the aperture is, the more light will reach the sensor. When the aperture opens, the depth of focus will be reduced. The depth of focus increases the further the aperture is closed (larger f-stop). Smaller aperture openings make longer exposure times necessary. Shorter exposure times require larger aperture openings.</td>
</tr>
<tr>
<td>Auto MDI-X</td>
<td>Recognizes the configuration of the other station and adapts the transmitter and receiver cables of a network connection automatically.</td>
</tr>
<tr>
<td>CheckKon</td>
<td>Software package for configuration and commissioning</td>
</tr>
<tr>
<td>CheckOpti</td>
<td>Software package for creating test programs</td>
</tr>
<tr>
<td>CMOS sensor</td>
<td>Opto-electronic sensor which converts light signals into electric signals. In addition to the pure sensor function, functions for image conversion are built into the chip, e.g. lighting check and contrast correction.</td>
</tr>
<tr>
<td>CP cable</td>
<td>Special cable used to connect the various CP modules in a CP string.</td>
</tr>
<tr>
<td>CP connection</td>
<td>Socket or plug on the CP modules which allows the modules to be interconnected using the CP cable.</td>
</tr>
<tr>
<td>CP node</td>
<td>CP field bus node with/without field bus connection, to which the I/O modules are connected.</td>
</tr>
<tr>
<td>CP master</td>
<td>Collective term for modules with one or more CP connections to which one CP string each can be connected. CP masters are the CPX-CP interface, CP field bus node, CPV Direct or CP interfaces.</td>
</tr>
<tr>
<td>CP modules</td>
<td>Collective term for the various modules that can be integrated in a CP system.</td>
</tr>
<tr>
<td>CP string</td>
<td>Entirety of the CP modules and CP cables connected together to a CP master’s CP connection.</td>
</tr>
<tr>
<td>CP system</td>
<td>Complete electrical installation system consisting of a CP master with one or more CP strings.</td>
</tr>
<tr>
<td>Term/abbreviation</td>
<td>Meaning</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td>CP valve terminal</td>
<td>Type 10 CPV valve terminal or type 12 CPA valve terminal, each with a CP connection (also regarded as CP modules).</td>
</tr>
<tr>
<td>CPI modules</td>
<td>CP modules with extended functionality</td>
</tr>
<tr>
<td>CPX modules</td>
<td>Common term for the various modules which can be incorporated in a CPX terminal.</td>
</tr>
<tr>
<td>CPX terminal</td>
<td>Complete system consisting of CPX modules with or without pneumatics.</td>
</tr>
<tr>
<td>Depth of field</td>
<td>see depth of focus</td>
</tr>
<tr>
<td>Depth of focus</td>
<td>The spatial area in front of and behind the focussed object which is still sharp (also known as depth of field). The depth of field depends on the focal depth of the lens and the set aperture. Short focal depths with small aperture openings lead to larger depth of field.</td>
</tr>
<tr>
<td>edge-controlled</td>
<td>The detection of a signal (e.g. input) reacts to the rising or falling edge.</td>
</tr>
<tr>
<td>Ethernet</td>
<td>Physical protocol and network for connecting various devices</td>
</tr>
<tr>
<td>Exposure time</td>
<td>The time during which the CMOS sensor is exposed to light during recording. The longer the exposure time, the more light will penetrate. The choice of exposure time depends e.g. on the movement speed, the light available and the light sensitivity of the sensor (see also sensor gain). With moving objects excessive exposure times result in blurred pictures.</td>
</tr>
<tr>
<td>Falling edge</td>
<td>Transition from logical 1 to logical 0 (falling)</td>
</tr>
<tr>
<td>Feature</td>
<td>Values defined by the computer (e.g. length) are determined from the images of a part and are used for making an analysis.</td>
</tr>
<tr>
<td>Fieldbus node</td>
<td>Provides the connection to specific fieldbuses. Conducts control signals to the connected modules and monitors their ability to function.</td>
</tr>
<tr>
<td>Focal depth</td>
<td>Long focal depths create a large image, short focal depths create a wide-angle image. Lenses with variable focal depths are known as zoom lenses. Lenses with longer focal depths usually have less depth of focus and less light intensity.</td>
</tr>
<tr>
<td>Gain</td>
<td>see sensor gain</td>
</tr>
<tr>
<td>I</td>
<td>Digital input</td>
</tr>
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<th>Meaning</th>
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</thead>
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<tr>
<td>Input module</td>
<td>Input module</td>
</tr>
<tr>
<td>I/O modules</td>
<td>Collective term for the modules which provide digital inputs and outputs (e.g., CPX I/O modules, CP input modules and CP output modules).</td>
</tr>
<tr>
<td>I/Os</td>
<td>Digital inputs and outputs</td>
</tr>
<tr>
<td>Logical 0</td>
<td>Input or output supplies 0 V</td>
</tr>
<tr>
<td>Logical 1</td>
<td>Input or output supplies 24 V</td>
</tr>
<tr>
<td>O</td>
<td>Digital output</td>
</tr>
<tr>
<td>Output module</td>
<td>Output module</td>
</tr>
<tr>
<td>PLC/IPC</td>
<td>Programmable logic controller/industrial PC</td>
</tr>
<tr>
<td>Rising edge</td>
<td>Transition from logical 0 to logical 1 (rising)</td>
</tr>
<tr>
<td>SBO-DeviceManager</td>
<td>Software package for setting the network properties and firmware</td>
</tr>
<tr>
<td>Sensor gain</td>
<td>Influences the light sensitivity of the sensor. If the gain is increased, the light sensitivity will also be increased. Excessive gain can lead to grainy pictures.</td>
</tr>
<tr>
<td>status-controlled</td>
<td>The detection of a signal (e.g. input) reacts to a logical 1 or logical 0.</td>
</tr>
<tr>
<td>String allocation</td>
<td>Type and sequence of the CP modules connected to one or more CP strings.</td>
</tr>
<tr>
<td>TCP/IP</td>
<td>Combination of the protocols TCP and IP, the most-widely used protocol in communication via Ethernet.</td>
</tr>
<tr>
<td>Test program</td>
<td>Definition of the parts to be detected and the features to be determined</td>
</tr>
</tbody>
</table>

Tab. 0/3: Product-specific terms and abbreviations
System overview

Chapter 1
1. System overview

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   1.5 Selection of a lens for SBOC ............................................ 1-12
   1.6 Lighting selection ............................................................ 1-15
1. System overview

1.1 Structure of the SBO Compact Vision System

Components

The SBO Compact Vision System is an intelligent camera with integrated electronics for image processing and communication. It is enclosed in a compact and sturdy housing and has:

- an imaging CMOS sensor with various resolutions, depending on the model, in colour or monochrome
- interfaces for communication and for connecting external devices
- for type SBOI:
  a built-in lens and built-in LED lighting
- for type SBOC:
  a standardised C-mount lens socket (matching lenses as well as optical accessories, such as filters and other lens elements, are available on request).

Function

The Compact Vision System SBO..-Q... allows visual test functions to be integrated at low cost in your machines and systems for analyzing parts for quality and position.

The configuration, commissioning and operation of the Compact Vision System SBO..-Q... are done with the software packages CheckKon, CheckOpti and the SBO-DeviceManager.

User-specific firmware versions can be loaded into the device for special applications.
1. System overview

Networking and control

The Compact Vision System can be linked directly to the PC via the Ethernet interface. Evaluations can be controlled via digital I/Os or by a PC.

1. Compact Vision System (here type SBOC-...)
2. PC with software packages

Fig. 1/1: Direct networking with the PC

1. Hub / switch
2. PC with software packages
3. Compact Vision System (here type SBOC-...)

Fig. 1/2: Camera network
1. System overview

1.2 Variants

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<tr>
<th>Feature</th>
<th>Type code</th>
<th>Advantages/range of application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor image control system</td>
<td>SBO</td>
<td></td>
</tr>
<tr>
<td>Design</td>
<td>I-...</td>
<td>Especially suitable for short working distances (± 22 mm to approx. 1000 mm, longer distances lead to loss of sharpness)</td>
</tr>
<tr>
<td>Design</td>
<td>C-...</td>
<td>Built-in lighting for distances up to approx. 200 mm</td>
</tr>
<tr>
<td>Design</td>
<td>Q-...</td>
<td>Simple to integrate due to compact design</td>
</tr>
<tr>
<td>Sensor</td>
<td>R1B (VGA resolution, monochrome)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R1C (VGA resolution, colour)</td>
<td></td>
</tr>
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Tab. 1/1: Type codes

<table>
<thead>
<tr>
<th>Type</th>
<th>Features</th>
<th>Advantages/range of application</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBOI-Q-R1B</td>
<td>- CMOS sensor (resolution 640 x 480 pixels; ½ inch; monochrome)</td>
<td>- Especially suitable for short working distances (± 22 mm to approx. 1000 mm, longer distances lead to loss of sharpness)</td>
</tr>
<tr>
<td></td>
<td>- Interfaces: Ethernet, digital I/Os and CAN</td>
<td>- Built-in lighting for distances up to approx. 200 mm</td>
</tr>
<tr>
<td></td>
<td>- Built-in lens</td>
<td>- Simple to integrate due to compact design</td>
</tr>
<tr>
<td></td>
<td>- Built-in LED lighting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Protection classes IP65 and IP67</td>
<td></td>
</tr>
<tr>
<td>SBOC-Q-R1B</td>
<td>- CMOS sensor and interfaces such as type SBOI-Q-R1B</td>
<td>- Any lens with a C-mount thread can be used</td>
</tr>
<tr>
<td></td>
<td>- standardized C-mount thread for lens fastening (external lens)</td>
<td>2) (selectable focal depth)</td>
</tr>
<tr>
<td></td>
<td>- No built-in lighting</td>
<td>- Especially fast and high-quality lenses for improving the imaging properties can be used</td>
</tr>
<tr>
<td></td>
<td>- Protection classes IP65 and IP67</td>
<td>- Filters and lens elements depending on the lens</td>
</tr>
<tr>
<td>SBOI-Q-R1C</td>
<td>- like type SBOI-Q-R1B only CMOS sensor in colour</td>
<td></td>
</tr>
<tr>
<td>SBOC-Q-R1C</td>
<td>- like type SBOC-Q-R1B only CMOS sensor in colour</td>
<td></td>
</tr>
</tbody>
</table>

1) Only in combination with the supplied protective tubing
2) Lenses with CS-mount thread without protective tubing can also be used (see section 1.5).
3) Entocentric, telecentric or hypercentric lenses are also possible

Tab. 1/2: Variants of the Compact Vision System type SBO...-Q-R1B
1. System overview

1.2.1 Mode of operation

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>The Compact Vision System can communicate via the network with the PC or with a PLC by means of the Ethernet interface. Other I/O options are available via the CAN interface.</td>
</tr>
<tr>
<td>Commissioning</td>
<td>For commissioning and operation, the corresponding software packages are used (see also Chapter 1.3).</td>
</tr>
</tbody>
</table>

The Compact Vision System of type SBO...-Q-... has different image sensors, depending on the model.

The available processing functions are built into the operating system (firmware) of the device.
1. System overview

1.2.2 Display and connecting elements

1. Built-in lens and LED lighting behind the safety window
2. Status LEDs
3. CAN interface
4. Ethernet interface
5. Power supply and digital I/Os
6. Focus adjustment

Fig. 1/3: Display and connecting element type SBOI-Q-...

1. Protective tubing
2. Lens (on request)
3. Status LEDs
4. CAN interface
5. Ethernet interface
6. Power supply and digital I/Os

Fig. 1/4: Display and connecting element type SBOC-Q-...
1. System overview

<table>
<thead>
<tr>
<th>Connection</th>
<th>Description</th>
</tr>
</thead>
</table>
| 24 V DC    | Power supply and digital I/Os
- Operating and load voltage supplies
- I/O circuitry (2 digital inputs and 3 digital outputs) |
| Ethernet   | Ethernet interface
- Communication with higher-order devices, e.g. the PC or PLC
- Data output (e.g. analysis data, etc.) |
| Bus        | CAN interface for extending the I/O functionality of the device |

Tab. 1/3: Connections of the Compact Vision System
1. System overview

1.3 Software packages

The software packages CheckKon, CheckOpti and SBO-DeviceManager help with commissioning and operation. They can run under the operating systems Windows® 2000 and XP and provide a user-friendly interface.

To find out what minimum requirements your PC must fulfil in connection with the software packages, see the Help for the respective software package.

The CheckKon software package provides the following functions:

<table>
<thead>
<tr>
<th>Subject</th>
<th>Function</th>
</tr>
</thead>
</table>
| Configuration and commissioning | - Defining the signal behaviour  
                              | - Defining the frame rate, sensor gain                                   
                              | - Defining the evaluation and output functions                         |
| Analysis                    | - Display of evaluated parts, live images, statistics and handling of test programs |
| Diagnosis                   | - Display of device properties                                          
                              | - Display of errors                                                     |
| Service                     | - System documentation                                                  |

Tab. 1/4: CheckKon function

The CheckOpti software package provides the following functions:

- Creation of test programs
1. System overview

The SBO-DeviceManager software package provides the following functions:

- Changing the network settings of the device (IP address, gateway, etc.)
- Transferring firmware to the device

1.4 Accessories

<table>
<thead>
<tr>
<th>Type</th>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIM-M12-8GD-2-PU</td>
<td>Plug sockets with cable</td>
<td>Cable for operating voltage supply</td>
</tr>
<tr>
<td>SIM-M12-8GD-5-PU</td>
<td>Plug sockets with cable</td>
<td>Straight socket, M12x1, 8-pin, core ends tin-plated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 m long</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 m long</td>
</tr>
<tr>
<td>SBOA-K30E-M12S</td>
<td>Cable</td>
<td>Ethernet cable for short-time use as a diagnostic cable 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Straight socket, M12, 4-pin, d-coded</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RJ-45 Ethernet plug</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 m long</td>
</tr>
<tr>
<td>SBOA-K20CP-SUP</td>
<td>Cable</td>
<td>CAN cable for use of the I/O extension for power supply and connection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 m long</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Plug, M12x1, 4-pin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Socket, 5-pin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Socket, M12x1, 5-pin</td>
</tr>
<tr>
<td>SBOA-K20CP-WS</td>
<td>Cable</td>
<td>CAN cable for using the device as a CPI module</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 m long</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Angled plug, M9x0.5, 5-pin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Straight plug, M12x1, 5-pin</td>
</tr>
<tr>
<td>SBOA-HMSV-39</td>
<td>Adapter-BS</td>
<td>Adapter kit for mounting with screw-on adapter plate (included in the adapter kit)</td>
</tr>
</tbody>
</table>

1) Cables and plug connectors for continuous use in an industrial environment are commercially available, e.g. from HARTING Electronics GmbH & Co. KG (product program Harax® M12 or from Harting RJ Industrial®) or from Franz Binder GmbH + Co. electrical components KG (series 825)
1. System overview

<table>
<thead>
<tr>
<th>Type</th>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBOA-HMSV-40</td>
<td>Adapter-BS</td>
<td>Adapter kit for connecting with screw-on adapter plate, e.g. adapter plate type HMSV-11 (not included in the adapter kit)</td>
</tr>
<tr>
<td>SBOA-HMSV-41</td>
<td>Adapter-BS</td>
<td>Adapter kit. The adapter has an internal thread G 1/4” for mounting to a commercially-available photo/video tripod.</td>
</tr>
<tr>
<td>SBOL-12</td>
<td>Lens</td>
<td>Standard lens</td>
</tr>
<tr>
<td>SBOL-25</td>
<td>Lens</td>
<td>– Focal depth 12 mm</td>
</tr>
<tr>
<td>SBOL-C-5</td>
<td>Adapter</td>
<td>5 mm spacer ring (CS mount to C mount)</td>
</tr>
<tr>
<td>SBOL-IP-50</td>
<td>Cylinder barrel BG</td>
<td>Protective tubing</td>
</tr>
</tbody>
</table>

Tab. 1/5: Accessories
1.5 Selection of a lens for SBOC

No lens is included in the delivery of the SBOC-Q-... The lens is available as an accessory for the device.

**Note**
Protection classes IP65 and IP67 can only be fulfilled in combination with the protective tubing (see Section A.4 Technical Data).

**Lens dimensions when the protective tubing is used**

Please observe the following if you wish to use the protective tubing:

- The maximum possible lens diameter is 38 mm
- The maximum possible length of the lens from the front edge of the lens to the flange surface of the thread side is 42 mm.

**Note**
- Note that with most lenses the lens length changes when the focus is re-adjusted. The setting “infinite” usually leads to the shortest lens dimension.

**Operation without protective tubing**

If you do not wish to use the protective tubing, you can use lenses of the standard CS-mount.

If you use C-mount lenses without protective tubing, you must screw in a 5 mm spacer ring in place of the protective tubing, in order to guarantee correct dimensions (see Section A.4).
Ascertaining the appropriate focal depth

The somewhat more expensive lenses with adjustable aperture angle (zoom) enable you to adapt the field of vision to your requirements. Lenses with fixed focal depth are less expensive. Whether a lens is suitable depends on:

- the smallest possible distance where image is still sharp (Minimum Object Distance - MOD)
- focal depth
- luminous intensity
- the permissible distortion.

The object distance, i.e. the distance between the camera and the object to be photographed, can be calculated according to the laws of optics. Please note that the following calculation formula describes the distance between the so-called main level and the object to be represented. With a thin lens element the main level is the centre of the lens. With a lens, the position of the main level cannot be so easily determined. As an estimate, you can assume the centre of the lens to be the main level.

<table>
<thead>
<tr>
<th>Formula</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>( g = f \times (G : B + 1) )</td>
<td>( g ) : Object distance (working distance) ( G ) : Object size (size of field of vision) ( f ) : Focal depth ( B ) : Image or sensor size ¹)</td>
</tr>
</tbody>
</table>

¹) The horizontal dimension of the sensor is 6.61 mm.

Tab. 1/6: Calculation formula
1. System overview

The following diagram offers help for other fixed focal depths and the necessary distances for certain horizontal fields of vision. The vertical field of vision can be obtained by multiplying the horizontal field of vision by 0.75 (=480/640).

The diagram serves as a rough estimate.

Fig. 1/5: Distances for other fixed focal depths

Examples:

- A lens with focal depth 12 generates a field of vision approx. 100 mm wide at a working distance of 200 mm.

- A lens with focal depth 25 generates a field of vision approx. 100 mm wide at a working distance of 400 mm.
1. System overview

1.6 Lighting selection

For SBOC:
- Use external lighting in any case.

For SBOI:
- Check whether the internal lighting of the device is sufficient for the required application.

External lights are commercially available.

**Note**
- Use screening - e.g. opaque, black housing - against uncontrollable extraneous light (e.g. ceiling lights, windows, etc.).

Uncontrollable extraneous light influences the image production and therefore the results.

If an external light is used:

You have the option of connecting external lights to the output A2 of the device. The lighting is then controlled by the device.

- Observe the correct system parameter configuration here.
- Observe the maximum residual current at the outputs.

The used light source for lighting the inspection parts has a major influence on the image quality. Often, inappropriate light sources are used. Which light source is appropriate for your application mostly depends on the properties of the inspection parts or the properties to be tested.

A light source is appropriate when the inspection part properties to be tested are brought out with the maximum contrast.
For the identification of various properties or inspection parts, you should switch among various light sources, if necessary.

Use the following light sources or lighting techniques:

<table>
<thead>
<tr>
<th>Light source</th>
<th>Properties</th>
<th>Detection of</th>
</tr>
</thead>
</table>
| Backlighting | Illuminates the inspection part from the opposite side. The light which shines around or through the inspection part indicates the shape of the inspection part. | – Contours of (transparent) inspection parts  
– Levels of colourless fluids in transparent containers |
| Dome light   | Throws indirect light toward the inspection part from different directions and produces a soft, diffuse and uniform light. Inspection parts with irregular shapes or curved surfaces are lighted uniformly. Apertures can be avoided. | – Labels on aluminium packaging  
– Coating defects on or holes in inspection parts with curved surfaces  
– Stains on uneven or curved surfaces |
| Rod light    | Produces uniform, direct light on long inspection parts. The light which hits at an angle produces diffuse reflection which allows slight differentiations to be made. For glossy surfaces, a polarization filter is recommended. | – Faulty contact galvanization  
– Edges of thin, transparent inspection parts |
1. System overview

<table>
<thead>
<tr>
<th>Light source</th>
<th>Properties</th>
<th>Detection of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wide-angle light</td>
<td>Throws direct light at a wide angle onto the edges of the inspection parts (angled illumination of the surface edges). This clearly accentuates the edges of the inspection part and surface defects.</td>
<td>- Split-offs on weak-contrast surfaces and edges</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Thickness deviations and surface defects</td>
</tr>
<tr>
<td>Coaxial-vertical light</td>
<td>Illuminates the inspection part along the same axis on which the lens is located. Reflecting light from shiny surfaces is amplified, and dark diffused light is scattered. This increases the contrast between dark and light areas.</td>
<td>- Punches/Stamps</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Indentations on moulded parts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Defects on the bottoms of deep-drawing parts</td>
</tr>
</tbody>
</table>

Tab. 1/7: Light sources

**Note**
- Use backlight preferably if it allows the type of detection.

This usually allows reliable images and results to be produced – even if there are disturbances by extraneous light.
1. System overview
Connecting

Chapter 2
2. Connecting

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   2.1.2 Dimensions of the SBO Compact Vision System ........ 2-5
   2.1.3 Mounting with adapter kit type SBOA-HMSV-39 .......... 2-6
   2.1.4 Mounting/dismantling of lens and protective tubing for SBOC ... 2-6
   2.1.5 Dismantling the protective foil for SBOI ................. 2-6
2. Connecting

2.1 Connecting

**Warning**
- Before carrying out connecting, installation and maintenance work, always switch off the power supply for the electronics.

**Caution**
If the permissible temperature range is exceeded, e.g. by powerful external sources of light, this can lead to system faults and cause damage.
- Install the Compact Vision System in a well ventilated location, especially screened from the heat emitted by other devices and from sources of light.

**Note**
The Compact Vision System may be damaged if it is not handled correctly.
- Make sure that glass surfaces and lenses are not scratched or dirty.
- Mount the Compact Vision System so that items passing by do not touch the device.

**Note**
- Use screening - e.g. opaque, black housing - against uncontrollable extraneous light (e.g. ceiling lights, windows, etc.).
Uncontrollable extraneous light influences the image production and therefore the results.
2. Connecting

2.1.1 Connecting the Compact Vision System

- Mount the camera using the mounting attachments so that the camera is vertical aligned toward the inspection part without an obstacle.

- Observe here that the distance between the camera and inspection part viewed in the optics is adapted.

Fine adjustment is carried out during commissioning (see Chapter 4.6).

On the bottom of the device there is a mounting profile with a dovetail guide. The following adapter kits can be used for mounting:

<table>
<thead>
<tr>
<th>Type</th>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBOA-HMSV-39</td>
<td>Adapter BS</td>
<td>Adapter kit for mounting with screw-on adapter plate (included in the adapter kit)</td>
</tr>
<tr>
<td>SBOA-HMSV-40</td>
<td>Adapter BS</td>
<td>Adapter kit for mounting with screw-on adapter plate, e.g. adapter plate type HMSV-11 (not included in the adapter kit)</td>
</tr>
<tr>
<td>SBOA-HMSV-41</td>
<td>Adapter BS</td>
<td>Adapter kit. The adapter has an internal thread G 1/4&quot; for mounting to a commercially-available photo/video tripod.</td>
</tr>
</tbody>
</table>

Tab. 2/1: Adapter kits for mounting
2. Connecting

2.1.2 Dimensions of the SBO Compact Vision System

Fig. 2/1: SBOI dimensions

Fig. 2/1: SBOC dimensions with protective tubing
2. Connecting

2.1.3 Mounting with adapter kit type SBOA-HMSV-39

The following figure shows the attachment with adapter kit type SBOA-HMSV-39 using the Compact Vision System type SBOI-... as an example:

![Diagram](image)

1. Dovetail of the Compact Vision System
2. Clamping devices
3. Hole for M5x16 socket head screw with centring sleeve
4. Adapter plate

Fig. 2/2: Mounting with adapter kit type SBOA-HMSV-39

Proceed with mounting as follows:

- Place the Compact Vision System so that the field of vision is unhindered and the LEDs on the rear of the housing can be seen.
- Tighten the mounting screws evenly.
2. Connecting

2.1.4 Mounting/dismantling of lens and protective tubing for SBOC

Note
Handle the protective tubing and lens with care.
- Avoid dirt. Work in a clean environment.
- Do not touch the inside of the camera, the lens element or the glass surface of the protective tubing.

Attaching the lens

- If necessary, remove the protective covers from the lens and from the camera housing.
- Carefully place the lens in the fixture of the camera housing and tighten it by hand by turning it in a clockwise direction.

Attaching the protective tubing

Before attaching the protective tubing:

- Check that the seal has a good fit on the protective tubing.
- Carefully place the protective tubing in the mounting and tighten it by hand by turning it in a clockwise direction.
2. Connecting

Dismantling the protective tubing

- Turn the protective tubing in a counterclockwise direction and pull it forwards out of the mounting.

On the support ring of the protective tubing there is a hole with a diameter of 2.5 mm. If you wish to separate the tube from the support ring of the protective tubing, you can fix the support ring, if required, with the aid of a pin (insert pin into hole).

Dismantling the lens

- Turn the lens in a counterclockwise direction and pull it forwards out of the mounting.

- Attach the protective covers to the lens and to the camera housing.

2.1.5 Dismantling the protective foil for SBOI

To protect against scratches or contamination during transportation and mounting, a protective foil has been applied to the front side of the safety window on devices of type SBOI...

- Carefully remove this protective foil before starting with commissioning.

Note

- Make sure that the safety window is not subject to any mechanical stress.

Any scratches or grooves have an influence on the image quality, and therefore on the test quality.
Installation

Chapter 3
3. Installation

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3.2 Electrical connections .................................................. 3-6
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  3.2.2 Connecting the Ethernet interface ......................... 3-11
  3.2.3 Connecting the CAN interface ............................. 3-15
3. INSTALLATION

3.1 General installation instructions

**Note**
Note the following if your application must comply with the requirements of the “Recognized Component Marks for Canada and the United States”:
- Regulations for complying with the UL certification can be found in the UL-specific brief operating instructions. The technical specifications listed there apply first.
- The technical specifications in this documentation may show deviating values.

**Warning**
Sudden unexpected movements of the connected actuators can cause personal injury and damage to property. Before carrying out installation and maintenance work, switch off the following:
- Operating and load voltage supplies
- Any other sources of energy, e.g. the compressed air supply.

**Caution**
Lines with high levels of interference can cause electromagnetic disturbances.
- Do not lay control lines in the vicinity of such lines: If necessary, use separate wiring channels, separate cable bundles or separate cables.

**Note**
If you mount the Compact Vision System type SBO..-Q-... on a moving part of a machine, you must provide strain relief on all connecting cables on the moving part.
3. Installation

Note
Long signal cables reduce the interference immunity.
- Make sure that the cable lengths specified in the following table are always complied with:

<table>
<thead>
<tr>
<th>Line type</th>
<th>Permitted line lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal cables</td>
<td>max. 30 m</td>
</tr>
<tr>
<td>Supply lines</td>
<td>max. 10 m</td>
</tr>
</tbody>
</table>

Tab. 3/1: Maximum permissible line lengths

Note
- Check within the framework of your EMERGENCY STOP circuit, to ascertain the measures necessary for putting your machine/system into a safe state in the event of an EMERGENCY STOP (e.g. switching off the load voltage for the valves and output modules, switching off the pressure).
3. Installation

3.1.1 Selecting the power supply unit

**Warning**
- For the electric power supply, use only PELV circuits in accordance with IEC/DIN EN 60204-1 (Protective Extra-Low Voltage, PELV). Also take into account the general requirements for PELV circuits in accordance with IEC/DIN EN 60204-1.
- Only use power sources which guarantee reliable electrical isolation of the operating voltage in accordance with IEC/DIN EN 60204-1.

By using PELV circuits, protection against electric shock (protection against direct and indirect contact) is guaranteed in accordance with IEC/DIN EN 60204-1 (electrical machine equipment, general requirements).

Recommendation: Use a separate regulated power supply which does not have to supply any other devices. You will then achieve the greatest resistance to interference.

Simple 24 V transformers with rectifier and smoothing capacitor achieve output voltages of 28 V and more with low output voltages. Correct operation can only be guaranteed if the permitted operating voltage range is not exceeded (see Technical Data in Appendix A.4).
3. Installation

3.2 Electrical connections

The following connection and display elements can be found on the rear side of the Compact Vision System:

1. CAN interface
2. Ethernet interface (plug M12x1)
3. Power supply and digital I/Os (plug M12x1)

Fig. 3/1: Electrical connections of the Compact Vision System type SBO...-

The following connection options are available (see also Chapter 4.9 and Tab. 4/4).

3.2.1 Connecting the operating voltage and I/Os

Caution
Damage to components
- Make sure that the max. permissible operating voltage range is not exceeded (see Technical Data, Chapter A.4).
- Protect the power supply of the Compact Vision System externally with a fast acting 2 A micro fuse.

Note
- Use only one of the following original cables from Festo for connecting the power supply and the inputs/outputs.
3. Installation

The following table shows the original cables which should be used for connecting the power supply and the I/Os:

<table>
<thead>
<tr>
<th>Type</th>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIM-M12-8GD-2-PU</td>
<td>Plug sockets with cable</td>
<td>2 m long</td>
</tr>
<tr>
<td>SIM-M12-8GD-5-PU</td>
<td>Plug sockets with cable</td>
<td>5 m long</td>
</tr>
<tr>
<td>Cable for power supply,</td>
<td>Plug sockets with cable</td>
<td>2 m long</td>
</tr>
<tr>
<td>straight socket, M12x1, 8-pin, core ends</td>
<td></td>
<td>5 m long</td>
</tr>
<tr>
<td>tin-plated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tab. 3/2: Cable for power supply and digital I/Os

The operating voltage is fed together with the input/output circuit via the 8-pin M12 plug marked “24 V DC” (see also Tab. 3/3). The following components are supplied with +24 V DC via this connection:

– the internal electronics of the Compact Vision System
– the load current of activated outputs.

The maximum permissible current at the supply is 2 A.

Caution
Correct earthing is important for trouble-free operation.

- Connect the screen of the plug socket with cable (SIM-M12-8GD-...) with low impedance to earth potential.
3. Installation

<table>
<thead>
<tr>
<th><strong>M12 plug 1)</strong></th>
<th><strong>Pin</strong></th>
<th><strong>Signal</strong></th>
<th><strong>Description</strong></th>
<th><strong>Core colour 2)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I0</td>
<td>Rising edge 3): Trigger signal</td>
<td>white (WH)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>24 V DC</td>
<td>+ 24 V DC (tolerance: ±10%)</td>
<td>brown (BN)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Reserved</td>
<td>Do not connect</td>
<td>green (GN)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>O1</td>
<td>Logical 1: Last evaluation resulted in good part 4)</td>
<td>yellow (YE)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I1</td>
<td>Rising edge 3): Accept input signal Error acknowledgement signal in event of error</td>
<td>grey (GY)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>O0</td>
<td>– Logical 1: Device ready for operation (Ready) – Logical 0: Device not yet ready for operation (e.g. evaluation running, system error)</td>
<td>pink (PK)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>0 V</td>
<td>0 V</td>
<td>blue (BU)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>O2</td>
<td>Logical 1: Last evaluation resulted in bad part 4)</td>
<td>red (RD)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Metal covering 5)</strong></td>
<td>Screen (shield)</td>
<td></td>
</tr>
</tbody>
</table>

1) Tighten union nut by hand
2) Core colours of the original cable type SIM-M12-8GD-...-PU
3) The signal levels/edges can be configured via the system parameters. The given description corresponds to the standard configuration.
4) The function can be configured via system parameters. The given description corresponds to the standard configuration.
5) Connect the cable screening with low impedance to the earth potential (see Fig. 3/2).

Tab. 3/3: Operating voltage connection and I/Os on the 8-pin M12 plug “24 V DC”

The function and function behaviour of the I/Os can be configured with the help of system parameters in CheckKon. The function behaviour of the I/Os is to be distinguished in the different evaluation modes, see Chapter 4.8.
3. Installation

Connection example: Fig. 3/2 shows an example of the connection for a configuration of the system parameters with the default values:

<table>
<thead>
<tr>
<th>Internal I/Os</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polarity I0</td>
<td>Trigger signal = rising edge</td>
</tr>
<tr>
<td>Polarity O0</td>
<td>Ready for operation = Logical 1</td>
</tr>
<tr>
<td>Function at O1</td>
<td>Good part = Logical 1</td>
</tr>
<tr>
<td>Function at O2</td>
<td>Bad part = Logical 1</td>
</tr>
</tbody>
</table>

Tab. 3/4: System parameters with standard configuration

- Please note that:
  - the tolerance of 24 V DC ±10% must be complied with.
  - the power supply of the Compact Vision System must be protected externally. Fast-acting 2 A micro fuse.
  - the residual current of all outputs must not exceed 1.5 A.
  - the cable screening must be connected with low impedance to the earth potential.
3. Installation

![Diagram]

**Fig. 3/2:** Example of a system parameter configuration with default values
3. Installation

3.2.2 Connecting the Ethernet interface

**Note**
Unauthorized access to your Compact Vision Systems can cause damage or malfunctioning.

- Ask your system administrator how you should protect your network against unauthorized access, e.g. with a firewall.

**Note**
When the camera is actively connected to the network, large amounts of data may be sent, depending on the operation mode. Due to this, the network between the PC and cameras is correspondingly heavily loaded. Therefore, it is preferable to have a direct connection, if possible.

- If in doubt, ask your network administrator whether appropriate bandwidths are available for you or what an optimum network structure for you would look like.
- Comply with the necessary system requirements.
3. Installation

For commissioning Compact Vision Systems you must create a connection between your PC and the Compact Vision Systems via the Ethernet. For the connection to a network or a PC, you will require the following cables:

<table>
<thead>
<tr>
<th>Connection</th>
<th>Type</th>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection via router or switch</td>
<td>SBOA-K30E-M12S Cable</td>
<td>Ethernet cable for simple demands 1) – Straight socket, M12, 4-pin, d-coded – RJ-45 Ethernet plug – 3 m long</td>
<td></td>
</tr>
<tr>
<td>Direct connection with the PC</td>
<td>SBOA-K30E-M12S Cable</td>
<td>– Coupling</td>
<td>Cable coupling for RJ45 plug connector 2)</td>
</tr>
<tr>
<td></td>
<td>– Coupling</td>
<td>– Cable</td>
<td>Ethernet cross-link 2)</td>
</tr>
</tbody>
</table>

1) The Ethernet cable type SBOA-K30E-M12S has been designed for short-term use as a diagnostic cable or for continuous use as a fixed cable for simple demands.
2) Only required if the network connection of the PC does not support automatic adaptation of the transmitting and receiving lines (AUTO MDI-X). This accessory is commercially available.

Tab. 3/5: Cable for the Compact Vision System type SBO..-....

For special requirements for use in an industrial environment, use a screened flexible Ethernet round cable of category 5, which will fulfill your requirements with regard to oil resistance, bending radius, permissible bending cycles etc. Connections: M12 socket, 4-pin d-coded and RJ45 plug

Cables and plug connectors for special requirements are commercially available - e.g. from Franz Binder GmbH & Co. (product program series 825) or from HARTING Electronics GmbH & Co. KG (product program Harax® M12 or Harting RJ Industrial®).

Ethernet connection

Via the Ethernet interface, the connection to the PC and to Festo FEDs or other EasyIP-compatible devices can be established. In order to make a connection possible, several requirements must be fulfilled with regard to the network address of the device as well as that of the PC. See Chapter 4.4.

The network properties of the device can be adapted with the help of the SBO-DeviceManager. See Chapter 4.4.
3. Installation

The support for EasyIP or other protocols must be activated via the corresponding system parameters. Additional information can be found in chapter 4.9.6.

For connection to the Ethernet there is a d-coded M12 plug on the rear side of the Compact Vision System.

<table>
<thead>
<tr>
<th>M12 plug 1)</th>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TD+</td>
<td>Transmitted data+</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>RD+</td>
<td>Received data+</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>TD-</td>
<td>Transmitted data –</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>RD-</td>
<td>Received data –</td>
<td></td>
</tr>
</tbody>
</table>

1) d-coded

Tab. 3/6: Pin assignment of the Ethernet interface

The Ethernet interface of the Compact Vision System complies with standard 10BaseT/100BaseTX for 100 Mbit networks.

**Note**
- Use a screened plug connector which will guarantee continuous contact between the screening/shield and the Compact Vision System.
- Connect the screening of the Ethernet cable with low impedance to earth potential.
3. Installation

Connection via router or switch

Recommendation: Use network components which support data rates of at least 100 Mbps.

If using a router, make sure that this is set so that the multicasts of address 239.255.2.3. are passed on. This address is used for searching for devices in the network. If the routers aren’t configured accordingly, the devices cannot be found using the search function. If in doubt, ask your network administrator.

Direct connection with the PC

If the network connection of the PC does not support automatic adaptation of the transmitting and receiving line (AUTO MDI-X), you will also require, in addition to the original cable, a crossover cable and a cable coupling (see also Tab. 3/5).

1 Original cable type SBOA-K30E-M12S
2 Cable coupling
3 Crossover cable

Fig. 3/3: Direct connection with the PC (here type SBOC-...)
3. Installation

3.2.3 Connecting the CAN interface

The mode of operation of the CAN interface depends on the set system parameters of the device. In order to use the CAN interface, this has to be configured accordingly. Here, the protocol to be used must also be defined (see Chapters 4.9.4 and 4.9.5).

<table>
<thead>
<tr>
<th>M12 plug</th>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>n.c. (not connected)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>n.c. (not connected)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>GND</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>CAN_H</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>CAN_L</td>
</tr>
</tbody>
</table>

Tab. 3/7: Pin assignment of the CAN interface

When the Compact Vision System is connected to a Festo CP string, the device does not feed supply current into the string, and also does not take any supply current out of the string.

- Use the matching CAN cable which is available from Festo as a Compact Vision System accessory (see Chapter 1.4).
- Otherwise, observe the following information.
3. Installation

**Note**
- Use a screened plug connector which will guarantee continuous contact between the screen and the Compact Vision System.
- Connect the screen of the CAN cable with low impedance to earth potential.
- Make sure that there is a terminal resistance connected at the end of the line on the device side (e.g. in the plug) between pin 4 and pin 5. (120 Ω / 0.25 W).
Commissioning

Chapter 4
# 4. Commissioning

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</tr>
</tbody>
</table>
4. Commissioning

4.1 Commissioning instructions

Before commissioning, the device should be completely connected and installed.

- Carry out commissioning with the CheckKon software package. See also CheckKon Help.

- Use the SBO-DeviceManager for changing network settings on the device.

- Create test programs with the CheckOpti software package. See also CheckOpti Help.

The commissioning steps are usually taken in the sequence of the following chapters. For optimising the system, it may be necessary to repeat steps which have already been carried out.
4. Commissioning

4.2 Installation of the software packages

Note
The software packages CheckKon and the SBO-DeviceManager can be downloaded via the Internet free of charge.
If you have any questions, please consult Festo Service.

The software packages are installed on your PC with an installation program.
The SBO-DeviceManager is part of the CheckKon installation.

Note
Administrator rights are required for installing the software packages.

You can install the software packages from the CD ROM as follows:

1. Close all programs.

2. Place the corresponding Festo CD in your CD ROM drive.
   If Auto Run is activated on your system, installation will start automatically and you can skip steps 3 and 4.


4. Enter D:\setup (if necessary, replace D by the letter of your CD ROM drive).
   The Setup program installs the application(s).

5. Follow the instructions on the screen.
4. Commissioning

4.3 Check the network settings on the PC

In order to establish a connection to the device, the used PC network connection must be correctly configured.

The settings of the PC network connection can be found on the Windows control panel under “Network and Dial-up Connections”. The available LAN connections are displayed there.

- Select the LAN connection with which you would like to establish a connection to the device and have its properties displayed.

Fig. 4/1: Network and dial-up connections

- Check in the window “Local Area Connection properties..”, especially the properties of the entry “Internet protocol (TCP/IP) properties”.

4. Commissioning

Fig. 4/2: Properties of LAN connections and properties of the Internet protocol (TCP/IP)

If the network connection is configured so that your IP address is automatically taken (from a DHCP server), the DHCP server must be reachable via the network connection.

If this isn't the case (e.g. when there is a direct connection to the camera), the network connection must be told which IP address is to be used (see fig. 4/2).

The settings of the PC network connection and the camera must match.

- Select different IP addresses which are not assigned to other network devices (see Tab. 4/1).
- Via the sub-network mask, select the identical address range (see Tab. 4/1).
4. Commissioning

<table>
<thead>
<tr>
<th>IP settings</th>
<th>PC</th>
<th>Camera</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP address</td>
<td>192.168.2.99</td>
<td>192.168.2.10</td>
</tr>
<tr>
<td>Sub-network mask</td>
<td>255.255.0.0</td>
<td>255.255.0.0</td>
</tr>
</tbody>
</table>

Tab. 4/1: Example of suitable network settings.

Further information can be found in Chapter 4.4 and Appendix A.2.

**Note**
The following address is set on the Compact Vision System when it leaves the factory: 192.168.2.10

**Note**
Start the PC again if network settings have been modified.
4. Commissioning

4.4 Making network settings with the Compact Vision System

The settings for the IP address of your Compact Vision System can be made using the SBO-DeviceManager. To do this, proceed as follows:

1. Start the SBO-DeviceManager by double-clicking on the corresponding symbol on the Windows Desktop. Or, in the case of a standard installation:
   In the Windows [Start] menu, select the entry [Festo Software] – [SBO-DeviceManager].

2. Establish a connection to the device with the SBO-DeviceManager.

3. Set the network parameters of your Compact Vision System with the SBO-DeviceManager (IP address, network mask and, if applicable, the IP address of the gateway).

Establish connection to the device

Device search function

The SBO-DeviceManager has a search function. This search function allows a connection to be established to devices for which there is no known network address. The search function uses a special Ethernet procedure (Multicast). With this procedure, messages can be transmitted simultaneously to several slaves or to a closed group of slaves. For this process, devices of type SBO always use the address 239.255.2.3. This cannot be changed.

If the search takes place within a network node, no special configuration of the network node (router, server etc.) is necessary. However, if devices which lie behind further network nodes are to be found, the network nodes must be enabled for multicast. You must also adapt the properties of the device search (search range and search duration) accordingly. If you have any problems, please consult your system administrator.
4. Commissioning

If you cannot establish a connection to the device with the search function of the SBO-DeviceManager:

- Check whether the network nodes are enabled for multicast.
- Check the set search range and search duration in the SBO-DeviceManager.

If you aren’t successful:

- Connect the device directly to your PC, if possible. By doing this, you rule out incorrect network configurations.

Also, the search function will find the device even if the setting “Visibility in search requests” is set to “Local (1 router).”
4. Commissioning

Making network settings

If you have established a connection with the SBO-Device-Manager, you can also modify the network settings of the devices.

You can:

- assign the IP address automatically (requires a DHCP server in the network).
- assign a fixed IP address.

Assign IP address automatically

Select this setting if you are using a DHCP server in your network and if the IP address is to be assigned automatically via DHCP (DHCP stands for Dynamic Host Configuration Protocol). The DHCP server manages a range of IP addresses and assigns them to the DHCP-compatible terminals.

Specify fixed IP address

If you are not using a DHCP server, you must specify a fixed IP address. Make sure here that the IP address and the network mask of the devices match the network settings of your PC. If you have any problems, please consult your system administrator.

Note

Additional information on IP addressing can be found in the Appendix and in the description for the SBO-Device-Manager.
4. Commissioning

4.5 Establishing a connection to the device with CheckKon

Note
- Switch the device to the stop state.
  This is the prerequisite for setting up and disconnecting connections and for modifications to the device.

CheckKon is used for the further commissioning of the Compact Vision System. To do this, carry out the following steps:

1. Connect the Compact Vision System via the Ethernet interface to your PC or router/switch. To do this, follow the instructions in Chapter 3.

2. Start CheckKon by double-clicking on the corresponding symbol on the Windows Desktop.
   Or, in the case of a standard installation:
   In the Windows [Start] menu, select the entry [Festo Software] – [Festo CheckKon].

   The program opens the dialog window “Welcome to CheckKon” (Start dialog). In this dialog window, configure the connection to the compact camera.

3. Select the entry “via Ethernet interface” from the “Connect...” selection. Confirm this selection by clicking on “Next >”.

4. In the following dialog, enter the IP network address (factory setting: 192.168.2.10). Confirm this entry by clicking on “Next >”, or click on “Search...” to find and select available devices.

   A connection is established between the PC and compact camera.

   Further information can be found in the CheckKon help, e.g. about the basic functions for connecting devices, device names and device control.
4. Commissioning

4.6 Fine adjustment of the mounting, lighting and optics, setting the image parameters

1. Open the “Live Image” window in CheckKon.

2. Activate the transmission and display of the camera image by clicking on this icon.

3. Activate the display of the camera image in addition by clicking on this icon.

The camera image corresponds to the image which the camera sensor records taking the set system parameters into account.

4. Switch on the dynamic help.
   In the “Live Image” window, you will then get support for setting the image and lighting control parameters.

Now carry out the following steps:

1. Switch the lighting on and direct these toward the test area.
   If the lighting is controlled by the device, make the corresponding system parameter settings for the lighting control.

2. Roughly adapt the following image parameters so that an image of the test area can be identified:
   – Viewing area (change of the shown area with the mouse or via parameter input)
   – Exposure time
   – Sensor gain

3. Place an inspection part in the test area the way it will be positioned later in operation.

4. Now, finely adjust the camera mounting, if necessary.
   The camera is optimally aligned to the inspection part if the part is in the centre of the camera image.
4. Commissioning

5. Adapt the camera optics so that the camera image sharply focuses on the inspection part. Set the focus of the lens accordingly. For devices of type SBOC, the lens protective tubing must be removed to do this.

**Note**
For setting the image sharpness, a “Siemens star” is provided in this description as an example. See Chapter A.3.

<table>
<thead>
<tr>
<th>Type SBOI-...</th>
<th>Type SBOC-... with standard lens from Festo</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use a screwdriver to turn the focus adjuster on the rear side of the camera housing.</td>
<td>• Loosen the locking screw on the lens.</td>
</tr>
<tr>
<td></td>
<td>• In order to focus the object, turn the focusing ring.</td>
</tr>
<tr>
<td></td>
<td>• Tighten the locking screw again slightly.</td>
</tr>
</tbody>
</table>

Tab. 4/2: Setting the focus

6. For devices of type SBOC: Set the aperture of the lens so that there is sufficient light available to the sensor.

<table>
<thead>
<tr>
<th>Type SBOI-...</th>
<th>Type SBOC-... with standard lens from Festo</th>
</tr>
</thead>
<tbody>
<tr>
<td>–</td>
<td>• Loosen the locking screw on the lens.</td>
</tr>
<tr>
<td></td>
<td>• Turn the aperture ring in order to set the aperture.</td>
</tr>
<tr>
<td></td>
<td>• Tighten the locking screw again slightly.</td>
</tr>
</tbody>
</table>

Tab. 4/3: Setting the aperture
4. Commissioning

7. Now adjust the lighting fixture, if necessary, in order to optimally align the lighting for the properties to be tested. The lighting is optimally aligned when the inspection part properties to be tested are enhanced with maximum contrast.

8. Now carry out an (iterative) optimisation of all steps and settings. To do this, repeat steps 4 to 7.

The optimum setting is reached when the inspection part properties to be tested are sharply displayed in the camera image and are brought out with maximum contrast.
4. Commissioning

4.7 Setting the system parameters for pre-processing

Pre-processing

Processing the image data of the camera image in three consecutive steps.

During pre-processing, the image is digitally optimised and changed. The properties to be tested should be optimally set off so that the parts can be reliably inspected.

The camera image is the image which the camera sensor records, taking the set system parameters into account.

The images “Pre-processing 1 to 3” show the results of the corresponding pre-processing steps, taking the set system parameters into account.

The inspection of workpieces is done based on the image “Pre-processing 3”.

Switch the display of the various images in the “Live Image” window on and off.

The pre-processing steps must be configured in CheckKon in the “Live Image” window so that the properties to be tested are reliably shown in the image “Pre-processing 3”.

Furthermore, the pre-processing should remove the image areas which aren’t associated with the inspection part or the properties to be tested since these may interfere with the determination of the test features – such as the background, workpiece carrier, etc.

The available pre-processing functions depend on the used firmware.

Switch on the dynamic help.
In the “Live Image” window, you can get support for the pre-processing functions.
4. Commissioning

Depending on the used pre-processing function, the calculation time per inspection part can greatly increase. For this reason, image optimisation with respect to the tested properties should always be attempted before pre-processing - e.g. by optimising the:

- type and position of the lighting
- position of the camera
- position of the test part
- optical properties (lens, filter, etc.)

See also Chapter 4.6.
4. Commissioning

4.8 Selection of the evaluation mode

Evaluation mode determines when an image of an inspection part is recorded, processed, tested and the results output.

The selection of the evaluation mode defines how the device reacts to input signals or when the test results are output. Observe, here, the descriptions of the signal curves, starting in Chapter 4.8.1.

The following evaluation modes can be selected via the system parameter “Evaluation mode” in the CheckKon “System parameters” window.

- Triggered: Single image recording and check at every valid trigger signal
- Free run: Continuous image recording and testing (without fixed frame rate) as long as the trigger signal is applied
- Fixed frame rate: Continuous image recording and testing (with fixed frame rate) as long as the trigger signal is applied.

The selection of the evaluation mode depends on the respective application, especially of:

- the inspection part rate and inspection part flow
- the inspection part (single part or endless)
- the interaction with a higher-order controller.
4. Commissioning

Mode applications and modes of operation

**Triggered**

Inspection of single parts in stop-and-go operation or slow part flow.

The trigger signal is triggered by a higher-ordered controller or a sensor as soon as the inspection part is in front of the camera. The test results are output after the test is completed. Afterwards, the device waits for the next valid trigger signal.

**Free run**

Inspection of single or endless parts for medium to fast (continuous) part flow.

The trigger signal is applied permanently, independent of whether an inspection part is in front of the camera. The device acts like a simple sensor. The test results are output after the test is finished. Afterwards, the device starts immediately with the next test.

**Fixed frame rate**

Test of endless parts at constant speed.

The trigger signal is permanently applied. The test results are output after the test is finished. The device starts the next test according to the defined frame rate.

4.8.1 I/O features for evaluation mode “Triggered”

In the evaluation mode “Triggered”, exactly one cycle is started (edge-controlled) by a valid signal at the “trigger signal” input. A cycle here includes the image evaluation and the output of the results.

Trigger signals are only valid under the following conditions:

- Output “Ready for operation” signalises a logical 1.
- and
- any set time span, since output “Ready for operation” = logical 1, has elapsed.

This setting is made via the system parameter “Ignore trigger signal after ready for operation”.

---

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The image evaluation starts with the trigger signal. During image evaluation, the output “Ready for operation” signalises a logical 0.

The start of image generation and lighting control can be defined with respect to the time of the trigger signal.

- For this, set the following system parameters:
  - Start image evaluation after trigger
  - Start lighting
  - Duration of lighting

The results are output at the outputs after the image evaluation is finished, at the earliest.

The output time can be delayed by prolonging the trigger signal. The outputs, in this case, are only written when the signal at the input “trigger signal” has been taken back. This way, the higher-ordered controller (PLC) can signalise its readiness to accept the results of the workpiece inspection.

- Also, set the output time and output duration via the following system parameters:
  - Earliest start of output after trigger
  - Ignore trigger signal after ready for operation

The output “Ready for operation” is only set to logical 1 when the results at all outputs are valid. The results can now be processed by a higher-ordered controller (PLC/IPC) for example.
4. Commissioning

These results are valid and applied at the outputs until:

- the specification “Earliest start of output after trigger” (system parameter) of the next started cycle has elapsed and
- the signal at the input “trigger signal” of the next started cycle has been withdrawn.

With the above-mentioned conditions, it is possible to define minimum times for evaluation and output, as well as to influence their starting times. A higher-ordered controller (PLC/IPC) can thus start a new cycle and only then read the results of the previous cycle. A high evaluation rate can be achieved with such an overlap.
4. Commissioning

4.8.1.1 Signal curve for standard settings

The signal curve for standard settings of the system parameters in the “triggered” evaluation mode could look like the following:

![Signal curve diagram]

System parameter settings (default values):

- Earliest start of output after trigger = 0 ms
- Ignore trigger signal after ready for operation = 0 ms
- Start image evaluation after trigger = 0 ms
- Function at output O2 = Bad part
- Start of lighting = 0 ms
- Duration of lighting = automatic

Fig. 4/3: Evaluation mode “triggered” – Signal curve for standard settings
4. Commissioning

4.8.1.2 Signal curve using system parameters

The signal curve when using system parameters in the “triggered” evaluation mode could look like this:

1. Case

The cycle duration results from the system parameter “Earliest start of output after trigger” or the long trigger signal of the PLC (PLC synchronisation):

---

**System parameter settings:**

1. Earliest start of output after trigger = 220 ms

2. Ignore trigger signal after ready for operation = 110 ms

3. Start image evaluation after trigger = 20 ms

4. Function at output O2 = external lighting, start lighting and duration of lighting = manual

5. Start of lighting = 40 ms

6. Duration of lighting = 100 ms
4. Commissioning

2. Case

The cycle duration results from the system parameter “Earliest start of output after trigger” or from the long image evaluation duration:

**Figure 1 Cycle duration**

Cycle duration = Earliest start of output after trigger + output + wait for next trigger

**Figure 2 Cycle duration**

Cycle duration = Wait for long image evaluation + output + wait for next trigger

---

**System parameter settings:**

1. Earliest start of output after trigger = 220 ms
2. Ignore trigger signal after ready for operation = 110 ms
3. Start image evaluation after trigger = 20 ms
4. Function at output O2 = external lighting, start lighting and duration of lighting = manual
5. Start of lighting = 40 ms
6. Duration of lighting = 100 ms

---

Fig. 4/5: Evaluation mode “triggered” – Signal curve using system parameters – 2nd case
4. Commissioning

Simplified representation of the signal curves; these contain no jitter, run times or system-related delay times. The duration for the write operation of the outputs, and thus the duration for an invalid output state, cannot be determined when external outputs are used (I/O extension, device as CPI module, EasyIP or CheckKon). If the external outputs are deactivated by the system parameters, and if only internal outputs are used, this duration is approx. 1 ms.

4.8.2 I/O features for evaluation mode “Free run”

In the “free run” evaluation mode, the free run mode remains activated as long as logical 1 is at the “trigger signal” input (status-controlled). During this time, images are generated and evaluated cyclically.

Sequence

The image evaluation starts with the beginning of the cycle. During image evaluation, the output “Ready for operation” signalises a logical 0.

The start of image generation and the control of the lighting can be defined with respect to the time of the beginning of the cycle.

- For this, set the following system parameters:
  - Start image evaluation after beginning of cycle
  - Start lighting
  - Duration of lighting

The results are output at the outputs after the image evaluation is finished, at the earliest.

- Set the output time via the following system parameters:
  - Earliest start of output after beginning of cycle
  - Ignore trigger signal after ready for operation
4. Commissioning

Note
The rate at which images are recorded/results are output varies and depends on the evaluation time of the individual images.

Function
In this evaluation mode, the device acts like a simple sensor which is constantly testing and outputting. With this, continuous evaluation is possible. Output synchronisation with the higher-ordered controller (PLC) is only possible under certain conditions, since the “ready for operation” output during this time stays at logical 0.

If such an output signal of the results is needed, the system parameter “Ignore trigger signal after ready for operation” can be used. In this case, the output “ready for operation” goes to logical 1 after outputting the results for the set duration. The higher-ordered controller (PLC) can now read the valid applied results.

If the “trigger signal” input still indicates logical 1 after the set duration has elapsed, the next evaluation is started.

The results are only written to the outputs when the device is finished with the image evaluation and the specified system parameter “earliest start of output” has elapsed. The outputs are valid until the specified system parameter “earliest start of output after beginning of cycle” of the next cycle has elapsed.

If the input “trigger signal” is reset to logical 0, the free run mode ends. After the current image evaluation is finished (incl. “earliest start of output after beginning of cycle”), the output “ready for operation” goes back to logical 1.
4. Commissioning

4.8.2.1 Signal curve for standard settings

The signal curve for standard settings of the system parameters in the “free run” evaluation mode could look like this:

![Signal curve diagram]

- **System parameter settings (default values):**
  - Earliest start of output after beginning of cycle = 0 ms
  - Ignore trigger signal after ready for operation = 0 ms
  - Start image evaluation after beginning of cycle = 0 ms
  - Function at output O2 = Reject part
  - Start of lighting = 0 ms
  - Duration of lighting = automatic

---

Fig. 4/6: Evaluation mode “free run” – Signal curve for standard settings
4.8.2.2 Signal curve using system parameters

The signal curve when using system parameters in the “free run” evaluation mode could look like this:

Fig. 4/7: Evaluation mode “free run” – Signal curve using system parameters

System parameter settings:

1. Earliest start of output after beginning of cycle = 220 ms
2. Ignore trigger signal after ready for operation = 65 ms
3. Start image evaluation after beginning of cycle = 20 ms
4. Function at output O2 = external lighting, start lighting and duration of lighting = manual
5. Start of lighting = 40 ms
6. Duration of lighting = 100 ms
4. Commissioning

Simplified representation of the signal curves; these contain no jitter, run times or system-related delay times. The duration for the write operation of the outputs, and thus the duration for an invalid output state, cannot be determined when external outputs are used (I/O extension, device as CPI module, EasyIP or CheckKon). If the external outputs are deactivated by the system parameters, and if only internal outputs are used, this duration is approx. 1 ms.

4.8.3 I/O features for evaluation mode “Fixed frame rate”

In the “fixed frame rate” evaluation mode, the mode remains activated as long as logical 1 is at the “trigger signal” input (status-controlled).

- During this time, images are generated with a preset cycle duration.

- During evaluation, the output “Ready for operation” shows a logical 0.

The start of image generation and the lighting begins with the cycle start. Only the duration of the lighting can be influenced via system parameters.

The evaluation and output of the results are temporally decoupled from each other.

- Images are generated at defined time intervals.

- The time of the associated output, however, is indeterminate and varies depending on the evaluation duration of the current image, and possibly even the previous images.
If the required evaluation period is longer than the defined frame rate, images are intermediately stored in the device. The output time can be shifted by several cycle periods. If intermediate storage is no longer possible, the device enters an error state or outputs a warning (can be configured via system parameter “Image buffer overflow”). Intermediately stored images are lost here.

This evaluation mode is especially suitable for time-critical tests, in which the inspection part cannot be stopped or where a constant test rate is required, e.g. for endless material testing.

Intermediate image storage should only be used to compensate for fluctuations in the evaluation duration. The frame rate should not be chosen higher than the average evaluation duration.

If the evaluation mode “fixed frame rate” is stopped (“trigger signal” input = logical 0), then any intermediately stored images are completely evaluated and the test result output – only after this does the output “ready for operation” go to logical 1.
4. Commissioning

4.8.3.1 Signal curve for standard settings

The signal curve for standard settings of the system parameters in the “fixed frame rate” evaluation mode could look like the following:

Fig. 4/8: Evaluation mode “fixed frame rate” – Signal curve for standard settings

System parameter settings (default values):

- Earliest start of output after beginning of cycle = 0 ms
- Function at output O2 = Bad part
- Start of lighting = 0 ms
- Duration of lighting = automatic
- Cycle duration = 220 ms
4. Commissioning

4.8.3.2 Signal curve using system parameters

The signal curve when using system parameters in the “fixed frame rate” evaluation mode could look like the following:

![Signal Curve Diagram]

**Fig. 4/9:** Evaluation mode “fixed frame rate” – Signal curve using system parameters

**Negative example**

Earliest start of output after beginning of cycle is chosen too high – after N frames, an error was triggered (see system parameter settings).

System parameter settings:
4. Commissioning

1. Earliest start of output after beginning of cycle = 300 ms
2. Cycle duration = 220 ms

Simplified representation of the signal curves; these contain no jitter, run times or system-related delay times.

The duration for the write operation of the outputs, and thus the duration for an invalid output state, cannot be determined when external outputs are used (I/O extension, device as CPI module, EasyIP or CheckKon). If the external outputs are deactivated by the system parameters, and if only internal outputs are used, this duration is approx. 1 ms.
4. Commissioning

4.9 Connecting the device to a higher-order controller (PLC/IPC)

A higher-order controller (PLC) can be connected with the camera via available connection options for controlling the device or for processing the test results.

The following connection options are available, depending on the used firmware:

<table>
<thead>
<tr>
<th>Connection</th>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
</table>
| Device-internal I/Os on plug “Power supply and digital I/Os” | - Trigger signal  
- Accept input signal/acknowledge error signal | - Ready for operation  
- Configurable (2x) |
| I/O expansion via CAN interface | - Test program preselection | - Identified part type |
| Device acts as a CPI module via CAN interface | - Trigger signal  
- Accept input signal  
- Acknowledge error signal  
- Test program preselection | - Ready for operation  
- Fundamental test results with identified part type  
- Warning and error status |
| Communication via Ethernet interface with EasyIP protocol | - Trigger signal  
- Accept input signal  
- Acknowledge error signal  
- Test program preselection  
- System parameters  
- Test program tolerances | - Ready for operation  
- Warning and error status  
- Extensive test results with identified part type and features |

Tab. 4/4: Connection options of the Compact Vision System

Which connection option is to be used depends on the required I/O functions of the application.

For a fast part flow, i.e. a fast testing rate, the device-internal I/Os in connection with a powerful higher-order controller (PLC) is preferable since here the shortest delay times are to be expected.
4. Commissioning

The used evaluation mode (see Chapter 4.8) defines how the device reacts to input signals or when the test results are output at the outputs. A higher-order controller must be programmed according to the signal behaviour of the selected evaluation mode.

4.9.1 General information about the use of inputs

There are inputs with signal function and other inputs.

Inputs with signal function

These inputs depend on the output mode, edge or status-controlled. They are read constantly. If the signals are valid with regard to the current operating state, the corresponding action is immediately executed. Inputs with signal function include:

- Trigger signal
- Accept input signal
- Acknowledge error signal

Other inputs

These inputs are status-controlled, i.e. they react to logical 1 or logical 0. They are read only after a valid "Accept inputs signal."

Example for “normal input”: Test program preselection.
If inputs with the same function contradict each other, there is a selection based on the following priority:

1. Inputs from internal I/Os
2. Inputs of an I/O expansion/CPI module
3. Inputs from EasyIP

4.9.1.1 “Trigger signal” input
The “trigger signal” input is for starting and stopping the test operation. The mode of operation, signal detection and the signal curve depend on the selected evaluation mode. See also Chapter 4.8.

4.9.1.2 “Accept input signal” input
The “accept input signal” tells the device to read normal inputs. The “accept input signal” is detected with edge control and is only valid when the output “ready for operation” outputs logical 1. In order to reread inputs, the signal, then, must first be reset.

As long as inputs are read and processed (e.g. loading of a new test program), the output “ready for operation” is at logical 0. During this time, no parts can be tested (the trigger signal is not valid as long as the output “ready for operation” is at logical 0).

As soon as the inputs have been completely processed, the “ready for operation” output goes back to logical 1. Trigger signals for a test are now accepted.
4. Commissioning

4.9.1.3 “Acknowledge error signal” input

If an error status occurs in the device, this is indicated at the “error status” output with a logical 1. In addition, the “ready for operation” output goes to logical 0.

Incoming trigger signals are not valid, i.e. no further evaluations are possible until the error is eliminated. The error must be eliminated by means of suitable measures while the system is in the error state. In the error state, it is possible to diagnose and change system parameters via CheckKon or EasyIP.

As soon as the error has been eliminated, this has to be signaled to the camera via the “acknowledge error signal” input.

If a warning status is signaled (e.g. at the “warning” output), this doesn’t have to be acknowledged with the acknowledge error signal. The warning status is automatically lifted when the cause is eliminated.

Error information (description and suggestions for elimination) can be found in Chapter 5.1.2.

4.9.2 General information about the use of outputs

All outputs of the device are to be used by a higher-order controller (PLC) as status-controlled signals (logical 0 or logical 1). At which time the outputs may be read – i.e. are validly applied – depends on the used evaluation mode.

Writing to the outputs takes a varying amount of time, depending on the connection. In the case of time-critical applications, only the device-internal outputs are to be used and further connection options deactivated.
4. Commissioning

4.9.3 Use of internal I/Os

The functions and the signal curves of the device-internal I/Os depend on in which output mode the device is in (see Chapter 4.8).

The function of selected I/Os can be defined via system parameters. With these, flexible adaptation to the application requirements is possible.

The following functions are available to the I/Os:

<table>
<thead>
<tr>
<th>I/O</th>
<th>Function</th>
</tr>
</thead>
</table>
| I0  | – Trigger signal  
     | – Polarity (rising/falling edge or logical 1/logical 0) can be changed via system parameters. |
| I1  | – “Accept input signal” or in case of error “acknowledge error signal”.  
     | – Polarity (rising/falling edge or logical 1/logical 0) can be changed via system parameters. |
| O0  | – Ready for operation |
| O1  | – Allocation of the function to be output can be configured via system parameters - e.g. good part, reject part, etc. |
| O2  | – Allocation of the function to be output can be configured via system parameters - e.g. good part, reject part, lighting, etc. |

Tab. 4/5: Functions at internal I/Os
4. Commissioning

4.9.4 Use of the I/O expansion

As soon as the use of the I/O expansion is activated via the system parameters, selected modules can be connected to the CAN interface of the Compact Vision System.

This connection option is for expanding the internal I/Os.

Use the I/O expansion, for example, when you:

- preselect test programs via digital inputs

or

- want to signalise detected part types via digital outputs

![24 V](image)

Fig. 4/10: Application example: Compact Vision System SBOI-Q-... with I/O expansion

Requirements for the I/O expansion

Only the following modules are permissible:

- Output module: 4 bit, 538790 CP-A04-M12-CL
- Input module: 8 bit, 538787 CP-E08-M12-CL

- Connect the modules to the camera in the specified order:
  - Camera – Adapter – Output module
  or
  - Camera – Adapter – Input module
  or
  - Camera – Adapter – Output module – Input module
4. Commissioning

**Note**

The input/output module requires a power supply which is not provided by the Compact Vision System.

- Use the CAN cable SBOA-K20CP-SUP, available as an accessory from Festo, or a corresponding adapter cable (see Chapter 3.2.3).

- Connect the modules with each other or with the adapter. Use CP cables for this (e.g.: type KVI-CP-1-...). Please note that the total length of cable must not exceed a maximum of 10 m.

The nominal configuration of the I/O expansion is specified by the system parameter “I/O expansion configuration”.

When the power supply is switched on and during operation, the device checks whether the string allocation specified by the system parameters will suffice.

**Installation:**

1. Make a connection to the device with the CheckKon program and set the system parameter "Function at CAN interface" to “Out”. Conclude the CheckKon program.

2. Switch the device off in order to avoid faults or damage. Disconnect the power supply to the device and the modules.

3. Connect the device, the adapter and the modules together by means of the specified cables.

4. Switch on the power supply again for the device and the modules.

5. Make a connection to the device with the CheckKon program and set the system parameter "Function at CAN interface to “I/O extension”.

6. Set the system parameter “Configuration I/O extension” according to your configuration.
4. Commissioning

7. If any faults in the I/O extension are displayed on the device, confirm with the fault quitting signal at input E1.

The device displays a warning or a fault depending on the system parameters when:

- the current I/O expansion is not sufficient for nominal configuration of the I/O expansion (also observe the module sequence).
- modules report errors (e.g. overload).

The allocation of the functions to the individual I/Os of the module is fixed.

**Input module CP-E08-M12-CL**

- E0..7 of the module is interpreted as a byte value and corresponds to the test program selection (0-255): “0” = test program 1.

**Output module CP-A04-M12-CL**

- A0..3 of the module is interpreted as a byte value and corresponds to the detected part type (0..15): “0” = part type 1

Additional information about the process and signal curve can be found in Chapter 4.8.

Additional information about the modules can be found in the descriptions P.BE-CP-EA-CL-...
4. Commissioning

4.9.5 Using the device as a CPI module at CP node

As far as the firmware of the device supports the function as a CPI module, this can be activated via a system parameter.

If the device is activated for use as a CPI module, the device then corresponds to a CP module with extended functions (CPI module) in the associated CP string. This way, it can be operated on a CPX-CP interface of a CPX terminal, for example.

**Note**
The device has no CAN output.
- Only connect the device at the end of a CP string.

**Note**
The device cannot be connected to the CP string with the conventional CP cables.
- Use the CAN cable SBOA-K20CP-WS, available as an accessory from Festo, or a corresponding adapter cable (see Chapter 3.2.3).

**Note**
In order that the Compact Vision System is recognized in the CP string when the power supply for the CP master is switched on (e.g. of a CPX-CP interface), the Compact Vision System must already have signalled “Ready for operation.”
- Activate the power supply for the Compact Vision System approximately 15 seconds before activating the power supply for the CP master.
4. Commissioning

Installation:

1. Make a connection to the device with the CheckKon program and set the system parameter "Function at CAN interface" to "Out." Conclude the CheckKon program.

2. Switch the system off in order to avoid faults or damage. Disconnect the power supply for the device and the CPX terminal.

3. Connect the device to the appropriate CP string with the specified cables.

4. Switch on the power supply for the device.

5. Make a connection to the device with the CheckKon program and set the system parameter "Function at CAN interface" to “CPI-Module”.

6. Now connect the power supply for the CPX-CP terminal.

7. Press the Save button on the CPX-CP terminal in order to save the new string allocation.

8. Restart the CPX-CP terminal. In order to do this, switch off the power supply briefly for the CPX-CP terminal.

9. If any faults in the CPI module function are displayed on the device, confirm with the fault quitting signal at input E1.
4. Commissioning

A string allocation together with other modules could look like this:

![Diagram](image)

**Fig. 4/11: Example - string allocation: Compact Vision System SBOI-Q-... as a CPI module**

The Compact Vision System can be addressed by a higher-order controller, which is either:

- integrated in the CPX terminal (e.g. CPX-FEC-... from Version R5)

or

- is connected to the higher-order fieldbus.
  To do this, the associated CPX terminal must also be connected to the same fieldbus (e.g. to Profibus via the CPX module “CPX-FB13-...” from Version R12).

Additional information about CP and CPX can be found in the “CPI system description” (P.BE-CPX-CP-...).
Additional information about fieldbus nodes can be found in the “Electronics description” (P.BE-CPX-FB-...).
4. Commissioning

The device is equivalent to a CPI module and always allocated 16 inputs and 16 outputs to CP masters (with and without extended functions).

The following table shows an overview of the assigned addresses for the CP input and output module.

<table>
<thead>
<tr>
<th>CP modules</th>
<th>Type</th>
<th>Module supports extended functions</th>
<th>Allocated I/Os on CP masters with extended functions</th>
<th>Allocated I/Os on CP masters without extended functions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Compact Vision System acts as CP input and output module</td>
<td>yes</td>
<td>16 I</td>
<td>16 O</td>
</tr>
</tbody>
</table>

Tab. 4/6: Allocated I/Os for the CP input and output module

**Note**
The input and output numbers specified here must be converted according to the above address assignment for the corresponding CP string number and string allocation.

16 CP inputs (from the camera's point of view, these are outputs)

<table>
<thead>
<tr>
<th>Input</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit I0:</td>
<td>Ready for operation</td>
</tr>
<tr>
<td>Bit I1:</td>
<td>Result output good</td>
</tr>
<tr>
<td>Bit I2:</td>
<td>Result output bad</td>
</tr>
<tr>
<td>Bit I3:</td>
<td>Result output correctly oriented</td>
</tr>
<tr>
<td>Bit I4:</td>
<td>Result output incorrectly oriented</td>
</tr>
<tr>
<td>Bit I5:</td>
<td>not used</td>
</tr>
</tbody>
</table>
4. Commissioning

<table>
<thead>
<tr>
<th>Input</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit I6:</td>
<td>Warning (corresponds to “LED C” red &amp; flashing)</td>
</tr>
<tr>
<td>Bit I7:</td>
<td>Error status (corresponds to “LED C” red)</td>
</tr>
<tr>
<td>Bit I8...11:</td>
<td>(is assessed as a byte) Identified part type (0..15): “0” = part type 1</td>
</tr>
<tr>
<td>Bit I12...15:</td>
<td>not used</td>
</tr>
</tbody>
</table>

Tab. 4/7: CP inputs

16 CP outputs (from the camera’s point of view, these are inputs)

<table>
<thead>
<tr>
<th>Output</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit O0:</td>
<td>Trigger signal</td>
</tr>
<tr>
<td>Bit O1:</td>
<td>Accept input signal</td>
</tr>
<tr>
<td>Bit O2:</td>
<td>Acknowledge error signal</td>
</tr>
<tr>
<td>Bit O3...7:</td>
<td>not used</td>
</tr>
<tr>
<td>Bit O8...15:</td>
<td>Test program preselection (is read after bit A1 = 1)</td>
</tr>
</tbody>
</table>

Tab. 4/8: CP outputs

The address assignment depends on:

a) the used CPX fieldbus node or CPX-FEC

b) the used string number

c) the CP modules used in the string in front of the device.
4. Commissioning

Example: The device is operated on a CPX-CP interface with a CPX-FB13 Profibus fieldbus node. The device is in the 1st string at the 2nd position after an output module of type CP-A04-M12-CL (see Fig. 4/11).

The address assignment for the CPX-CP interface is as follows:

**Inputs (string 1: E0..E31):**
- I0 ... I15 are assigned to the 16 device inputs
- I16 ... I31 free

**Outputs (string 1: A0..A31):**
- O0 ... O7 is assigned to CP-A04-M12-CL (occupies 8 outputs, of these 4 not used)
- O8 ... O23 are assigned to the 16 device outputs
- O24 ... O31 free

The address O8 therefore corresponds to the trigger signal.

Information about the process and signal curve can be found in Chapter 4.8.

**CPX-FEC controller:** The device can be controlled via the CPI module function of a CPX-FEC. Appropriate system programs can be transferred to the controller (CPX-FEC) with the aid of the Festo FST programming software.

**Please note**
- Make sure that the system can function and run correctly.
- The current string configuration must already be saved.

When a new system program is transferred, the controller must be started again before commissioning can be carried out.
- Switch off the power supply briefly for the CPX-FEC.
4. Commissioning

4.9.6 Communication via the Ethernet interface with EasyIP protocol

The device provides the Festo Easy IP protocol for communication with a higher-order controller or a Festo FED. This makes very comprehensive output and control options possible, e.g. for processing further test results in the higher-order controller.

The support of the EasyIP protocol by the compact camera must be activated via the system parameters.

For communication with Festo FED-50 and FED-90, please observe that the additional communication module FEDZ-IET is required. Additional information about Festo FEDs can be found in the FED-HB1 and FEDZ-HB1 descriptions.

Reading and writing is done via the data packages assigned by EasyIP, whereby the data to be read/written is defined by memory addresses.

The device not only provides I/Os via memory addresses, but also allows access to the results of a test and to the settings of the system parameters.

Certain memory addresses can be read and written, some can be read only or written only (see table in Appendix A.6).

Installation:

1. Switch the system off in order to avoid faults or damage. Switch off the power supply for the Compact Vision System and for the device to be connected (e.g. CPX-FEC or FES).

2. Connect the Compact Vision System to the relevant device by means of the specified cables, e.g. via an Ethernet switch or hub.

3. Switch the power supply on again.

4. Make a connection to the device with the CheckKon program and set the system parameter "Function at Ethernet interface" to "EasyIP."
4. Commissioning

5. Set the IP address of the camera in the device to be connected.

6. The device to be connected must now be programmed accordingly in order that it can access data of the camera.

Additional information about inputs can be found in Chapter 4.9.1.
The available memory addresses, their function and an example of a program for FST can be found in Appendix A.6.
4. Commissioning

4.10 Creation of test programs

Test programs define how parts are to be tested, especially which features of an inspection part are to be calculated (e.g. length of the inspection part) and which values are permissible for a good part.

The test program to be used is defined via the test program preselection. The selection is made via:

- system parameters

or

- device inputs.

Test programs which are on the device can be updated using the following system parameters in the section System\Operation modes\Teach mode.

- Teach mode
- Part type
- Part orientation

A test program must be updated as soon as system parameters, which influence the creation of the picture and picture processing, are modified. System parameters in the following sections belong here:

- evaluation
- lighting
- camera picture and pre-processing.

Information for creating test programs and for setting the system parameters can be found in the parameter help in the “System parameters” window of the CheckKon software package.

Test programs can be conveniently created and evaluated with the CheckOpti software package. The created test pro-
4. Commissioning

grams can then be transferred to the device with CheckOpti or CheckKon.

Additional information for creating test programs can be found in the CheckOpti Help. If necessary, please consult your local Festo Service.
4. Commissioning

4.11 Test system

When commissioning is finished, it is imperative that the following items be checked again.

- Emergency Stop circuits and function
- Wiring
- Control program
- Reliability of the results for various inspection parts
- Reliability of the results for various extraneous light conditions.

Save the data of the software packages as files.
4. Commissioning

4.12 Instructions for operation

**Caution**
- Make sure that no dangers are posed by the systems connected to the Compact Vision System.

If the permitted temperature range is exceeded, this will be detected by the internal electronics and will lead to a error status.

**Caution**
Further heating beyond this point can lead to uncontrolled malfunctions.
- Make sure that the max. permitted temperature range is not exceeded (see Technical Data).
Diagnosis and error handling

Chapter 5
5. Diagnosis and error handling

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5. Diagnosis and error handling

5.1 General diagnosis options

The following diagnosis options are available:

- CheckKon can display operating statuses and error messages of the used Compact Vision Systems (see also CheckKon Help).

- The four LEDs on the rear side of the Compact Vision System supply the status information listed in the following section.

5.1.1 Status display

The visual indicator of the operating statuses is shown via LEDs.

<table>
<thead>
<tr>
<th>LED</th>
<th>Sequence</th>
<th>Status</th>
<th>Meaning/error handling</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED flashing green</td>
<td>ON</td>
<td>Device is ready for operation</td>
<td>-</td>
</tr>
<tr>
<td>LED illuminated in red</td>
<td>OFF</td>
<td>Initialisation running</td>
<td>Wait until initialisation is completed</td>
</tr>
<tr>
<td>LED is off</td>
<td>ON</td>
<td>Undefined status, e.g. operating voltage not applied</td>
<td>Check the power supply of the electronics</td>
</tr>
</tbody>
</table>

Tab. 5/1: Ready status LED (A)
5. Diagnosis and error handling

<table>
<thead>
<tr>
<th>Ethernet traffic LED (B)</th>
<th>Sequence</th>
<th>Status</th>
<th>Meaning/error handling</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED flashing green</td>
<td>ON OFF</td>
<td></td>
<td>Ethernet data traffic</td>
</tr>
<tr>
<td>LED is off</td>
<td>ON OFF</td>
<td></td>
<td>No Ethernet data traffic</td>
</tr>
</tbody>
</table>

Tab. 5/2: Ethernet traffic LED (B)

<table>
<thead>
<tr>
<th>Activity LED (C)</th>
<th>Sequence</th>
<th>Status</th>
<th>Meaning/error handling</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED illuminated in red</td>
<td>ON OFF</td>
<td>Error</td>
<td></td>
</tr>
<tr>
<td>LED flashing red</td>
<td>ON OFF</td>
<td>Warning</td>
<td></td>
</tr>
<tr>
<td>LED illuminated in yellow</td>
<td>ON OFF</td>
<td>Device is ready for operation, and evaluation can begin</td>
<td></td>
</tr>
<tr>
<td>LED is off</td>
<td>ON OFF</td>
<td>Evaluation in progress</td>
<td></td>
</tr>
</tbody>
</table>

Tab. 5/3: Activity LED (C)
5. Diagnosis and error handling

<table>
<thead>
<tr>
<th>LED</th>
<th>Sequence</th>
<th>Status</th>
<th>Meaning/error handling</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Red LED" /></td>
<td>ON OFF</td>
<td>LED illuminated in red</td>
<td>Last evaluation resulted in bad part</td>
</tr>
<tr>
<td><img src="image2.png" alt="Yellow LED" /></td>
<td>ON OFF</td>
<td>LED illuminated in yellow</td>
<td>Last evaluation resulted in good part</td>
</tr>
<tr>
<td><img src="image3.png" alt="Off LED" /></td>
<td>ON OFF</td>
<td>LED is off</td>
<td>No result</td>
</tr>
</tbody>
</table>

Tab. 5/4: Output LED (D)

The function of the output LED can be configured via system parameters. The given description corresponds to the standard configuration.
## 5. Diagnosis and error handling

### 5.1.2 Error handling

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>The device does not supply any evaluations</td>
<td>Operating voltage not applied or is below the permissible tolerance</td>
<td>• Switch on operating voltage or comply with tolerances.</td>
</tr>
<tr>
<td></td>
<td>System parameters are not correct.</td>
<td>• Check the system parameters with CheckKon</td>
</tr>
<tr>
<td></td>
<td>Trigger signal missing or has incorrect polarity</td>
<td>• Check trigger signal</td>
</tr>
<tr>
<td></td>
<td>Hardware fault</td>
<td>Servicing required</td>
</tr>
<tr>
<td>The device evaluation only results in reject parts</td>
<td>Wrong part type</td>
<td>• Diagnosis of operation with CheckKon</td>
</tr>
<tr>
<td></td>
<td>Wrong test program</td>
<td></td>
</tr>
<tr>
<td></td>
<td>System parameters are not correct.</td>
<td>• Check the system parameters with CheckKon</td>
</tr>
</tbody>
</table>
| The firmware of the device crashes. (Status LED A doesn’t flash) | Electromagnetic interference in the environment caused by non-CE conform devices | • Eliminate source of interference  
• Check that the screening of the connecting cables of the Compact Vision System is laid technically correctly with low impedance.  
• Use a separate power supply unit only for the Compact Vision System |
| The image of the evaluation is blurred or fuzzy. | The device was moved (e.g. by vibrations on the machine/system). | • Check mounting, reduce vibrations |
| | The object moves too quickly. | • Reduce exposure time |
| | The subject lies outside the focal range. | • Observe the minimum distance. With SBOI-Q:...: 22 mm  
With SBOC-Q:...: depends on the chosen lens |
| | Lens not focussed | • Focus the lens |
## 5. Diagnosis and error handling

<table>
<thead>
<tr>
<th>Problem</th>
<th>Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical error in the evaluation image</td>
<td>- Lens or safety window contaminated</td>
<td>• Carefully clean lens or safety window</td>
</tr>
<tr>
<td>CheckKon can not establish a connection to the Compact Vision System</td>
<td>- Wrong cable</td>
<td>• For a direct connection to the PC, you will probably require a connecting piece and a so-called crossover cable in addition to the original cable. This is not necessary for a connection via a router or a switch (see also Section 3.2.2.).</td>
</tr>
<tr>
<td></td>
<td>- Your network blocks data exchange.</td>
<td>• Make sure that your router transmits the multicast address 239.255.2.3. If in doubt, consult your system administrator.</td>
</tr>
<tr>
<td>Windows error message</td>
<td>- Insufficient free virtual memory</td>
<td>• Comply with system requirements (see CheckKon Help)</td>
</tr>
</tbody>
</table>

Tab. 5/5: Error elimination
5. Diagnosis and error handling
Technical appendix

Appendix A
A. Technical appendix

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<td>Addressing on the Ethernet (basics)</td>
<td>A-4</td>
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<td>A-7</td>
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<td>A.4</td>
<td>Technical Data</td>
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<td>A.5</td>
<td>Error messages</td>
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<td>A.6</td>
<td>EasyIP</td>
<td>A-13</td>
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<td>A.6.1</td>
<td>Input register</td>
<td>A-13</td>
</tr>
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<td>A.6.2</td>
<td>Output register</td>
<td>A-14</td>
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<td>A.6.3</td>
<td>Fast access to input and output register</td>
<td>A-15</td>
</tr>
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<td>A.6.4</td>
<td>Extended system status/system information</td>
<td>A-15</td>
</tr>
<tr>
<td>A.6.5</td>
<td>Device system time</td>
<td>A-16</td>
</tr>
<tr>
<td>A.6.6</td>
<td>Total type tolerance in the current test program</td>
<td>A-17</td>
</tr>
<tr>
<td>A.6.7</td>
<td>Basic results of the last test</td>
<td>A-18</td>
</tr>
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<td>A.6.8</td>
<td>Features – Results of the last test</td>
<td>A-19</td>
</tr>
<tr>
<td>A.6.9</td>
<td>System parameters</td>
<td>A-22</td>
</tr>
<tr>
<td>A.6.10</td>
<td>Example of program</td>
<td>A-23</td>
</tr>
</tbody>
</table>
A. Technical appendix

A.1 Cleaning and maintenance

Caution
A dirty and scratched lens or a dirty and scratched safety window can lead to visual defects.

- Make sure that the safety window/lens are not scratched.
- Do not use any abrasive cleaning agents.

- Switch off the operating voltage before cleaning.
- Clean the the lens or the safety window if they are dirty or if there are dirt deposits on them:
  - with an air gun or with clean, unlubricated compressed air.
  - with a soft moist cloth and non-abrasive cleaning agents.
- Clean the device if it is dirty.

Permitted cleaning agents are soap suds (max. +60 °C) and all non-abrasive agents.
A.2 Addressing on the Ethernet (basics)

Due to the separation into logical and physical protocol layers (Ethernet and TCP/IP), there are two types of addresses in a network:

- a fixed Ethernet address (MAC-ID) for each device and
- an IP address which is assigned to every device in the network.

Before the application, data is always sent to or received from an IP address. In order for the data to reach the receiver, a correlation must be created between the logical IP address and the physical Ethernet address. The Address Resolution Protocol ARP is used for this purpose: An ARP table is saved in each network PC. This table lists the respective physical Ethernet address for each IP address in the network. If an Ethernet address is not listed in the ARP table, the IP driver can determine what it is with the aid of an ARP request.

**Ethernet address (MAC-ID)**

The unchangeable Ethernet address (MAC-ID) of the Compact Vision System, which is unique worldwide, can be found on the type plate. With this, you can clearly distinguish between the different Compact Vision Systems.

**IP address**

An IP address, according to the standard IPv4, is usually specified with 4 decimal numbers separated by points (1 byte each).

**Example of an IP address: 192.168.2.10**

With an IP address, a network, as well as an individual station in the network, can be addressed. In addition, the IP address contains:

- the net ID (specifies the address of a network) and
- the host ID (specifies the address of an individual station in this network).
A. Technical appendix

Net mask
Which numbers in an IP address now represent the net ID and the host ID are defined by the specification of a so-called “net mask.”

The telephone number of Festo Germany can be used as an example to explain the IP address and the net mask: 00497113470

Which of these numbers represents the dialling code and which represents the subscriber number becomes clear when you also know: “that the first 7 figures represent the dialling code, the last 4 represent the subscriber number.” That is the “net mask” for the telephone number above.

Net classes
The net mask for IP addresses defines which bytes are used for addressing the slave (host ID), with “0” as a position marker. Networks belong to different net classes depending on the number of these bytes:

<table>
<thead>
<tr>
<th>Net class</th>
<th>Net mask</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>255.0.0.0</td>
<td>Large network</td>
</tr>
<tr>
<td>B</td>
<td>255.255.0.0</td>
<td>Medium network</td>
</tr>
<tr>
<td>C</td>
<td>255.255.255.0</td>
<td>Small network with max. 254 stations</td>
</tr>
</tbody>
</table>

Tab. A/1: The most important net classes with the appropriate net masks (example)

Gateway
Networks with different Net-IDs are connected to each other via a router or gateway. If a slave in a network is to send data to slaves in other networks, the IP address of the gateway must be specified.
A. Technical appendix

Three specifications are therefore required for addressing in the Internet Protocol IP:

- IP address
- IP net mask
- IP address of the gateway

**Note**
The following is preset at the factory:
- IP address: 192.168.2.10
- IP net mask: 255.255.0.0
- IP address of the gateway: –
A.3 Siemens star

The Siemens star shown here is a helpful model for roughly setting the focus.
A. Technical appendix
### A.4 Technical Data

<table>
<thead>
<tr>
<th>Compact Vision System type</th>
<th>..I-Q-R1B</th>
<th>..I-Q-R1C</th>
<th>..C-Q-R1B</th>
<th>..C-Q-R1C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Image sensors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sensitivity</td>
<td>[V/luxs]</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Exposure time</td>
<td>[ms]</td>
<td>0.027 ... 1,000</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>- Frame rate (full image)</td>
<td>[fps]</td>
<td>640 x 480</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sensor resolution</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sensor size</td>
<td>[inch]</td>
<td>1/2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Sensor type</td>
<td></td>
<td>CMOS Global Shutter R1B = Monochrome R1C = Colour</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Optics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Working distance</td>
<td>[mm]</td>
<td>22 ± 1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Field of vision</td>
<td>[mm]</td>
<td>14 x 10 ... 520 x 390</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Lens mounting</td>
<td></td>
<td>built-in lens</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Electrical components</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Current consumption with load-free outputs</td>
<td>[mA]</td>
<td>120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Maximum permissible residual current of the 24 V outputs</td>
<td>[A]</td>
<td>1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Nominal operating voltage</td>
<td>[V DC]</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Permissible voltage fluctuations</td>
<td>[%]</td>
<td>±10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fuse protection for supply (external)</td>
<td>[A]</td>
<td>2 (micro fuse, fast-acting)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Interfaces</strong></td>
<td></td>
<td>Ethernet interface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Bus connection</td>
<td></td>
<td>Ethernet interface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- IEE802.3U (100BaseT), 100 Mbps, TCP/IP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- CAN interface Festo CP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Geometry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Width</td>
<td>[mm]</td>
<td>45</td>
<td>45</td>
<td>45</td>
</tr>
<tr>
<td>- Height</td>
<td>[mm]</td>
<td>45</td>
<td>45</td>
<td>139.4 (with protective tubing)</td>
</tr>
<tr>
<td>- Length</td>
<td>[mm]</td>
<td>83.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weights</strong></td>
<td>[g]</td>
<td>Approx. 184</td>
<td>Approx. 182</td>
<td></td>
</tr>
</tbody>
</table>
A. Technical appendix

<table>
<thead>
<tr>
<th>Compact Vision System type SBO..</th>
<th>..I-Q-R1B</th>
<th>..I-Q-R1C</th>
<th>..C-Q-R1B</th>
<th>..C-Q-R1C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials (free of copper and PTFE)</td>
<td>Anodised aluminium</td>
<td>Acrylic butadiene styrene, glass fibre reinforced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Housing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Cover</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Ambient temperature</td>
<td>–10°C ... +50°C</td>
<td>–10°C ... +50°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Storage temperature</td>
<td>–10°C ... +60°C</td>
<td>–10°C ... +60°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient conditions</td>
<td>– Screened from extreme external light sources</td>
<td>– Cleanest possible ambient air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection class in accordance with EN 60 529 (Plug connector when fully plugged-in or provided with protective cap)</td>
<td>Protection classes IP65 and IP67</td>
<td>with protective tubing: Protection classes IP65 and IP67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protection against electric shock (protection against direct and indirect contact in accordance with IEC/DIN EN 60204-1)</td>
<td>by means of PELV power circuit (Protected Extra-Low Voltage)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electromagnetic compatibility</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Interference immunity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>– Emitted interference</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>See declaration of conformity (<a href="http://www.festo.com">www.festo.com</a>)</td>
<td>see declaration of conformity (<a href="http://www.festo.com">www.festo.com</a>)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Vibration and shock**

| – Vibration | tested in accordance with DIN/IEC 68/EN 60068 parts 2-6; 0.35 mm displacement at 10 ... 60 Hz; 5 g acceleration at 60 ... 150 Hz tested in accordance with DIN/IEC 68/EN 60068 parts 2-27; ±30 g at 11 ms duration; 5 shocks per direction |
| – Shock      |          |          |

**Continuous shock resistance**

| tested in accordance with DIN/IEC 68/EN 60068 parts 2-29; ±15 g at 6 ms duration; 1,000 shocks per direction |

1) The component is intended for industrial use.

Tab. A/2: Technical Data
A. Technical appendix

A.5 Error messages

<table>
<thead>
<tr>
<th>Name</th>
<th>No.</th>
<th>Error/warning</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General errors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E00</td>
<td>0</td>
<td>–</td>
<td>No error</td>
</tr>
<tr>
<td>E09</td>
<td>9</td>
<td>F</td>
<td>Overload on internal I/Os 1</td>
</tr>
<tr>
<td>E12</td>
<td>12</td>
<td>F 1)</td>
<td>Over-temperature</td>
</tr>
<tr>
<td>E19</td>
<td>19</td>
<td>F</td>
<td>Firmware not compatible or is defective</td>
</tr>
<tr>
<td><strong>Teach error</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E20</td>
<td>20</td>
<td>F</td>
<td>Error in test program, orientations cannot be separated.</td>
</tr>
<tr>
<td>E21</td>
<td>21</td>
<td>F</td>
<td>Error in test program, types or orientations cannot be separated.</td>
</tr>
<tr>
<td><strong>Error in generating image</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E30</td>
<td>30</td>
<td>F 1)</td>
<td>Image buffer overflow (only for evaluation mode = fixed frame rate)</td>
</tr>
<tr>
<td><strong>Errors in test programs or system parameters</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E40</td>
<td>40</td>
<td>F</td>
<td>Test program cannot be read/found</td>
</tr>
<tr>
<td>E41</td>
<td>41</td>
<td>F</td>
<td>System parameter cannot be read/interpreted</td>
</tr>
<tr>
<td>E43</td>
<td>43</td>
<td>F</td>
<td>Test program is not compatible with the firmware</td>
</tr>
<tr>
<td><strong>CP I/O expansion errors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E100</td>
<td>100</td>
<td>F 1)</td>
<td>General CAN error</td>
</tr>
<tr>
<td>E101</td>
<td>101</td>
<td>F 1)</td>
<td>General I/O expansion error</td>
</tr>
<tr>
<td>E102</td>
<td>102</td>
<td>F 1)</td>
<td>Output module not found</td>
</tr>
<tr>
<td>E103</td>
<td>103</td>
<td>F 1)</td>
<td>Input module not found</td>
</tr>
</tbody>
</table>

1) Error can be configured.
## Technical appendix

<table>
<thead>
<tr>
<th>Name</th>
<th>No.</th>
<th>Error/warning</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E105</td>
<td>105</td>
<td>F ¹</td>
<td>Communication error with output module</td>
</tr>
<tr>
<td>E106</td>
<td>106</td>
<td>F ¹</td>
<td>Communication error with input module</td>
</tr>
<tr>
<td>E107</td>
<td>107</td>
<td>F ¹</td>
<td>Overload/short circuit in output module</td>
</tr>
<tr>
<td>E108</td>
<td>108</td>
<td>F ¹</td>
<td>Overload/short circuit in input module</td>
</tr>
<tr>
<td>E109</td>
<td>109</td>
<td>F ¹</td>
<td>Undervoltage output module</td>
</tr>
<tr>
<td>E110</td>
<td>110</td>
<td>F ¹</td>
<td>Undervoltage input module</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>CPI-module errors</strong></td>
</tr>
<tr>
<td>E150</td>
<td>150</td>
<td>F ¹</td>
<td>Communication error</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>EasyIP errors</strong></td>
</tr>
<tr>
<td>E200</td>
<td>200</td>
<td>F</td>
<td>General EasyIP error</td>
</tr>
<tr>
<td>E201</td>
<td>201</td>
<td>F</td>
<td>EasyIP server isn't running</td>
</tr>
<tr>
<td>E202</td>
<td>202</td>
<td>F</td>
<td>EasyIP communication error</td>
</tr>
<tr>
<td>E203</td>
<td>203</td>
<td>W</td>
<td>Invalid EasyIP request</td>
</tr>
</tbody>
</table>

¹ Error can be configured.

Tab. A/3: Error messages
A. Technical appendix

A.6 EasyIP

Read and/or write access to the entries described can be made via EasyIP. The entries are of the EasyIP access type "Flagword" (FW) or "String" (STR).

A.6.1 Input register

<table>
<thead>
<tr>
<th>Name</th>
<th>Read/write</th>
<th>FW</th>
<th>Value type</th>
<th>Allowed values</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger signal</td>
<td>W</td>
<td>0</td>
<td>uint16</td>
<td>0 or 1</td>
<td></td>
</tr>
<tr>
<td>Accept input signal</td>
<td>W</td>
<td>1</td>
<td>uint16</td>
<td>0 or 1</td>
<td></td>
</tr>
<tr>
<td>Acknowledge error signal</td>
<td>W</td>
<td>2</td>
<td>uint16</td>
<td>0 or 1</td>
<td></td>
</tr>
<tr>
<td>not used</td>
<td></td>
<td>3</td>
<td>uint16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>not used</td>
<td></td>
<td>4</td>
<td>uint16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>not used</td>
<td></td>
<td>5</td>
<td>uint16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>not used</td>
<td></td>
<td>6</td>
<td>uint16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>not used</td>
<td></td>
<td>7</td>
<td>uint16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test program preselection bit 0</td>
<td>R/W</td>
<td>8</td>
<td>uint16</td>
<td>0 or 1</td>
<td>Accept preselected test program by setting the accept input signal</td>
</tr>
<tr>
<td>Test program preselection bit 1</td>
<td>R/W</td>
<td>9</td>
<td>uint16</td>
<td>0 or 1</td>
<td></td>
</tr>
<tr>
<td>Test program preselection bit 2</td>
<td>R/W</td>
<td>10</td>
<td>uint16</td>
<td>0 or 1</td>
<td></td>
</tr>
<tr>
<td>Test program preselection bit 3</td>
<td>R/W</td>
<td>11</td>
<td>uint16</td>
<td>0 or 1</td>
<td></td>
</tr>
<tr>
<td>Test program preselection bit 4</td>
<td>R/W</td>
<td>12</td>
<td>uint16</td>
<td>0 or 1</td>
<td></td>
</tr>
<tr>
<td>Test program preselection bit 5</td>
<td>R/W</td>
<td>13</td>
<td>uint16</td>
<td>0 or 1</td>
<td></td>
</tr>
<tr>
<td>Test program preselection bit 6</td>
<td>R/W</td>
<td>14</td>
<td>uint16</td>
<td>0 or 1</td>
<td></td>
</tr>
<tr>
<td>Test program preselection bit 7</td>
<td>R/W</td>
<td>15</td>
<td>uint16</td>
<td>0 or 1</td>
<td></td>
</tr>
</tbody>
</table>

Tab. A/4: Input register
A. Technical appendix

A.6.2 Output register

<table>
<thead>
<tr>
<th>Name</th>
<th>Read/write</th>
<th>FW</th>
<th>Value type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready for operation</td>
<td>R</td>
<td>16</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Result output good</td>
<td>R</td>
<td>17</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Result output bad</td>
<td>R</td>
<td>18</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Result output correctly oriented</td>
<td>R</td>
<td>19</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Result output incorrectly oriented</td>
<td>R</td>
<td>20</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Warning (corresponds to “LED C” red &amp; flashing)</td>
<td>R</td>
<td>22</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Error status (corresponds to “LED C” red)</td>
<td>R</td>
<td>23</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Identified part type bit 0</td>
<td>R</td>
<td>24</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Identified part type bit 1</td>
<td>R</td>
<td>25</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Identified part type bit 2</td>
<td>R</td>
<td>26</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Identified part type bit 3</td>
<td>R</td>
<td>27</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Identified part type bit 4</td>
<td>R</td>
<td>28</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Identified part type bit 5</td>
<td>R</td>
<td>29</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Identified part type bit 6</td>
<td>R</td>
<td>30</td>
<td>uint16</td>
<td></td>
</tr>
<tr>
<td>Identified part type bit 7</td>
<td>R</td>
<td>31</td>
<td>uint16</td>
<td></td>
</tr>
</tbody>
</table>

Tab. A/5: Output register
A. Technical appendix

A.6.3 Fast access to input and output register

<table>
<thead>
<tr>
<th>Name</th>
<th>Read/write</th>
<th>FW</th>
<th>Value type</th>
<th>Allowed values</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast access to identified part type</td>
<td>R</td>
<td>32</td>
<td>uint16</td>
<td></td>
<td>Equivalent to flag-word 24 to 31</td>
</tr>
<tr>
<td>Fast access to test program preselection</td>
<td>R/W</td>
<td>33</td>
<td>uint16</td>
<td>0 to 255 for writing</td>
<td>Equivalent to flag-word 8 to 15. For accepting, the “accept input signal” must be set afterwards.</td>
</tr>
</tbody>
</table>

Tab. A/6: Fast access to input and output registers

A.6.4 Extended system status/system information

<table>
<thead>
<tr>
<th>Name</th>
<th>Read/write</th>
<th>FW</th>
<th>Value type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Error code of the current error</td>
<td>R</td>
<td>100</td>
<td>word</td>
<td>0 = no error, x = error number (see table Chapter A.5)</td>
</tr>
<tr>
<td>Error code of the current warning</td>
<td>R</td>
<td>101</td>
<td>word</td>
<td>0 = no error, x = error number (see table Chapter A.5)</td>
</tr>
<tr>
<td>Device type</td>
<td>R</td>
<td>102</td>
<td>word</td>
<td>SBO1-Q-R1B: 701, SBOC-Q-R1B:702, SBO1-Q-R1C: 703, SBOC-Q-R1C:704</td>
</tr>
<tr>
<td>Firmware version major</td>
<td>R</td>
<td>103</td>
<td>word</td>
<td>e.g. version 3.2.0.9: high byte = 3, low byte = 2</td>
</tr>
<tr>
<td>Firmware version minor</td>
<td>R</td>
<td>104</td>
<td>word</td>
<td>e.g. version 3.2.0.9: high byte = 0, low byte = 9</td>
</tr>
</tbody>
</table>
A. Technical appendix

<table>
<thead>
<tr>
<th>Name</th>
<th>Read/write</th>
<th>FW</th>
<th>Value type</th>
<th>Comment</th>
</tr>
</thead>
</table>
| Connection to PC      | R          | 130| word       | 0 = Device is not connected to the PC
1 = Device is connected e.g. with CheckKon |

Tab. A/7: Extended system status / system information

A.6.5 Device system time

<table>
<thead>
<tr>
<th>Name</th>
<th>Read/write</th>
<th>FW</th>
<th>Value type</th>
<th>Allowed values</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date, year</td>
<td>R/W</td>
<td>150</td>
<td>uint16</td>
<td>2000 to 9999</td>
<td>The system time must be set again when the device is started again.</td>
</tr>
<tr>
<td>Date, month</td>
<td>R/W</td>
<td>151</td>
<td>uint16</td>
<td>1 to 12</td>
<td></td>
</tr>
<tr>
<td>Date, day</td>
<td>R/W</td>
<td>152</td>
<td>uint16</td>
<td>1 to 31</td>
<td></td>
</tr>
<tr>
<td>Time, hours</td>
<td>R/W</td>
<td>153</td>
<td>uint16</td>
<td>0 to 23</td>
<td></td>
</tr>
<tr>
<td>Time, minutes</td>
<td>R/W</td>
<td>154</td>
<td>uint16</td>
<td>0 to 59</td>
<td></td>
</tr>
<tr>
<td>Time, seconds</td>
<td>R/W</td>
<td>155</td>
<td>uint16</td>
<td>0 to 59</td>
<td></td>
</tr>
</tbody>
</table>

Tab. A/8: System time
## A.6.6 Total type tolerance in the current test program

<table>
<thead>
<tr>
<th>Name</th>
<th>Read/write</th>
<th>FW</th>
<th>Value type</th>
<th>Allowed values</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part type 0</td>
<td>R</td>
<td>200</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 1</td>
<td>R</td>
<td>201</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 2</td>
<td>R</td>
<td>202</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 3</td>
<td>R</td>
<td>203</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 4</td>
<td>R</td>
<td>204</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 5</td>
<td>R</td>
<td>205</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 6</td>
<td>R</td>
<td>206</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 7</td>
<td>R</td>
<td>207</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 8</td>
<td>R</td>
<td>208</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 9</td>
<td>R</td>
<td>209</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 10</td>
<td>R</td>
<td>210</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 11</td>
<td>R</td>
<td>211</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 12</td>
<td>R</td>
<td>212</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 13</td>
<td>R</td>
<td>213</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 14</td>
<td>R</td>
<td>214</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
<tr>
<td>Part type 15</td>
<td>R</td>
<td>215</td>
<td>uint16</td>
<td>0 to 20</td>
<td></td>
</tr>
</tbody>
</table>

Tab. A/9: Total type tolerance in the current test program
### A.6.7 Basic results of the last test

<table>
<thead>
<tr>
<th>Name</th>
<th>Read/write</th>
<th>FW</th>
<th>Value type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used test program</td>
<td>R</td>
<td>250</td>
<td>uint16</td>
<td>1 ... 256</td>
</tr>
<tr>
<td>Used mode</td>
<td>R</td>
<td>251</td>
<td>uint16</td>
<td>0 = Teach, 2 = Auto</td>
</tr>
<tr>
<td>Identified part type</td>
<td>R</td>
<td>252</td>
<td>uint16</td>
<td>1 ... 16</td>
</tr>
<tr>
<td>Identified orientation</td>
<td>R</td>
<td>253</td>
<td>uint16</td>
<td>1 ... 8</td>
</tr>
<tr>
<td>Auto mode:</td>
<td>R</td>
<td>254</td>
<td>uint16</td>
<td>Auto mode:</td>
</tr>
<tr>
<td>Identification quality</td>
<td></td>
<td></td>
<td></td>
<td>Teach mode:</td>
</tr>
<tr>
<td>C value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orientation quality</td>
<td>R</td>
<td>255</td>
<td>uint16</td>
<td>Orientation quality</td>
</tr>
<tr>
<td>Used overall tolerance</td>
<td>R</td>
<td>256</td>
<td>uint16</td>
<td>Used overall tolerance for testing the part</td>
</tr>
<tr>
<td>Part no. low word</td>
<td>R</td>
<td>257</td>
<td>uint16</td>
<td>Low word of part no. (running no. since device start) for identification</td>
</tr>
<tr>
<td>Part no. high word</td>
<td>R</td>
<td>258</td>
<td>uint16</td>
<td>Part no. (running no. since device start) for identification</td>
</tr>
<tr>
<td>Date, year of recording</td>
<td>R</td>
<td>259</td>
<td>uint16</td>
<td>at trigger signal</td>
</tr>
<tr>
<td>Date – Month of recording</td>
<td>R</td>
<td>260</td>
<td>uint16</td>
<td>at trigger signal</td>
</tr>
<tr>
<td>Date – Day of recording</td>
<td>R</td>
<td>261</td>
<td>uint16</td>
<td>at trigger signal</td>
</tr>
<tr>
<td>Time – Hours of recording</td>
<td>R</td>
<td>262</td>
<td>uint16</td>
<td>at trigger signal</td>
</tr>
<tr>
<td>Time – Minutes of recording</td>
<td>R</td>
<td>263</td>
<td>uint16</td>
<td>at trigger signal</td>
</tr>
<tr>
<td>Time – Seconds of recording</td>
<td>R</td>
<td>264</td>
<td>uint16</td>
<td>at trigger signal</td>
</tr>
</tbody>
</table>
A. Technical appendix

<table>
<thead>
<tr>
<th>Name</th>
<th>Read/write</th>
<th>FW</th>
<th>Value type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing time</td>
<td>R</td>
<td>265</td>
<td>uint16</td>
<td>Processing time of the part in ms starting from the trigger signal, up to a max of 32 s</td>
</tr>
<tr>
<td>Number of actually used features</td>
<td>R</td>
<td>266</td>
<td>uint16</td>
<td>0 ... 63 (determined by test program)</td>
</tr>
</tbody>
</table>

Tab. A/10: Basic results of the last test

A.6.8 Features – Results of the last test

The addressing of the feature values is grouped into sections. The sections begin at flagword 400 and are each offset by 100.

Therefore

- section 1 of the feature values begins at 400
- section 2 of the feature values begins at 500
- etc.

The feature values are also saved as strings. The addresses of the feature values begin at string 0 and are each offset by 5.

Therefore

- the string of the 1st. feature begins at 0
- the string of the 2nd. feature begins at 5
- the string of the 3rd. feature begins at 10
- etc. (See Tab. A/13)

There is a maximum total of 64 feature sections. The number of features actually used is contained in flagword 266.
### A. Technical appendix

<table>
<thead>
<tr>
<th>Name</th>
<th>Read/write</th>
<th>FW 1)</th>
<th>Value type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feature value</td>
<td>R</td>
<td>400</td>
<td>double64</td>
<td></td>
</tr>
<tr>
<td>Tolerance</td>
<td>R</td>
<td>404</td>
<td>double64</td>
<td>Used tolerance for feature (incl. tolerance factor)</td>
</tr>
<tr>
<td>not used</td>
<td>R</td>
<td>408</td>
<td>double64</td>
<td></td>
</tr>
<tr>
<td>Feature value as text</td>
<td>R</td>
<td>412</td>
<td>char[64]</td>
<td>Feature value as string</td>
</tr>
<tr>
<td>Tool name</td>
<td>R</td>
<td>444</td>
<td>char[32]</td>
<td>Name assigned by user (cut off, if necessary)</td>
</tr>
<tr>
<td>Feature name</td>
<td>R</td>
<td>460</td>
<td>char[32]</td>
<td>Fixed feature name (cut off, if necessary)</td>
</tr>
<tr>
<td>Valid flag</td>
<td>R</td>
<td>476</td>
<td>uint16</td>
<td>1 = Feature could be calculated, 0 = Calculation failed</td>
</tr>
<tr>
<td>Feature type</td>
<td>R</td>
<td>477</td>
<td>int16</td>
<td>Feature ID</td>
</tr>
<tr>
<td>Deviation</td>
<td>R</td>
<td>478</td>
<td>int16</td>
<td>Deviation (-32000 ... 32000), Good part = −100 ... 100</td>
</tr>
<tr>
<td>Feature value, in front of the decimal</td>
<td>R</td>
<td>479</td>
<td>uint16</td>
<td>Feature value as integer (up to +/− 32767)</td>
</tr>
<tr>
<td>Feature value, after the decimal</td>
<td>R</td>
<td>480</td>
<td>uint16</td>
<td>Number of decimal places of the feature value * 10,000 as integer</td>
</tr>
</tbody>
</table>

1) Example of the section of the 1st. feature values as from flagword 400.

Tab. A/11: Feature – Results of the last test

<table>
<thead>
<tr>
<th>ID of feature value (Tool ROI)</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Start left</td>
</tr>
<tr>
<td>101</td>
<td>Start top</td>
</tr>
<tr>
<td>102</td>
<td>Start bottom</td>
</tr>
<tr>
<td>103</td>
<td>Start right</td>
</tr>
<tr>
<td>104</td>
<td>Area</td>
</tr>
</tbody>
</table>
### A. Technical appendix

The features available depend on the test program and on the firmware version of the device.

<table>
<thead>
<tr>
<th>ID of feature value (Tool ROI)</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>105</td>
<td>Length_x</td>
</tr>
<tr>
<td>106</td>
<td>Height_y</td>
</tr>
<tr>
<td>107</td>
<td>Area x/2</td>
</tr>
<tr>
<td>108</td>
<td>Area y/2</td>
</tr>
<tr>
<td>109</td>
<td>Center of gravity x</td>
</tr>
<tr>
<td>110</td>
<td>Center of gravity y</td>
</tr>
<tr>
<td>111</td>
<td>Inertia x</td>
</tr>
<tr>
<td>112</td>
<td>Inertia y</td>
</tr>
<tr>
<td>113</td>
<td>Inertia xy</td>
</tr>
<tr>
<td>114</td>
<td>Degree of inertia axis</td>
</tr>
<tr>
<td>115</td>
<td>Pol. min</td>
</tr>
<tr>
<td>116</td>
<td>Pol. max</td>
</tr>
<tr>
<td>117</td>
<td>Circumference</td>
</tr>
</tbody>
</table>

**Tab. A/12: ID of feature value**

The features available depend on the test program and on the firmware version of the device.

**Note**

Further information is available from the service personnel of Festo AG & Co. KG.
A. Technical appendix

Results in the form of texts are also available as EasyIP access type "String" (STR)

<table>
<thead>
<tr>
<th>Name</th>
<th>Read/Write</th>
<th>STR</th>
<th>Value type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feature value</td>
<td>R</td>
<td>0</td>
<td>string</td>
<td></td>
</tr>
<tr>
<td>Tool name</td>
<td>R</td>
<td>1</td>
<td>string</td>
<td>Name assigned by user (cut off, if necessary)</td>
</tr>
<tr>
<td>Feature name</td>
<td>R</td>
<td>2</td>
<td>string</td>
<td>Fixed feature name (cut off, if necessary)</td>
</tr>
<tr>
<td>not used</td>
<td>R</td>
<td>3</td>
<td>string</td>
<td></td>
</tr>
<tr>
<td>not used</td>
<td>R</td>
<td>4</td>
<td>string</td>
<td></td>
</tr>
</tbody>
</table>

1) Example of addressing the 1st. feature as from STR0; the 2nd. Feature begins at STR5.

Tab. A/13: Features – Results of the last test as string

A.6.9 System parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Read/Write</th>
<th>Offset</th>
<th>Value type</th>
<th>Allowed values</th>
</tr>
</thead>
<tbody>
<tr>
<td>System parameters “...”</td>
<td>R/W</td>
<td>7000</td>
<td>uint16</td>
<td>See dynamic help in the “System parameters” window in CheckKon</td>
</tr>
</tbody>
</table>

Tab. A/14: System parameters
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A.6.10 Example of program

The following program code shows as an example how a trigger can be actuated with the aid of an FST program and a Festo FEC controller in the camera via EasyIP, and subsequently how 2 feature values can be read.

```plaintext
****************************************************
** Example IP of camera: 192.168.2.10
** Example IP of PLC: 192.168.2.77
** Result is in FW400/401 and FW479
****************************************************

STEP                                 " Ini of all needed FWs
** Eli of all needed FWs

THEN LOAD V0             " Ini of FWs with value 0
  TO FW0            'Flagword 0 in PLC
  TO FW400          'Double Value 1
  TO FW401          'Double Wert 2
  TO FW479          'Word Pre Comma
  TO FW255          'FW for Status

STEP                                 " Communicate IP of camera and type in table

** Communication IP of camera and type in table

THEN CFM 2                         " type/interrogate IP in/of table
  WITH V1             " 1:type; 2:interrogate
  WITH V192           " IP−adress
  WITH V168           " IP−adress
  WITH V2             " IP−adress
  WITH V10            " IP−adress

IF                   FU32           'first transfer
=            V0             " 0 if successful
THEN CMP 0                         " Time Bap with T1

WITH V1000          " delay time of 10s until camera has rebooted

STEP loop                            " Set trigger to camera logical 1 and send --> Easy−Send

** Set trigger to camera logical 1 and send --> Easy−Send

THEN SET F0.0           ' Trigger Merker in der SPS erstes Bit
  CFM 1            ' EASY_S
  WITH V1             " Index number in IP−table
  WITH V1             " Operand, 1:M; 2:E; 3:A; 4:R; 5:TV; 11:Str
  WITH V0             " No. of first operand to send
  WITH V0             " No. of first operand in CPU
  WITH V255           " Address of Flagword for status

IF                   FU32           'first transfer
=            V0             " 0 if successful
THEN CMP 0                         " Time Bap with T1
  WITH V100           " 1 Sec
```

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STEP
"Set trigger to camera logical 0 --> Easy-Send"
******************************************************************************
THEN RESET F0.0
"Trigger Flag in PLC first Bit"
CPM 1
WITH V1
"Index number in IP-tabelle"
WITH V1
"Operand, 1:M; 2:E; 3:A; 4:R; 5:TV; 11:Str"
WITH V1
"Number of operands to send (256 max.)"
WITH V0
"No. of first operand to send"
WITH V0
"No. of first operand in CPU"
WITH V255
"Address of Flagword for status"

IF FU32 = V0
' first transfer
THEN CMP 0
' Time Bap with T1
WITH V100
' 1 Sec

STEP
"Read Pre and Next separated "Double" --> Easy-Read"
******************************************************************************
THEN CFM 0
' Read operands of a controller
WITH V1
"Index number in IP-tabelle"
WITH V1
"Operand, 1:M; 2:E; 3:A; 4:R; 5:TV; 11:Str"
WITH V2
"Number of wished operand (256 max.)"
WITH V400
"No. of first lokal Op. for data"
WITH V400
"No. of First Operand in source-CPU"
WITH V255
"Address of FW for status"

IF FU32 = V0
' first transfer
THEN CMP 0
' Time Bap with T1
WITH V100
' 1 Sec

STEP
"Lesen Ganzahl "Word" --> Easy-Read"
******************************************************************************
THEN CFM 0
' Read operands of controller
WITH V1
"Index number in IP-tabelle"
WITH V1
"Operand, 1:M; 2:E; 3:A; 4:R; 5:TV; 11:Str"
WITH V2
"Number of wished operand (256 max.)"
WITH V479
"No. of first lokal Op. for data"
WITH V479
"No. of First Operand in source-CPU"
WITH V255
"Address of FW for status"

IF FU32 = V0
' first transfer
THEN CMP 0
' Time Bap with T1
WITH V300
' Update-time 3 Sec until new image
JMP TO loop
' Jump to Step-Loop PRG runs endless
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## B.1 Index

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<th>XIV</th>
</tr>
</thead>
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<tr>
<td>Accept input signal input</td>
<td>4-35</td>
</tr>
<tr>
<td>Acknowledge error signal input</td>
<td>4-36</td>
</tr>
<tr>
<td>Activity LED (C)</td>
<td>5-4</td>
</tr>
<tr>
<td>Adapter kit</td>
<td>2-6</td>
</tr>
<tr>
<td>Aperture</td>
<td>XIV-4-13</td>
</tr>
<tr>
<td>Assign IP address automatically</td>
<td>4-10</td>
</tr>
<tr>
<td>Auto MDI-X</td>
<td>XIV</td>
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<tr>
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<th>1-16</th>
</tr>
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<tbody>
<tr>
<td>Beginning of cycle</td>
<td>4-24</td>
</tr>
</tbody>
</table>

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<table>
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<th>C mount</th>
<th>1-12</th>
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<tr>
<td>calculation time</td>
<td>4-16</td>
</tr>
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<td>Camera image</td>
<td>4-16</td>
</tr>
<tr>
<td>CAN interface</td>
<td>3-15</td>
</tr>
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<td>CE marking</td>
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<td>Certifications</td>
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<td>Characteristic</td>
<td>XV</td>
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<tr>
<td>CheckKon</td>
<td>XIV</td>
</tr>
<tr>
<td>CheckOpti</td>
<td>XIV</td>
</tr>
<tr>
<td>CMOS sensor</td>
<td>XIV</td>
</tr>
</tbody>
</table>

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